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ALARACT Demonstration for the Primary Ventilation Systems at the DST Tank Farms for the Interim Stabilization Project (SaltWell Pumping)

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ALARACT DEMONSTRATION FOR THE PRIMARY VENTILATION SYSTEMS AT THE DST TANK FARMS FOR THE SST INTERIM STABILIZATION PROJECT (SALTWELL PUMPING)

RPP-9782, Rev. 0

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1.0 SCOPE AND EXECUTIVE SUMMARY

A demonstration of As Low As Reasonably Achievable Control Technology (ALARACT) was performed for the existing Double Shell Tank (DST) farm primary ventilation systems in support of the Single Shell Tanks (SSTs) Interim Stabilization Project. The primary ventilation systems evaluated in this ALARACT are located at the 241-AW, AN, AP, and SY tank farms. Of these farms, only the AP and SY farms are scheduled to receive SST waste prior to new ventilation systems being installed at the farms. As a result, full evaluations were performed for the 241-AP and SY systems, whereas only partial evaluations were performed for the 241-AN and AW systems. The full evaluation included the evaluation of the stack sampling system, whereas the partial evaluation did not. Also, 241-AY and AZ are not scheduled to receive SST waste so they were both excluded completely from the evaluation.

This ALARACT demonstration evaluated the ability of the abatement and control technologies in the DST ventilation systems identified above to function during SST waste transfers as part of the SST Interim Stabilization Project. Where available, field data (waste temperatures) gathered during actual saltwell pumping activities, were used to support this demonstration. Also used were other process data and equipment capacities associated with the system evaluation. Where actual field data were not available, conservative assumptions, based upon process knowledge and standard engineering calculation methodologies, were used.

The DST ventilation systems were also evaluated for compliance against the technology standards identified in Washington Administrative Code (WAC) 246-247, *Radioactive Air Emissions,* as well as other governing codes and standards.

The radionuclide emissions of concern when saltwell pumping liquid waste from a SST into a DST will be in the form of particles. This is based on process knowledge of the radiological content of the DSTs and SSTs and previously permitted activities such as "Saltwell Pumping Tanks 241-SX-101, 241-SX-102, 241-SX-103," AIR 00-108 (Ref. 7) and "Rotary Mode Core Sampling [RMCS] Systems 3 & 4, Rev.1" AIR 98-301 (Ref. 8). These State of Washington Department of Health (WDOH) approvals concur with the conclusion that radionuclides in particulate state comprise well over 90% of the potential emissions from these tanks.

The primary control technology to abate the release of particulate emissions is high-efficiency particulate air (HEPA) filters. HEPA filters are used at Department of Energy (DOE) and commercial nuclear sites to control particulate emissions, and have extensive and successful operating history.

Each exhaust train in the DST farms contains two Nuclear Grade HEPA filters in series. Each HEPA filter is made of Nuclear Grade throw-away dry-type extended-media in a rigid frame having minimum particle collection efficiency of 99.97% for 0.3-μm median diameter, thermally generated mono-dispersed dioctylphthalate particles or other specified challenge aerosols. Pressure drop of a clean filter is a maximum of 1-inch water gauge at rated flow. In addition, the HEPA filters meet the requirements of ASME AG-1, Section FC and are tested in-place annually to the requirements of ASME N510 (Ref. 9), with guidance from ERDA 76-21 (Ref. 10), for an efficiency of 99.95%.

SST waste transfers into the DSTs will be liquid waste transported by way of pipes. The waste will be introduced into the DSTs either by falling directly through the vapor space of the tank by way of a tank riser, or discharged below the surface of the waste. In either case, changes to the DST vapor space will occur. These changes include environment changes, such as temperature, en-trained moisture (e.g., aerosol particles), and humidity. This evaluation focused on the free falling type of discharge method into the tank vapor space because this transfer method is the bounding condition

The following environmental changes to the vapor space were identified as having possible effects on the control technologies of the ventilation system.

1. Increased radionuclide particles in the vapor space. The ventilation system must safely remove radioactive particulate from the air-stream before this stream is released to the atmosphere.

2. Liquid SST waste transfers into the DSTs easily possess the potential to increase the moisture content in the vapor space of the DST. This will also result in an increase in the moisture of the air stream being pulled from the vapor space and may lead to increased condensation in the ductwork and housings.

An increase in the particle concentration in the vapor space due to SST waste transfers will not affect the function of the HEPA filters.

An increase in the moisture content of the air stream (due to SST waste transfer) has the potential to affect the performance of the HEPA filters. The primary concerns from the increased moisture is plugging of the filters due to condensation on the filter face and pooling in the filter housing.

The ventilation systems use several technologies to prevent and/or minimize condensation in the exhaust train. The three primary moisture control technologies are:

- De-misters (removes entrained water particles from the air stream)
- Heaters (to decrease the relative humidity of the air stream)
- Drain lines (to remove pooling condensate)

An extensive evaluation (Attachment 1) of these technologies and their ability to remove the moisture in the air stream during SST waste transfers was performed as part of this ALARACT demonstration. Environmental variables such as temperature (both air stream and ambient), moisture content in the air stream (both humidity and entrained particles) and the size of the water particles in the air stream were evaluated.

The ability of the de-misters to remove the aerosols in the air stream generated by SST waste transfers was evaluated (Attachment 1). It was determined that the de-misters are capable of handling the increased water particles generated during SST waste transfers.

Extreme conditions were used to evaluate the possible condensation in the exhaust trains. Measurement data and standard heat transfer equations were used to perform the evaluation. As part of the evaluation, "unusually" warm air at 100% relative humidity (RH) was assumed to enter the exhaust trains. The air was then subjected to "extreme" heat loss conditions. It was determined

that the drain lines in the SY (primary A-train system), AP, and AW farms are sufficient to handle the condensation predicted from the above conditions. However, the AN system does not have drains in the filter section of the housing or the fan housing.

The ability of the heaters to reduce the condensation through the filter housing was evaluated. Again, extreme heat loss through the filter housing was used. For the AP, AN, AW, and SY (primary A-train) exhausters it was determined that the heaters maintained the air stream above the dew-point temperature until the end of the filter housing, downstream of the last filter. Therefore, the heaters in all of the exhausters evaluated reduce the possibility of condensation on the filters and help prevent failure and degradation from plugging.

The four ventilation systems were evaluated for compliance against the technology standards identified in WAC 246-247, *Radioactive Air Emissions,* as well as other governing codes and standards. A compliance matrix for the four farms was compiled and is presented as Attachments 2 through 19 to this demonstration. The results of the evaluation indicate several deviations are necessary due to the lack of documentation to show whether the component meets the requirement. All of the components identified with "Deviation Required" are considered acceptable based on past successful operating history. Concurrence of this ALARACT demonstration by the State of Washington Department of Health constitutes approval of the deviations. See the attached tables for the details on this evaluation. See Section 4.3 for details.

2.0 INTRODUCTION AND BACKGROUND

The Hanford Site is a Department of Energy (DOE) facility located northwest of Richland, Washington. The DSTs are located in areas identified as the 200 East and the 200 West Areas. There are a total of 28 underground DSTs in the two areas, each with a nominal capacity of one million gallons. Three of the DSTs are located in the 200 West Area, 241-SY tank farm. The remaining 25 are located in the 200 East Area. The five East Area tank farms contain the following numbers of tanks: 7 in 241-AN, 8 in 241-AP, 6 in 241-AW, 2 in 241-AY and 2 in 241-AZ. The primary DST ventilation systems that are being evaluated in this ALARACT demonstration are all located in the AN, AP, AW, and SY tank farms.

The DSTs are designed to contain various types of mixed radioactive waste including; high-level waste (HLW), low-activity waste (LAW), and high heat generating waste. The waste types consist of both organic and inorganic compounds that have been generated by various processes used at the Hanford Site.

Work is currently underway to resolve tank waste safety and environmental issues as part of the Hanford Site's mission of safe storage of nuclear waste, as well as, the overall clean-up of the site. This work includes the transfer of liquid waste from Hanford SSTs to the DSTs.

SST waste transfers into the DSTs will be liquid waste transported by way of pipes. The waste will be introduced into the DSTs either by falling directly through the vapor space of the tank by way of a tank riser, or discharged below the surface of the waste. In either case, changes to the DST vapor space will occur. These changes include environment changes, such as temperature, en-trained moisture (e.g., aerosol particles), and humidity. This evaluation focused on the free falling type of discharge method into the tank vapor space because this transfer method is the bounding condition.

3.0 DESCRIPTION OF THE VENTILATION SYSTEMS

The ventilation for each DST tank farm consists of two completely separate systems: (1) the primary tank ventilation system, and (2) the annulus space ventilation system. This ALARACT Demonstration evaluates only the primary ventilation system for each DST tank farm identified in the scope, Section 1.0.

The primary ventilation systems for the four DST tank farms evaluated in the ALARACT consist of the following subsystems:

- Air Inlet Subsystem
- Tank exhaust ductwork and header
- Exhaust air moisture removal components
- Exhaust trains (containing heaters, filters and fans)
- Exhaust stack (containing sampling and monitoring equipment)
- Condensate collection system

The subsystems and their major components are outlined in the following sections.

3.1 Air Inlet Subsystems

Outside air is drawn into the DST vapor space through either one, or a combination of, inlet filters or miscellaneous in-leakage pathways.

All of the tanks located in the 241-AN and AW farms are equipped with filtered inlet stations. The inlet stations consist of a filter housing containing a pre-filter, a HEPA filter, an isolation/modulating damper and a component known as a Constant Flow Device (CFD). The CFD is a passive component that adjusts automatically to changes in pressure, thus allowing a constant flow to be drawn through the device. Since the device is passive, with no reliance on electrical power or manual manipulation, it is considered a very stable and reliable component. The inlet stations are connected to tank risers, which are direct connections to the tank vapor space. To maintain a desired vacuum in the tanks, some of the inlet stations in the AN and AW farms are currently isolated from the tanks (i.e. valved-out).

Inlet filter systems have not yet been installed on the 241-AP farm, therefore, flow into the AP tanks is accomplished through miscellaneous in-leakage pathways.

All of the tanks located in the 241-SY farm are equipped with filtered inlet stations. The inlet stations are very similar in design to those in 241-AN and AW. They consist of a filter housing containing a pre-filter, a HEPA filter, and an isolation/modulating damper.

3.2 Tank Exhaust Ductwork and Header

3.2.1 AN, AP, and AW Tank Farms

After mixing with the air inside the tank vapor space, the air is then drawn out of each tank through a discharge riser. The discharge riser is a 12-inch diameter carbon steel pipe. The discharge risers are connected to below grade ductwork that leads to the below grade vent pits.

The vent pits provide access to the exhaust ductwork and to butterfly valves located in each tank's exhaust duct. The butterfly valves are used for controlling the volumetric flow in the tank exhaust ducts. The valves are manually manipulated and remain in a fixed position to assure proper flow and pressure is maintained within the individual tanks.

After leaving the ventilation pits, the exhaust ducts from the individual tanks are combined to form the primary exhaust header.

3.2.2 SY Tank Farm

After mixing with the air inside the tank vapor space, the air is then drawn out of each SY tank through a discharge riser. A 12-inch diameter riser from each tank connects to the exhaust header. Each riser connection to the exhaust header contains a butterfly valve used to control the volumetric flow in the tank exhaust ducts.

The exhaust header starts at Tank SY-103 and runs above grade to each of the SY tanks in series. The exhaust header piping is sloped towards the tanks to allow any condensation generated in the ductwork header to drain back to the tanks.

3.3 Exhaust Air Moisture Removal Components

3.3.1 AN, AP, and AW Exhausters

Each of the two de-misters servicing the primary ventilation system has its own connection to the exhaust header. The de-misters may be isolated from the exhaust header by butterfly valves located upstream and downstream. Under normal operating conditions, one de-mister is operational and the other is in standby. However, both de-misters may be used in parallel if desired.

The de-misters contain Koch FLEXICHEVRON® flow devices in combination with wire-mesh pads. The chevron device separates the heavy moisture particles from the air stream, while the wire mesh pad removes smaller particles. The performance of this system is 99% of all particles greater than 20 μm (Ref. 2).

The ductwork exiting each de-mister is then re-combined into a common header to enter the primary exhaust trains.

3.3.2 SY Primary A-Train Exhauster

The SY primary A-train ventilation system contains an in-line Kimre Inc. B-Gon™ de-mister. This de-mister has an efficiency rating of 99.49% for 4 to 6 micron particles with a corresponding air stream velocity of 5.2 ft/s (479 cfm) (see Attachment 1 evaluation). The efficiency of this de-mister increases slightly with increasing flow. At a velocity of 8.2 ft/s (755 cfm), the de-mister has an efficiency of 99.58% for 4 to 6 micron particles. For conservatism, the efficiency at the lower velocity/flow was used for the evaluation of the primary A-train de-mister.

3.4 Exhaust Trains (Heaters, Filters, Fans and Housings)

3.4.1 AN, AP and AW Exhausters

The air stream enters either one of two independent and parallel exhaust trains. Motor-operated isolation valves are used to direct the airflow through one of the two independent trains. Under normal operation, one exhaust train is running and the other is on standby.

Each primary exhaust train consists of an air stream heater, a pre-filter, two HEPA filters in series, and a fan. As described above, the primary ventilation exhaust systems for all three DST tank farms are a dual system.

The HEPA filters are relied upon to provide primary control of radioactive particulate emissions to the atmosphere. Each train contains two Nuclear Grade HEPA filters in series. The HEPA filters are rated to remove particles as small as 0.3-μm with a rated efficiency of no less than 99.97%. The filters used in the DST ventilation systems have face dimensions of 24 x 24 inches, and are 11 ½ inches in depth. The filters are rated for maximum pressure drop of 1.0 inch W.G. at 1000 cfm.

The HEPA filter media is treated with a water-resistant binder and will tolerate both high humidity and direct wetting. However, long-term exposure to excessive amounts of moisture, either from airborne droplets or condensation on the element, can completely plug the filter and can result in failure by over-pressurization or degradation of performance.

The HEPA filters have frames made from corrosion resistant stainless steel. The filter media is bonded to the frame with a fire-retardant urethane sealant.

The HEPA filters are installed in a stainless steel housing. The housings have filter test sections, monitoring instrumentation, and have insulation 2-inches thick on their outer surface to help reduce the heat transfer from the housing, thus reducing the opportunity for condensation.

The exhaust fans are automatically shutdown upon detection of high differential pressure across the first stage of HEPA filtration and low differential pressure on the second HEPA filter. High differential pressure indicates blockages caused by an accumulation of solids in the filters. Low differential pressure indicates the failure of a HEPA filter.

Other exhaust train components aid the HEPA filter performance. For example, the pre-filters, located upstream of the HEPA filters, increase the life of the HEPA filters by trapping larger airborne particles. The pre-filter allows for a more economical operating system and As Low As

Reasonably Achievable (ALARA) concepts are applied through less frequent replacements of the HEPA filters.

The heaters are located after the de-misters and before the pre-filters. The heaters decrease the relative humidity of the air by increasing the air temperature. The heaters (Indeeco® No. 83) provide up to 10 Kilo-Watts (KW) of heat to the air stream.

The AW and AN heaters are controlled with a temperature differential controller. This controller monitors the temperature of the air upstream of the heater and in the filter housing. The controller then maintains a desired temperature difference of approximately 30°F between the two points. This temperature is based on actual field measurements (see Attachment 1).

The AP farm heaters use temperature and pressure interlocks for heater control. The heater provides full output (10 KW) until a downstream high-temperature set point is reached. At that time, the heater would be shut off and not reactivated until the temperature goes below the high set point. In addition, pressure sensors indicate flow conditions in the ductwork and shut the heaters off in a low flow condition.

3.4.2 SY Primary A-Train Exhauster

The primary A-train exhauster consists of an air stream heater, a pre-filter, two HEPA filters in series, and a fan. The primary A-train exhaust train is a single train system.

As with the east farm systems, the HEPA filters provide primary control of radioactive particulate emissions to the atmosphere. The primary A-train exhaust train contains two Nuclear Grade HEPA filters in series. The HEPA filters are identical in size and rating to those contained in the east tank farm systems.

The exhaust fan is shutdown automatically upon detection of high differential pressure across the first stage of HEPA filtration and low differential pressure on the second HEPA filter.

As was the case for the east area exhaust trains, components aid the HEPA filter performance. The pre-filter, located upstream of the HEPA filters, increases the life of the HEPA filters by trapping larger airborne particles.

The heater is located after the de-mister and before the pre-filter. The heater decreases the relative humidity of the air by increasing the air temperature. The heater (Nutherm® No. BSC-5721) provides up to 9 KW of heat to the air stream. Although 1 KW lower than those heaters in the east area, this is not a concern because the analysis shows this is acceptable.

The primary A-train heater is controlled with a temperature controller. This controller monitors the temperature of the air upstream of the heater and in the filter housing. The controller then maintains a desired temperature difference of approximately 20°F between the two points.

3.5 Exhaust Stacks

The exhaust stacks for all of the primary ventilation systems evaluated contain a record sampler and a continuous air monitor (CAM).

The ventilation system is monitored to ensure the HEPA filters are functioning properly. The exhaust fans shutdown automatically on high stack radiation.

3.5.1 AN, AP, and AW Exhaust Stacks

The AN, AP, and AW exhaust systems have a 10-inch diameter stacks.

3.5.2 SY Exhaust Stack

The SY primary A-train exhaust system has an 8-inch diameter stack.

3.6 Condensation Collection System

3.6.1 AN, AP, and AW Exhausters

Condensate that is removed from the air passing through the de-mister and exhaust train is routed to seal-pots by a network of 1-inch and 3-inch diameter drain lines.

Each de-mister and the de-mister pits have 3-inch diameter drain lines. These drain lines connect the de-misters and pits with a seal-pot that collects the condensate. The seal pot has a 3-inch line that returns the collected condensate to a waste tank.

Drain lines are also present in the exhaust trains to collect and route accumulated condensation back to the tanks (via a seal pot). The AN, AP, and AW exhaust trains have 1-inch diameter drain lines servicing the heater and pre-filter. The AP and AW ventilation systems also have 1-inch diameter drain lines servicing the HEPA filters and exhaust fan. However, the AN ventilation system does not have drain lines servicing each HEPA filter sections or the exhaust fan.

3.6.2 SY Primary A-train Exhauster

Condensate that is removed from the air passing through the de-mister and primary exhaust train is routed to a seal-pot by a network of 1-inch diameter drain lines.

Three 1-inch drain lines service the de-mister housing. These drain lines connect the de-mister to the seal-pot and collect the condensate removed from the air stream.

One-inch drain lines remove condensate that may form in the primary A-train exhaust train. Drain lines are located in the heater plenum, pre-filter, first HEPA section, test section, second HEPA section and the fan housing. These drain lines collect and route the condensate to the seal pot.

4.0 DISCUSSION OF ALARACT EVALUATION

This ALARACT demonstration evaluated the ability of the abatement and control technologies in the DST ventilation systems to function during SST waste transfers as part of the Interim Stabilization Project. The DST ventilation systems were also evaluated against the technology standards identified in Washington State Code (WAC) 246-247, *Radioactive Air Emissions,* as well as other governing codes and standards.

Several DST farms will receive SST waste as part of the Interim Stabilization Project. The ventilation system evaluation performed as part of this ALARACT demonstration specifically evaluated the AW, AN, AP and SY tank farms. Only DST farms scheduled to receive saltwell waste were evaluated in this ALARACT demonstration (the AY and AZ farms were therefore excluded).

Of the farms identified above, only the AP and SY farms are scheduled to receive SST waste prior to new ventilation systems being installed at the farms. Therefore, a full evaluation of the effects of SST waste transfers on those ventilation systems was performed. The AN and AW farms are not scheduled to receive SST waste prior to a new ventilation system being installed at the farms. Even though they will not be receiving SST waste, a partial evaluation was still performed on the AN and AW systems. The only reason for the partial evaluation was that the AN and AW systems are similar in design to the AP system and that a partial evaluation did not take additional time or funding. The partial evaluation is the same as for the AP and SY farms, with the exception of the stack sampling system.

As indicated earlier in this report, SST waste transfers into the DSTs will be liquid waste transported by way of pipes. The waste will be introduced into the DSTs either by falling directly through the vapor space of the tank by way of a tank riser, or discharged below the surface of the waste. In either case, changes to the DST vapor space will occur. These changes include environment changes, such as temperature, en-trained moisture (e.g., aerosol particles), and humidity. This evaluation focused on the free falling type of discharge method into the tank vapor space because this transfer method is the bounding condition

As a result of the SST waste transfers, the following changes to the vapor space were identified as having possible effects on the control technologies of the ventilation system.

1. Increased radionuclide particles in the vapor space. The ventilation system must safely remove radioactive particulate from the air-stream before this stream is released to the atmosphere.

2. SST waste transfers into the DSTs easily possess the potential to increase the moisture content in the vapor space of the DST. This will also result in an increase in the moisture of the air stream being pulled from the vapor space and may lead to:
   a) HEPA filter degradation by "plugging" the filters.
   b) Excessive condensation in the ductwork and exhaust trains.

The radionuclide particulate emission control and abatement technologies in the DST primary ventilation systems were evaluated against the above conditions. Section 4.1 describes the emissions and technologies used to control radiation release to the atmosphere. Section 4.2 presents

the evaluation of the ventilation system equipment to control the emissions during SST waste transfers. Section 4.3 presents the results of the code and standard evaluation.

4.1 Vapor Space Emission Characterization and Abatement

The nature of the SST waste to be transferred to the DSTs is such that possible air emissions from various radionuclide, organic, and inorganic compounds are expected. The vapor spaces in the DSTs are anticipated to contain a mixture of solid and liquid particulate matter (aerosol) and vapors. Emission estimates have been developed for the DSTs while receiving SST liquids based upon characterization of the waste to be stored in the DSTs as waste-feed for the Waste Treatment Plant (WTP).

The radionuclide emissions of concern when saltwell pumping liquid waste from a SST into a DST will be in the form of particles. This is based on process knowledge of the radiological content of the DSTs and SSTs and previously permitted activities such as "Saltwell Pumping Tanks 241-SX-101, 241-SX-102, 241-SX-103" AIR 00-108 (Ref. 7) and "Rotary Mode Core Sampling [RMCS] Systems 3 & 4, Rev.1" AIR 98-301 (Ref. 8). These WDOH approvals concur with the conclusion that radionuclides in particulate state comprise well over 90% of the potential emissions from these tanks. This section will address the ability of the ventilation system to control the release of radionuclide particles to the atmosphere.

The primary control technology to abate the release of particulate emissions is HEPA filters. HEPA filters are used at DOE and commercial nuclear sites to control particulate emissions, and have an extensive successful operating history.

Each exhaust train in the DST farms contains two Nuclear Grade HEPA filters in series. Each HEPA filters is made of Nuclear Grade throw-away dry-type extended-media in a rigid frame having minimum particle collection efficiency of 99.97% for 0.3-μm median diameter, thermally generated mono-dispersed dioctylphthalate particles or other specified challenge aerosols. Pressure drop of a clean filter is a maximum of 1-inch water gauge at rated flow. In addition, the HEPA filters meet the requirements of ASME AG-1, Section FC and are tested in-place annually to the requirements of ASME N510 (Ref. 9), with guidance from ERDA 76-21 (Ref. 10), for an efficiency of 99.95%.

The test sections in the filter housing provide a means for in-place testing of the HEPA filters. One test section is located after the pre-filter and upstream of the first HEPA filter section. The second test section is placed between the first HEPA filter and the second HEPA filter housing.

Therefore, given the fact that the HEPA filters are in sound functioning order, they will prevent the release of radionuclide particles to the atmosphere within the governing codes and limits. An increase in the particle concentration in the vapor space due to SST waste transfers will not affect the function of the HEPA filters.

4.2 Increased Moisture in the Vapor Space

Waste transfers for the Interim Stabilization Project will be liquid waste transported by way of pipelines from the SSTs to the DSTs. Introduction of the waste is expected to increase the two sources of moisture in the vapor space; aerosols (i.e. fog and droplet) and humidity.

An analysis was performed to evaluate the primary ventilation system during periods of increased moisture in the vapor space. The analysis is provided in Attachment 1. Input from previous waste transfer analyses performed by May (Ref. 3) and Bailey (Ref. 2) were used and considered in the Attachment 1 analysis.

The analytical methodology used to evaluate the effects of increased moisture in the ventilation system is summarized below.

1. The aerosol mass loading of the air entering the ventilation system was determined. This includes the generation of aerosols by both mechanical (i.e. free falling waste) and natural methods.

2. The ability of the de-misters to remove the entrained moisture in the air was evaluated.

3. Extreme environmental conditions (e.g., humidity and temperature) both inside the exhaust train and for the outside air were developed.

4. Based on the conditions identified in Item 3, an extreme heat loss was applied to the air in the ventilation system and the amount of condensation was calculated.

5. The ability of the ventilation system to process the extreme condensation was determined.

These steps are summarized in the following sections.

4.2.1 Aerosol Mass Loading in the Tank Vapor Space

Condensation and mechanical generation represent the sources for aerosols in the tank vapor spaces.

Mechanical aerosols are generated when water falls through air. Aerosols are created by the kinetic energy of the water overcoming the surface energy of the water to create a larger number of smaller droplets (May, Ref. 3). The sizes of the droplets are dependent upon the available kinetic energy (i.e. velocity) of the water. The droplets will be smaller as the kinetic energy available increases (i.e. the faster the water is traveling). Finer droplets are more likely to stay suspended in the air, and thus create higher mass loading in the tank vapor space.

Mechanical aerosol generation in a tank vapor space due to waste transfer activities was evaluated by May (Ref. 3). Theoretical calculations and data from aerosol tests (Tank 241-C-106 sluicing tests) were used to provide a correlation between the aerosol mass loading in vapor space and the transfer velocity of the waste. A correlation for the mass loading of mechanically generated aerosols as a function of the velocity of the waste being discharged into the vapor space was developed and is presented in the May report (Ref. 3).

The correlation developed by May was used in the Attachment 1 calculation to determine the aerosol mass loading from the falling waste. The discharge velocity of the waste was based on transfers from three possible sources, 1) a SST, 2) the cross-site transfer line, and 3) the Double Contain Receive Tank (DCRT). A velocity of 4.5 ft/sec is expected from the DCRT (based on the 100 gph rating on the pump and a 3-inch transfer line, see Attachment 1). This was the highest velocity identified out of the three sources, which results in the highest mass loading of mechanically generated aerosols. To provide conservatism and a safety margin, a transfer velocity of 18 ft/sec (four-times) was used to completely bound the possible velocities from these sources, thus bounding the mechanically generated aerosols.

Aerosols in the air may also be generated due to condensation. These aerosols are formed when water saturated air sub-cools in the presence of nucleation sites (e.g. dust and smog). Video observations made of various tank vapor spaces have found visual "fogs" present (Werry, Ref. 6). In addition, when camera equipment is lowered into the tank vapor spaces in the winter months, condensation forms on the camera lens.

A mass loading for condensation aerosols in the vapor space was provided by May (Ref. 3). As was the case for the mechanically generated aerosols, for conservatism the analysis in Attachment 1 applied a factor of four to the condensation aerosol mass loading predicted by May (Ref. 3) to provide safety margin and bounding conditions.

The following mass loading for the aerosols were determined (Attachment 1):

Mechanical	0.94 e-6 lb/ft^3
Condensation	2.49 e-6 lb/ft^3
Total	3.43 e-6 lb/ft^3

A comparison was made between the total aerosol mass loading calculated for the tank farm de-misters and the requirements identified in ASME N509 (Ref. 6) for de-misters. De-misters manufactured to ASME N509 specifications are required to remove 99% by weight of the entrained moisture in an air stream having 1.5 to 2 lbs/ft^3 of entrained moisture. The total aerosol mass loading predicted in the tank vapor space, as identified above, is 3.43 e-6 lb/ft^3. This mass loading is considerably lower than the design requirement for mass loading of ASME N509 moisture separators.

Once the quantity of aerosols was determined, the remaining variable to evaluate was the size of the aerosol particles. May (Ref. 3) reported the following typical sizes for various aerosols (which is in agreement with data provided by ASHRAE):

TABLE 1

Aerosol Condition	Typical Size Distribution
Mists	0.01 to 10 μm
Clouds and Fogs	0.1 to 100 μm
Sprays	10 to 5000 μm
Rain	> 100 μm

In addition, a correlation between the falling waste velocity and the maximum aerosol size generated was provided as part of the May (Ref. 3) report. The May correlation was used in the Attachment 1 calculation to predict the maximum aerosol size in a DST during SST waste transfers. The correlation was used with the transfer velocity of 18 ft/sec to calculate a maximum mechanical generated aerosol size of 280 μm. However, aerosols having a size of 280 μm will quickly fall out of the air due to gravity. Therefore, the maximum size of the mechanical aerosols was set to the maximum size of fog, 100 μm. The minimum size mechanically generated particle was assumed to be 1-μm. This assumption was based on a relatively "small" size for fogs and is lower than typical for mechanically generated sprays.

The condensation aerosols in the tank vapor space were assumed to have sizes corresponding to fogs and clouds. This assumption was based on the nuclei (i.e. the dust that condensation will form on) in the tank vapor space being similar to that in common air. Therefore as the data in Table 1 indicates the size of the fog in the tank vapor space is assumed to range from 0.1 to 100 μm.

4.2.2 De-mister Operation

The ability of the de-misters to remove these aerosols from the air stream and to handle the quantity of these aerosols was evaluated in Attachment 1.

As stated in Section 3 of this report, the de-misters at the AN, AP, and AW farms will remove 99% of the particles greater than 20-μm in diameter. To determine the quantity of the aerosols in the vapor space that are smaller than 20-μm in size, the size of these aerosols was assumed to follow a standard-normal statistical distribution. The 99th percentiles of the condensation and mechanical aerosol populations were set equal to the calculated maximum sizes of 100 μm for both populations. The 1st percentiles of these populations were set equal to the minimum size, 0.1 μm for the condensate aerosols and 1 μm for the mechanical aerosols.

Using a standard statistical Z-table, the estimated quantity of aerosols from both populations under 20 μm was determined. The 1% inefficiency of the de-mister was accounted for. The Attachment 1 calculation found the quantity of aerosols passing the de-misters to be 0.002 grain per cubic feet of air. Since this quantity is so small, it was ignored.

The SY primary A-train ventilation system contains an in-line Kimre Inc. B-Gon™ de-mister. This de-mister has an efficiency rating of 99.49% for 4 to 6 micron particles with a corresponding air stream velocity of 5.2 ft/s (479 cfm) (see Attachment 1 evaluation). The efficiency of this de-mister increases slightly with increasing flow. At a velocity of 8.2 ft/s (755 cfm), this de-mister has an efficiency of 99.58% for 4 to 6 micron particles. To evaluate the primary A-train de-mister, the efficiency at the lower velocity was used. The primary A-train exhauster is rated at 1000 cfm. Therefore, the efficiency of the de-mister is at least 99.49% for 4 to 6 micron particles at the rated flow conditions for the SY primary A-train. The quantity of particles passing the primary A-train de-mister is also small enough to ignore, given the fact that the primary A-train exhauster has a higher efficiency of removing smaller particles than the AN, AP, and AW exhausters.

The ability of the AN farm de-misters to handle the quantity of aerosols and water vapor generated by SST waste transfers (as part of the waste retrieval operations) was evaluated by Bailey (Ref. 2).

Specifically, the total mass loading of aerosols and water vapor, as a function of the ventilation system flow rate and the waste temperatures in the tanks, was calculated.

In the Bailey analysis, ventilation system flow conditions ranging from the current 1000 cfm up to 3000 cfm and tank waste temperatures up to the Limiting Condition of Operation (LCO) of 195°F were evaluated. The capacity of the de-misters (each rated at 0.25 lbm water/sec [Bailey Ref. 2]) was compared to the total quantity of water (aerosols and water vapor) entering the ventilation system.

For this ALARACT demonstration, the total mass loading predicted for a flow of 1000 cfm (the flow rating of the HEPA Filters) calculated by Bailey was compared to the capacity of a single de-mister in the Attachment 1 calculation. It was determined that a single de-mister can handle the water mass in the air (both aerosol and water vapor) for all but the extreme temperature conditions in a tank (i.e. at or above 190°F). However, both the Attachment 1 calculation and Bailey (Ref. 2) concluded that it is not realistic for the entire mass of water vapor in the air to be condensed by the de-mister. This is based on the fact an extreme temperature difference would have to be maintained between the de-mister and the air stream to precipitate the entire water vapor content. The temperature changes in the tank waste and vapor space resulting from waste transfers generally occur over days and weeks. Ventilation system temperature measurements corresponding to a waste transfer in the AW farm confirm this assumption (see Attachment 1). Therefore, the temperature of the de-mister and air stream will have time to adjust and move towards a steady-state condition and not maintain the low temperatures required to flash cool the air stream.

A similar approach was taken for the primary A-train de-mister at the SY farm. For this system, the aerosol mass loading was combined with an extreme amount of condensation predicted during saltwell transfers (the extreme conditions for condensation during saltwell transfers are discussed in Section 4.2.3 of this report). A scenario was developed where environmental conditions (tank temperatures, waste temperatures ambient conditions, etc.) combine to form an extreme amount of condensation throughout the exhaust train (i.e. in the filter housings, fans, and stack, see Section 4.2.3 for details). The extreme amount of condensation is approximately 5 gallons per hour. For conservatism, it was assumed that the 5 gallons per hour predicted for the exhaust train would occur entirely in the de-mister. It was concluded that the drainage capacity of the primary A-train de-mister could handle the predicted 5 gallons per hour described above (Attachment 1).

4.2.3 Extreme Conditions for Condensation in the Ductwork and Housing

In this section, the water vapor contained in the air stream that passes through the de-misters will be evaluated. This water vapor has the potential to precipitate out of the air stream in the form of condensation.

Condensation in the ductwork (and related equipment) may form through one or two primary mechanisms. The first is the condensation of water vapor from the air-stream because the temperature inside the duct drops below the saturation temperature of the air (a.k.a., the dewpoint temperature). The second is through "localized" condensation formed by air coming into contact with surfaces that are below the saturation temperature to form condensation on these surfaces.

Both the quantity of vapor in the tank exhaust air and the amount of this vapor that will come out of solution in the ventilation system is dependent on many environmental factors. These factors include:

- Ambient Conditions (i.e. humidity, temperature, wind, and solar radiation)
- Waste Temperature and Quantity
- Air Flow Through the Ventilation System
- The Output of the Ventilation System Heater
- Heat Loss in the Ventilation System (a function of insulation and geometry)

The Attachment 1 calculation used an extreme scenerio to evaluate the condensation in the ventilation system. In this scenerio, extreme conditions combine to create unusually high amounts of condensation to challenge the ventilation system. In summary, the extreme scenerio corresponds to the warmest air with the highest relative humidity entering the ventilation system and then being cooled to the maximum extent. To produce these conditions in the ventilation system, the high temperatures normally seen in the tanks during the summer months were extended into November. In November, it was assumed that the ambient conditions changed radically, and record low temperatures occurred. The details on this analysis are presented in the following sections.

4.2.3.1 Inlet Temperature and Humidity

First, the humidity of the air exiting the tanks was evaluated. Psychrometric measurements taken on tanks in the AN-farm were reviewed (Attachment 1 calculation). Measurements conducted on a winter day (24°F ambient) with high ambient humidity (90-100% Relative Humidity [RH]) found that the relative humidity of the air exiting four of the seven tanks approached 100% RH. It should be noted that three of the tanks had humidity less than 100% RH. In addition, two of the flow rates were very low (< 30 cfm). Based on these measurement data, the Attachment 1 calculation assumed the air exiting all of the tanks would be at 100% RH. This case represents the extreme scenerio.

The temperature of the air entering the ventilation system was based on measurement data and analysis results provided in Bailey (Ref. 2). In the Bailey report, the ventilation system inlet temperature was determined as a function of tank waste temperature. Specifically, the waste temperatures in six of the AN farm tanks were set to their seasonal high temperatures. The temperature in the remaining tank was allowed to vary up to the LCO temperature of 195°F (due to the operation of mixing pumps in that tank).

The waste temperatures of all the SY tanks and in randomly selected AN, AP, and AW tanks were evaluated to provide input for the Bailey temperature correlation. It was observed that the waste temperatures generally fluctuate seasonally (see Attachment 1 calculation). The maximum waste temperatures generally occur in September (slightly lagging behind the summer months), and the minimum temperatures generally occur in March (slightly lagging behind the winter months).

The maximum observed waste temperature in November for the east tank farms (AN, AW, and AP) was 95°F. The highest observed temperature from any tank examined, both east and west area, was approximately 125°F in Tank SY-101 (January 2001). Of particular interest is the data from Tank

SY-102. This tank currently receives saltwell waste. The peak temperature reading from this tank was 115°F during a SST waste transfer (November 2000).

Based on the above temperature data, and to provide conservatism to the analysis, a tank waste temperature of 130°F was selected as input to the Bailey temperature correlation. This waste temperature corresponds to a predicted ventilation inlet temperature of 85°F.

The calculated value of 85°F was compared to randomly selected temperature measurements from the AP and AW tank farms during November. The calculated value of 85°F was approximately 30°F higher than the highest measured temperature for November in these tank farms. Again, this provides conservatism to the analysis.

4.2.3.2 Heat Transfer and Condensation in the Exhaust Train

Now that the extreme conditions for the air entering the exhaust train are defined (humidity and temperature), the final step to determine the amount of condensation is to calculate the heat loss from the air in the exhaust train. An analytical and/or computer based model of this system would be relatively complex. For example, the model would have to account for conditions in the tanks (waste temperatures, humidity, and waste quantities), the environment (i.e. wind, humidity, and solar energy), and the ventilation system (i.e. materials, flow, and geometry). Such a model was not developed for this ALARACT demonstration. In its place, measurement data and standard heat transfer methods were used to calculate the heat loss through the exhaust train.

The sensible heat loss by air flowing through a duct is calculated by the following equation:

$Q = 1.08 * Flow * (\Delta T)$ (Eq. 1) (Ref. 11)

Where:

Q = The heat loss of the air, Btu/hr
Flow = The flow of the air in the ductwork, cfm
ΔT = Temperature difference between two points in the ductwork, °F

In our case, temperature measurements are made at two locations in the ventilation systems. Temperature and relative humidity measurements are taken annually in the DST ventilation system exhaust stacks. In addition, the temperature of the air stream after the heater is recorded daily as part of the tank farm maintenance/surveillance program.

The available temperature measurements and Equation 1 provide an easy way to calculate the heat loss of the air. However, a shortfall of the available data is the lack of direct correlation between the times of day these measurements were taken. The lack of correlation makes it difficult to know if an accurate heat loss is calculated from the measurement data. On the other hand, the goal of this evaluation is to predict an extreme scenerio. Therefore, the data were used in such a way as to err on the side of overestimating the "real" heat loss. To calculate the heat loss in Equation 1, the maximum daily temperature recorded after the heater during the week in which the stack temperature measurements were taken was used in conjunction with the with the measured stack

temperature. This method correlates the highest measured temperature from the heater (during the relative time period of the stack measurement) to the measured stack temperature.

Using the temperature measurement data and Equation 1, the heat loss from the air traveling through the exhaust train was calculated. The heat loss from the air inside the exhaust train (from the heater to the stack) is equal to the heat loss to the environment through the exhaust train (from the heater to the stack). This is based on no other known method for energy transfer except for the heat input to the air from the operation of the fan. Since the heat addition to the air from the fan is insignificant, it will be considered negligible for this evaluation. From a very simplified view point, the heat transfer from the exhaust train to the environment can be expressed as:

$Q = U * A * (\Delta T)$ Btu/hr (Eq. 2) (Ref. 11)

Where:

- Q = The heat transfer
- U = The overall heat transfer coefficient
- A = The heat transfer surface area
- ΔT = Temperature difference between two sources

In this case, we know the heat loss from the air temperature measurements. Therefore, we will solve Equation 1 for the term U*A as follows:

$U * A = Q / (\Delta T)$ (Eq. 3)

Again, the Q in the above equation is the heat lost by the air from the heater to the stack (Equation 1). The temperature difference in Equation 3 is between the inside of the exhaust train and the outside air. The temperature inside the exhaust train was taken as the average of the temperatures used in Equation 1 (i.e. the average between the exhaust stack temperature and the corresponding maximum heater temperature). The average daily temperature reported by the Hanford Weather Station on the day of the stack temperature measurement was used as the outside air temperature. The U*A terms (Equation 3) were then calculated.

Now that the term U*A is known, Equation 3 can be used to calculate the heat loss from the exhaust train to the environment for various ambient temperatures. An extreme amount of condensation in the exhaust train can be determined by subjecting warm, moist air in the exhaust train to high heat loss. In order to assure complete certainty and conservatism, only the highest U*A term calculated from the measurement data was used for this purpose in the Attachment 1 calculation, and the highest term was increased by 25%. This approach is consistent with the factor of four margin previously used in the Attachment 1 calculation.

For the extreme case, the outside air temperature was set to –13°F. The ambient temperature of -13°F corresponds to the lowest recorded temperature during the month of November at the Hanford site (see Attachment 1 calculation).

The properties of the air entering the exhaust train were defined in Section 4.2.3.1 as:

T= 85°F

RH = 100%

To calculate the extreme condensation in the exhaust train, it will be assumed that the heater is off (i.e. 0 KW of heat is added). Therefore, the inlet temperature and humidity above will be used to determine the amount of condensation.

The heat loss to the environment could be calculated using the inlet temperature. However, this is unrealistic. Instead, the average temperature in the exhaust train (defined as the average temperature between the stack and the inlet) will again be used for Equation 3. However, the temperature of the air at the stack is still unknown. To calculate the stack temperature, we will again use the fact that the heat loss by the air in the exhaust train (i.e. the energy loss by the air traveling through the exhaust train) is equal to the heat transferred to the environment.

Equation 1 can no longer be used to determine the heat loss by the air because the air is at 100% RH. Both latent and sensible cooling must now be accounted for. The sensible and latent heat loss by air and water vapor flowing through a ductwork is calculated by the following equation:

$Q = 4.5 * Flow * (Th2 - Th1)$ (Eq. 4) (Ref. 11)

Where:

Q = The heat loss of the air, Btu/hr
Flow = The flow of the air in the ductwork, cfm
Th1 = Inlet enthalpy of air/water mixture Btu/lbm of air
Th2 = Exit enthalpy of air/water mixture Btu/lbm of air

To determine the heat loss by the air in the extreme case, Equations 2 and 4 were set equal to each other. The stack temperatures corresponding to the inlet conditions of 85°F and 100% RH, the outside temperature of -13°F, and the high U*A factor determined from the measurement data above was solved for using the following flow rates:

Flow rate: 500, 750 and 1000 cfm

The condensation was determined by subtracting the difference in water content between air at 100% RH at the inlet temperature of 85°F and that of the calculated stack temperature. The most condensation was calculated for the flow rate of 1000 cfm. Using the extreme conditions, approximately 5 gallons per hour (gph) of condensate was calculated in the ventilation system.

4.2.4 Ventilation System Processing of Humidity and Condensation

The quantity of condensation in the primary ventilation systems will range between none to a theoretical worse case condition discussed in the previous section. The ability of the ventilation systems to process these conditions will be reviewed in this section.

The primary ventilation systems are designed to both reduce the occurrence of condensation and to drain possible condensate out of the system. Equipment designed to reduce the occurrence of condensation includes the de-mister, heaters, and insulation (on the exhaust train).

Drain lines are also present in the exhaust trains to collect and route accumulated condensation back to the tanks (via a seal pot). The SY (primary A-train), AN, AP, and AW farms have 1-inch diameter drain lines servicing the heater and pre-filter. The SY (primary A-train), AP and AW ventilation systems also have 1-inch diameter drain lines servicing the HEPA filters and exhaust fan. The AN ventilation system does not have drain lines servicing the HEPA filters or the exhaust fan. Therefore, condensation may accumulate in that system in the filter and fan housings.

As discussed in Section 4.2.2, the de-misters are very effective in removing the entrained water particles from the air stream. The de-misters in all of the tank farms evaluated were determined to be capable of processing the condensation and aerosols predicted to occur. It should be noted that some condensation might occur in the de-misters. This will decrease the water vapor available to condense in the exhaust train. However for conservatism, no credit was taken for condensation in the de-misters.

HEPA filters are designed to withstand humidity levels well into the 90% range for short periods of time without being damaged (Ref. 5). If the filters are wet, they actually work more efficiently by not allowing larger particles to pass. However, if the filters get dirty and/or wet to an 'excessive' degree, there will be a noticeable increase in the differential pressure readings across the filters (Ref. 5). Thus increasing the possibility for filter damage and reduced performance.

All of the primary exhaust trains in the SY (primary A-train), AP, AN, and AW farms have heaters before the pre-filter. The ability of the heater to prevent condensation on the filters was evaluated in the Attachment 1 calculation. It was determined that under the extreme conditions provided above, the air in the SY, AN, AP, and AW exhaust trains will remain above the dew-point temperature up to the exit of the filter housing, downstream of the last filter. The heaters, therefore, protect the pre-filter and HEPA filters from excessive condensation build-up.

In addition, the differential pressure across the filters is monitored. In the unlikely event that condensation on the filters starts to plug the filters (for example, if the heater is down when the air-stream has high humidity) the differential pressure will indicate the filters are plugging and approaching operational limits. In this scenerio, the back-up train will be engaged.

4.3 GOVERNING CODES AND STANDARDS

As part of the ALARACT demonstration, the ventilation system equipment and processes were evaluated against WAC 246-247-130 and 075.

A compliance matrix for the four farm ventilation systems was compiled and is presented as Attachments 2 through 19 to this demonstration. The following control technology standards were considered in this compliance matrix:

- ASME/ANSI AG-1, *Code on Nuclear Air and Gas Treatment*
- ASME/ANSI N509, *Nuclear Power Plant Air-Cleaning Units and Components*
- ASME/ANSI N510, *Testing of Nuclear Air Treatment Systems*
- ANSI/ASME NQA-1, *Quality Assurance Program Requirements for Nuclear Facilities*

Since the component sections from ASME N509 are being replaced by ASME AG-1; and the WAC recognizes that AG-1 will take precedence on any discrepancies between the two requirements, the assessment was performed against AG-1. Furthermore, since ASME AG-1 also identifies NQA-1, a separate evaluation matrix of NQA-1 was not created, but included as part of the AG-1 assessment.

A separate matrix was also not created for ASME N510. This was due to the fact that the only deviations that would be necessary from the N510 requirements would be those related to the testing deviations identified as part of ASME AG-1. Those deviations are the factory acceptance pressure testing and field acceptance pressure testing. The in-place aerosol test portion of ASME N510 is being met.

The results of the evaluation indicate several components did not meet the requirements of the above codes and deviations were necessary. These components are identified with a "Deviation Required" (DR) identifier in the attached tables. All of the components identified with a "DR" are considered acceptable based on past operating history. Concurrence of this ALARACT demonstration by the State of Washington Department of Health constitutes approval of the deviations. See Attachments 2 through 19 for the details on this evaluation.

The SY primary A-train and AP ventilation systems were also evaluated against the sampling system requirements of 40 CFR 61.93 and WAC 246-247-075. These ventilation systems were chosen because their farms are scheduled to receive waste before the ventilation systems are replaced.

4.3.1 SY Primary A-train Sampling System Design

The following is a summary of the SY primary A-train exhauster sampling system design with respect to the requirements of 40 CFR 61.93 and WAC 246-247-075.

The primary A-train stack is an 8-inch Schedule 40 pipe with an inside diameter of 7.981 inches. According to ANSI N13.1-1969, Attachment 1, Paragraph A3.2: "For ducts less than 8 inches in diameter (20 cm), one sampling point is adequate." There are two individual sampling probes with single nozzles, each, installed in this stack. One probe is connected to a beta CAM; the other is connected to a record sampler.

The tips of both probe nozzles are approximately 62 inches from the top of the stack and 16 inches above the ports where stack flow measurements are taken. The nozzle tips are equally spaced within this stack cross section. Each nozzle has an inside diameter of approximately 0.326 inches. From the nozzle tip, the probe nozzle expands by 8 degrees to reduce sample loss. After the expansion, the probe nozzle bends with a 4.5-inch radius.

Placed in the same plane as the sample probe nozzles is a static and a total pressure manifold. Above these is installed an instrument which measures stack flow temperature. These are connected to appropriate instrumentation that provides for continuous stack flow measurement readouts. These readouts are automatically density compensated for temperature and pressure changes.

The sample flows are controlled to maintain isokinetic sampling. Deposition 2.0 (Ref. 4) computations provide the following 10-micron sized particle collection efficiencies for the CAM and Record Sampler system:

Free Stream Velocity (CFM)	750	900	1050
CAM (%)	73.7	72.2	70.6
Record Sampler (%)	72.6	71.3	69.9

4.3.2 AP Exhauster Sampling System Design

The following is a summary of the AP exhauster sampling system design with respect to the requirements of 40 CFR 61.93 and WAC 246-247-075.

The AP stack is 10 inches in diameter. Two sampling points are recommended in ANSI N13.1-1969, Attachment 1, Section A3.2 (ANSI 1969), for this size stack, 10 inches. There are two separate identical sampling probes with two nozzles on each of these probes. One probe is routed to a record sampler. The other probe is routed to a CAM.

The sample probe assembly is located 8 ft above the fan discharge point into the stack and 20 inches below the top of the stack. Stack flow rate measurements are taken annually from two ports located 90 degrees apart and which are 9.5 inches below the probe assembly.

The sample extraction flow rates are held constant. Deposition 2.0 (Ref. 4) computations provide 10-micron sized particle collection efficiencies for the Record Sampler system of between 37.5 and 73.5 percent.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

In conclusion, it has been determined that the control technology, as described in this evaluation, for the emission units evaluated is adequate to support SST Interim Stabilization Project saltwell pumping.

An increase in the moisture content of the air stream (due to SST waste transfer) has the potential to affect the performance of the HEPA filters. The primary concerns from the increased moisture is plugging of the filters due to condensation on the filter face and pooling in the filter housing.

The ventilation systems use several technologies to prevent and/or minimize condensation in the exhaust train. The three primary moisture control technologies are:

- De-misters (removes entrained water particles from the air stream)
- Heaters (to decrease the relative humidity of the air stream and vaporize entrained water particles)
- Drain lines (to remove pooling condensate)

The ability of the de-misters to remove the aerosols in the air stream generated by SST waste transfers was evaluated. It was determined that the de-misters are capable of processing the increased water particles generated during SST waste transfers.

Extreme conditions were used to evaluate the possible condensation in the exhaust trains. Measurement data and standard heat transfer equations were used to perform the evaluation. The ability of the heaters to reduce the condensation through the filter housing was evaluated. Again, extreme heat loss through filter housing was used. It was determined that the AN, AW, AP and SY heaters maintained the air stream above its dewpoint until the end of the filter housing, downstream of the last filter. Therefore, the heaters reduce possible condensation on the filters and help prevent failure from plugging.

A compliance matrix for the four farms was compiled and is presented Attachments 2 through 19 to this demonstration. The results of the evaluation indicate several deviations are necessary due to the lack of documentation to show whether the component meets the requirement. All of the components identified with "Deviation Required" are considered acceptable based on past successful operating history. Concurrence of this ALARACT demonstration by the State of Washington Department of Health constitutes approval of the deviations.

5.2 Recommendations

Based on the system review and analysis performed for this ALARACT demonstration, the following recommendations are presented for implementation when saltwell pumping directly from a SST to a DST :

1. The heaters in the ventilation system should be functional in the winter months while receiving SST waste. When this ALARACT demonstration was performed, the heater in one of the AW-farm ventilation trains was not functioning. A work order was being processed to replace/repair this heater. It is recommended that this work be completed in a timely manner in order to have a fully functioning backup train in this ventilation system.

2. If SST waste transfers are planned for the AN-farm before the new ventilation system is in place, drain lines should be installed in the HEPA test sections and the fan housing. Under certain conditions, condensation will accumulate in these locations. To prevent the accumulation of water in the ventilation system, it is recommended that drain lines (to the seal pot) be installed in these locations.

3. During the review of the ventilation systems for this ALARACT demonstration it was noted that Drawing H-14-020103 Rev. 1 shows the flow through the AP farm as 0-1170 cfm. The HEPA filters for these systems are tested and rated for a flow of 1000 cfm. It is recommended that the drawings and design aspects for these systems reflect a flow rate equal to or less than the rated flow of the filters.

4. This recommendation applies to 241-AN and AW only if SST interim stabilization waste is transferred in these farms. The temperature controllers in both the AN and AW farms need to be examined. Field data shows a temperature difference of approximately 30 to 40°F. However, discussions with tank farm personnel indicate the temperature controllers are set at approximately 10°F. The controller set point and the actual field operation do not correlate. The differential temperature needed to support the conclusions of this report is approximately 30°F for these farms.

6.0 REFERENCES

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3. T. H. May, RPP-6023 Rev. 0, *Non-radioactive Environmental Emissions Chemical Source Term for the Double-Shell Tank Vapor Space During Waste Retrieval Operations*, CH2Mhill Hanford Group, April 21, 2000.
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Attachment 1

The Environmental Effects (Temperature, Humidity and Aerosols) of SST Waste Transfers on the DST Farm Primary Ventilation Systems

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CALCULATION COVER SHEET

Calculation No: VET-1084-001
Revision: 0
Calculation Title: The Environmental Effects (Temperature, Humidity and Aerosols) of SST Waste Transfers on the DST Farm Primary Ventilation Systems
Project No. & Title: VET-1084, ALARACT Demonstration

	Name	Signature	Date
Originator:	Erik Stam	[signature]	1/4/02

Checker's Review Items	Circle Response
Purpose of calculation is completely defined	Yes / No / NA
Assumptions are clearly stated, supported, and valid	Yes / No / NA
Computer codes and data files are documented	Yes / No / NA
Data used in calculations are clearly stated and supported	Yes / No / NA
Mathematical derivations checked, including dimensional consistency of results	Yes / No / NA
Models are appropriate and used within range of validity	Yes / No / NA
Hand calculations were checked for errors	Yes / No / NA
Code output consistent with input and with results reported in analysis	Yes / No / NA
Acceptable limits on analytical results applicable and supported	Yes / No / NA
Safety margins consistent with good engineering practices	Yes / No / NA
Conclusions and recommendations consistent with analytical results	Yes / No / NA
Results and conclusions address all points required in purpose of calculation	Yes / No / NA

✓ Checker's comments attached ____ Checker had no comments

	Name	Signature	Date
Checked By:	Ray Schwehr	[signature]	1/8/02

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CALCULATION COVER SHEET

Calculation No: VET-1084-001
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Item	Checker's Comment	Originator's Response
1.	Section 1.1, Purpose should be redefined. Current Scope is too general.	Rewrote purpose to define the scope as looking at the environmental effects of SST waste transfers to DSTs
2.	Section 2.2, Assumption 1. SI velocity for 18 ft/s is 5.5 m/s.	Corrected SI velocity in Assumption.
3.	Section 2.2, Assumption 7. Is the November temperature of –13°F the coldest for any month?	No. The coldest temperature recorded at Hanford is –23°F in early February. This calculation combines the high seasonal temperatures of the waste tanks (normally occurring in September) with the lowest ambient temperature in November. It is conservative to assume the high waste temperatures in the tanks will occur in November. Under normal conditions, the waste will cool as the air and ground temperatures decrease in the fall (generally starting in September). As shown later in the calculation, the ventilation system inlet temperature used in this calculation is 30°F higher than currently observed conditions in the tank farms.
4.	Section 6.1.1. Per Reference 1, page 6-6, 100 microns is the largest possible, 280 is very conservatism.	True. This does bring up a good point. As Reference 1 points out, the aerosols that are greater than 100 microns are not likely to stay in the air. They will fall out of the vapor space due gravity. Therefore, the value of 100 microns will be used as the maximum size of the aerosols entering the ventilation system. The mass loading will not be changed.
5.	Section 6.2. How does the rating of the SY de-mister at 5.2 ft/s relate the flow in the system?	Per the vendor data, the efficiency of the de-mister increases with increasing air velocity. The 5.2 ft/s is below the rated flow of the system. The text will be updated to reflect this.
6.	Section 6.2.1.1. Value for mechanical aerosol mass loading is 0.015 g/m^3.	Corrected value for mechanical mass loading. Conclusions do not change.
7.	Section 6.3.1. Could not find data in Attachment.	Changed text to reflect data is not attached to calculation. Data is provided in Ref. 29.
8.	Section 6.4.1. Reference 8 should be 28.	Corrected references in Section.
9.	Section 6.4.1. Value of 37.69 should be 37.48.	Corrected value. Conclusions do not change.
10.	Provide more data on R values used for materials in Section 6.5.	The values used are "general" values for steel and stainless steel. These values are used to compare the relative heat loss through the ventilation system areas

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		(i.e. the filter housing versus the stack). Because these values are used for comparison reasons only, minor differences in the actual material R values to those used in the calculation will not significantly change the conclusions.

All Comments have been addressed and are closed.

Checker: Ray Schwehn Date: 1/8/02

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CALCULATION COVER SHEET

Calculation No:	VET-1084-001
Revision:	0
Calculation Title:	The Environmental Effects (Temperature, Humidity and Aerosols) of SST Waste Transfers on the DST Farm Primary Ventilation Systems
Project No. & Title:	VET-1084, ALARACT Demonstration

Analytical Calculations Approval

Subject: The Environmental Effects (Temperature, Humidity and Aerosols) of SST Waste Transfers on the DST Farm Primary Ventilation Systems

The subject document has been reviewed by the undersigned.
The reviewer reviewed and verified the following items as applicable.

Documents Reviewed: Calculation VET-1084-001 Rev. 0

Analysis performed by: Erik Stam

- Engineering Specification
- Design Input
- Basic Assumption
- Approach/Design Methodology
- Related Information
- Conclusion/Result Interpretation

Reviewer/Approver (print) Ray Schwehr

Reviewer/Approver (signature) Ray Schwehr Date: 1/8/02

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CALCULATION COVER SHEET

Calculation No: VET-1084-001
Revision: 0
Calculation Title: The Environmental Effects (Temperature, Humidity and Aerosols) of SST Waste Transfers on the DST Farm Primary Ventilation Systems
Project No. & Title: VET-1084, ALARACT Demonstration

Analytical Calculations Checklist

Subject: The Environmental Effects (Temperature, Humidity and Aerosols) of SST Waste Transfers on the DST Farm Primary Ventilation Systems

Originator: [signature] Date: 1/4/02

Checker: Ray Schwebke Date: 1/8/02

Design Review Checklist for Simple Designs/
Simple Design Changes (Routine Engineering Change Notices)

Documents/Engineering Change Notices Reviewed: N/A

Affected Document(s) (Optional) N/A

Yes	No	N/A	
[X]	[ ]	[ ]	Were the design inputs correctly selected?
[X]	[ ]	[ ]	Are assumptions necessary to perform the design activity adequately described and reasonable?
[ ]	[ ]	[X]	Where necessary, are the assumptions identified for subsequent re-verifications when the detailed design activities area completed?
[X]	[ ]	[ ]	Was an appropriate design method used?
[ ]	[ ]	[X]	Were the design inputs correctly incorporated into the design?
[X]	[ ]	[ ]	Is the design output reasonable compared to design inputs?
[ ]	[ ]	[X]	Are the necessary design input and verification requirements for interfacing organizations specified in the design documents or in supporting procedures or instructions?

Checklist Completed By: Ray Schwebke Date: 1/8/02

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Project No. & Title: VET-1084, ALARACT Demonstration	Checker: RPS	Date: 1/8/02

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Table of Attachments:

Attachment 1	Excel Spreadsheets (calcs and stack temp. data) (dated 11/6/01)	37 pages
Attachment 2	DST Waste and Vapor Space Data (dated 12/31/01)	11 pages
Attachment 3	DST Ventilation Round Sheets (dated 11/6/01)	40 pages
Attachment 4	Hanford Meteorological data (dated 11/6/01)	9 pages
Attachment 5	Email References (dated 12/31/01)	7 pages

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Project No. & Title: VET-1084, ALARACT Demonstration	**Checker:** RPS	**Date:** 1/8/02

1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this calculation is to evaluate the environmental effects of saltwell waste transfers from Single Shell Tanks (SSTs) on the emission abatement/control technologies used in the Double Shell Tank (DST) farm ventilation systems receiving the waste. The environmental conditions considered in this calculation include the temperature, humidity, and entrained water particles of the air entering the primary ventilation systems.

The primary ventilation systems in the AP, AN, and AW tank farms and the primary A-train ventilation system in the SY tank farm will be evaluated.

This calculation is only valid for the design inputs and assumptions used within this calculation.

This calculation was performed in accordance with Vista Engineering Technologies (VET) and CH2M HILL Hanford Group (CHG) practices.

1.2 BACKGROUND

The AP, AN, and AW tank farms are located in the 200 east area at the Hanford site. The SY tank farm is located in the 200 west area at the Hanford site. All of these tank farms contain Double Shell Tanks (DSTs). These farms are being evaluated because they may receive waste from Single Shell Tanks (SSTs) as part of the Interim Stabilization Project.

The AP, AN, AW, and SY farms have two completely separate ventilation systems: (1) the primary tank ventilation system, and (2) the annulus ventilation system. For the purposes of this As Low As Reasonable Achievable Control Technologies (ALARACT) evaluation, only the primary ventilation systems were evaluated.

The AP, AW, and AN primary ventilation systems are dual systems. Under normal operating conditions, one of the primary ventilation trains is operating and the other provides back up. The SY farm primary A-train is a single exhaust train.

Outside air is drawn into the DST vapor space through inlet filters and/or miscellaneous in-leakage paths due to the negative pressure created by the ventilation system exhaust fan.

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Air is drawn out of the tank vapor space through tank risers. Butterfly valves located in the exhaust ductwork control the volumetric flow coming from each tank. Exhaust ducts from the individual tanks are combined to form a common header to enter the primary ventilation system trains.

Each primary ventilation system train consists of a de-mister (to remove entrained water particles), a heater (to prevent condensation on the down-stream filters), a pre-filter, two high-efficiency particulate air (HEPA) filters in series, and a fan.

The air exits the ventilation system via a stack. The stack contains a record sampler and a continuous air monitor (CAM).

2.0 DESIGN BASIS

2.1 CRITERIA

There are no specific design criteria for this calculation. This calculation is being performed as a system evaluation.

2.2 ASSUMPTIONS

Assumptions used to support this calculation are listed, as applicable, in the Calculation/Analysis, Section 6. The assumptions are listed below.

1. Velocity of the saltwell transfer stream entering the tank was based on the possible source of saltwell waste (the SSTs, DCRT, and cross site transfer line). The pump for the DCRT combined with the transfer line size provides a velocity of 4.5 ft/s. To provide calculation margin, this calculation will assume a velocity of 18 ft/s (5.5 m/s).
2. It is assumed that the sizes of the aerosols generated by condensation and mechanical means have a standard-normal statistical distribution.
3. For purposes of this calculation, it will be assumed that the maximum droplet size for the mechanically generated aerosols is 100 um. Water particles greater in size are likely to fall out of the air due to gravity. The value of 100 um represents the 99th percentile of aerosol size population. To represent the 1st percentile of the mechanically generated aerosol size population, it will be assumed that the minimum droplet size is 1-um. The value of 1-um is selected based on the distribution of cloud and fog particle size given in Reference 1 (page 6-3). This value is relatively small for sprays and represents a "lower" size of particles in fogs.
4. Condensate aerosols form clouds and fogs, and have, in general, smaller droplet size distributions than mechanically generated aerosols. Particle size for fogs and mists

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generally range between 0.01 to 100 um (Ref. 1). For this calculation, it is assumed that these values represent the 1st and 99th percentiles of the population of aerosols.

5. It is assumed that all of the tanks contribute air having 100% relative humidity to the ventilation system. This assumption is based on measurement data that indicates the relative humidity of individual tanks may approach 100%.
6. The provided condensation mass loading from Reference 1 was increased by a factor of four to provide a calculation margin.
7. To predict an extreme amount of condensation in the ventilation system, the in-line heater was assumed not to function. Therefore, condensation begins as the air enters the ventilation system due to cooling.
8. To predict an extreme amount of condensation in the ventilation system, all of the water vapor that is calculated to come out of solution is assumed to form condensation in the ventilation system.
9. The maximum tank temperatures generally occur in the September and October time frame. For this analysis, these high tank temperatures will be assumed to continue into November, and the coldest expected temperature in November will be used as the ambient temperature. The coldest recorded ambient conditions on record for the Hanford site for the month of November is –13°F.
10. For the heat transfer model, it is assumed the air entering and exiting the ventilation system is at 100% relative humidity.
11. To calculate the heat loss in the ventilation system, the maximum temperature recorded after the heater during the week the stack measurement was taken was used to calculate the heat loss. This method assumes the highest temperature capable from the heater (during the relative time period of the stack measurement) corresponds to the stack measurement. All things being equal, a greater heat loss will be calculated the higher the temperature after the heater compared to the temperature in the stack.
12. To account for the shortfalls of the measurement data and to account for the changes in environmental conditions, the highest heat transfer constant calculated from the measurement data was increased by 25%.
13. To evaluate the heater's ability to decrease the relative humidity of the air in the filter housing, the heat loss from the fan housing was ignored
14. To evaluate the heater's ability to decrease the relative humidity of the air in the filter housing, the overall heat transfer from the ventilation system to the environment was assumed to be linear through the ventilation system. The actual heat transfer will not be linear due to system geometry and materials. The heat loss through the filter housing is expected to be less than the stack because the filter housing is insulated.
15. It is assumed that the inlet conditions calculated for the east tanks farms (Section 6.3) are representative for the SY farm (air at 100% relative humidity and at 85°F).

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3.0 REFERENCES AND INPUTS

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4.0 METHODS

Waste transfers will be liquid transported by way of pipelines from the SSTs, DCRT, or the cross-site transfer line to the DSTs. The waste will be introduced into the DSTs by falling through the vapor space of the DST.

The waste transfers affect the vapor space environment inside the DST. Changing the tank vapor space environment may effect the control and abatement technologies of the ventilation systems. The following items were identified as having possible effects on the ventilation system control technologies resulting from waste transfers:

1. The falling waste will generate aerosols in the DST vapor space.
2. The transferred waste may increase the tank temperature. All things being equal, an increase in the waste temperature will increase the vapor space temperature and increase the waste evaporation. Therefore, the humidity level of the vapor space and the aerosol content due to condensation in the DST vapor space will increase.

The affects of the increased water vapor, aerosol, and elevated waste temperatures are evaluated in Section 6.0.

Analytical/computer heat transfer models of the ventilation system would be relatively complex to account for all of the variables involved (i.e. environmental, ventilation system geometry and materials, flow, tank waste conditions, etc...). This calculation will not use detailed analytical models to predict the heat loss and behavior of the air through the ventilation systems. More simplified methods will be employed based on standard heat transfer equations. Measurement data and past studies on the DST ventilation systems will be used to develop the models used in this calculation.

Specific methods used in this calculation are outlined, as applicable, in Section 6.

5.0 RESULTS AND CONCLUSIONS

This section summarizes the results and conclusions made in Section 6.0.

The waste transfers from SSTs to DSTs will increase the amount of mechanically generated aerosols in the DST vapor space. The quantity of mechanically generated aerosols (mass loading) and size distribution were calculated based on data provided in Reference 1. The mass

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loading and size distribution of condensate generated aerosols were also calculated based on data provided in Reference 1. A total mass loading of 0.055 g/m^3 (3.43 e-6 lb/ft^3) was found.

It was determined that the de-misters currently used in the AN, AW, AP, and SY primary A-train ventilation systems effectively remove the aerosols from the air-stream. The mass loading of aerosols passing the de-misters was insignificant.

The ability of the de-misters to remove the quantity of aerosols generated by SST waste transfer activities was evaluated in Reference 11. For the AN, AP, and AW systems, it was determined that one de-mister will be sufficient to handle the quantity of aerosols generated by waste transfers (using the current rated flow of 1000 cfm through the ventilation system). The de-mister in the SY primary A-train system was determined to handle the quantity of aerosols generated by SST waste transfers.

An extreme scenerio for condensation in the ventilation system was developed using past measurement data and input from Reference 11. This scenerio was based on warm air at 100% relative humidity entering the ventilation system and then being cooled to the 'maximum' extent possible. The extreme scenerio corresponds to the high waste temperatures usually observed in September being extended into the November time frame (i.e., a usually hot fall). In November, an extreme ambient temperature change occurs and the outside air drops to record lows (the lowest record temperature of Hanford during the month of November is –13°F).

The temperature of the air entering the ventilation system was calculated using measurement data and input from Reference 11. A maximum waste temperature of 130°F was used to calculate the inlet temperature. This temperature bounds the temperature of the waste observed during SST waste transfers. This waste temperature corresponds to an inlet temperature of 85°F. This value was compared to inlet temperature measurements from the AP, AN and AW tank farms. The calculated value of 85°F was approximately 30°F higher than the highest measured temperature for November in the tank farms.

To estimate the heat loss in the ventilation system, stack temperature measurements were combined with recorded temperatures in the ventilation system. Conservative methods and factors were applied to the calculated heat loss to overcome a lack of direct correlation between the stack and ventilation temperature measurements. These factors were applied in a way to over-predict the heat loss in the system.

The amount of condensation in the ventilation system was calculated based on the heat loss through the ventilation system, the inlet conditions, the flow through the ventilation system, and the coldest ambient temperature recorded in November for the Hanford site. Based on a flow rate of 1000 cfm, approximately 4.97 gph of condensate was calculated.

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The above condensation is considered conservative for the following reasons:

a) The calculated inlet temperature is 30°F above the current temperatures.
b) Assumptions and input used in Reference 11 are conservative.
c) No credit was taken for the cold ambient air (occurring in November) lowering the vapor space temperature of the tanks.

The ventilation systems in the AP, AW and SY farms have drains for the HEPA filters and fans that are sufficient to carry the maximum predicted condensation in the ventilation system. Therefore, if water forms in the filter housing the drain lines will prevent the water form pooling and protect the HEPA filters.

The AN-farm does not have drains for the HEPA filters and fans. Therefore, it is possible for water to accumulate in this ventilation system.

The existing seal pots have a 3-inch return line to the tanks. These return lines are sufficient to handle the estimated amount of condensation in the ventilation system.

The ability of the heater to reduce the humidity of the air entering the filter housing was evaluated. In the extreme conditions it was determined that 10 KW of heat provided by the AN, AW, and AP heaters was sufficient to prevent condensation is all but the last ½ foot of the filter housing. The of heat provided by the SY primary A-train heater is sufficient to prevent condensation past the filter housing. Therefore, the heaters protect the HEPA filters from condensation. In all cases, condensation was prevented past the last HEPA filter.

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6.0 CALCULATION AND ANALYSIS

As outlined in Section 4.0, the following items were identified as having a possible affect on the ventilation system control technologies resulting from waste transfers:

1. The falling waste will generate aerosols in the DST vapor space.
2. The transferred waste may increase the tank temperature. All things being equal, an increase in the waste temperature will increase the vapor space temperature and increase the waste evaporation. Therefore, the humidity level of the vapor space and the aerosol content due to condensation in the DST vapor space will increase.

To evaluate the affects of waste transfer on the ventilation system, the following steps will be performed.

1. The **aerosol mass loading** due to waste transfer and condensation will be determined.
2. The ***ability of the de-misters to remove the entrained moisture*** in the air will be determined.
3. **Condensation** in the ventilation system housings will be determined. First, the **extreme properties of the air entering the ventilation** system will be determined.
4. Second, to calculate an extreme amount of condensation in the ductwork, a **'maximum' heat loss** will be applied to the air in the ventilation system.
5. The **ability of the heaters** to reduce the relative humidity of the air through the filter housing will be determined.
6. Finally, because the SY **primary A-train system** has not been operated, no measurement data are available to perform heat loss calculations. Therefore, this system will be compared to east tank farm systems.

These steps are evaluated in the following sections.

6.1 AEROSOL MASS LOADING

Aerosol or entrained water can affect the ventilation control technologies. If the entrained water is collected on the HEPA filters, the filters could become plugged. In addition, the housings may collect standing water if the entrained water falls out of the airstream in the housings.

The primary means of removing the aerosols is by using demisters. The ability of the demisters to remove the entrained water will be evaluated in the following sections.

Aerosol mass loading in the ventilation system will be from two sources, mechanical and condensation.

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6.1.1 Mechanical Aerosol Distribution and Size

Mechanical aerosol generation occurs on the conversion of kinetic energy to overcome the surface energy of water droplets to create a larger number of smaller droplets (and increase their collective surface area) (Ref. 1). Figure 6-1 of Reference 1 (page 6-2) demonstrates the relationship between droplet size and the velocity of a free flow stream. Mechanically produced aerosols become finer, and are more likely to persist and create higher mass loading in the vapor space, when more kinetic energy is available to overcome the surface tension of the water droplets.

Aerosol generation in the DST vapor space due to waste transfer was evaluated in Reference 1. Theoretical calculations and aerosol test results (from the Tank 241-C-106 sluicing tests) were used to provide an estimation of aerosol mass loading. It was concluded that the best estimation for aerosol generation during waste transfer was based on measurements obtained from the tests related to the Tank 241-C-106 sluicing operation.

A correlation of aerosol generation versus the velocity of the waste falling through the vapor space of the DST is presented in Reference 1. This correlation is:

Mass loading = $0.01(1 + 33\ (v / v_{ref})^2)$ g/m^3

Where:
v_{ref} = 140 ft/s (43 m/s)

The transfer rates from the various saltwell waste sources are different. Based on conversations with Stephen Swaney (tank farm engineer), a worse case condition will be based on the transfer from the DCRT. The transfer pump contained in the DCRT is rated at 100 gpm (Ref. 12). Combined with the standard 3-inch transfer lines (Ref. 12), a resulting velocity of 4.5 ft/sec (Ref. 13, page B-14) is predicted. For this calculation, a factor of four will be applied to the velocity. This will provide margin to the actual velocities in the system. Therefore, the transfer velocity will be 18 ft/s (5.5 m/s).

Based on this velocity, the following mass loading is predicted:

Mass loading = $0.01(1 + 33\ (5.5 / 43)^2)$ g/m^3 **= 0.015 g/m^3**

The maximum diameter of a water droplet verses the stream velocity is provided in Reference 1. For the assumed velocity of 5.5 m/s, a maximum droplet size of

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approximately 280-um (Figure 6-1, page 6-2, Ref. 1) is provided. However, droplets of this size will fall out of the vapor space due to gravity. For this calculation, it will be assumed that the maximum size of the mechanically generated aerosols is 100 um. This size corresponds to the upper size range of clouds, and the minimum size for rain (Table 6-1, Ref. 1).

For purposes of this calculation, it will be assumed that the maximum droplet size provided above represents the 99th percentile of aerosol size population.

To represent the 1st percentile of the mechanical aerosol size population, it will be assumed that the minimum droplet size is 1-um. The value of 1-um is selected based on the distribution of cloud and fog particle size given in Reference 1 (page 6-3). This value is relatively small for sprays and represents a "lower" size of aerosols in fogs.

6.1.2 Condensation Aerosol Distribution and Size

Condensation aerosols form when water saturated air sub-cools in the presence of nucleation sites. Observations made of various tank vapor spaces have found visual "fogs" in the vapor space (Ref. 3). In addition, a heavy condensate forms on the camera lens when the camera is lowered into the vapor space during winter months (Ref. 3).

Condensate aerosols form clouds and fogs, and have, in general, smaller droplet size distributions than mechanically generated aerosols. Particle size for fogs and mists generally range between 0.01 to 100 um (Ref. 1). For this calculation, it is assumed that these values represent the 1st and 99th percentiles of the population of aerosols.

It can be estimated that typical condensation aerosols that form in a tank vapor space would possess a mass concentration of about 0.010 g/m^3 (Ref. 1). For this calculation, the mass concentration in Reference 1 will be increased by four to **0.040 g/m^3** to provide calculation margin.

6.1.3 Total Aerosol Mass Loading

The total mass loading from mechanical and condensation predicted in the tanks is:

Total loading = 0.040 g/m^3 + 0.015 g/m^3 = 0.055 g/m^3
Total loading = 0.0001 lb/m^3 = 3.43 e-6 lb/ft^3

Moisture separators meeting ASME N509 (Ref. 21) standards will remove at least 99% of entrained moisture in an airstream having 1.5 to 2 lbs/ft^3 of entrained moisture. The

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predicted entrained moisture in the tanks is considerably less than the minimums called for by ASME N509.

6.2 THE ABILITY OF THE DE-MISTERS TO REMOVE THE ENTRAINED MOSITURE

The de-misters in the AN, AW, and AP ventilation systems are comprised of two components. The first is a Koch FLEXICHEVRON® that will remove 99% of all particles greater than 40 microns in diameter (Ref. 2). This component is used to remove the large aerosol particles. Down stream of the chevron is a wire mesh. The wire mesh removes smaller particles from the air. The guaranteed performance of this system is 99% of all particles greater than 20 um (Ref. 2).

The SY primary A-train system contains an in-line Kimre Inc. B-Gon demister. This demister has an efficiency rating of 99.49% for 4 to 6 micron particles with a corresponding airstream velocity of 5.2 ft/s (Ref. 23). At a velocity of 8.2 ft/s, the efficiency rating for 4 to 6 micron particles is 99.58%. Therefore, the efficiency of the demister increases with increasing velocity. For this calculation, the efficiency of the demister at 5.2 ft/s will be used. The flow area of the demister is found from Reference 22 as:

Flow area = 11 inch x 10.125 inch = 221.375 in^2 = 1.537 ft^2

For a velocity of 5.2 ft/s through the demister, the corresponding flow rate is:

Flow rate = 1.537 ft^2 x 5.2 ft/s = 7.99 ft^3/s = 479 ft^3/m

The primary A-train exhauster is rated at 1000 cfm. Therefore, the demister will have a minimum efficiency of 99.49% at operating conditions.

6.2.1 Water Particles Removed from the Air-stream by the De-mister

The 99th percentile of particle size generated by the free fall of waste is 100-um.
The 1st percentile of particle size generated by the free fall of waste is 1-um.

The 99th percentile of particle size generated by condensate is 100-um.
The 1st percentile of particle size generated by condensate is 0.01-um.

A standard-normal distribution will be assumed for the water particles (mean = 0, variance = 1). Standard statistical Z-tables are based on ½ the area under the standard-normal curve. Therefore, to find the Z –value corresponding to one percent:

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0.50 - 0.01 = 0.49

From a Z-table (Ref. 4, front cover), the value of 0.490 is approximately Z=2.33. Assigning:

Mechanical Aerosols:
1st percentile = 1-um = -2.33
99th percentile = 100-um = 2.33

Condensate Aerosols:
1st percentile = 0.1-um = -2.33
99th percentile = 100-um = 2.33

6.2.1.1 AN, AP, and AW Demisters

The Z-value corresponding to 20-um is found as:

Mechanical Aerosols:
$(100 - 20) / (100 - 1) = (2.33 - Z_{20}) / (2.33 - (-2.33))$
$Z_{20} = -1.44$

The area corresponding to a Z-value of 1.44 is 0.4251 (Ref. 4). The probability of Z having a value less than 20-um for our population is:

0.500 – 0.4251 = 0.07 = 7.0%

Therefore, based on the efficiency of the de-mister and size of particles, the following particles generated by the free-fall of the waste into the headspace will make it pass the de-mister:

$0.015\ g/m^3\ (0.07 + 0.01) = 0.0012\ g/m^3$

Condensate Aerosols:
$(100 - 20) / (100 - 0.01) = (2.33 - Z_{20}) / (2.33 - (-2.33))$
$Z_{20} = -1.40$

The area corresponding to a Z-value of 1.40 is 0.4192 (Ref. 4). The probability of Z having a value less than 20-um for our population is:

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$0.500 - 0.4192 = 0.081 = 8.1\%$

Therefore, based on the efficiency of the de-mister and size of particles, the following particles generated by the condensate into the headspace will make it pass the de-mister:

$0.040\ g/m^3\ (0.08 + 0.01) = 0.0036\ g/m^3$

Therefore, the total aerosol content of the water passing the de-mister is:

Total aerosol = $0.0012 + 0.0036 = 0.0048\ g/m^3$
Total aerosol = $0.0047\ g/m^3 = 1.05\ E\text{-}5\ lb / m^3 = 2.93\ E\text{-}7\ lb/ft^3 = .002\ grains/ft^3$

This amount of water is sufficiently small enough to be neglected.

6.2.1.2 SY Demister

The demister in the SY farm has a higher efficiency rating for smaller particles than those contained in the AN, AP, and AW farms. Therefore, based on the conclusions for the east tank farms, the moisture passing this demister is also considered small enough to ignore.

6.2.2 De-misters and Water Load

The quantity of water the de-misters are capable of handling was evaluated in Reference 11 (page 3-15). In the Reference 11 evaluation, condensate and droplet (aerosol) loading were considered. The predicted water loading is presented in Figure 3-20, page 3-16, Reference 11. A flow rate of 1000 cfm and one de-mister will be evaluated (the current ventilation configuration) in this calculation. From Figure 3-20 (Reference 11), a single de-mister (rated at 0.25 lbm/sec) will handle the expected water load up to a tank waste temperature of 190°F. At this point, the capacity of the de-mister may be exceeded. However, this assumes all of the droplets and water vapor in the air condensate on the de-mister. As Reference 11 indicates, this is unlikely. The de-mister temperature may lag changes in the tank temperatures, however, the de-mister will change with the air-stream in the ventilation system. The temperatures between the de-mister and tanks are not capable of maintaining a difference required to flash cool the air (and remove all of the water vapor). Therefore, for the operating ranges in the tank farms, the de-misters are sufficient to handle the condensate.

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6.3 CONDENSATION: EXTREME PROPERTIES OF THE AIR ENTERING THE VENTILATION SYSTEM

In Section 6.2, the entrained moisture in the airstream was evaluated. Now, condensation will be considered. Condensation in the ductwork (and related equipment) may form from two primary sources. The first is the formation of condensate aerosols because the air is cooled below its saturation temperature (or dew point) temperature. The second is the air coming into contact with surfaces that are below the saturation temperature to form condensation on these surfaces.

The amount of condensation that occurs in the ductwork is dependent on many factors. These factors include:

The ambient conditions (i.e. humidity, temperature, wind, and solar radiation).
Waste temperatures in the individual tanks.
Air flow through the ventilation system.
Ventilation heater output.
Ventilation heat loss (a function of insulation and geometry).

This ALARACT calculation will use an extreme scenerio where the above conditions combine to create the highest amount of condensation in the ventilation system.

All things being equal, the warmer the air temperature, the more water vapor the air can hold (reference a standard psychrometric chart). Condensate is formed as the air is cooled below its saturation temperature. Therefore, to predict the highest levels of condensate in the ventilation system, warm, moist, air will enter the system and then be cooled to the maximum extent. For this calculation, all of the water that is predicted to come out of solution will be assumed to form condensation in the ventilation system.

As the following sections will demonstrate, the maximum tank temperatures occur in the September time period. For the extreme scenerio, these high temperatures will be assumed to last into the November time period, when the ambient temperatures will drop. The large delta between the warm tanks and cold air will result in the maximum condensation in the ventilation system.

6.3.1 Humidity:

The relative humidity of the air stream will be based on measurement data obtained from the AN-tank farm. Wet and dry bulb measurements were made of the exhaust lines from the seven AN-tanks in December of 1996. The ambient temperature during these measurements was 24°F (Ref. 29). The ambient relative humidity was recorded as

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approximately 100% (Ref. 29). The recorded humidity from Reference 7 on this date was 91% (Attachment 4).

Four of the seven measurements made in December indicated relatively humidity in the exhaust lines at or near 100%. (Note; The flow on two of these tanks was relatively low (0 and 30 cfm).) This is consistent with camera examinations that indicate high humidity levels in the tanks during winter months (Ref. 3).

Based on these measurement data, it can be concluded that conditions of 100% relative humidity can exist in individual tanks (although 100% humidity was not observed in all of the tanks). This is further backed-up by an email correspondence from Mr. Daniel Reynolds (Ref. 24).

As an extreme condition, the air exiting **all** of the tanks will be assumed to be at a relative humidity of 100%.

6.3.2 Calculated Ventilation System Inlet Temperature:

Now that the humidity of the air entering the ventilation system is defined, the temperature of this air will be determined.

The inlet temperature to the ventilation system as a function of tank waste temperature was calculated in Reference 11. The Reference 11 calculation evaluated the tank ventilation system due to the operation of mixer pumps in a single AN-tank (supporting waste retrieval operations). The waste temperature of the tank with the mixer pumps was increased to the LCO maximum temperature of 195°F. The other tanks in the AN-farm were set to the maximum annual temperatures observed in these tanks (observed for one year from 8/14/99, Reference 11, page 2-6).

This ALARACT calculation will use the Reference 11 calculation to provide a conservative inlet temperature to the ventilation system as a result of waste transfers. To support this calculation, the tank waste temperatures were examined.

6.3.2.1 Tank Waste Temperatures:

The waste temperatures for various tanks (randomly selected) were obtained between October 1999 to October 2001 from the Hanford PCSAC database. These temperatures are provided in Attachment 2.

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To summarize these data, the waste temperatures vary with seasonal conditions for the AP, AN, and AW farms. Generally, the waste temperatures peak in the September time frame and decrease over the winter months, with a low in the March time frame (excluding the affects of waste transfers).

The maximum observed waste temperature in November for the east tanks farms (AN, AW, and AP) was in tank AN104 (approximately 95°F). Of particle interest is the data from Tank SY-102 (west tank farms). This tank currently receives saltwell waste. The peak thermocouple reading from this tank was 115°F in November 2000 during a waste transfer. It should be noted that only the upper portion of tank SY 102 obtained this temperature. The lower layers of the tank remained relatively unaffected by the waste transfer. The highest observed temperature in any tank examined was approximately 125°F in Tank SY-101 in January 2001.

Information provided by Mr. Stephen Swaney (Ref. 12) indicates the maximum temperature of the waste being transfer to the east tank farms will be 125°F. The data from Tank SY-102 indicates a maximum observed temperature of 115°F for current waste transfers. The maximum observed temperature was 125°F. Therefore, this calculation will use a waste temperature of 130°F as a conservative input for the temperature of the waste in the receiving tank.

6.3.2.2 Inlet Air Temperature:

For a tank waste temperature of 130°F, the predicted inlet temperature for the ventilation system is approximately 85°F (Ref. 11, Figure 3-10, page 3-9).

6.3.2.3 Summary of Inlet Conditions and Comparison of Calculated Values to Measurement Data:

Summary of Inlet Conditions for this ALARACT:

Inlet relative humidity: 100%
Inlet temperature: 85°F

The inlet temperature to the ventilation system calculated in this ALARACT calculation is 85°F. Randomly selected round sheets from the AN, AP and AW farms were obtained for the winter months (November through February) and are provided in Attachment 3. Reviewing these data indicates that high inlet temperatures to the heater are in the range of 55°F. Therefore, the calculated temperature of 85°F is 30°F above the currently observed temperatures in these tank farms.

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As another check of the calculation, the inlet temperatures for the AW-farm corresponding to an April 2000 waste transfer in Tank AW106 were examined. The ventilation system inlet temperatures were examined before and after the April 22nd, 2000 start of the transfer. The measurements are provided in Attachment 3. The data do not indicate a sharp increase in the ventilation system temperature. The maximum recorded temperature in the week after the transfer started was 2°F higher the maximum recorded temperature in the week before the transfer started. This further validates the statement in Reference 11 that the changes in temperature will occur over time and try to reach steady-state conditions.

6.3.3 Ambient Conditions

The outside air temperature will affect how much condensation is predicted in the ductwork. First, cold outside air will affect the heat loss through the above grade ventilation system (thus affecting the temperature of the air in the ducts). Second, the outside air is drawn into the tanks and thus affects the vapor space temperatures. Therefore, colder outside air will lower the vapor space temperature and thus reduce the moisture content in the air.

For the extreme case for condensation, the warm vapor space and high humidity conditions outlined above will be combined with a worst case temperature. As outlined above, the maximum tank temperatures generally occur in the September and October time frame. For this analysis, these high tank temperatures will be assumed to continue into November. In November, it will be assumed that the ambient conditions go to "record lows."

The coldest temperature recorded in November was –13°F in 1985 (Ref. 7).

6.4 HEAT TRANSFER IN THE DUCTWORK

Now that the inlet and ambient conditions have been defined, the heat loss through the ventilation system will be evaluated.

An analytical based heat transfer model of this system would be relatively complex. For example, a model would have to account for the ventilation system variables (i.e. geometry, material, flow, etc...) as well as ambient variables (i.e. wind, solar, temperature, etc...). Such a model will not be developed for this ALARACT calculation. In its place, a simplified model based on measurement data will be used.

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Actual temperature measurements from the east farm ventilation systems will be used to estimate the heat loss in the ducts. Stack temperature and flow measurements were obtained from Johan Lorbasi (CH2M Hill Tank Farm Ventilation Engineer) and are provided in Attachment 1. The stack temperatures were combined with ventilation temperature measurements (from the daily rounds sheets) in Attachment 1.

The available temperature measurements provide an easy way to calculate the heat loss of the air. However, as the rounds temperatures and stack temperatures are compared, several discrepancies were discovered. For example, there are several entries were the stack temperature is higher than the temperature after the heater on the rounds. These discrepancies are due to several factors. Primary, there is no way to correlate the time between the two measurements. Therefore, if the heater output varies over time (which it is expected to do), the temperature in the stack and ventilation system will vary (leading to the discrepancies observed).

The goal of this calculation is to predict an extreme scenerio. Therefore, the measurement data were used in such a way to error on the side of overestimating the "real" heat loss in the ventilation systems. To accomplish this, the rounds data for the week the stack psychrometric measurements were taken were examined. The maximum temperature recorded after the heater during the week the stack measurement was taken was used to calculate the heat loss. This method assumes the highest temperature capable from the heater (during the relative time period of the stack measurement) corresponds to the stack measurement. All things being equal, a greater heat loss will be calculated the higher the temperature after the heater compared to the temperature in the stack.

The equation for sensible heating/cooling of air at standard conditions (i.e. room temperature and conditions) is provided in Reference 5 as:

$Q = (cfm)\ 1.08\ (\Delta T)$ Btu/hr (Eq. 1)

Because the humidity for the stack measurements are always less than 100%, the cooling that occurred in the ductwork was sensible.

The heat transfer for the various stack measurements were calculated in Attachment 1.

Of course, the heat loss calculated for the air in the ventilation system was ultimately loss to the environment via the ducts. From a very simplified viewpoint, the heat transfer from the duct to the environment can be expressed as (Ref. 6, pg 695):

$Q = U * A * (\Delta T)$ Btu/hr (Eq. 2)

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Where:
U = the overall heat transfer coefficient
A = The heat transfer surface area

In this case, we know the heat loss. Therefore, we will solve Equation 2 for the term U*A as follows:

$U * A = Q / (\Delta T)$

For the temperature difference, the "average" ventilation temperature will be compared to the "average" daily temperature (as reported in Ref. 7). Therefore:

$\Delta T = TAmb - \frac{1}{2} (Tstack + Thtrout)$

Where:
Tamb = Average daily reading from Reference 7
Tstack = Stack temperature measurement
Thtrout = Highest weekly temperature after the heater from rounds

The values for U*A were calculated in an Excel spreadsheet in Attachment 1.

The overall heat transfer coefficient calculated above is the combination of the primary heat transfer mechanisms; radiation, conduction, and convection. Some aspects of the overall U*A will not vary significantly. For example, the conductive heat properties of the system are dependent on the materials in the system (i.e. ductwork and insulation). Other aspects of the overall U*A will vary. For example, the convection coefficient will increase with increasing wind. In addition, the contribution of radiation is dependent on atmospheric conditions.

For this calculation, seven stack temperature measurements were used to calculate the overall U*A (Attachment 1). Based on this limited sample size, it is unlikely that the "worse" convection and radiation heat loss was observed. To account for the changes in environmental conditions, the highest calculated U*A factor from Attachment 1 will be increased by 25%.

UAsystem = 1.25 * UAhighest = 1.25 * 543 Btu/hr/°F = 679 Btu/hr/°F

Now, for given temperatures in the duct and outside air, we can calculate the value of heat transfer as:

$Q = 679 \text{ Btu/hr/°F } (\Delta T)$
$Q = 679 \text{ Btu/hr/°F } (Tamb - \frac{1}{2} (Tstack + Thtrout))$

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From the extreme case conditions, we have the following:

Q = 679 Btu/hr/°F (-13°F - ½ (Tstack + 85°F)) (Eq. 3)

Again, the heat loss to the environment is equal to the heat loss by the air in the ventilation system. As defined in Section 6.3, the inlet conditions were defined as 85°F and 100% relative humidity. We will assume the air exiting the stack is also at 100% relative humidity. Therefore, as the air/water vapor cool, both latent and sensible heating will occur.

To account for latent and sensible cooling, the following equation is used (Ref. 5, pg 17):

Q = cfm * 4.5 (Th2 – Th1) (Eq. 4)

Where:
Th2 = exit enthalpy of air/water mixture
Th1 = entrance enthalpy of air/water mixture

Setting the two equations for heat transfer equal provides:
Eq 3 = Eq 4
cfm * 4.5 (Th2 – Th1) = 679 Btu/hr/°F (-13°F - ½ (Tstack + 85°F))

or

0 = 679 Btu/hr/°F (-13°F - ½ (Tstack + 85°F)) – (cfm * 4.5 (Th2 – Th1))

This equation was entered into an Excel spreadsheet (see Attachment 1). The value for Th1 was obtained from a standard psychrometric chart for air at 85°F, 100%RH as:

Th1 = 49.5 Btu/lbm-air

Now, various temperatures were selected and an iterative process was used to solve for the final temperature. This work is provided in Attachment 1.

The following stack temperatures were determined for the following flow rates:

500 cfm	56.5°F.
750 cfm	67°F
1000 cfm	72°F

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6.4.1 Extreme Condensation in the Ventilation Systems

To predict extreme condensation in the ventilation systems, it will be assumed the in-line heater does not function. Therefore, the air enters the ventilation system at its dew point and immediately beings to cool. In addition, all of the water that will come out of solution will be assumed to form condensation in the ventilation system.

From the psychrometric chart, air at 85°F and 100% relative humidity as approximately 184 grains of moisture per pound of dry air (extrapolation value).

For the case of 500 cfm air flow through the ventilation system:

From the psychrometric chart, air at 56.5°F and 100% humidity as approximately 67 grains of moisture per pound of dry air.

The specific weight of air at 70.75°F (approximate mean temperature of 85 and 56.5) is approximately 0.0750 lb / ft^3 (Ref. 28, page 697, interpolation).

The corresponding pounds of air passing through the system per minute is:

Air-lbs = 500 cfm * .0750 lbf/ft^3 = 37.48 lb/min

Therefore, the amount of moisture lost in the ventilation system is:

(184 – 67) grains water/air-lb * 37.48 air-lb/min * (lb / 7000 grains) = <u>0.63 lbs / min</u>

For the case of 750 cfm air flow through the ventilation system:

From the psychrometric chart, air at 67°F and 100% humidity as approximately 100 grains of moisture per pound of dry air.

The specific weight of air at 76°F (approximate mean temperature of 85 and 67) is approximately 0.0756 lb / ft^3 (Ref. 28, page 697, interpolation valve).

The corresponding pounds of air passing through the system per minute is:

Air-lbs = 750 cfm * .0756 lbf/ft^3 = 56.65 lb/min

Therefore, the amount of moisture lost in the ventilation system is:

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(184 – 100) grains water/air-lb * 56.65 air-lb/min * (lb / 7000 grains) = 0.68 lbs / min

For the case of 1000 cfm air flow through the ventilation system:

From the psychrometric chart, air at 72°F and 100% humidity has approximately 118 grains of moisture per pound of dry air.

The specific weight of air at 78.5°F (approximate mean temperature of 85 and 72) is approximately 0.0737 lb / ft^3 (Ref. 28, page 697, interpolation valve).

The corresponding pounds of air passing through the system per minute is:

Air-lbs = 1000 cfm * .0737 lbf/ft^3 = 73.71 lb/min

Therefore, the amount of moisture lost in the ventilation system is:

(184 – 118) grains water/air-lb * 73.71 air-lb/min * (lb / 7000 grains) = 0.69 lbs / min

Therefore, the flow condition of 1000 cfm provides the most condensation.

For the worst case of 1000 cfm, using the specific weight of water at 78.5°F of 62.29 lb/ft^3 (Ref. 8, page 699), the volume of water is:

0.69 lbs/min * (ft^3 / 62.29 lbs) = 0.0111 ft^3/min
Or
Condensate = 0.083 gpm
Or
Condensate = 4.97 gph

6.4.2 Condensation Effects on the Ventilation System

As indicated on References 8 and 9, the AP and AW farms have 1-inch drain lines servicing the filter, heater and fan housings. A 1-inch pipe is adequate to handle the estimated 4.97 gph condensation rate.

As indicated on Reference 10, the AN farm has a drain line servicing the heater, but does not have drain lines to the fan and filter housings.

As indicated on Reference 8, 9, and 10, all the farms contain a 3-inch drain line from the seal pot(s) to the tank. This line is sufficient to handle the estimated condensation.

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6.5 THE PERFORMANCE OF THE IN-LINE HEATERS

All of the primary ventilation systems in the AP, AN, and AW farms have electric heaters before the pre-filter. The heaters decrease the relative humidity of the air by increasing the air temperature. The heaters (Indeeco No. 83) provide up to 10 KW of heat to the air stream (Ref. 18).

The AP heaters are controlled by manually switches (Ref. 19) with automated temperature interlocks. The heater provides full output until a downstream high-temperature set point is reached. At that time, the heater will shut off and not reactivated until the temperature goes below the high set point. In addition, pressure sensors indicate flow conditions in the ductwork and shut the heaters off in a low flow condition.

The AW and AN heaters are controlled with a temperature differential controller. This controller monitors the temperature of the air stream upstream of the heater and in the filter housing and maintains a desired temperature difference. The data in Attachment 3 indicates that the temperature difference across the heater at the AW and AN farms is typically 30°F or higher.

First, we will evaluate the heat added by the AP heater and the predicted condensation of the system.

For sensible heating:

$Q = (cfm)\ 1.08\ (\Delta T)$ Btu/hr (Eq. 1)

Using 1000 cfm and 10 KW (569.2 Btu/min or 34,152.0 Btu/hr)

34152 Btu/hr = 1000 (1.08) (ΔT)
$\Delta T = 31.6$ °F

Therefore, if the air enters the ventilation system at 85°F and receives 10 KW of heat, the temperature after the heater would be 116.6°F. It should be noted that the temperature increase at 10 KW (31.6°F) is representative of the heater output at the AN and AW farms. Therefore, the AN, AW, and AP farms will be modeled together.

Of course, since the air entered at 100% relative humidity at 85°F, 85°F is the dew-point temperature. In addition, we know it will take 34,152 Btu/hr to cool the air from 116.6°F to 85°F.

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Earlier in this calculation, the overall heat transfer from the duct to the environment was expressed as:

$Q = U * A * (\Delta T)$ Btu/hr (Eq. 2)

The value for U*A was determined for the ventilation system previously in this calculation as:

$U * A = 679$ Btu/hr/°F

In addition, the heat loss that occurs in the air will equal the heat loss to the environment. For the case of the heater, the following events occur:

The air at 85°F and 100% RH is sensible heated by 10 KW of heat
The air then cools, sensible, back to 85°F (where it will have 100% RH)
The air and water vapor will then cool through the remaining ventilation system.

Therefore, a means to predict how far down the duct the sensible cooling occurs is required. To estimate the filter housing's contribution to the estimated heat loss, the length and thermal resistance of various components in the ventilation system will be compared. These values will be based on approximate lengths. The goal of this calculation is to obtain an approximate contribution of the heat loss from the filter housing and exact measurements are not required.

An approximate length of the filter housing (from the heater to the end plenum) was obtained from Reference 16 as follows:

Filter length = ½ (3.17 ft) + 2.5 ft + 4.38 ft + 3.58 ft + ½ (2.58 ft) = 13.34 ft

After the filter housing, the approximate length of the shortest section of duct to the fan was obtained from Reference 16 and 17(Section B) as follows:

Duct length = ½ (2.58 ft) + 3.25 ft + 1.25 ft + (.25 + 3 + 7 + 2 + 6)/12 ft = 7.31 ft

After the fan, the approximate length of the 10-inch stack to the test ports was found from Reference 18 (Section L) as follows:

Stack length = 1.09ft + 13.33ft – 3.67ft – 1.67ft – 0.79 ft = 8.29 ft

The total length of the system is:

13.34 + 7.31 + 8.29 = 28.94 ft

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The thermal resistances will now be compared. The conductive thermal resistance is defined as (Ref. 6, page 12):

$R = T / K * A$

Where:
T = material thickness
K = material thermal conductivity
A = Surface area

The filter housings are approximately 24 ¼ x 26 ¾ inches (Ref. 14) and are made from 14 gauge stainless steel sheet metal (.07 inch thickness). The housing has 2-inches of insulation on the exterior (Ref. 15). As indicated above, the length of the housing is 13.34 feet (160.1 inch). The surface area of the filter housing is therefore:

Filter area = $2 * (24.25*160.1) + 2 * (26.75*160.1) = 16330 \text{ in}^2$

The exhaust ducts have a 12-inch diameter (Ref. 17). There is approximately 7.31 feet (87.7 inches) to the fan housing. The surface area of the 12-inch diameter ducts is:

Duct area = $\pi * 12 * 87.7 = 3306 \text{ inch}^2$

The exhaust stack has a 10-inch diameter (Ref. 18) with 16 gauge (.06 inch) steel. The stack is approximately 8.29 feet (99.5 inches) to the test ports. The 10-inch diameter stack has a surface area of:

Stack area = $\pi * 10 * 99.5 = 3125 \text{ inch}^2$

The total surface area is:

Total area = $16{,}330 + 3{,}306 + 3{,}125 = 22761 \text{ inch}^2 = 158.1 \text{ ft}^2$

In terms of percentage of area, the following are found for the components:

Filter = 71.7 %
Duct = 14.6%
Stack = 13.7%

The thermal conductive properties for the various components were selected from common materials. These values are listed below (obtained from Ref. 6).

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Filter housing = 5 Btu / (hr-ft-°F) page 9, Ref. 6, general value for stainless steel at 70°F.
Duct and stack = 30 Btu / (hr-ft-°F) page 9, Ref. 6, general value for steel at 70°F.
Insulation = 0.27 Btu-in / (hr-ft^2-°F) CVI data for AP farm. Data at 70°F.
Insulation = 0.27 Btu in * (ft/12 in) / (hr –ft^2 - °F) = 0.023 Btu / (hr – ft- °F)

Comparing the thermal resistance of the filter housing to the ducts per linear inch (ignoring the corner affects).

R filter = 0.07 inch / [(5 Btu/ hr-ft-°F) (107.8 ft^2)] + 2 inch/[(0.023 Btu/ hr-ft-°F)(107.8 ft^2)]
R filter = 0.807 hr-°F-inch/(Btu-ft) * ft/12 inch
R filter = 0.067 hr-°F / Btu

R duct = 0.06 inch / [(5 Btu / hr-ft-°F) * 23.0 ft^2] + 2 inch/[(0.023 Btu/ hr-ft-°F)(23.0 ft^2)]
R duct = 3.78 hr-°F-inch/Btu-ft * ft/12 inch
R duct = 0.315 hr-°F / Btu

R stack = 0.06 inch / [(5 Btu / hr-ft-°F) * 21.7 ft^2]
R stack = 5.530 e-4 hr-°F-inch/Btu-ft * ft/12 inch
R stack = 4.608 e-5 hr-°F / Btu

What the above comparison shows us is that while the filter housing has 72% of the conductive heat transfer area, it has far more resistance to conductive heat transfer than the stack (thanks to the insulation). Comparing the filter housing to the stack provides:

R filter / R stack = (0.067 hr-°F / Btu) / (4.608 e-5 hr-°F / Btu) = 1454

Of course, the thermal conductivity of the material is just one aspect of the heat transfer. For example, because the flow area of the filter housing is large, the velocity of the air will be relatively smaller through this component (promoting more heat transfer). However, based on the insulation on the filter housing, a conservative assumption is that the heat transfer from the ventilation system to the environment will be linear through the ventilation system. Using this assumption provides:

Q = 679 / 28.94 (ΔT) Btu/hr/ft * ft

Knowing that the heat loss will be 10 KW (the amount of heat added by the heater) and the air temperature will decrease from 116.6°F to 85°F, the following length is solved for:

-34152 Btu/hr * 28.94 ft / 679 / (-13 – 0.5(116.6 + 85)) = 12.79 ft

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Comparing this value to the filter housing length of 13.34 ft, indicates the air will become saturated approximately 0.55 ft from the end of the filter housing.

Again, this assumes extreme environmental and tank conditions combined with highly conservatively heat loss predictions. Therefore, the heaters are determined to be sufficient to prevent condensation in the filter housing. Given that the filter is located at least 1 foot from the end of the filter housing (Ref. 16), the heater prevent condensation in the last HEPA filter.

6.6 PRIMARY A-TRAIN VENTILATION SYSTEM AT THE SY TANK FARM

In Section 6.2 the SY K1-A demister was determined to be adequate to remove the entrained moisture in the air.

It is assumed that the inlet conditions calculated for the east tanks farms (Section 6.3) are representative for the SY farm (air at 100% relative humidity and at 85°F).

In Sections 6.4 and 6.5, the heat transfer and performance of the in-line heater for the east tank farms was evaluated. Because the SY K1-A system has not been operated, there are no temperature measurements for this system. Therefore, this system will be compared to the east tank farms systems to estimate the heat loss and performance of the in-line heater.

6.6.1 Comparison of Physical Dimensions

As indicated in Section 6.5, the east farm filter housings have the following surface areas:

Filter housing area = 16,330 $inch^2$
Exhaust duct area = 3,306 $inch^2$
Stack area = 3,125 $inch^2$
Total heat transfer area = 22761 $inch^2$ = 158.1 ft^2

The SY K1-A uses Flanders filter and test sections (Ref. 22). The approximate cross section dimensions for the Flanders series E-5 test section are 30 x 27.25 inches (Ref. 25). The length of the filter housing is approximately 90.75 inches (Ref. 22). The total area for the SY primary A-train filter housing is:

$$SY\text{-}Fharea = 2 \times (30 \times 90.75) + 2 \times (27.25 \times 90.75) = 10390.9 \text{ in}^2$$

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The primary A-train system has a short transition piece 7-inches in length (Ref. 26) and then a short piece of flex hose to the fan housing (Ref. 22). This transition piece will be modeled as a square section with the following surface area:

SY-Exhduct = 2 * 7 * 30 + 2 * 7 * 27.25 = 801.5 in^2

The primary A-train stack is 8-inches in diameter and there slightly more than 7-feet (84 inches) to the test ports (Ref. 26). The stack is insulated (Ref. 26 and 27). The approximate area of the stack is:

SY-stackarea = π * 8 * 84 = 2111.1 $inch^2$

The total surface area of the SY primary A-train exhauster (excluding the fan housing) is:

SY total = 10390.9 + 801.5 + 2111.1 = 13303.5 in^2

In terms of total heat transfer area, the primary A-train has the following percent as compared to the east farms:

13303.5 / 22761 = 58.5 %

Other heat loss considerations are the insulated stack. Therefore, the heat loss in the primary A-train stack will be far less than the heat loss in the east tank farms. In addition, the primary A-train stack is slightly smaller than the east farm stacks. Again this will lead to smaller heat loss.

6.6.2 Heat Loss in the Primary A-Train Exhauster

The heat loss in the primary A-train exhauster is expected to be less than the east tank farm exhausters based on the physical comparisons performed in the previous section. As a conservative measure, it will be assumed that the primary A-train has 60% of the heat loss calculated for the east tank farms exhausters (based on the ratio of the surface areas).

Earlier in this calculation, the overall heat transfer for the east farm ventilation systems to the environment was expressed as:

Q = 679 Btu/hr/°F * (ΔT) (Eq. 2)

Assuming 60% for the SY primary A-train provides:

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$Q = 407$ Btu/hr/°F (ΔT)

The heat added by the heater is defined as:

$Q = (cfm)\ 1.08\ (\Delta T)$ Btu/hr (Eq. 1)

The primary A-train heater is controlled with a temperature controller. This controller monitors the temperature of the air upstream of the heater and in the filter housing. The controller then maintains a desired temperature difference (i.e 20°F) between these two points. Knowing the temperature increase, the amount of heat added by the heater can be determined. For the SY ventilation system, the using 1000 cfm and a 20 °F differences:

Q Btu/hr = 1000 (1.08) (20)
Q = 21,600 Btu/hr = 6.33 KW

The temperature after the heater is therefore:

85 + 20 = 105°F

As with the east farm exhausters, knowing that the heat loss will be 6.33 KW (the amount of heat added by the heater) and the air temperature will decrease from 105°F to 85°F, the following length is solved for:

-21600 Btu/hr * 15.1 ft / 407 / (-13 – 0.5(105 + 85)) = 7.4 ft = 89.0 inches

The filter housing is 90.75 inches long. Therefore, the heater guards against condensation in the filter housing. The last HEPA filter housing in the SY primary A-train is 24" long. The HEPA filter is approximately 12 inches in length. Given the fact that condensation is predicted 1.75 inches (90.75 – 89) from the end of this filter housing, the heater prevents condensation in the filter housing pass the last HEPA filter.

6.6.3 SY Seal Pot

From the east farms, the mass loading from aerosols was predicted to be:
Total loading = 0.0001 lb/m^3 = 3.43 e-6 lb/ft^3

Given the 1000 cfm rating of the ventilation system, this provides:
1000 ft^3/min * 3.43 e-6 lb/ft^3 = .0034 lb/min

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Given the density of water at 70°F of 62.30 lb/ft^3, the volume of water is:
0.0034 lb/min / (62.30 lb/ft^3) = 5.5 e-6 ft^3/min = 0.0004 gpm = 0.02 gph

From the east farms, the extreme amount of condensation was calculated to be:
Condensate = 4.97 gph

Therefore, the total predicted condensation and aerosol removal from the airstream is:
Total = 4.97 + 0.02 = 4.99 gph.

The primary A-train exhauster has a 1 inch drain line from the seal pot. This line will handle the flow rate of 5 gph.

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7/13/99
2E-99-1323

TEST PORT K (241-AN ,Primary Stack Air Flow, 296-A-29)					
Relative Humidity:		18 (RH)		RETEST	
Static Pressure:		0.14 (Pg)		(Pg)	
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	98	0.155	1576.77		0
1/2	98	0.155	1576.77		0
7/8	98	0.164	1621.901		0
1 1/4	98	0.159	1596.986		0
1 3/4	98	0.157	1586.91		0
2 1/4	98	0.151	1556.292		0
2 7/8	98	0.15	1551.13		0
3 3/4	98	0.146	1530.308		0
6 1/4	98	0.143	1514.504		0
7 1/8	98	0.135	1471.531		0
7 3/4	98	0.138	1487.791		0
8 1/4	98	0.134	1466.071		0
8 3/4	98	0.134	1466.071		0
9 1/8	98	0.134	1466.071		0
9 1/2	98	0.13	1444.023		0
9 1/2	98	0.13	1444.023		0
TOTAL Ts	1568	TOTAL FPM	24357.15	TOTAL FPM	0

Pages 1 through 35 ~~36~~ of this Attachment were provided by Johan Lorenzi. The pages are attached to show the source of stack flow and temperature data. The calculations will not be over-checked as part of the ALARACT calculation. 11/6/01

TEST PORT L (241-AN, Primary Stack Air Flow, 296-A-29)					
AIR FLOW MEASUREMENTS (continued)				RETEST	
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	98	0.135	1471.531		0
1/2	98	0.135	1471.531		0
7/8	98	0.143	1514.504		0
1 1/4	98	0.146	1530.308		0
1 3/4	98	0.144	1519.791		0
2 1/4	98	0.136	1476.971		0
2 7/8	98	0.144	1519.791		0
3 3/4	98	0.14	1498.534		0
6 1/4	98	0.136	1476.971		0
7 1/8	98	0.14	1498.534		0
7 3/4	98	0.144	1519.791		0
8 1/4	98	0.15	1551.13		0
8 3/4	98	0.158	1591.956		0
9 1/8	98	0.163	1616.949		0
9 1/2	98	0.154	1571.675		0
9 1/2	98	0.154	1571.675		0
TOTAL Ts	1568	TOTAL FPM	24401.64	TOTAL FPM	0

STACK AIR FLOW CALCULATIONS		
	Total Port K	1568
	Total Port L	1568
Total ts=ts1+ts2+ts3+....	ts (Total K+L)	3136
Average ts=Total ts/32	ts (Avg.)	98
Velocity (FPM)=4005 SQRT (VP)	Data Sheet 3	
	Total Port K	24357.15
	Total Port L	24401.64
Total FPM=FPM1+FPM2+FPM3+...	ts (Total K+L)	48758.8
Average FPM= Total FPM/32	fpm(Avg.)	1523.712
Total CFM=Aveg FPMx.5454 Sq ft	cfm (total)	831.0327

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Originator:
Prepared by: E. Stam Checked by: RPS
Date: ~~10/29/01~~ 11/6/01 1/8/02
Project No. & Title: VET-1084, DST Ventilation ALARACT

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Eq. Input	Description	Value	
RH	Stack Relative Humidity, percent	18	SHT3
Pws	Vapor Pressure of H2O at Temp. ts (Avg)	1.82134	In Put
Pb	Parometric pressure at test port, in. Hg	29.141	(SHT 2) In Put
Pg	Stack static pressure, in. wg	0.14	(SHT 3)
Ps	Absolute stack gas pressure, in. Hg: Ps=Pb+(Pg/13.6)	29.15129	
Bws	Stack gas water vapor: Bws=(RH/100)(Pws/Ps)	0.011246	
(SQRTVP)Avg	Average of velocity pressure sqrt, in. wg: (SQRTVP)=fpmavg/4005	0.380453	
ts(avg)	Average stack gas Temp., F	98	
Ts(avg)	Average absolute stack Temp., R Ts(avg)=460+Ts(avg)	558	
Ms	Molecular weight stack gas, wet, ib/ib-mole: Ms=29(1-Bw)+18Bws	28.87629	
Kp	Pitot tube constant: 85.49 ft/sec((ib*in.*Hg)/(ib-mole*R*un.*H20))**.5	85.49	
Cp	Pitot tube coefficient, standard	0.99	
A	Cross0sectional stack area, ft2	0.5454	In Put
Tstd	Standard absolute Temp. R	528	
Pstd	Standard absolute Presurre, in. Hg	29.92	
Qsd	Average Stack Gas Dry Volumetric Flow Rate (Qsd)	782.022	

1/27/99

TEST PORT K (241-AN ,Primary Stack Air Flow, 296-A-29)					
Relative Humidity:		30 (RH)		RETEST	2E-99-2688
Static Pressure:		0.14 (Pg)			(Pg)
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	88	0.15	1551.13		0
1/2	88	0.15	1551.13		0
7/8	88	0.14	1498.534		0
1 1/4	88	0.14	1498.534		0
1 3/4	88	0.14	1498.534		0
2 1/4	88	0.13	1444.023		0
2 7/8	88	0.13	1444.023		0
3 3/4	88	0.13	1444.023		0
6 1/4	88	0.13	1444.023		0
7 1/8	88	0.13	1444.023		0
7 3/4	88	0.13	1444.023		0
8 1/4	88	0.13	1444.023		0
8 3/4	88	0.13	1444.023		0
9 1/8	88	0.13	1444.023		0
9 1/2	88	0.12	1387.373		0
9 1/2	88	0.12	1387.373		0
TOTAL Ts	1408	TOTAL FPM	23368.82	TOTAL FPM	0

TEST PORT L (241-AN, Primary Stack Air Flow, 296-A-29)					
AIR FLOW MEASUREMENTS (continued)				RETEST	
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	88	0.14	1498.534		0
1/2	88	0.14	1498.534		0
7/8	88	0.14	1498.534		0
1 1/4	88	0.14	1498.534		0
1 3/4	88	0.14	1498.534		0
2 1/4	88	0.13	1444.023		0
2 7/8	88	0.13	1444.023		0
3 3/4	88	0.12	1387.373		0
6 1/4	88	0.13	1444.023		0
7 1/8	88	0.13	1444.023		0
7 3/4	88	0.14	1498.534		0
8 1/4	88	0.14	1498.534		0
8 3/4	88	0.14	1498.534		0
9 1/8	88	0.15	1551.13		0
9 1/2	88	0.15	1551.13		0
9 1/2	88	0.15	1551.13		0
TOTAL Ts	1408	TOTAL FPM	23805.13	TOTAL FPM	0

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Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer Originator: Prepared by: E. Stam _____ Checked by: RPS Date: ~~10/25/01~~ 11/6/01 Project No. & Title: VET-1084, DST Ventilation ALARACT	Calc. #: VET-1084-001 Rev: 0 Attachment 1 Page: 3 of 37

STACK AIR FLOW CALCULATIONS		
	Total Port K	1408
	Total Port L	1408
Total ts=ts1+ts2+ts3+....	ts (Total K+L)	2816
Average ts=Total ts/32	ts (Avg.)	88
Velocity (FPM)=4005 SQRT (VP)	Data Sheet 3	
	Total Port K	23368.82
	Total Port L	23805.13
Total FPM=FPM1+FPM2+FPM3+...	ts (Total K+L)	47173.94
Average FPM= Total FPM/32	fpm(Avg.)	1474.186
Total CFM=Aveg FPMx.5454 Sq ft	cfm (total)	804.0209

Eq. Input	Description	Value	
RH	Stack Relative Humidity, percent	30	SHT3
Pws	Vapor Pressure of H2O at Temp. ts (Avg)	1.33608	In Put
Pb	Parometric pressure at test port, in. Hg	29.73	(SHT 2) In Put
Pg	Stack static pressure, in. wg	0.14	(SHT 3)
Ps	Absolute stack gas pressure, in. Hg: Ps=Pb+(Pg/13.6)	29.74029	
Bws	Stack gas water vapor: Bws=(RH/100)(Pws/Ps)	0.013477	
(SQRTVP)Avg	Average of velocity pressure sqrt, in. wg: (SQRTVP)=fpmavg/4005	0.368086	
ts(avg)	Average stack gas Temp., F	88	
Ts(avg)	Average absolute stack Temp., R Ts(avg)=460+Ts(avg)	548	
Ms	Molecular weight stack gas, wet, ib/ib-mole: Ms=29(1-Bw)+18Bws	28.85175	
Kp	Pitot tube constant: 85.49 ft/sec[(ib*in.*Hg)/(ib-mole*R*in.*H20)]**.5	85.49	
Cp	Pitot tube coefficient, standard	0.99	
A	Cross0sectional stack area, ft2	0.5454	In Put
Tstd	Standard absolute Temp. R	528	
Pstd	Standard absolute Presurre, in. Hg	29.92	
Qsd	Average Stack Gas Dry Volumetric Flow Rate (Qsd)	769.7367	

4/27/00

TEST PORT K (241-AN ,Primary Stack Air Flow, 296-A-29)					
Relative Humidity:		47 (RH)		RETEST	2E-00-665
Static Pressure:		0.117 (Pg)			(Pg)
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	82	0.126	1421.634		0
1/2	82	0.116	1364.054		0
7/8	82	0.112	1340.329		0
1 1/4	82	0.113	1346.3		0
1 3/4	82	0.106	1303.934		0
2 1/4	82	0.111	1334.332		0
2 7/8	82	0.108	1316.177		0
3 3/4	82	0.106	1303.934		0
6 1/4	82	0.103	1285.349		0
7 1/8	82	0.102	1279.094		0
7 3/4	82	0.103	1285.349		0
8 1/4	82	0.106	1303.934		0
8 3/4	82	0.107	1310.07		0
9 1/8	82	0.106	1303.934		0
9 1/2	82	0.089	1194.806		0
9 1/2	82	0.089	1194.806		0
TOTAL Ts	1312	TOTAL FPM	20888.04	TOTAL FPM	0

Poor Quality Original

Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer
Originator:
Prepared by: E. Stam Checked by: RPS
Date: ~~10/29/01~~ 11/6/01
Project No. & Title: VET-1084, DST Ventilation ALARACT

Calc. #: VET-1084-001
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TEST PORT L (241-AN, Primary Stack Air Flow, 296-A-29)					
AIR FLOW MEASUREMENTS (continued)				RETEST	
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	82	0.113	1346.3		0
1/2	82	0.114	1352.244		0
7/8	82	0.111	1334.332		0
1 1/4	82	0.107	1310.07		0
1 3/4	82	0.112	1340.329		0
2 1/4	82	0.109	1322.257		0
2 7/8	82	0.116	1364.054		0
3 3/4	82	0.118	1375.763		0
6 1/4	82	0.127	1427.264		0
7 1/8	82	0.121	1393.141		0
7 3/4	82	0.122	1398.886		0
8 1/4	82	0.128	1432.872		0
8 3/4	82	0.123	1404.608		0
9 1/8	82	0.129	1438.459		0
9 1/2	82	0.123	1404.608		0
9 1/2	82	0.123	1404.608		0
TOTAL Ts	1312	TOTAL FPM	22049.79	TOTAL FPM	0

STACK AIR FLOW CALCULATIONS		
	Total Port K	1312
	Total Port L	1312
Total ts=ts1+ts2+ts3+....	ts (Total K+L)	2624
Average ts=Total ts/32	ts (Avg.)	82
Velocity (FPM)=4005 SQRT (VP)	Data Sheet 3	
	Total Port K	20888.04
	Total Port L	22049.79
Total FPM=FPM1+FPM2+FPM3+...	ts (Total K+L)	42937.83
Average FPM= Total FPM/32	fpm(Avg.)	1341.807
Total CFM=Aveg FPMx.5454 Sq ft	cfm (total)	731.8216

Eq. Input	Description	Value	
RH	Stack Relative Humidity, percent	47	SHT3
Pws	Vapor Pressure of H2O at Temp. ts (Avg)	1.1025	In Put
Pb	Parometric pressure at test port, in. Hg	28.98	(SHT 2) In Put
Pg	Stack static pressure, in. wg	0.117	(SHT 3)
Ps	Absolute stack gas pressure, in. Hg: Ps=Pb+(Pg/13.6)	28.9886	
Bws	Stack gas water vapor: Bws=(RH/100)(Pws/Ps)	0.017875	
(SQRTVP)Avg	Average of velocity pressure sqrt, in. wg: (SQRTVP)=fpmavg/4005	0.335033	
ts(avg)	Average stack gas Temp., F	82	
Ts(avg)	Average absolute stack Temp., R Ts(avg)=460+Ts(avg)	542	
Ms	Molecular weight stack gas, wet, ib/ib-mole: Ms=29(1-Bw)+18Bws	28.80337	
Kp	Pitot tube constant: 85.49 ft/sec((ib*in.*Hg)/(ib-mole*R*un.*H20))**.5	85.49	
Cp	Pitot tube coefficient, standard	0.99	
A	Cross0sectional stack area, ft2	0.5454	In Put
Tstd	Standard absolute Temp. R	528	
Pstd	Standard absolute Presurre, in. Hg	29.92	
Qsd	Average Stack Gas Dry Volumetric Flow Rate (Qsd)	693.0042	

Poor Quality Original

Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer Originator: Prepared by: E. Stam Checked by: RPS Date: ~~10/29/01~~ 11/6/01 Project No. & Title: VET-1084, DST Ventilation ALARACT	Calc. #: VET-1084-001 Rev: 0 Attachment 1 Page: 5 of 37

7/18/00

2E-00-1317

TEST PORT K (241-AN ,Primary Stack Air Flow, 296-A-29)					
Relative Humidity:		27 (RH)		RETEST	
Static Pressure:		0.1 (Pg)		(Pg)	
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	97	0.109	1322.257		0
1/2	97	0.109	1322.257		0
7/8	97	0.117	1369.921		0
1 1/4	97	0.114	1352.244		0
1 3/4	97	0.11	1328.308		0
2 1/4	97	0.11	1328.308		0
2 7/8	97	0.106	1303.934		0
3 3/4	97	0.102	1279.094		0
6 1/4	97	0.101	1272.809		0
7 1/8	97	0.096	1240.904		0
7 3/4	97	0.097	1247.35		0
8 1/4	97	0.094	1227.91		0
8 3/4	97	0.092	1214.777		0
9 1/8	97	0.093	1221.361		0
9 1/2	97	0.091	1208.157		0
9 1/2	97	0.091	1208.157		0
TOTAL Ts	1552	TOTAL FPM	20447.75	TOTAL FPM	0

TEST PORT L (241-AN, Primary Stack Air Flow, 296-A-29)					
AIR FLOW MEASUREMENTS (continued)				RETEST	
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	100	0.079	1125.683		0
1/2	100	0.079	1125.683		0
7/8	99	0.09	1201.5		0
1 1/4	99	0.098	1253.763		0
1 3/4	99	0.096	1240.904		0
2 1/4	99	0.099	1260.144		0
2 7/8	99	0.095	1234.424		0
3 3/4	99	0.096	1240.904		0
6 1/4	99	0.095	1234.424		0
7 1/8	99	0.096	1240.904		0
7 3/4	99	0.097	1247.35		0
8 1/4	99	0.099	1260.144		0
8 3/4	99	0.095	1234.424		0
9 1/8	99	0.094	1227.91		0
9 1/2	99	0.099	1260.144		0
9 1/2	99	0.099	1260.144		0
TOTAL Ts	1586	TOTAL FPM	19648.45	TOTAL FPM	0

STACK AIR FLOW CALCULATIONS		
	Total Port K	1552
	Total Port L	1586
Total ts=ts1+ts2+ts3+....	ts (Total K+L)	3138
Average ts=Total ts/32	ts (Avg.)	98.0625
Velocity (FPM)=4005 SQRT (VP)	Data Sheet 3	
	Total Port K	20447.75
	Total Port L	19648.45
Total FPM=FPM1+FPM2+FPM3+...	ts (Total K+L)	40096.19
Average FPM= Total FPM/32	fpm(Avg.)	1253.006
Total CFM=Aveg FPMx.5454 Sq ft	cfm (total)	683.3895

Poor Quality Original

Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer
Originator:
Prepared by: E. Stam Checked by: RPS
Date: ~~10/29/01~~ 11/6/01
Project No. & Title: VET-1084, DST Ventilation ALARACT

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Eq. Input	Description	Value	
RH	Stack Relative Humidity, percent	27	SHT3
Pws	Vapor Pressure of H2O at Temp. ts (Avg)	1.87736	In Put
Pb	Parometric pressure at test port, in. Hg	29.25	(SHT 2) In Put
Pg	Stack static pressure, in. wg	0.1	(SHT 3)
Ps	Absolute stack gas pressure, in. Hg: Ps=Pb+(Pg/13.6)	29.25735	
Bws	Stack gas water vapor: Bws=(RH/100)(Pws/Ps)	0.017325	
(SQRTVP)Avg	Average of velocity pressure sqrt, in. wg: (SQRTVP)=fpmavg/4005	0.31286	
ts(avg)	Average stack gas Temp., F	98.0625	
Ts(avg)	Average absolute stack Temp., R Ts(avg)=460+Ts(avg)	558.0625	
Ms	Molecular weight stack gas, wet, ib/ib-mole: Ms=29(1-Bw)+18Bws	28.80942	
Kp	Pitot tube constant: 85.49 ft/sec((ib*in.*Hg)/(ib-mole*R*un.*H20))**.5	85.49	
Cp	Pitot tube coefficient, standard	0.99	
A	Cross0sectional stack area, ft2	0.5454	In Put
Tstd	Standard absolute Temp. R	528	
Pstd	Standard absolute Presurre, in. Hg	29.92	
Qsd	Average Stack Gas Dry Volumetric Flow Rate (Qsd)	641.0007	

10/24/00

TEST PORT K (241-AN ,Primary Stack Air Flow, 296-A-29)					
Relative Humidity:		50 (RH)		RETEST	2E-00-1479
Static Pressure:		0.13 (Pg)		(Pg)	
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	76	0.15	1551.13		0
1/2	76	0.15	1551.13		0
7/8	76	0.153	1566.564		0
1 1/4	76	0.148	1540.754		0
1 3/4	76	0.14	1498.534		0
2 1/4	76	0.135	1471.531		0
2 7/8	76	0.122	1398.886		0
3 3/4	76	0.111	1334.332		0
6 1/4	76	0.115	1358.162		0
7 1/8	76	0.117	1369.921		0
7 3/4	76	0.105	1297.768		0
8 1/4	76	0.109	1322.257		0
8 3/4	76	0.105	1297.768		0
9 1/8	76	0.086	1174.497		0
9 1/2	76	0.072	1074.654		0
9 1/2	76	0.072	1074.654		0
TOTAL Ts	1216	TOTAL FPM	21882.54	TOTAL FPM	0

TEST PORT L (241-AN, Primary Stack Air Flow, 296-A-29)					
AIR FLOW MEASUREMENTS (continued)				RETEST	
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	76	0.122	1398.886		0
1/2	76	0.122	1398.886		0
7/8	76	0.116	1364.054		0
1 1/4	76	0.13	1444.023		0
1 3/4	76	0.127	1427.264		0
2 1/4	76	0.116	1364.054		0
2 7/8	76	0.12	1387.373		0
3 3/4	76	0.118	1375.763		0
6 1/4	76	0.118	1375.763		0
7 1/8	76	0.124	1410.306		0
7 3/4	76	0.13	1444.023		0
8 1/4	76	0.132	1455.089		0
8 3/4	76	0.136	1476.971		0
9 1/8	76	0.141	1503.876		0
9 1/2	76	0.141	1503.876		0
9 1/2	76	0.141	1503.876		0
TOTAL Ts	1216	TOTAL FPM	22834.08	TOTAL FPM	0

Poor Quality Original

Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer Originator: Prepared by: E. Stam _____ Checked by: RPS Date: ~~10/29/01~~ 11/6/01 Project No. & Title: VET-1084, DST Ventilation ALARACT	Calc. #: VET-1084-001 Rev: 0 Attachment 1 Page: 7 of 37

STACK AIR FLOW CALCULATIONS		
	Total Port K	1216
	Total Port L	1216
Total ts=ts1+ts2+ts3+....	ts (Total K+L)	2432
Average ts=Total ts/32	ts (Avg.)	76
Velocity (FPM)=4005 SQRT (VP)	Data Sheet 3	
	Total Port K	21882.54
	Total Port L	22834.08
Total FPM=FPM1+FPM2+FPM3+...	ts (Total K+L)	44716.63
Average FPM= Total FPM/32	fpm(Avg.)	1397.395
Total CFM=Aveg FPMx.5454 Sq ft	cfm (total)	762.139

Eq. Input	Description	Value	
RH	Stack Relative Humidity, percent	50	SHT3
Pws	Vapor Pressure of H2O at Temp. ts (Avg)	0.90532	In Put
Pb	Parometric pressure at test port, in. Hg	29.38	(SHT 2) In Put
Pg	Stack static pressure, in. wg	0.13	(SHT 3)
Ps	Absolute stack gas pressure, in. Hg: Ps=Pb+(Pg/13.6)	29.38956	
Bws	Stack gas water vapor: Bws=(RH/100)(Pws/Ps)	0.015402	
(SQRTVP)Avg	Average of velocity pressure sqrt, in. wg: (SQRTVP)=fpmavg/4005	0.348913	
ts(avg)	Average stack gas Temp., F	76	
Ts(avg)	Average absolute stack Temp., R Ts(avg)=460+Ts(avg)	536	
Ms	Molecular weight stack gas, wet, ib/ib-mole: Ms=29(1-Bw)+18Bws	28.83058	
Kp	Pitot tube constant: 85.49 ft/sec((ib*in.*Hg)/(ib-mole*R*un.*H20))**,5	85.49	
Cp	Pitot tube coefficient, standard	0.99	
A	Cross0sectional stack area, ft2	0.5454	In Put
Tstd	Standard absolute Temp. R	528	
Pstd	Standard absolute Presurre, in. Hg	29.92	
Qsd	Average Stack Gas Dry Volumetric Flow Rate (Qsd)	732.2378	

1/25/01

TEST PORT K (241-AN ,Primary Stack Air Flow, 296-A-29)					
Relative Humidity:		29 (RH)		RETEST	2E-00-2237
Static Pressure:		0.14 (Pg)		(Pg)	
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	92	0.133	1460.59		0
1/2	92	0.133	1460.59		0
7/8	92	0.135	1471.531		0
1 1/4	92	0.138	1487.791		0
1 3/4	92	0.14	1498.534		0
2 1/4	92	0.14	1498.534		0
2 7/8	92	0.14	1498.534		0
3 3/4	92	0.142	1509.2		0
6 1/4	92	0.147	1535.54		0
7 1/8	92	0.149	1545.951		0
7 3/4	92	0.156	1581.848		0
8 1/4	92	0.157	1586.91		0
8 3/4	82	0.16	1602		0
9 1/8	92	0.167	1636.669		0
9 1/2	92	0.134	1466.071		0
9 1/2	92	0.134	1466.071		0
TOTAL Ts	1462	TOTAL FPM	24306.36	TOTAL FPM	0

Poor Quality Original

Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer
Originator:
Prepared by: E. Stam Checked by: RPS
Date: ~~10/29/01~~ 11/6/01
Project No. & Title: VET-1084, DST Ventilation ALARACT

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TEST PORT L (241-AN, Primary Stack Air Flow, 296-A-29)					
AIR FLOW MEASUREMENTS (continued)				RETEST	
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	92	0.15	1551.13		0
1/2	92	0.15	1551.13		0
7/8	92	0.15	1551.13		0
1 1/4	92	0.152	1561.436		0
1 3/4	92	0.156	1581.848		0
2 1/4	92	0.154	1571.675		0
2 7/8	92	0.154	1571.675		0
3 3/4	92	0.155	1576.77		0
6 1/4	92	0.151	1556.292		0
7 1/8	92	0.151	1556.292		0
7 3/4	92	0.154	1571.675		0
8 1/4	92	0.156	1581.848		0
8 3/4	92	0.16	1602		0
9 1/8	92	0.16	1602		0
9 1/2	92	0.127	1427.264		0
9 1/2	92	0.127	1427.264		0
TOTAL Ts	1472	TOTAL FPM	24841.43	TOTAL FPM	0

STACK AIR FLOW CALCULATIONS		
	Total Port K	1462
	Total Port L	1472
Total ts=ts1+ts2+ts3+....	ts (Total K+L)	2934
Average ts=Total ts/32	ts (Avg.)	91.6875
Velocity (FPM)=4005 SQRT (VP)	Data Sheet 3	
	Total Port K	24306.36
	Total Port L	24841.43
Total FPM=FPM1+FPM2+FPM3+...	ts (Total K+L)	49147.79
Average FPM= Total FPM/32	fpm(Avg.)	1535.869
Total CFM=Aveg FPMx.5454 Sq ft	cfm (total)	837.6627

Eq. Input	Description	Value	
RH	Stack Relative Humidity, percent	29	SHT3
Pws	Vapor Pressure of H2O at Temp. ts (Avg)	1.51468	In Put
Pb	Parometric pressure at test port, in. Hg	29.35	(SHT 2) In Put
Pg	Stack static pressure, in. wg	0.14	(SHT 3)
Ps	Absolute stack gas pressure, in. Hg: Ps=Pb+(Pg/13.6)	29.36029	
Bws	Stack gas water vapor: Bws=(RH/100)(Pws/Ps)	0.014961	
(SQRTVP)Avg	Average of velocity pressure sqrt, in. wg: (SQRTVP)=fpmavg/4005	0.383488	
ts(avg)	Average stack gas Temp., F	91.6875	
Ts(avg)	Average absolute stack Temp., R Ts(avg)=460+Ts(avg)	551.6875	
Ms	Molecular weight stack gas, wet, ib/ib-mole: Ms=29(1-Bw)+18Bws	28.83543	
Kp	Pitot tube constant: 85.49 ft/sec{(ib*in.*Hg)/(ib-mole*R*un.*H20)}**.5	85.49	
Cp	Pitot tube coefficient, standard	0.99	
A	Cross0sectional stack area, ft2	0.5454	In Put
Tstd	Standard absolute Temp. R	528	
Pstd	Standard absolute Presurre, in. Hg	29.92	
Qsd	Average Stack Gas Dry Volumetric Flow Rate (Qsd)	793.167	

Poor Quality Original

Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer
Originator:
Prepared by: E. Stam Checked by: RPS
Date: ~~10/20/01~~ 11/6/11
Project No. & Title: VET-1084, DST Ventilation ALARACT

Calc. #: VET-1084-001
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4/24/01

TEST PORT K (241-AN ,Primary Stack Air Flow, 296-A-29)					
Relative Humidity:		35.1 (RH)		RETEST	2e-01-517
Static Pressure:		0.15 (Pg)		(Pg)	
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	85	0.15	1551.13		0
1/2	85	0.15	1551.13		0
7/8	85	0.13	1444.023		0
1 1/4	85	0.14	1498.534		0
1 3/4	85	0.15	1551.13		0
2 1/4	85	0.15	1551.13		0
2 7/8	85	0.15	1551.13		0
3 3/4	85	0.15	1551.13		0
6 1/4	85	0.16	1602		0
7 1/8	85	0.17	1651.304		0
7 3/4	85	0.17	1651.304		0
8 1/4	85	0.17	1651.304		0
8 3/4	85	0.15	1551.13		0
9 1/8	85	0.13	1444.023		0
9 1/2	85	0.14	1498.534		0
9 1/2	85	0.14	1498.534		0
TOTAL Ts	1360	TOTAL FPM	24797.47	TOTAL FPM	0

TEST PORT L (241-AN, Primary Stack Air Flow, 296-A-29)					
AIR FLOW MEASUREMENTS (continued)				*RETEST*	
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	85	0.13	1444.023		0
1/2	85	0.13	1444.023		0
7/8	85	0.15	1551.13		0
1 1/4	85	0.16	1602		0
1 3/4	85	0.16	1602		0
2 1/4	85	0.15	1551.13		0
2 7/8	85	0.15	1551.13		0
3 3/4	85	0.15	1551.13		0
6 1/4	85	0.15	1551.13		0
7 1/8	85	0.15	1551.13		0
7 3/4	85	0.15	1551.13		0
8 1/4	85	0.16	1602		0
8 3/4	85	0.16	1602		0
9 1/8	85	0.15	1551.13		0
9 1/2	85	0.12	1387.373		0
9 1/2	85	0.12	1387.373		0
TOTAL Ts	1360	TOTAL FPM	24479.83	TOTAL FPM	0

STACK AIR FLOW CALCULATIONS		
	Total Port K	1360
	Total Port L	1360
Total ts=ts1+ts2+ts3+....	ts (Total K+L)	2720
Average ts=Total ts/32	ts (Avg.)	85
Velocity (FPM)=4005 SQRT (VP)	Data Sheet 3	
	Total Port K	24797.47
	Total Port L	24479.83
Total FPM=FPM1+FPM2+FPM3+...	ts (Total K+L)	49277.3
Average FPM= Total FPM/32	fpm(Avg.)	1539.916
Total CFM=Aveg FPMx.5454 Sq ft	cfm (total)	839.87

Poor Quality Original

Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer
Originator:
Prepared by: E. Stam Checked by: RPS
Date: ~~10/29/01~~ 11/1/01
Project No. & Title: VET-1084, DST Ventilation ALARACT

Calc. #: VET-1084-001
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Eq. Input	Description	Value	
RH	Stack Relative Humidity, percent	35.1	SHT3
Pws	Vapor Pressure of H2O at Temp. ts (Avg)	1.21442	In Put
Pb	Parometric pressure at test port, in. Hg	29.054	(SHT 2) In Put
Pg	Stack static pressure, in. wg	0.15	(SHT 3)
Ps	Absolute stack gas pressure, in. Hg: Ps=Pb+(Pg/13.6)	29.06503	
Bws	Stack gas water vapor: Bws=(RH/100)(Pws/Ps)	0.014666	
(SQRTVP)Avg	Average of velocity pressure sqrt, in. wg: (SQRTVP)=fpmavg/4005	0.384498	
ts(avg)	Average stack gas Temp., F	85	
Ts(avg)	Average absolute stack Temp., R Ts(avg)=460+Ts(avg)	545	
Ms	Molecular weight stack gas, wet, ib/ib-mole: Ms=29(1-Bw)+18Bws	28.83868	
Kp	Pitot tube constant: 85.49 ft/sec((ib*in.*Hg)/(ib-mole*R*un.*H20))**.5	85.49	
Cp	Pitot tube coefficient, standard	0.99	
A	Cross0sectional stack area, ft2	0.5454	In Put
Tstd	Standard absolute Temp. R	528	
Pstd	Standard absolute Presurre, in. Hg	29.92	
Qsd	Average Stack Gas Dry Volumetric Flow Rate (Qsd)	796.2816	

10/9/01

TEST PORT K (241-AN ,Primary Stack Air Flow, 296-A-29)					
Relative Humidity:		50 (RH)		RETEST	2E-01-0049
Static Pressure:		0.12 (Pg)		(Pg)	
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	79	0.08	1132.785		0
1/2	79	0.08	1132.785		0
7/8	79	0.14	1498.534		0
1 1/4	79	0.13	1444.023		0
1 3/4	79	0.13	1444.023		0
2 1/4	79	0.12	1387.373		0
2 7/8	79	0.12	1387.373		0
3 3/4	79	0.12	1387.373		0
6 1/4	79	0.12	1387.373		0
7 1/8	79	0.12	1387.373		0
7 3/4	79	0.11	1328.308		0
8 1/4	79	0.11	1328.308		0
8 3/4	79	0.11	1328.308		0
9 1/8	79	0.11	1328.308		0
9 1/2	79	0.11	1328.308		0
9 1/2	79	0.11	1328.308		0
TOTAL Ts	1264	TOTAL FPM	21558.86	TOTAL FPM	0

TEST PORT L (241-AN, Primary Stack Air Flow, 296-A-29)					
AIR FLOW MEASUREMENTS (continued)				RETEST	
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	79	0.11	1328.308		0
1/2	79	0.11	1328.308		0
7/8	79	0.12	1387.373		0
1 1/4	79	0.13	1444.023		0
1 3/4	79	0.12	1387.373		0
2 1/4	79	0.12	1387.373		0
2 7/8	79	0.12	1387.373		0
3 3/4	79	0.12	1387.373		0
6 1/4	79	0.12	1387.373		0
7 1/8	79	0.12	1387.373		0
7 3/4	79	0.12	1387.373		0
8 1/4	79	0.12	1387.373		0
8 3/4	79	0.13	1444.023		0
9 1/8	79	0.13	1444.023		0
9 1/2	79	0.13	1444.023		0
9 1/2	79	0.13	1444.023		0
TOTAL Ts	1264	TOTAL FPM	22363.09	TOTAL FPM	0

Poor Quality Original

Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer Originator: Prepared by: E. Stam ES Checked by: RPS Date: ~~10/29/01~~ 11/6/01 ES Project No. & Title: VET-1084, DST Ventilation ALARACT	Calc. #: VET-1084-001 Rev: 0 Attachment 1 Page: 11 of 37

STACK AIR FLOW CALCULATIONS		
	Total Port K	1264
	Total Port L	1264
Total ts=ts1+ts2+ts3+....	ts (Total K+L)	2528
Average ts=Total ts/32	ts (Avg.)	79
Velocity (FPM)=4005 SQRT (VP)	Data Sheet 3	
	Total Port K	21558.86
	Total Port L	22363.09
Total FPM=FPM1+FPM2+FPM3+...	ts (Total K+L)	43921.95
Average FPM= Total FPM/32	*fpm(Avg.)*	*1372.561*
Total CFM=Aveg FPMx.5454 Sq ft	cfm (total)	748.5947

Eq. Input	Description	Value	
RH	Stack Relative Humidity, percent	50	SHT3
Pws	Vapor Pressure of H2O at Temp. ts (Avg)	0.99968	In Put
Pb	Parometric pressure at test port, in. Hg	29.422	(SHT 2) In Put
Pg	Stack static pressure, in. wg	0.12	(SHT 3)
Ps	Absolute stack gas pressure, In. Hg: Ps=Pb+(Pg/13.6)	29.43082	
Bws	Stack gas water vapor: Bws=(RH/100)(Pws/Ps)	0.016984	
(SQRTVP)Avg	Average of velocity pressure sqrt, in. wg: (SQRTVP)=fpmavg/4005	0.342712	
ts(avg)	Average stack gas Temp., F	79	
Ts(avg)	Average absolute stack Temp., R Ts(avg)=460+Ts(avg)	539	
Ms	Molecular weight stack gas, wet, ib/ib-mole: Ms=29(1-Bw)+18Bws	28.81318	
Kp	Pitot tube constant: 85.49 ft/sec((ib*in.*Hg)/(ib-mole*R*un.*H20))**.5	85.49	
Cp	Pitot tube coefficient, standard	0.99	
A	Cross0sectional stack area, ft2	0.5454	In Put
Tstd	Standard absolute Temp. R	528	
Pstd	Standard absolute Presurre, in. Hg	29.92	
Qsd	*Average Stack Gas Dry Volumetric Flow Rate* (Qsd)	716.7874	

Poor Quality Original

Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer
Originator:
Prepared by: E. Stam _____ Checked by: RPS
Date: ~~10/29/01~~ 11/6/01
Project No. & Title: VET-1084, DST Ventilation ALARACT

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4/27/99
2E-99-1009

TEST PORT K (241-AW Primary Stack Air Flow, 296-A-27)					
Relative Humidity:		80 (RH)		RETEST	
Static Pressure:		0.27 (Pg)		(Pg)	
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	64	0.3	2193.629		0
1/2	64	0.3	2193.629		0
7/8	64	0.29	2156.759		0
1 1/4	64	0.28	2119.247		0
1 3/4	64	0.26	2042.157		0
2 1/4	64	0.25	2002.5		0
2 7/8	64	0.25	2002.5		0
3 3/4	64	0.24	1962.041		0
6 1/4	64	0.25	2002.5		0
7 1/8	64	0.25	2002.5		0
7 3/4	64	0.26	2042.157		0
8 1/4	64	0.25	2002.5		0
8 3/4	64	0.24	1962.041		0
9 1/8	64	0.23	1920.731		0
9 1/2	64	0.2	1791.09		0
9 1/2	64	0.2	1791.09		0
TOTAL Ts	1024	TOTAL FPM	32187.07	TOTAL FPM	0

TEST PORT L (241-AW Primary Stack Air Flow, 296-A-27)					
AIR FLOW MEASUREMENTS (continued)				RETEST	
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	64	0.22	1878.512		0
1/2	64	0.22	1878.512		0
7/8	64	0.22	1878.512		0
1 1/4	64	0.22	1878.512		0
1 3/4	64	0.22	1878.512		0
2 1/4	64	0.23	1920.731		0
2 7/8	64	0.24	1962.041		0
3 3/4	64	0.24	1962.041		0
6 1/4	64	0.25	2002.5		0
7 1/8	64	0.26	2042.157		0
7 3/4	64	0.27	2081.059		0
8 1/4	64	0.28	2119.247		0
8 3/4	64	0.28	2119.247		0
9 1/8	64	0.19	1745.739		0
9 1/2	64	0.14	1498.534		0
9 1/2	64	0.14	1498.534		0
TOTAL Ts	1024	TOTAL FPM	30344.39	TOTAL FPM	0

STACK AIR FLOW CALCULATIONS		
	Total Port F	1024
	Total Port K	1024
Total ts=ts1+ts2+ts3+....	ts (Total K+L)	2048
Average ts=Total ts/32	ts (Avg.)	64
Velocity (FPM)=4005 SQRT (VP)	Data Sheet 3	
	Total Port K	32187.07
	Total Port L	30344.39
Total FPM=FPM1+FPM2+FPM3+...	ts (Total K+L)	62531.46
Average FPM= Total FPM/32	fpm(Avg.)	1954.108
Total CFM=Aveg FPMx0.5454Sq ft	cfm (total)	1065.771

Poor Quality Original

Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer Originator: Prepared by: E. Stam _____ Checked by: RPS Date: ~~10/29/01~~ 11/6/01 Project No. & Title: VET-1084, DST Ventilation ALARACT	Calc. #: VET-1084-001 Rev: 0 Attachment 1 Page: 13 of 37

Eq. Input	Description	Value	
RH	Stack Relative Humidity, percent	80	SHT3
Pws	Vapor Pressure of H2O at Temp. ts (Avg)	0.60112	In Put
Pb	Parometric pressure at test port, in. Hg	29.571	(SHT 2) In Put
Pg	Stack static pressure, in. wg	0.27	(SHT 3)
Ps	Absolute stack gas pressure, in. Hg: Ps=Pb+(Pg/13.6)	29.59085	
Bws	Stack gas water vapor: Bws=(RH/100)(Pws/Ps)	0.016252	
(SQRTVP)Avg	Average of velocity pressure sqrt, in. wg: (SQRTVP)=fpmavg/4005	0.487917	
ts(avg)	Average stack gas Temp., F	64	
Ts(avg)	Average absolute stack Temp., R Ts(avg)=460+Ts(avg)	524	
Ms	Molecular weight stack gas, wet, ib/ib-mole: Ms=29(1-Bw)+18Bws	28.82123	
Kp	Pitot tube constant: 85.49 ft/sec((ib*in.*Hg)/(ib-mole*R*un.*H20))**.5	85.49	
Cp	Pitot tube coefficient, standard	0.99	
A	Cross0sectional stack area, ft2	0.5454	In Put
Tstd	Standard absolute Temp. R	528	
Pstd	Standard absolute Presurre, in. Hg	29.92	
Qsd	Average Stack Gas Dry Volumetric Flow Rate (Qsd)	1038.428	

7/21/99

2E-99-1527

TEST PORT K (241-Aw Primary Stack Air Flow,296-A-27)					
Relative Humidity:		39 (RH)		RETEST	
Static Pressure:		0.49 (Pg)		(Pg)	
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	83	0.178	1689.711		0
1/2	83	0.178	1689.711		0
7/8	83	0.24	1962.041		0
1 1/4	83	0.24	1962.041		0
1 3/4	83	0.24	1962.041		0
2 1/4	83	0.24	1962.041		0
2 7/8	83	0.23	1920.731		0
3 3/4	83	0.23	1920.731		0
6 1/4	83	0.23	1920.731		0
7 1/8	83	0.23	1920.731		0
7 3/4	83	0.22	1878.512		0
8 1/4	83	0.22	1878.512		0
8 3/4	83	0.23	1920.731		0
9 1/8	83	0.24	1962.041		0
9 1/2	83	0.23	1920.731		0
9 1/2	83	0.23	1920.731		0
TOTAL Ts	1328	TOTAL FPM	30391.77	TOTAL FPM	0

Poor Quality Original

Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer
Originator:
Prepared by: E. Stam Checked by: RPS
Date: ~~10/29/01~~ 11/6/01
Project No. & Title: VET-1084, DST Ventilation ALARACT

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TEST PORT L (241-Aw Primary Stack Air Flow, 296-A-27)					
AIR FLOW MEASUREMENTS (continued)				RETEST	
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	83	0.173	1665.81		0
1/2	83	0.173	1665.81		0
7/8	83	0.2	1791.09		0
1 1/4	83	0.21	1835.322		0
1 3/4	83	0.22	1878.512		0
2 1/4	83	0.22	1878.512		0
2 7/8	83	0.22	1878.512		0
3 3/4	83	0.23	1920.731		0
6 1/4	83	0.23	1920.731		0
7 1/8	83	0.24	1962.041		0
7 3/4	83	0.24	1962.041		0
8 1/4	83	0.24	1962.041		0
8 3/4	83	0.23	1920.731		0
9 1/8	83	0.24	1962.041		0
9 1/2	83	0.23	1920.731		0
9 1/2	83	0.23	1920.731		0
TOTAL Ts	1328	TOTAL FPM	30045.39	TOTAL FPM	0

STACK AIR FLOW CALCULATIONS		
	Total Port F	1328
	Total Port K	1328
Total ts=ts1+ts2+ts3+....	ts (Total K+L)	2656
Average ts=Total ts/32	ts (Avg.)	83
Velocity (FPM)=4005 SQRT (VP)	Data Sheet 3	
	Total Port K	30391.77
	Total Port L	30045.39
Total FPM=FPM1+FPM2+FPM3+...	ts (Total K+L)	60437.15
Average FPM= Total FPM/32	fpm(Avg.)	1888.661
Total CFM=Aveg FPMx0.5454Sq ft	cfm (total)	1030.076

Eq. Input	Description	Value	
RH	Stack Relative Humidity, percent	39	SHT3
Pws	Vapor Pressure of H2O at Temp. ts (Avg)	1.13877	In Put
Pb	Parometric pressure at test port, in. Hg	29.23	(SHT 2) In Put
Pg	Stack static pressure, in. wg	0.49	(SHT 3)
Ps	Absolute stack gas pressure, in. Hg: Ps=Pb+(Pg/13.6)	29.26603	
Bws	Stack gas water vapor: Bws=(RH/100)(Pws/Ps)	0.015175	
(SQRTVP)Avg	Average of velocity pressure sqrt, in. wg: (SQRTVP)=fpmavg/4005	0.471576	
ts(avg)	Average stack gas Temp., F	83	
Ts(avg)	Average absolute stack Temp., R Ts(avg)=460+Ts(avg)	543	
Ms	Molecular weight stack gas, wet, ib/ib-mole: Ms=29(1-Bw)+18Bws	28.83307	
Kp	Pitot tube constant: 85.49 ft/sec[(ib*in.*Hg)/(ib-mole*R*un.*H20)]**.5	85.49	
Cp	Pitot tube coefficient, standard	0.99	
A	Cross0sectional stack area, ft2	0.5454	In Put
Tstd	Standard absolute Temp. R	528	
Pstd	Standard absolute Presurre, in. Hg	29.92	
Qsd	Average Stack Gas Dry Volumetric Flow Rate (Qsd)	981.3777	

Poor Quality Original

Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer Originator: Prepared by: E. Stam Checked by: RPS Date: ~~10/29/01~~ 11/6/01 Project No. & Title: VET-1084, DST Ventilation ALARACT	Calc. #: VET-1084-001 Rev: 0 Attachment 1 Page: 15 of 37

1/24/00

2E-99-2691

TEST PORT K (241-Aw Primary Stack Air Flow,296-A-27)					
Relative Humidity:		93 (RH)		RETEST	
Static Pressure:		0.34 (Pg)		(Pg)	
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	51	0.181	1703.891		0
1/2	51	0.18	1699.178		0
7/8	51	0.185	1722.616		0
1 1/4	51	0.173	1665.81		0
1 3/4	51	0.17	1651.304		0
2 1/4	51	0.173	1665.81		0
2 7/8	51	0.16	1602		0
3 3/4	51	0.158	1591.956		0
6 1/4	51	0.169	1646.44		0
7 1/8	51	0.164	1621.901		0
7 3/4	51	0.161	1606.998		0
8 1/4	51	0.163	1616.949		0
8 3/4	51	0.15	1551.13		0
9 1/8	51	0.152	1561.436		0
9 1/2	51	0.161	1606.998		0
9 1/2	51	0.161	1606.998		0
TOTAL Ts	816	TOTAL FPM	26121.42	TOTAL FPM	0

TEST PORT L (241-Aw Primary Stack Air Flow, 296-A-27)					
AIR FLOW MEASUREMENTS (continued)				RETEST	
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	51	0.149	1545.951		0
1/2	51	0.154	1571.675		0
7/8	51	0.151	1556.292		0
1 1/4	51	0.152	1561.436		0
1 3/4	51	0.148	1540.754		0
2 1/4	51	0.152	1561.436		0
2 7/8	51	0.154	1571.675		0
3 3/4	51	0.162	1611.981		0
6 1/4	51	0.161	1606.998		0
7 1/8	51	0.163	1616.949		0
7 3/4	51	0.169	1646.44		0
8 1/4	51	0.156	1581.848		0
8 3/4	51	0.147	1535.54		0
9 1/8	51	0.13	1444.023		0
9 1/2	51	0.131	1449.567		0
9 1/2	51	0.131	1449.567		0
TOTAL Ts	816	TOTAL FPM	24852.13	TOTAL FPM	0

STACK AIR FLOW CALCULATIONS		
	Total Port L	816
	Total Port K	816
Total ts=ts1+ts2+ts3+....	ts (Total K+L)	1632
Average ts=Total ts/32	ts (Avg.)	51
Velocity (FPM)=4005 SQRT (VP)	Data Sheet 3	
	Total Port K	26121.42
	Total Port L	24852.13
Total FPM=FPM1+FPM2+FPM3+...	ts (Total K+L)	50973.55
Average FPM= Total FPM/32	fpm(Avg.)	1592.923
Total CFM=Aveg FPMx0.5454Sq ft	cfm (total)	868.7805

Poor Quality Original

Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer
Originator:
Prepared by: E. Stam Checked by: RPS
Date: ~~10/20/01~~ 11/6/01
Project No. & Title: VET-1084, DST Ventilation ALARACT

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Eq. Input	Description	Value	
RH	Stack Relative Humidity, percent	93	SHT3
Pws	Vapor Pressure of H2O at Temp. ts (Avg)	0.37635	In Put
Pb	Parometric pressure at test port, in. Hg	29.37	(SHT 2) In Put
Pg	Stack static pressure, in. wg	0.34	(SHT 3)
Ps	Absolute stack gas pressure, in. Hg: Ps=Pb+(Pg/13.6)	29.395	
Bws	Stack gas water vapor: Bws=(RH/100)(Pws/Ps)	0.011907	
(SQRTVP)Avg	Average of velocity pressure sqrt, in. wg: (SQRTVP)=fpmavg/4005	0.397734	
ts(avg)	Average stack gas Temp., F	51	
Ts(avg)	Average absolute stack Temp., R Ts(avg)=460+Ts(avg)	511	
Ms	Molecular weight stack gas, wet, ib/ib-mole: Ms=29(1-Bw)+18Bws	28.86902	
Kp	Pitot tube constant: 85.49 ft/sec((ib*in.*Hg)/(ib-mole*R*un.*H20))**.5	85.49	
Cp	Pitot tube coefficient, standard	0.99	
A	Cross0sectional stack area, ft2	0.5454	In Put
Tstd	Standard absolute Temp. R	528	
Pstd	Standard absolute Presurre, in. Hg	29.92	
Qsd	Average Stack Gas Dry Volumetric Flow Rate (Qsd)	857.4123	

4/26/00

TEST PORT K (241-Aw Primary Stack Air Flow,296-A-27)					
Relative Humidity:		26 (RH)		RETEST	
Static Pressure:		0.23 (Pg)		(Pg)	
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	96	0.19	1745.739		0
1/2	96	0.19	1745.739		0
7/8	96	0.189	1741.139		0
1 1/4	96	0.197	1777.607		0
1 3/4	96	0.22	1878.512		0
2 1/4	96	0.22	1878.512		0
2 7/8	96	0.23	1920.731		0
3 3/4	96	0.25	2002.5		0
6 1/4	96	0.26	2042.157		0
7 1/8	96	0.25	2002.5		0
7 3/4	96	0.24	1962.041		0
8 1/4	96	0.24	1962.041		0
8 3/4	96	0.23	1920.731		0
9 1/8	96	0.23	1920.731		0
9 1/2	96	0.2	1791.09		0
9 1/2	96	0.2	1791.09		0
TOTAL Ts	1536	TOTAL FPM	30082.86	TOTAL FPM	0

2E-00-668

Poor Quality Original

Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer
Originator:
Prepared by: E. Stam Checked by: RPS
Date: ~~10/29/01~~ 11/6/01
Project No. & Title: VET-1084, DST Ventilation ALARACT

Calc. #: VET-1084-001
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TEST PORT L (241-Aw Primary Stack Air Flow, 296-A-27)					
AIR FLOW MEASUREMENTS (continued)				RETEST	
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	96	0.24	1962.041		0
1/2	96	0.24	1962.041		0
7/8	96	0.23	1920.731		0
1 1/4	96	0.23	1920.731		0
1 3/4	96	0.23	1920.731		0
2 1/4	96	0.23	1920.731		0
2 7/8	96	0.24	1962.041		0
3 3/4	96	0.23	1920.731		0
6 1/4	96	0.21	1835.322		0
7 1/8	96	0.184	1717.954		0
7 3/4	96	0.176	1680.192		0
8 1/4	96	0.165	1626.839		0
8 3/4	96	0.152	1561.436		0
9 1/8	96	0.143	1514.504		0
9 1/2	96	0.138	1487.791		0
9 1/2	96	0.138	1487.791		0
TOTAL Ts	1536	TOTAL FPM	28401.61	TOTAL FPM	0

STACK AIR FLOW CALCULATIONS		
	Total Port L	1536
	Total Port K	1536
Total ts=ts1+ts2+ts3+....	ts (Total K+L)	3072
Average ts=Total ts/32	ts (Avg.)	96
Velocity (FPM)=4005 SQRT (VP)	Data Sheet 3	
	Total Port K	30082.86
	Total Port L	28401.61
Total FPM=FPM1+FPM2+FPM3+...	ts (Total K+L)	58484.46
Average FPM= Total FPM/32	fpm(Avg.)	1827.64
Total CFM=Aveg FPMx0.5454Sq ft	cfm (total)	996.7946

Eq. Input	Description	Value	
RH	Stack Relative Humidity, percent	26	SHT3
Pws	Vapor Pressure of H2O at Temp. ts (Avg)	1.71364	In Put
Pb	Parometric pressure at test port, in. Hg	29.51	(SHT 2) In Put
Pg	Stack static pressure, in. wg	0.23	(SHT 3)
Ps	Absolute stack gas pressure, In. Hg: Ps=Pb+(Pg/13.6)	29.52691	
Bws	Stack gas water vapor: Bws=(RH/100)(Pws/Ps)	0.01509	
(SQRTVP)Avg	Average of velocity pressure sqrt, in. wg: (SQRTVP)=fpmavg/4005	0.456339	
ts(avg)	Average stack gas Temp., F	96	
Ts(avg)	Average absolute stack Temp., R Ts(avg)=460+Ts(avg)	556	
Ms	Molecular weight stack gas, wet, ib/ib-mole: Ms=29(1-Bw)+18Bws	28.83402	
Kp	Pitot tube constant: 85.49 ft/sec((ib*in.*Hg)/(ib-mole*R*un.*H20))**.5	85.49	
Cp	Pitot tube coefficient, standard	0.99	
A	Cross0sectional stack area, ft2	0.5454	In Put
Tstd	Standard absolute Temp. R	528	
Pstd	Standard absolute Presurre, in. Hg	29.92	
Qsd	Average Stack Gas Dry Volumetric Flow Rate (Qsd)	942.7425	

Poor Quality Original

Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer Originator: Prepared by: E. Stam ES Checked by: RPS Date: ~~10/29/01~~ 11/6/01 Project No. & Title: VET-1084, DST Ventilation ALARACT	Calc. #: VET-1084-001 Rev: 0 Attachment 1 Page: 11 of 37

7/24/00

2E-00-1324

TEST PORT K (241-Aw Primary Stack Air Flow,296-A-27)					
Relative Humidity:		38.3 (RH)		RETEST	
Static Pressure:		0.18 (Pg)			(Pg)
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	87	0.182	1708.591		0
1/2	87	0.182	1708.591		0
7/8	87	0.192	1754.903		0
1 1/4	87	0.196	1773.089		0
1 3/4	87	0.2	1791.09		0
2 1/4	87	0.2	1791.09		0
2 7/8	87	0.2	1791.09		0
3 3/4	87	0.198	1782.112		0
6 1/4	87	0.191	1750.327		0
7 1/8	87	0.191	1750.327		0
7 3/4	87	0.19	1745.739		0
8 1/4	87	0.186	1727.265		0
8 3/4	87	0.186	1727.265		0
9 1/8	87	0.19	1745.739		0
9 1/2	87	0.168	1641.562		0
9 1/2	87	0.168	1641.562		0
TOTAL Ts	1392	TOTAL FPM	27830.34	TOTAL FPM	0

TEST PORT L (241-Aw Primary Stack Air Flow, 296-A-27)					
AIR FLOW MEASUREMENTS (continued)				RETEST	
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	87	0.134	1466.071		0
1/2	87	0.134	1466.071		0
7/8	87	0.153	1566.564		0
1 1/4	87	0.16	1602		0
1 3/4	87	0.16	1602		0
2 1/4	87	0.166	1631.761		0
2 7/8	87	0.163	1616.949		0
3 3/4	87	0.165	1626.839		0
6 1/4	87	0.177	1684.958		0
7 1/8	87	0.182	1708.591		0
7 3/4	87	0.191	1750.327		0
8 1/4	87	0.193	1759.467		0
8 3/4	87	0.181	1703.891		0
9 1/8	87	0.165	1626.839		0
9 1/2	87	0.122	1398.886		0
9 1/2	87	0.122	1398.886		0
TOTAL Ts	1392	TOTAL FPM	25610.1	TOTAL FPM	0

STACK AIR FLOW CALCULATIONS		
	Total Port L	1392
	Total Port K	1392
Total ts=ts1+ts2+ts3+....	ts (Total K+L)	2784
Average ts=Total ts/32	ts (Avg.)	87
Velocity (FPM)=4005 SQRT (VP)	Data Sheet 3	
	Total Port K	27830.34
	Total Port L	25610.1
Total FPM=FPM1+FPM2+FPM3+...	ts (Total K+L)	53440.44
Average FPM= Total FPM/32	fpm(Avg.)	1670.014
Total CFM=Aveg FPMx0.5454Sq ft	cfm (total)	910.8256

Poor Quality Original

Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer
Originator:
Prepared by: E. Stam Checked by: RPS
Date: 10/29/01 11/6/01
Project No. & Title: VET-1084, DST Ventilation ALARACT

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Eq. Input	Description	Value	
RH	Stack Relative Humidity, percent	38.3	SHT3
Pws	Vapor Pressure of H2O at Temp. ts (Avg)	1.2944	In Put
Pb	Parometric pressure at test port, in. Hg	29.38	(SHT 2) In Put
Pg	Stack static pressure, in. wg	0.18	(SHT 3)
Ps	Absolute stack gas pressure, in. Hg: Ps=Pb+(Pg/13.6)	29.39324	
Bws	Stack gas water vapor: Bws=(RH/100)(Pws/Ps)	0.016866	
(SQRTVP)Avg	Average of velocity pressure sqrt, in. wg: (SQRTVP)=fpmavg/4005	0.416982	
ts(avg)	Average stack gas Temp., F	87	
Ts(avg)	Average absolute stack Temp., R Ts(avg)=460+Ts(avg)	547	
Ms	Molecular weight stack gas, wet, ib/ib-mole: Ms=29(1-Bw)+18Bws	28.81447	
Kp	Pitot tube constant: 85.49 ft/sec((ib*in.*Hg)/(ib-mole*R*in.*H20))**.5	85.49	
Cp	Pitot tube coefficient, standard	0.99	
A	Cross0sectional stack area, ft2	0.5454	In Put
Tstd	Standard absolute Temp. R	528	
Pstd	Standard absolute Presurre, in. Hg	29.92	
Qsd	Average Stack Gas Dry Volumetric Flow Rate (Qsd)	865.2549	

10/24/00

TEST PORT K (241-Aw Primary Stack Air Flow,296-A-27)					
Relative Humidity:		38 (RH)		RETEST	2E-00-1477
Static Pressure:		0.25 (Pg)		(Pg)	
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	84	0.22	1878.512		0
1/2	84	0.22	1878.512		0
7/8	84	0.21	1835.322		0
1 1/4	84	0.22	1878.512		0
1 3/4	84	0.2	1791.09		0
2 1/4	84	0.22	1878.512		0
2 7/8	84	0.22	1878.512		0
3 3/4	84	0.25	2002.5		0
6 1/4	84	0.26	2042.157		0
7 1/8	84	0.29	2156.759		0
7 3/4	84	0.29	2156.759		0
8 1/4	84	0.3	2193.629		0
8 3/4	84	0.27	2081.059		0
9 1/8	84	0.24	1962.041		0
9 1/2	84	0.2	1791.09		0
9 1/2	84	0.2	1791.09		0
TOTAL Ts	1344	TOTAL FPM	31196.05	TOTAL FPM	0

Poor Quality Original

Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer
Originator:
Prepared by: E. Stam Checked by: RPS
Date: ~~10/29/01~~ 11/6/01
Project No. & Title: VET-1084, DST Ventilation ALARACT

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TEST PORT L (241-Aw Primary Stack Air Flow, 296-A-27)					
AIR FLOW MEASUREMENTS (continued)				RETEST	
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	84	0.25	2002.5		0
1/2	84	0.25	2002.5		0
7/8	84	0.25	2002.5		0
1 1/4	84	0.25	2002.5		0
1 3/4	84	0.26	2042.157		0
2 1/4	84	0.27	2081.059		0
2 7/8	84	0.29	2156.759		0
3 3/4	84	0.27	2081.059		0
6 1/4	84	0.26	2042.157		0
7 1/8	84	0.22	1878.512		0
7 3/4	84	0.21	1835.322		0
8 1/4	84	0.177	1684.958		0
8 3/4	84	0.166	1631.761		0
9 1/8	84	0.139	1493.172		0
9 1/2	84	0.115	1358.162		0
9 1/2	84	0.115	1358.162		0
TOTAL Ts	1344	TOTAL FPM	29653.24	TOTAL FPM	0

STACK AIR FLOW CALCULATIONS		
	Total Port L	1344
	Total Port K	1344
Total ts=ts1+ts2+ts3+....	ts (Total K+L)	2688
Average ts=Total ts/32	ts (Avg.)	84
Velocity (FPM)=4005 SQRT (VP)	Data Sheet 3	
	Total Port K	31196.05
	Total Port L	29653.24
Total FPM=FPM1+FPM2+FPM3+...	ts (Total K+L)	60849.29
Average FPM= Total FPM/32	fpm(Avg.)	1901.54
Total CFM=Aveg FPMx0.5454Sq ft	cfm (total)	1037.1

Eq. Input	Description	Value	
RH	Stack Relative Humidity, percent	38	SHT3
Pws	Vapor Pressure of H2O at Temp. ts (Avg)	1.17606	In Put
Pb	Parometric pressure at test port, in. Hg	29.39	(SHT 2) In Put
Pg	Stack static pressure, in. wg	0.25	(SHT 3)
Ps	Absolute stack gas pressure, in. Hg: Ps=Pb+(Pg/13.6)	29.40838	
Bws	Stack gas water vapor: Bws=(RH/100)(Pws/Ps)	0.015196	
(SQRTVP)Avg	Average of velocity pressure sqrt, in. wg: (SQRTVP)=fpmavg/4005	0.474792	
ts(avg)	Average stack gas Temp., F	84	
Ts(avg)	Average absolute stack Temp., R Ts(avg)=460+Ts(avg)	544	
Ms	Molecular weight stack gas, wet, ib/ib-mole: Ms=29(1-Bw)+18Bws	28.83284	
Kp	Pitot tube constant: 85.49 ft/sec((ib*in.*Hg)/(ib-mole*R*un.*H20))**.5	85.49	
Cp	Pitot tube coefficient, standard	0.99	
A	Cross0sectional stack area, ft2	0.5454	In Put
Tstd	Standard absolute Temp. R	528	
Pstd	Standard absolute Presurre, in. Hg	29.92	
Qsd	Average Stack Gas Dry Volumetric Flow Rate (Qsd)	989.5421	

Poor Quality Original

Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer Originator: Prepared by: E. Stam Checked by: RPS Date: ~~10/20/01~~ 11/6/01 Project No. & Title: VET-1084, DST Ventilation ALARACT	Calc. #: VET-1084-001 Rev: 0 Attachment 1 Page: 61 of 37

1/25/01

2E-00-2236

TEST PORT K (241-Aw Primary Stack Air Flow,296-A-27)					
Relative Humidity:		46 (RH)		RETEST	
Static Pressure:		0.23 (Pg)		(Pg)	
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	78	0.178	1689.711		0
1/2	78	0.178	1689.711		0
7/8	78	0.192	1754.903		0
1 1/4	78	0.198	1782.112		0
1 3/4	78	0.199	1786.607		0
2 1/4	78	0.2	1791.09		0
2 7/8	78	0.21	1835.322		0
3 3/4	78	0.21	1835.322		0
6 1/4	78	0.22	1878.512		0
7 1/8	78	0.22	1878.512		0
7 3/4	78	0.24	1962.041		0
8 1/4	78	0.25	2002.5		0
8 3/4	78	0.25	2002.5		0
9 1/8	78	0.26	2042.157		0
9 1/2	78	0.21	1835.322		0
9 1/2	78	0.21	1835.322		0
TOTAL Ts	1248	TOTAL FPM	29601.64	TOTAL FPM	0

TEST PORT L (241-Aw Primary Stack Air Flow, 296-A-27)					
AIR FLOW MEASUREMENTS (continued)				RETEST	
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	78	0.24	1962.041		0
1/2	78	0.24	1962.041		0
7/8	78	0.24	1962.041		0
1 1/4	78	0.25	2002.5		0
1 3/4	78	0.24	1962.041		0
2 1/4	78	0.25	2002.5		0
2 7/8	78	0.25	2002.5		0
3 3/4	78	0.25	2002.5		0
6 1/4	78	0.25	2002.5		0
7 1/8	78	0.24	1962.041		0
7 3/4	78	0.22	1878.512		0
8 1/4	78	0.183	1713.279		0
8 3/4	78	0.188	1736.527		0
9 1/8	78	0.154	1571.675		0
9 1/2	78	0.133	1460.59		0
9 1/2	78	0.133	1460.59		0
TOTAL Ts	1248	TOTAL FPM	29643.88	TOTAL FPM	0

STACK AIR FLOW CALCULATIONS		
	Total Port L	1248
	Total Port K	1248
Total ts=ts1+ts2+ts3+....	ts (Total K+L)	2496
Average ts=Total ts/32	ts (Avg.)	78
Velocity (FPM)=4005 SQRT (VP)	Data Sheet 3	
	Total Port K	29601.64
	Total Port L	29643.88
Total FPM=FPM1+FPM2+FPM3+...	ts (Total K+L)	59245.52
Average FPM= Total FPM/32	fpm(Avg.)	1851.423
Total CFM=Aveg FPMx0.5454Sq ft	cfm (total)	1009.766

Poor Quality Original

Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer
Originator:
Prepared by: E. Stam Checked by: RPS
Date: ~~10/29/01~~ 11/6/01
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Eq. Input	Description	Value	
RH	Stack Relative Humidity, percent	46	SHT3
Pws	*Vapor Pressure of H2O at Temp. ts (Avg)*	*0.96732*	*In Put*
Pb	Parometric pressure at test port, in. Hg	29.35	(SHT 2) In Put
Pg	Stack static pressure, in. wg	0.23	(SHT 3)
Ps	Absolute stack gas pressure, In. Hg: Ps=Pb+(Pg/13.6)	29.36691	
Bws	Stack gas water vapor: Bws=(RH/100)(Pws/Ps)	0.015152	
(SQRTVP)Avg	Average of velocity pressure sqrt, in. wg: (SQRTVP)=fpmavg/4005	0.462278	
ts(avg)	Average stack gas Temp., F	78	
Ts(avg)	Average absolute stack Temp., R Ts(avg)=460+Ts(avg)	538	
Ms	Molecular weight stack gas, wet, lb/lb-mole: Ms=29(1-Bw)+18Bws	28.83333	
Kp	Pitot tube constant: 85.49 ft/sec((lb*in.*Hg)/(lb-mole*R*un.*H20))**.5	85.49	
Cp	Pitot tube coefficient, standard	0.99	
A	Cross0sectional stack area, ft2	0.5454	In Put
Tstd	Standard absolute Temp. R	528	
Pstd	Standard absolute Presurre, in. Hg	29.92	
Qsd	Average Stack Gas Dry Volumetric Flow Rate (Qsd)	968.171	

TEST PORT K (241-Aw Primary Stack Air Flow,296-A-27) — *4/24/01*

Relative Humidity:		24 (RH)		RETEST	2E-01-517
Static Pressure:		0.22 (Pg)		(Pg)	
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	100	0.19	1745.739		0
1/2	100	0.19	1745.739		0
7/8	100	0.19	1745.739		0
1 1/4	100	0.2	1791.09		0
1 3/4	100	0.2	1791.09		0
2 1/4	100	0.2	1791.09		0
2 7/8	100	0.22	1878.512		0
3 3/4	100	0.23	1920.731		0
6 1/4	100	0.25	2002.5		0
7 1/8	100	0.25	2002.5		0
7 3/4	100	0.27	2081.059		0
8 1/4	100	0.27	2081.059		0
8 3/4	100	0.27	2081.059		0
9 1/8	100	0.26	2042.157		0
9 1/2	100	0.14	1498.534		0
9 1/2	100	0.14	1498.534		0
TOTAL Ts	1600	TOTAL FPM	29697.13	TOTAL FPM	0

Poor Quality Original

Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer
Originator:
Prepared by: E. Stam Checked by: RPS
Date: ~~10/29/01~~ 11/6/01
Project No. & Title: VET-1084, DST Ventilation ALARACT

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TEST PORT L (241-Aw Primary Stack Air Flow, 296-A-27)					
AIR FLOW MEASUREMENTS (continued)				RETEST	
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	100	0.2	1791.09		0
1/2	100	0.2	1791.09		0
7/8	100	0.26	2042.157		0
1 1/4	100	0.25	2002.5		0
1 3/4	100	0.25	2002.5		0
2 1/4	100	0.25	2002.5		0
2 7/8	100	0.25	2002.5		0
3 3/4	100	0.25	2002.5		0
6 1/4	100	0.26	2042.157		0
7 1/8	100	0.26	2042.157		0
7 3/4	100	0.22	1878.512		0
8 1/4	100	0.17	1651.304		0
8 3/4	100	0.15	1551.13		0
9 1/8	100	0.12	1387.373		0
9 1/2	100	0.12	1387.373		0
9 1/2	100	0.12	1387.373		0
TOTAL Ts	1600	TOTAL FPM	28964.22	TOTAL FPM	0

STACK AIR FLOW CALCULATIONS		
	Total Port L	1600
	Total Port K	1600
Total ts=ts1+ts2+ts3+....	ts (Total K+L)	3200
Average ts=Total ts/32	ts (Avg.)	100
Velocity (FPM)=4005 SQRT (VP)	Data Sheet 3	
	Total Port K	29697.13
	Total Port L	28964.22
Total FPM=FPM1+FPM2+FPM3+...	ts (Total K+L)	58661.35
Average FPM= Total FPM/32	fpm(Avg.)	1833.167
Total CFM=Aveg FPMx0.5454Sq ft	cfm (total)	999.8094

Eq. Input	Description	Value	
RH	Stack Relative Humidity, percent	24	SHT3
Pws	Vapor Pressure of H2O at Temp. ts (Avg)	1.93485	In Put
Pb	Parometric pressure at test port, in. Hg	29.054	(SHT 2) In Put
Pg	Stack static pressure, in. wg	0.22	(SHT 3)
Ps	Absolute stack gas pressure, in. Hg: Ps=Pb+(Pg/13.6)	29.07018	
Bws	Stack gas water vapor: Bws=(RH/100)(Pws/Ps)	0.015974	
(SQRTVP)Avg	Average of velocity pressure sqrt, in. wg: (SQRTVP)=fpmavg/4005	0.45772	
ts(avg)	Average stack gas Temp., F	100	
Ts(avg)	Average absolute stack Temp., R Ts(avg)=460+Ts(avg)	560	
Ms	Molecular weight stack gas, wet, ib/ib-mole: Ms=29(1-Bw)+18Bws	28.82429	
Kp	Pitot tube constant: 85.49 ft/sec((ib*in.*Hg)/(ib-mole*R*un.*H20))**.5	85.49	
Cp	Pitot tube coefficient, standard	0.99	
A	Cross0sectional stack area, ft2	0.5454	In Put
Tstd	Standard absolute Temp. R	528	
Pstd	Standard absolute Presurre, in. Hg	29.92	
Qsd	Average Stack Gas Dry Volumetric Flow Rate (Qsd)	934.213	

Poor Quality Original

Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer
Originator:
Prepared by: E. Stam Checked by: RPS
Date: ~~10/29/01~~ 11/6/01
Project No. & Title: VET-1084, DST Ventilation ALARACT

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2E-01-915

TEST PORT K (241-Aw Primary Stack Air Flow,296-A-27)					
Relative Humidity:		49.4 (RH)		RETEST	
Static Pressure:		0.192 (Pg)			(Pg)
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	84	0.162	1611.981		0
1/2	84	0.177	1684.958		0
7/8	84	0.195	1768.56		0
1 1/4	84	0.196	1773.089		0
1 3/4	84	0.196	1773.089		0
2 1/4	84	0.198	1782.112		0
2 7/8	84	0.2	1791.09		0
3 3/4	84	0.22	1878.512		0
6 1/4	84	0.21	1835.322		0
7 1/8	84	0.23	1920.731		0
7 3/4	84	0.24	1962.041		0
8 1/4	84	0.25	2002.5		0
8 3/4	84	0.25	2002.5		0
9 1/8	84	0.26	2042.157		0
9 1/2	84	0.26	2042.157		0
9 1/2	84	0.26	2042.157		0
TOTAL Ts	1344	TOTAL FPM	29912.96	TOTAL FPM	0

TEST PORT L (241-Aw Primary Stack Air Flow, 296-A-27)					
AIR FLOW MEASUREMENTS (continued)				RETEST	
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	84	0.22	1878.512		0
1/2	84	0.22	1878.512		0
7/8	84	0.26	2042.157		0
1 1/4	84	0.25	2002.5		0
1 3/4	84	0.25	2002.5		0
2 1/4	84	0.24	1962.041		0
2 7/8	84	0.23	1920.731		0
3 3/4	84	0.22	1878.512		0
6 1/4	84	0.21	1835.322		0
7 1/8	84	0.2	1791.09		0
7 3/4	84	0.192	1754.903		0
8 1/4	84	0.196	1773.089		0
8 3/4	84	0.183	1713.279		0
9 1/8	84	0.16	1602		0
9 1/2	84	0.149	1545.951		0
9 1/2	84	0.149	1545.951		0
TOTAL Ts	1344	TOTAL FPM	29127.05	TOTAL FPM	0

STACK AIR FLOW CALCULATIONS		
	Total Port L	1344
	Total Port K	1344
Total ts=ts1+ts2+ts3+....	ts (Total K+L)	2688
Average ts=Total ts/32	ts (Avg.)	84
Velocity (FPM)=4005 SQRT (VP)	Data Sheet 3	
	Total Port K	29912.96
	Total Port L	29127.05
Total FPM=FPM1+FPM2+FPM3+...	ts (Total K+L)	59040.01
Average FPM= Total FPM/32	fpm(Avg.)	1845
Total CFM=Aveg FPMx0.5454Sq ft	cfm (total)	1006.263

Poor Quality Original

Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer
Originator:
Prepared by: E. Stam Checked by: RPS
Date: ~~10/29/01~~ 11/6/01
Project No. & Title: VET-1084, DST Ventilation ALARACT

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Eq. Input	Description	Value	
RH	Stack Relative Humidity, percent	49.4	SHT3
Pws	Vapor Pressure of H2O at Temp. ts (Avg)	1.17606	In Put
Pb	Parometric pressure at test port, in. Hg	29.105	(SHT 2) In Put
Pg	Stack static pressure, in. wg	0.192	(SHT 3)
Ps	Absolute stack gas pressure, in. Hg: Ps=Pb+(Pg/13.6)	29.11912	
Bws	Stack gas water vapor: Bws=(RH/100)(Pws/Ps)	0.019952	
(SQRTVP)Avg	Average of velocity pressure sqrt, in. wg: (SQRTVP)=fpmavg/4005	0.460674	
ts(avg)	Average stack gas Temp., F	84	
Ts(avg)	Average absolute stack Temp., R Ts(avg)=460+Ts(avg)	544	
Ms	Molecular weight stack gas, wet, ib/ib-mole: Ms=29(1-Bw)+18Bws	28.78053	
Kp	Pitot tube constant: 85.49 ft/sec((ib*in.*Hg)/(ib-mole*R*un.*H20))**.5	85.49	
Cp	Pitot tube coefficient, standard	0.99	
A	Cross0sectional stack area, ft2	0.5454	In Put
Tstd	Standard absolute Temp. R	528	
Pstd	Standard absolute Presurre, in. Hg	29.92	
Qsd	Average Stack Gas Dry Volumetric Flow Rate (Qsd)	951.636	

Poor Quality Original

Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer Originator: Prepared by: E. Stam _____ Checked by: RPS Date: ~~10/29/01~~ 11/6/01 Project No. & Title: VET-1084, DST Ventilation ALARACT	Calc. #: VET-1084-001 Rev: 0 Attachment 1 Page: 26 of 37

6/24/99

2E-99-01324

TEST PORT K (296-A-40, 241-AP Air FLOW)					
Relative Humidity:		31 (RH)		RETEST	
Static Pressure:		0.157 (Pg)		(Pg)	
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	90	0.22	1878.512		0
1/2	90	0.22	1878.512		0
7/8	90	0.24	1962.041		0
1 1/4	90	0.25	2002.5		0
1 3/4	90	0.24	1962.041		0
2 1/4	90	0.24	1962.041		0
2 7/8	90	0.23	1920.731		0
3 3/4	90	0.195	1768.56		0
6 1/4	90	0.141	1503.876		0
7 1/8	90	0.154	1571.675		0
7 3/4	90	0.133	1460.59		0
8 1/4	90	0.13	1444.023		0
8 3/4	90	0.181	1703.891		0
9 1/8	90	0.175	1675.412		0
9 1/2	90	0.2	1791.09		0
9 1/2	90	0.2	1791.09		0
TOTAL Ts	1440	TOTAL FPM	28276.59	TOTAL FPM	0

STACK AIR FLOW CALCULATIONS PORT K		
Total ts=ts1+ts2+ts3+....	Total Port K	1440
Average ts=Total ts/16	ts (Avg.)	90
Velocity (FPM)=4005 SQRT (VP)	Data Sheet 3	
Total FPM=FPM1+FPM2+FPM3+...	Total Port K	28276.586
Average FPM= Total FPM/16	fpm(Avg.)	1767.2866
Total CFM=Aveg FPMx.5454 Sq ft	cfm (total)	963.87813

Eq. Input	Description	Value	
RH	Stack Relative Humidity, percent	31	SHT3
Pws	Vapor Pressure of H2O at Temp. ts (Avg)	1.42295	In Put
Pb	Parometric pressure at test port, in. Hg	28.959	(SHT 2) In Put
Pg	Stack static pressure, in. wg	0.157	(SHT 3)
Ps	Absolute stack gas pressure, in. Hg: Ps=Pb+(Pg/13.6)	28.970544	
Bws	Stack gas water vapor: Bws=(RH/100)(Pws/Ps)	0.0152263	
(SQRTVP)Avg	Average of velocity pressure sqrt, in. wg: (SQRTVP)=fpmavg/4005	0.4412701	
ts(avg)	Average stack gas Temp., F	90	
Ts(avg)	Average absolute stack Temp., R Ts(avg)=460+Ts(avg)	550	
Ms	Molecular weight stack gas, wet, ib/ib-mole: Ms=29(1-Bw)+18Bws	28.832511	
Kp	Pitot tube constant: 85.49 ft/sec((ib*in.*Hg)/(ib-mole*R*un.*H20))**.5	85.49	
Cp	Pitot tube coefficient, standard	0.99	
A	Cross0sectional stack area, ft2	0.5454	In Put
Tstd	Standard absolute Temp. R	528	
Pstd	Standard absolute Presurre, in. Hg	29.92	
Qsd	Average Stack Gas Dry Volumetric Flow Rate (Qsd)	907.79103	

Poor Quality Original

Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer Originator: Prepared by: E. Stam _____ Checked by: RPS Date: ~~10/29/01~~ 11/6/01 Project No. & Title: VET-1084, DST Ventilation ALARACT	Calc. #: VET-1084-001 Rev: 0 Attachment 1 Page: 27 of 37

9/21/99

2E-99-01821

TEST PORT K (Stack 296-A-40, 241-AP Air Flow)					
Relative Humidity:		26.9 (RH)		RETEST	
Static Pressure:		0.11 (Pg)		(Pg)	
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	95	0.21	1835.322		0
1/2	95	0.21	1835.322		0
7/8	95	0.22	1878.512		0
1 1/4	95	0.21	1835.322		0
1 3/4	95	0.2	1791.09		0
2 1/4	95	0.19	1745.739		0
2 7/8	95	0.17	1651.304		0
3 3/4	95	0.16	1602		0
6 1/4	95	0.12	1387.373		0
7 1/8	95	0.11	1328.308		0
7 3/4	95	0.11	1328.308		0
8 1/4	95	0.1	1266.492		0
8 3/4	95	0.08	1132.785		0
9 1/8	95	0.07	1059.623		0
9 1/2	95	0.07	1059.623		0
9 1/2	95	0.07	1059.623		0
TOTAL Ts	1520	TOTAL FPM	23796.75	TOTAL FPM	0

STACK AIR FLOW CALCULATIONS PORT K		
Total ts=ts1+ts2+ts3+....	Total Port K	1520
Average ts=Total ts/16	ts (Avg.)	95
Velocity (FPM)=4005 SQRT (VP)	Data Sheet 3	
Total FPM=FPM1+FPM2+FPM3+...	Total Port K	23796.746
Average FPM= Total FPM/16	fpm(Avg.)	1487.2966
Total CFM=Aveg FPMx.5454 Sq ft	cfm (total)	811.17158

Eq. Input	Description	Value	
RH	Stack Relative Humidity, percent	26.9	SHT3
Pws	Vapor Pressure of H2O at Temp. ts (Avg)	1.66189	In Put
Pb	Parometric pressure at test port, in. Hg	29.132	(SHT 2) In Put
Pg	Stack static pressure, in. wg	0.11	(SHT 3)
Ps	Absolute stack gas pressure, in. Hg: Ps=Pb+(Pg/13.6)	29.140088	
Bws	Stack gas water vapor: Bws=(RH/100)(Pws/Ps)	0.0153414	
(SQRTVP)Avg	Average of velocity pressure sqrt, in. wg: (SQRTVP)=fpmavg/4005	0.37136	
ts(avg)	Average stack gas Temp., F	95	
Ts(avg)	Average absolute stack Temp., R Ts(avg)=460+Ts(avg)	555	
Ms	Molecular weight stack gas, wet, ib/ib-mole: Ms=29(1-Bw)+18Bws	28.831245	
Kp	Pitot tube constant: 85.49 ft/sec((ib*in.*Hg)/(ib-mole*R*un.*H20))**.5	85.49	
Cp	*Pitot tube coefficient, standard*	*0.99*	
A	Cross0sectional stack area, ft2	0.5454	In Put
Tstd	Standard absolute Temp. R	528	
Pstd	Standard absolute Presurre, in. Hg	29.92	
Qsd	Average Stack Gas Dry Volumetric Flow Rate (Qsd)	762.67102	

Poor Quality Original

Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer Originator: Prepared by: E. Stam ____ Checked by: RPS Date: 10/29/01 // 16 Oct 01 Project No. & Title: VET-1084, DST Ventilation ALARACT	Calc. #: VET-1084-001 Rev: 0 Attachment 1 Page: 28 of 37

12/20/99
2E-99-2471

TEST PORT K (Stack 296-A-40, 241-AP Air Flow)					
Relative Humidity:		34 (RH)		RETEST	
Static Pressure:		0.12 (Pg)		(Pg)	
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	88	0.188	1736.527		0
1/2	88	0.188	1736.527		0
7/8	88	0.194	1764.02		0
1 1/4	88	0.154	1571.675		0
1 3/4	88	0.178	1689.711		0
2 1/4	88	0.109	1322.257		0
2 7/8	88	0.094	1227.91		0
3 3/4	88	0.069	1052.027		0
6 1/4	88	0.085	1167.648		0
7 1/8	88	0.083	1153.829		0
7 3/4	88	0.125	1415.981		0
8 1/4	88	0.127	1427.264		0
8 3/4	88	0.168	1641.562		0
9 1/8	88	0.32	2265.57		0
9 1/2	88	0.31	2229.89		0
9 1/2	88	0.31	2229.89		0
TOTAL Ts	1408	TOTAL FPM	25632.29	TOTAL FPM	0

STACK AIR FLOW CALCULATIONS PORT K		
Total ts=ts1+ts2+ts3+....	Total Port K	1408
Average ts=Total ts/16	ts (Avg.)	88
Velocity (FPM)=4005 SQRT (VP)	Data Sheet 3	
Total FPM=FPM1+FPM2+FPM3+...	Total Port K	25632.287
Average FPM= Total FPM/16	fpm(Avg.)	1602.018
Total CFM=Aveg FPMx.5454 Sq ft	cfm (total)	873.74059

Eq. Input	Description	Value	
RH	Stack Relative Humidity, percent	34	SHT3
Pws	Vapor Pressure of H2O at Temp. ts (Avg)	1.33608	In Put
Pb	Parometric pressure at test port, in. Hg	29.79	(SHT 2) In Put
Pg	Stack static pressure, in. wg	0.12	(SHT 3)
Ps	Absolute stack gas pressure, in. Hg: Ps=Pb+(Pg/13.6)	29.798824	
Bws	Stack gas water vapor: Bws=(RH/100)(Pws/Ps)	0.0152445	
(SQRTVP)Avg	Average of velocity pressure sqrt, in. wg: (SQRTVP)=fpmavg/4005	0.4000045	
ts(avg)	Average stack gas Temp., F	88	
Ts(avg)	Average absolute stack Temp., R Ts(avg)=460+Ts(avg)	548	
Ms	Molecular weight stack gas, wet, ib/ib-mole: Ms=29(1-Bw)+18Bws	28.832311	
Kp	Pitot tube constant: 85.49 ft/sec((ib*in.*Hg)/(ib-mole*R*un.*H20))**.5	85.49	
Cp	Pitot tube coefficient, standard	0.99	
A	Cross0sectional stack area, ft2	0.5454	In Put
Tstd	Standard absolute Temp. R	528	
Pstd	Standard absolute Presurre, in. Hg	29.92	
Qsd	Average Stack Gas Dry Volumetric Flow Rate (Qsd)	836.08816	

Poor Quality Original

Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer Originator: Prepared by: E. Stam ____ Checked by: RPS Date: ~~10/29/01~~ 11/6/01 Project No. & Title: VET-1084, DST Ventilation ALARACT	Calc. #: VET-1084-001 Rev: 0 Attachment 1 Page: 19 of 37

1/27/00

2E-99-2695

TEST PORT K (Stack 296-A-40, 241-AP Air Flow)					
Relative Humidity:		33 (RH)		RETEST	
Static Pressure:		-0.12 (Pg)		(Pg)	
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	71	0.13	1444.023		0
1/2	71	0.13	1444.023		0
7/8	71	0.17	1651.304		0
1 1/4	71	0.19	1745.739		0
1 3/4	71	0.2	1791.09		0
2 1/4	71	0.22	1878.512		0
2 7/8	71	0.21	1835.322		0
3 3/4	71	0.2	1791.09		0
6 1/4	71	0.11	1328.308		0
7 1/8	71	0.09	1201.5		0
7 3/4	71	0.09	1201.5		0
8 1/4	71	0.1	1266.492		0
8 3/4	71	0.12	1387.373		0
9 1/8	71	0.12	1387.373		0
9 1/2	71	0.14	1498.534		0
9 1/2	71	0.14	1498.534		0
TOTAL Ts	1136	TOTAL FPM	24350.72	TOTAL FPM	0

STACK AIR FLOW CALCULATIONS PORT K		
Total ts=ts1+ts2+ts3+....	Total Port K	1136
Average ts=Total ts/16	ts (Avg.)	71
Velocity (FPM)=4005 SQRT (VP)	Data Sheet 3	
Total FPM=FPM1+FPM2+FPM3+...	Total Port K	24350.717
Average FPM= Total FPM/16	fpm(Avg.)	1521.9198
Total CFM=Aveg FPMx.5454 Sq ft	cfm (total)	830.05506

Eq. Input	Description	Value	
RH	Stack Relative Humidity, percent	33	SHT3
Pws	Vapor Pressure of H2O at Temp. ts (Avg)	0.76526	In Put
Pb	Parometric pressure at test port, in. Hg	29.79	(SHT 2) In Put
Pg	Stack static pressure, in. wg	-0.12	(SHT 3)
Ps	Absolute stack gas pressure, in. Hg: Ps=Pb+(Pg/13.6)	29.781176	
Bws	Stack gas water vapor: Bws=(RH/100)(Pws/Ps)	0.0084797	
(SQRTVP)Avg	Average of velocity pressure sqrt, in. wg: (SQRTVP)=fpmavg/4005	0.3800049	
ts(avg)	Average stack gas Temp., F	71	
Ts(avg)	Average absolute stack Temp., R Ts(avg)=460+Ts(avg)	531	
Ms	Molecular weight stack gas, wet, ib/ib-mole: Ms=29(1-Bw)+18Bws	28.906723	
Kp	Pitot tube constant: 85.49 ft/sec{(ib*in.*Hg)/(ib-mole*R*un.*H20)}**,5	85.49	
Cp	Pitot tube coefficient, standard	0.99	
A	Cross0sectional stack area, ft2	0.5454	In Put
Tstd	Standard absolute Temp. R	528	
Pstd	Standard absolute Presurre, in. Hg	29.92	
Qsd	Average Stack Gas Dry Volumetric Flow Rate (Qsd)	811.15587	

Poor Quality Original

Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer Originator: Prepared by: E. Stam _____ Checked by: RPS Date: ~~10/29/01~~ 11/6/01 Project No. & Title: VET-1084, DST Ventilation ALARACT	Calc. #: VET-1084-001 Rev: 0 Attachment 1 Page: 3 of 37

4/26/00

2E-00-477

TEST PORT L (241-AP ,Primary Stack Air Flow, 296-A-40)					
Relative Humidity:		24.3 (RH)		RETEST	
Static Pressure:		0.005 (Pg)			(Pg)
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	93	0.131	1449.567		0
1/2	93	0.131	1449.567		0
7/8	93	0.126	1421.634		0
1 1/4	93	0.152	1561.436		0
1 3/4	93	0.168	1641.562		0
2 1/4	93	0.151	1556.292		0
2 7/8	93	0.25	2002.5		0
3 3/4	93	0.25	2002.5		0
6 1/4	93	0.21	1835.322		0
7 1/8	93	0.2	1791.09		0
7 3/4	93	0.162	1611.981		0
8 1/4	93	0.148	1540.754		0
8 3/4	93	0.153	1566.564		0
9 1/8	93	0.152	1561.436		0
9 1/2	93	0.148	1540.754		0
9 1/2	93	0.148	1540.754		0
TOTAL Ts	1488	TOTAL FPM	26073.71	TOTAL FPM	0

TEST PORT M (241-AP, Primary Stack Air Flow, 296-A-40)					
AIR FLOW MEASUREMENTS (continued)				RETEST	
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	93	0.075	1096.814		0
1/2	93	0.075	1096.814		0
7/8	93	0.083	1153.829		0
1 1/4	93	0.103	1285.349		0
1 3/4	93	0.116	1364.054		0
2 1/4	93	0.181	1703.891		0
2 7/8	93	0.31	2229.89		0
3 3/4	93	0.38	2468.848		0
6 1/4	93	0.38	2468.848		0
7 1/8	93	0.37	2436.146		0
7 3/4	93	0.37	2436.146		0
8 1/4	93	0.34	2335.296		0
8 3/4	93	0.31	2229.89		0
9 1/8	93	0.3	2193.629		0
9 1/2	93	0.26	2042.157		0
9 1/2	93	0.26	2042.157		0
TOTAL Ts	1488	TOTAL FPM	30583.76	TOTAL FPM	0

STACK AIR FLOW CALCULATIONS		
	Total Port L	1488
	Total Port M	1488
Total ts=ts1+ts2+ts3+....	ts (Total L+M)	2976
Average ts=Total ts/32	ts (Avg.)	93
Velocity (FPM)=4005 SQRT (VP)	Data Sheet 3	
	Total Port L	26073.714
	Total Port M	30583.76
Total FPM=FPM1+FPM2+FPM3+...	ts (Total L+M)	56657.473
Average FPM= Total FPM/32	fpm(Avg.)	1770.546
Total CFM=Aveg FPMx.5454 Sq ft	cfm (total)	965.65581

Poor Quality Original

Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer
Originator:
Prepared by: E. Stam Checked by: RPS
Date: 10/29/01 11/1/01
Project No. & Title: VET-1084, DST Ventilation ALARACT

Calc. #: VET-1084-001
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Eq. Input	Description	Value	
RH	Stack Relative Humidity, percent	24.3	SHT3
Pws	Vapor Pressure of H2O at Temp. ts (Avg)	1.56244	In Put
Pb	Parometric pressure at test port, in. Hg	29.49	(SHT 2) In Put
Pg	Stack static pressure, in. wg	0.005	(SHT 3)
Ps	Absolute stack gas pressure, in. Hg: Ps=Pb+(Pg/13.6)	29.490368	
Bws	Stack gas water vapor: Bws=(RH/100)(Pws/Ps)	0.0128745	
(SQRTVP)Avg	Average of velocity pressure sqrt, in. wg: (SQRTVP)=fpmavg/4005	0.4420839	
ts(avg)	Average stack gas Temp., F	93	
Ts(avg)	Average absolute stack Temp., R Ts(avg)=460+Ts(avg)	553	
Ms	Molecular weight stack gas, wet, ib/ib-mole: Ms=29(1-Bw)+18Bws	28.858381	
Kp	Pitot tube constant: 85.49 ft/sec{(ib*in.*Hg)/(ib-mole*R*un.*H20)}**.5	85.49	
Cp	Pitot tube coefficient, standard	0.99	
A	Cross0sectional stack area, ft2	0.5454	In Put
Tstd	Standard absolute Temp. R	528	
Pstd	Standard absolute Presurre, in. Hg	29.92	
Qsd	Average Stack Gas Dry Volumetric Flow Rate (Qsd)	916.87021	

TEST PORT L (241-AP ,Primary Stack Air Flow, 296-A-40)					
Relative Humidity:		16.1 (RH)		RETEST	
Static Pressure:		0.083 (Pg)			(Pg)
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	110	0.07	1059.623		0
1/2	110	0.07	1059.623		0
7/8	110	0.098	1253.763		0
1 1/4	110	0.105	1297.768		0
1 3/4	110	0.121	1393.141		0
2 1/4	110	0.125	1415.981		0
2 7/8	110	0.169	1646.44		0
3 3/4	110	0.178	1689.711		0
6 1/4	110	0.31	2229.89		0
7 1/8	110	0.34	2335.296		0
7 3/4	110	0.36	2403		0
8 1/4	110	0.35	2369.39		0
8 3/4	110	0.34	2335.296		0
9 1/8	110	0.25	2002.5		0
9 1/2	110	0.21	1835.322		0
9 1/2	110	0.21	1835.322		0
TOTAL Ts	1760	TOTAL FPM	28162.07	TOTAL FPM	0

7/24/00
2E-00-1319

TEST PORT M (241-AP, Primary Stack Air Flow, 296-A-40)					
AIR FLOW MEASUREMENTS (continued)				RETEST	
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	110	0.194	1764.02		0
1/2	110	0.194	1764.02		0
7/8	110	0.24	1962.041		0
1 1/4	110	0.26	2042.157		0
1 3/4	110	0.28	2119.247		0
2 1/4	110	0.28	2119.247		0
2 7/8	110	0.27	2081.059		0
3 3/4	110	0.25	2002.5		0
6 1/4	110	0.196	1773.089		0
7 1/8	110	0.168	1641.562		0
7 3/4	110	0.155	1576.77		0
8 1/4	110	0.15	1551.13		0
8 3/4	110	0.136	1476.971		0
9 1/8	110	0.133	1460.59		0
9 1/2	110	0.112	1340.329		0
9 1/2	110	0.112	1340.329		0
TOTAL Ts	1760	TOTAL FPM	28015.06	TOTAL FPM	0

Poor Quality Original

Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer
Originator:
Prepared by: E. Stam Checked by: RPS
Date: ~~10/29/01~~ 11/6/01
Project No. & Title: VET-1084, DST Ventilation ALARACT

Calc. #: VET-1084-001
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STACK AIR FLOW CALCULATIONS		
	Total Port L	1760
	Total Port M	1760
Total ts=ts1+ts2+ts3+....	ts (Total L+M)	3520
Average ts=Total ts/32	ts (Avg.)	110
Velocity (FPM)=4005 SQRT (VP)	Data Sheet 3	
	Total Port L	28162.068
	Total Port M	28015.061
Total FPM=FPM1+FPM2+FPM3+...	ts (Total L+M)	56177.128
Average FPM= Total FPM/32	fpm(Avg.)	1755.5353
Total CFM=Aveg FPMx.5454 Sq ft	cfm (total)	957.46893

Eq. Input	Description	Value	
RH	Stack Relative Humidity, percent	16.1	SHT3
Pws	Vapor Pressure of H2O at Temp. ts (Avg)	2.59885	In Put
Pb	Parometric pressure at test port, in. Hg	29.35	(SHT 2) In Put
Pg	Stack static pressure, in. wg	0.083	(SHT 3)
Ps	Absolute stack gas pressure, in. Hg: Ps=Pb+(Pg/13.6)	29.356103	
Bws	Stack gas water vapor: Bws=(RH/100)(Pws/Ps)	0.0142531	
(SQRTVP)Avg	Average of velocity pressure sqrt, in. wg: (SQRTVP)=fpmavg/4005	0.4383359	
ts(avg)	Average stack gas Temp., F	110	
Ts(avg)	Average absolute stack Temp., R Ts(avg)=460+Ts(avg)	570	
Ms	Molecular weight stack gas, wet, ib/ib-mole: Ms=29(1-Bw)+18Bws	28.843216	
Kp	Pitot tube constant: 85.49 ft/sec((ib*in.*Hg)/(ib-mole*R*un.*H20))**.5	85.49	
Cp	Pitot tube coefficient, standard	0.99	
A	Cross0sectional stack area, ft2	0.5454	In Put
Tstd	Standard absolute Temp. R	528	
Pstd	Standard absolute Presurre, in. Hg	29.92	
Qsd	Average Stack Gas Dry Volumetric Flow Rate (Qsd)	892.38369	

1/26/01

TEST PORT L (241-AP ,Primary Stack Air Flow, 296-A-40)					
Relative Humidity:		57 (RH)		RETEST	2E-00-2238
Static Pressure:		0.015 (Pg)		(Pg)	
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	74	0.102	1279.094		0
1/2	74	0.102	1279.094		0
7/8	74	0.119	1381.58		0
1 1/4	74	0.119	1381.58		0
1 3/4	74	0.125	1415.981		0
2 1/4	74	0.131	1449.567		0
2 7/8	74	0.134	1466.071		0
3 3/4	74	0.153	1566.564		0
6 1/4	74	0.16	1602		0
7 1/8	74	0.172	1660.989		0
7 3/4	74	0.183	1713.279		0
8 1/4	74	0.26	2042.157		0
8 3/4	74	0.33	2300.697		0
9 1/8	74	0.34	2335.296		0
9 1/2	74	0.37	2436.146		0
9 1/2	74	0.33	2300.697		0
TOTAL Ts	1184	TOTAL FPM	27610.79	TOTAL FPM	0

Poor Quality Original

Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer
Originator:
Prepared by: E. Stam Checked by: RPS
Date: 10/29/01 11/6/01
Project No. & Title: VET-1084, DST Ventilation ALARACT

Calc. #: VET-1084-001
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TEST PORT M (241-AP, Primary Stack Air Flow, 296-A-40)					
AIR FLOW MEASUREMENTS (continued)				RETEST	
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	74	0.4	2532.984		0
1/2	74	0.4	2532.984		0
7/8	74	0.43	2626.254		0
1 1/4	74	0.4	2532.984		0
1 3/4	74	0.38	2468.848		0
2 1/4	74	0.36	2403		0
2 7/8	74	0.31	2229.89		0
3 3/4	74	0.3	2193.629		0
6 1/4	74	0.2	1791.09		0
7 1/8	74	0.158	1591.956		0
7 3/4	74	0.139	1493.172		0
8 1/4	74	0.113	1346.3		0
8 3/4	74	0.09	1201.5		0
9 1/8	74	0.071	1067.165		0
9 1/2	74	0.09	1201.5		0
9 1/2	74	0.09	1201.5		0
TOTAL Ts	1184	TOTAL FPM	30414.76	TOTAL FPM	0

STACK AIR FLOW CALCULATIONS		
	Total Port L	1184
	Total Port M	1184
Total ts=ts1+ts2+ts3+....	ts (Total L+M)	2368
Average ts=Total ts/32	ts (Avg.)	74
Velocity (FPM)=4005 SQRT (VP)	Data Sheet 3	
	Total Port L	27610.794
	Total Port M	30414.757
Total FPM=FPM1+FPM2+FPM3+...	ts (Total L+M)	58025.551
Average FPM= Total FPM/32	fpm(Avg.)	1813.2985
Total CFM=Aveg FPMx.5454 Sq ft	cfm (total)	988.97299

Eq. Input	Description	Value	
RH	Stack Relative Humidity, percent	57	SHT3
Pws	Vapor Pressure of H2O at Temp. ts (Avg)	0.84682	In Put
Pb	Parometric pressure at test port, in. Hg	29.462	(SHT 2) In Put
Pg	Stack static pressure, in. wg	0.015	(SHT 3)
Ps	Absolute stack gas pressure, in. Hg: Ps=Pb+(Pg/13.6)	29.463103	
Bws	Stack gas water vapor: Bws=(RH/100)(Pws/Ps)	0.0163828	
(SQRTVP)Avg	Average of velocity pressure sqrt, in. wg: (SQRTVP)=fpmavg/4005	0.4527587	
ts(avg)	Average stack gas Temp., F	74	
Ts(avg)	Average absolute stack Temp., R Ts(avg)=460+Ts(avg)	534	
Ms	Molecular weight stack gas, wet, ib/ib-mole: Ms=29(1-Bw)+18Bws	28.819789	
Kp	Pitot tube constant: 85.49 ft/sec[(ib*in.*Hg)/(ib-mole*R*un.*H20)]**.5	85.49	
Cp	Pitot tube coefficient, standard	0.99	
A	Cross0sectional stack area, ft2	0.5454	In Put
Tstd	Standard absolute Temp. R	528	
Pstd	Standard absolute Presurre, in. Hg	29.92	
Qsd	Average Stack Gas Dry Volumetric Flow Rate (Qsd)	952.3692	

Poor Quality Original

Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer Originator: Prepared by: E. Stam _____ Checked by: RPS Date: ~~10/29/01~~ 11/6/01 Project No. & Title: VET-1084, DST Ventilation ALARACT	Calc. #: VET-1084-001 Rev: 0 Attachment 1 Page: 34 of 37

4/6/01

TEST PORT L (241-AP ,Primary Stack Air Flow, 296-A-40)					
Relative Humidity:		21.8 (RH)		RETEST	2E-01-535
Static Pressure:		0.02 (Pg)		(Pg)	
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	99	0.095	1234.424		0
1/2	99	0.095	1234.424		0
7/8	99	0.11	1328.308		0
1 1/4	99	0.118	1375.763		0
1 3/4	99	0.15	1551.13		0
2 1/4	99	0.136	1476.971		0
2 7/8	99	0.144	1519.791		0
3 3/4	99	0.172	1660.989		0
6 1/4	99	0.193	1759.467		0
7 1/8	99	0.22	1878.512		0
7 3/4	99	0.26	2042.157		0
8 1/4	99	0.27	2081.059		0
8 3/4	99	0.31	2229.89		0
9 1/8	99	0.31	2229.89		0
9 1/2	99	0.33	2300.697		0
9 1/2	99	0.33	2300.697		0
TOTAL Ts	1584	TOTAL FPM	28204.17	TOTAL FPM	0

TEST PORT M (241-AP, Primary Stack Air Flow, 296-A-40)					
AIR FLOW MEASUREMENTS (continued)				RETEST	
	Temp.	Velocity		Velocity	
Trav. Points (in.)	Ts (F)	VP (in. wg)	FPM (ft/min)	VP (in. wg)	FPM (ft/min)
1/2	99	0.32	2265.57		0
1/2	99	0.32	2265.57		0
7/8	99	0.4	2532.984		0
1 1/4	99	0.42	2595.537		0
1 3/4	99	0.4	2532.984		0
2 1/4	99	0.35	2369.39		0
2 7/8	99	0.31	2229.89		0
3 3/4	99	0.3	2193.629		0
6 1/4	99	0.25	2002.5		0
7 1/8	99	0.22	1878.512		0
7 3/4	99	0.155	1576.77		0
8 1/4	99	0.129	1438.459		0
8 3/4	99	0.117	1369.921		0
9 1/8	99	0.104	1291.574		0
9 1/2	99	0.095	1234.424		0
9 1/2	99	0.095	1234.424		0
TOTAL Ts	1584	TOTAL FPM	31012.14	TOTAL FPM	0

STACK AIR FLOW CALCULATIONS		
	Total Port L	1584
	Total Port M	1584
Total ts=ts1+ts2+ts3+....	ts (Total L+M)	3168
Average ts=Total ts/32	ts (Avg.)	99
Velocity (FPM)=4005 SQRT (VP)	Data Sheet 3	
	Total Port L	28204.168
	Total Port M	31012.137
Total FPM=FPM1+FPM2+FPM3+...	ts (Total L+M)	59216.305
Average FPM= Total FPM/32	fpm(Avg.)	1850.5095
Total CFM=Aveg FPMx.5454 Sq ft	cfm (total)	1009.2679

Poor Quality Original

Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer
Originator:
Prepared by: E. Stam Checked by: RPS
Date: ~~10/29/01~~ 11/6/01
Project No. & Title: VET-1084, DST Ventilation ALARACT

Calc. #: VET-1084-001
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Eq. Input	Description	Value	
RH	Stack Relative Humidity, percent	21.8	SHT3
Pws	Vapor Pressure of H2O at Temp. ts (Avg)	1.87736	In Put
Pb	Parometric pressure at test port, in. Hg	28.91	(SHT 2) In Put
Pg	Stack static pressure, in. wg	0.02	(SHT 3)
Ps	Absolute stack gas pressure, in. Hg: Ps=Pb+(Pg/13.6)	28.911471	
Bws	Stack gas water vapor: Bws=(RH/100)(Pws/Ps)	0.0141558	
(SQRTVP)Avg	Average of velocity pressure sqrt, in. wg: (SQRTVP)=fpmavg/4005	0.4620498	
ts(avg)	Average stack gas Temp., F	99	
Ts(avg)	Average absolute stack Temp., R Ts(avg)=460+Ts(avg)	559	
Ms	Molecular weight stack gas, wet, ib/ib-mole: Ms=29(1-Bw)+18Bws	28.844286	
Kp	Pitot tube constant: 85.49 ft/sec((ib*in.*Hg)/(ib-mole*R*un.*H20))**.5	85.49	
Cp	Pitot tube coefficient, standard	0.99	
A	Cross0sectional stack area, ft2	0.5454	In Put
Tstd	Standard absolute Temp. R	528	
Pstd	Standard absolute Presurre, in. Hg	29.92	
Qsd	Average Stack Gas Dry Volumetric Flow Rate (Qsd)	942.72628	

Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer Originator:

Prepared by: E. Stam _____ Checked by: RPS

Date: ~~10/29/01~~ 11/6/01 ES

Project No. & Title: VET-1084, DST Ventilation ALARACT

Calc. #: VET-1084-001
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1/8/02 RPS

$UA = \frac{Q}{T_{amb} + T_{HTR}/2}$

Farm	Date	Stack RH	Flow (cfm)	Stack Temp	Test Day Htr Inlet (F)	Test Day Htr Out (F)	Week Htr out low (F)	Week Htr Out High (F)	Q based on Day Temp (Btu/hr)	Q based on Wk high Temp (Btu/hr)	Amb. Temp High (F)	Amb. Temp Low (F)	Amb. Temp Avg (F)	UA Based on Highest Q
AN	10/13/99	18	831	98					0.0	0.0				0.0
	1/27/01	30	804	88	53	98	64	102	-8683.2	-12156.5	43	21	32	193.0
	4/27/00	47	731	82	67	72	72	104	7894.8	-17368.6	72	50	61	542.8
	7/18/00	27	683	97					0.0	0.0				0.0
	10/24/00	50	762	76					0.0	0.0				0.0
	1/25/00	29	838	92	46	102	94	103	-9050.4	-9955.4	36	28	32	152.0
	4/24/01	35	840	85	60	74	70	98	9979.2	-11793.6	77	37	57	341.8
	10/9/01	50	749	79					0.0	0.0				0.0
AP	6/24/99	31	964	90										
	9/21/99	27	811	95										
	12/20/99	34	874	88										
	1/27/00	33	830	71	No temp correlation, measured in stack to ventilation system									
	4/26/00	24	966	93										
	7/24/00	16	957	110										
	1/26/01	57	989	74										
	4/6/01	22	1009	99										
AW	4/27/99	80	1065	64					0.0	0.0				0.0
	7/21/99	83	981	83					0.0	0.0				0.0
	1/24/00	93	869	51	40	40	40	65	10323.7	-13139.3	34	32	33	525.6
	4/26/00	26	997	96	65	105	100	106	-9690.8	-10767.6	67	34	50	211.1
	7/24/00	38	911	87					0.0	0.0				0.0
	10/24/00	38	1037	84					0.0	0.0				0.0
	1/25/01	46	1010	78	52	92	89	92	-15271.2	-15271.2	36	28	32	288.1
	4/24/01	24	1000	100	61	98	80	110	2160.0	-10800.0	77	37	57	225.0
	6/27/01	49	1006	84					0.0	0.0				0.0

1/8/02 RPS

$UA = \frac{Q}{T_{amb} - \left(\frac{T_{htr} + T_{stack}}{2}\right)}$

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cfm * 4.5 (Th2 – Th1) = 679 Btu/hr/°F (-13°F - ½ (Tstack + 85°F))

0 = 679 Btu/hr/°F (-13°F - ½ (Tstack + 85°F)) - cfm * 4.5 (Th2 – Th1)

Flow	Th1	Select T(stack) (Tstack)	Correspd. Th2	Equ. Value
500	49.5	50	20.3	11040.5
500	49.5	60	26.5	-6304.5
500	49.5	55	23.25	2705.5
500	49.5	56	23.85	1016
500	49.5	57	24.5	-786
500	49.5	56.5	24.1	283.75
750	49.5	60	26.5	19570.5
750	49.5	70	34.1	-9474.5
750	49.5	68	32.4	-3058
750	49.5	67	31.6	-18.5
1000	49.5	70	34.1	7850.5
1000	49.5	72	35.7	-28.5

$= 679 \times (-13 - 0.5 \times (T_{stack} + 85)) - (Flow \times 4.5 \times (Th_2 - Th_1))$

RPS 1/8/02

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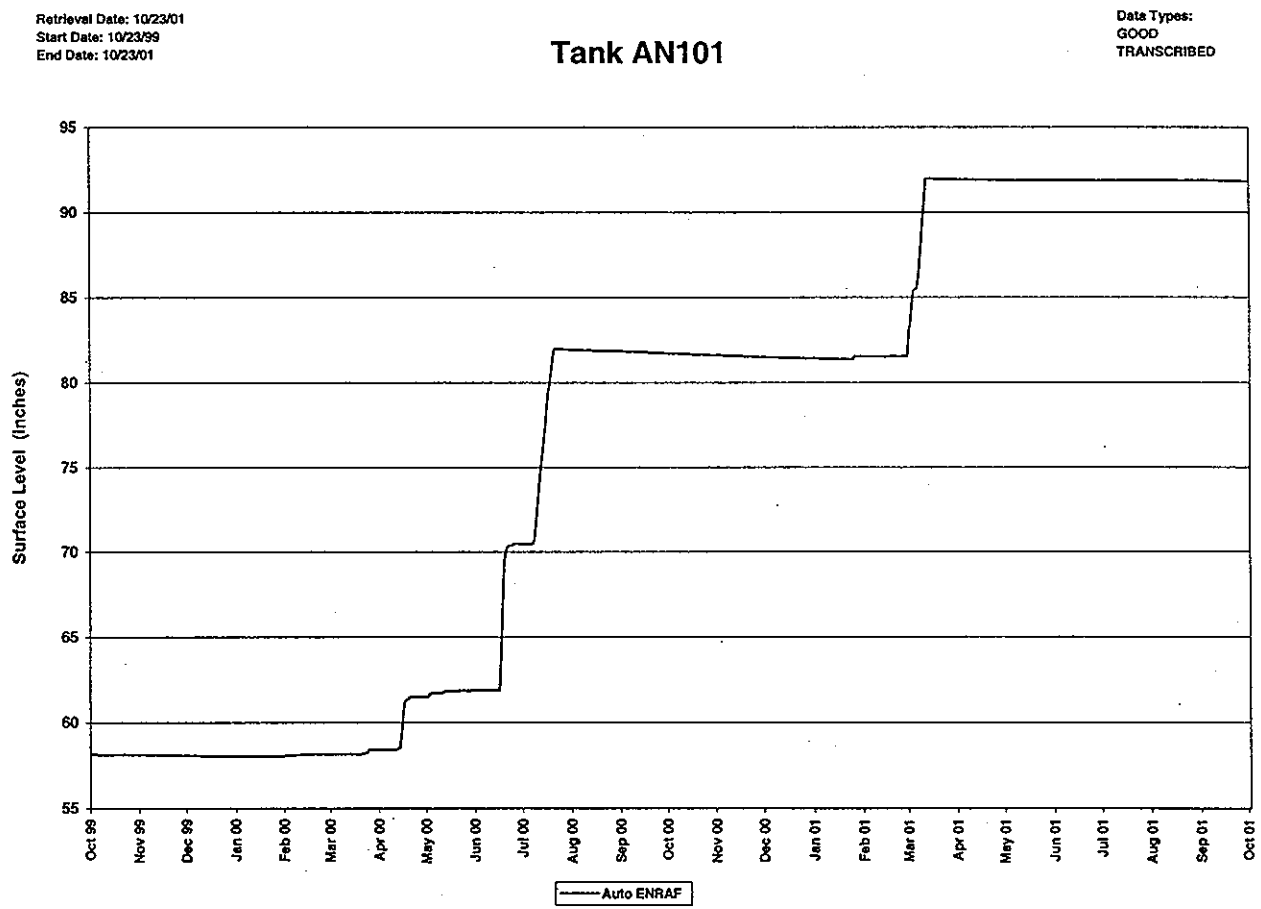

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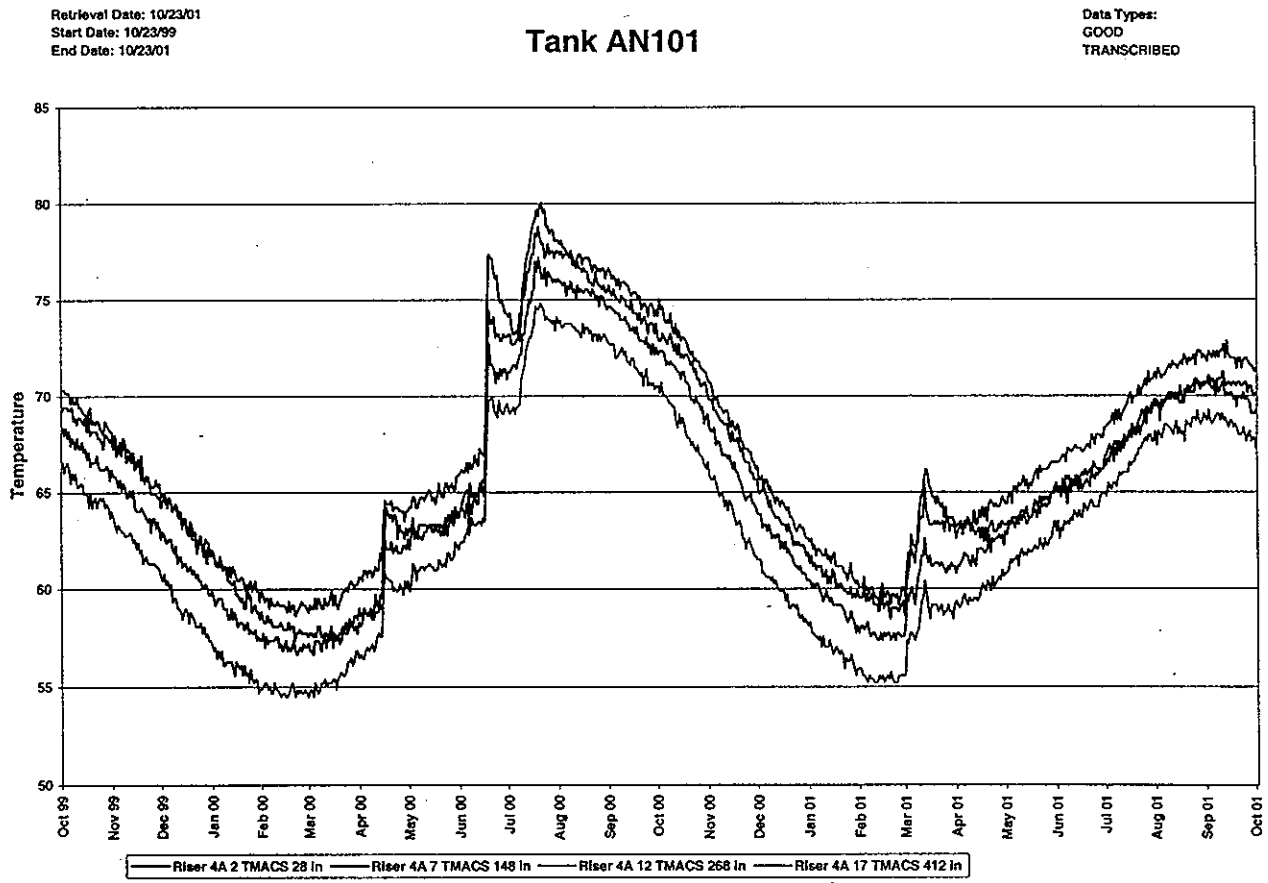

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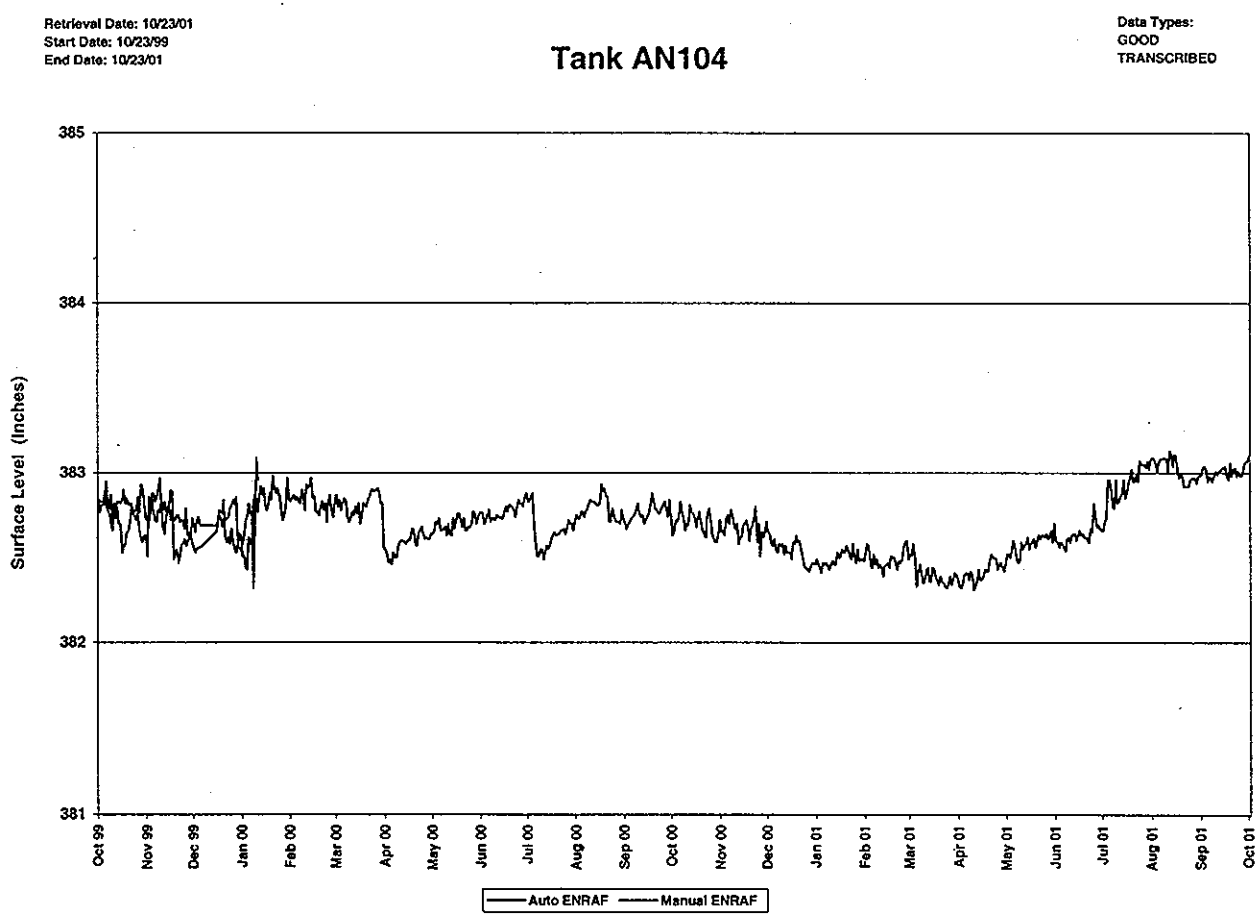

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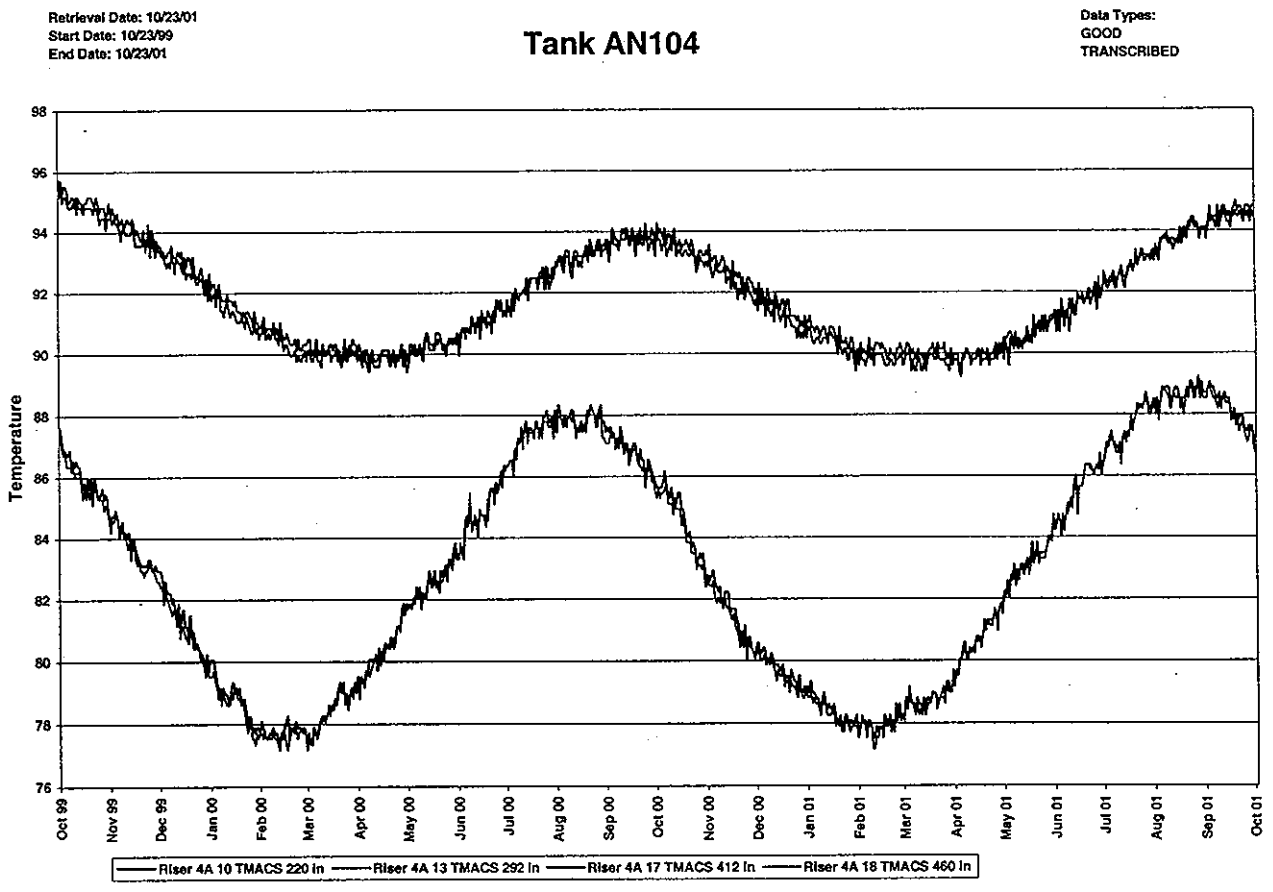

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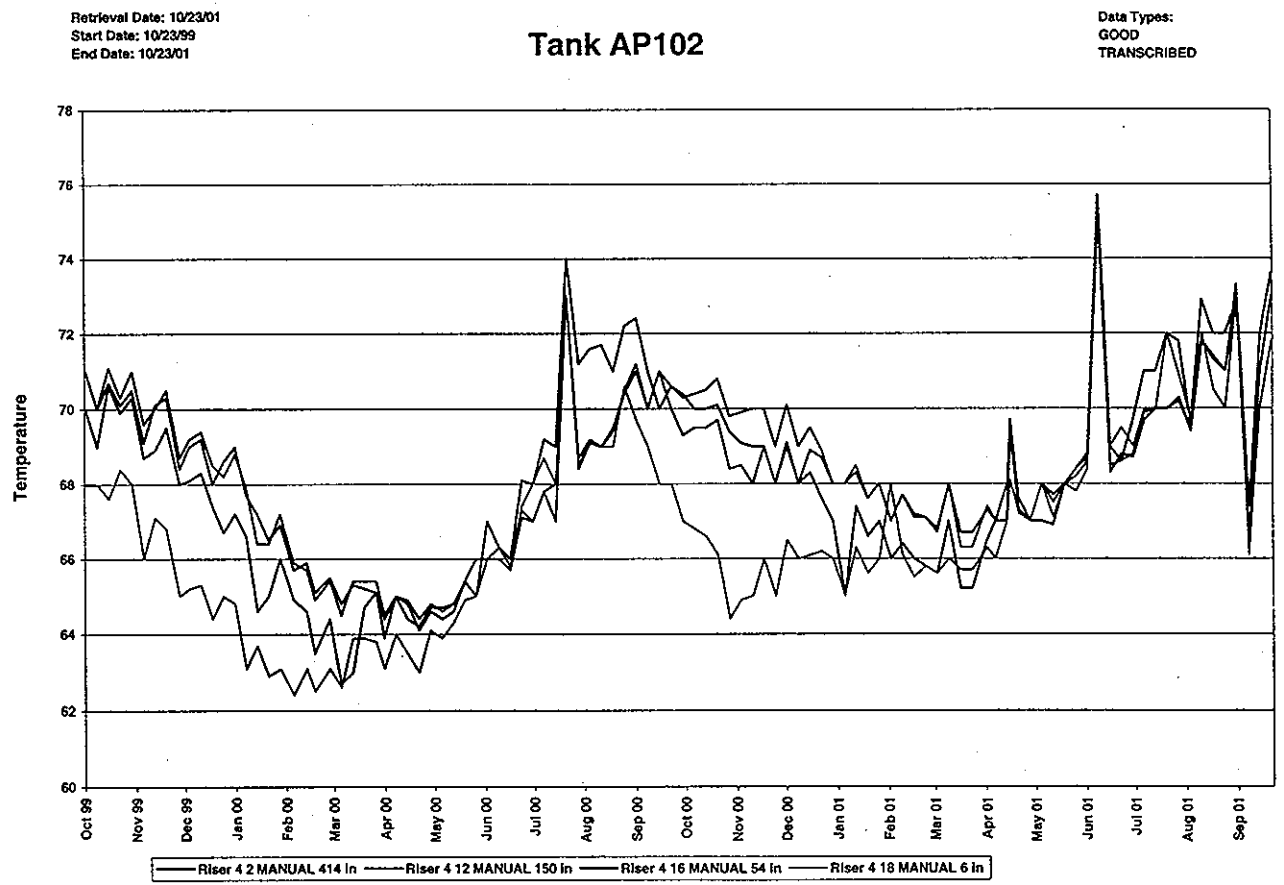

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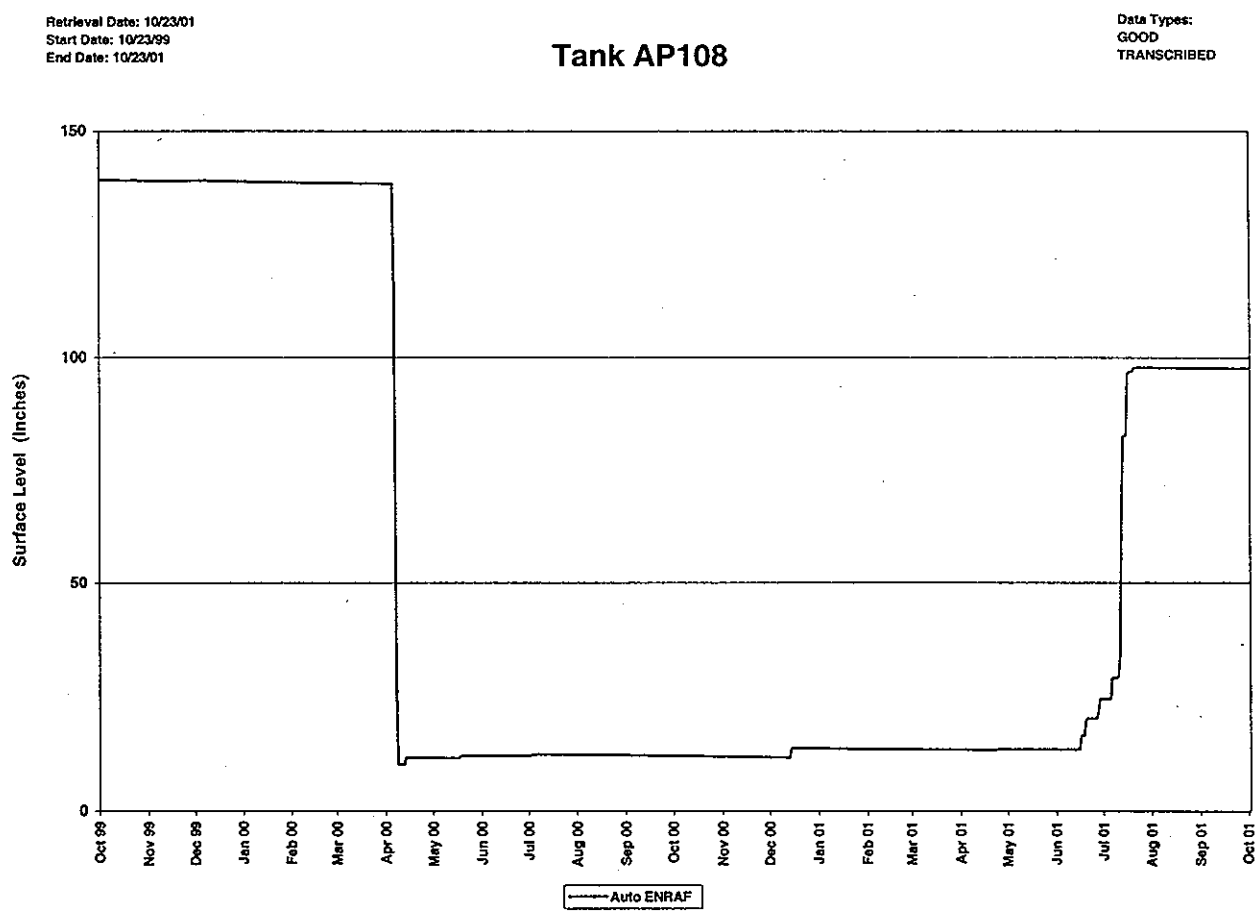

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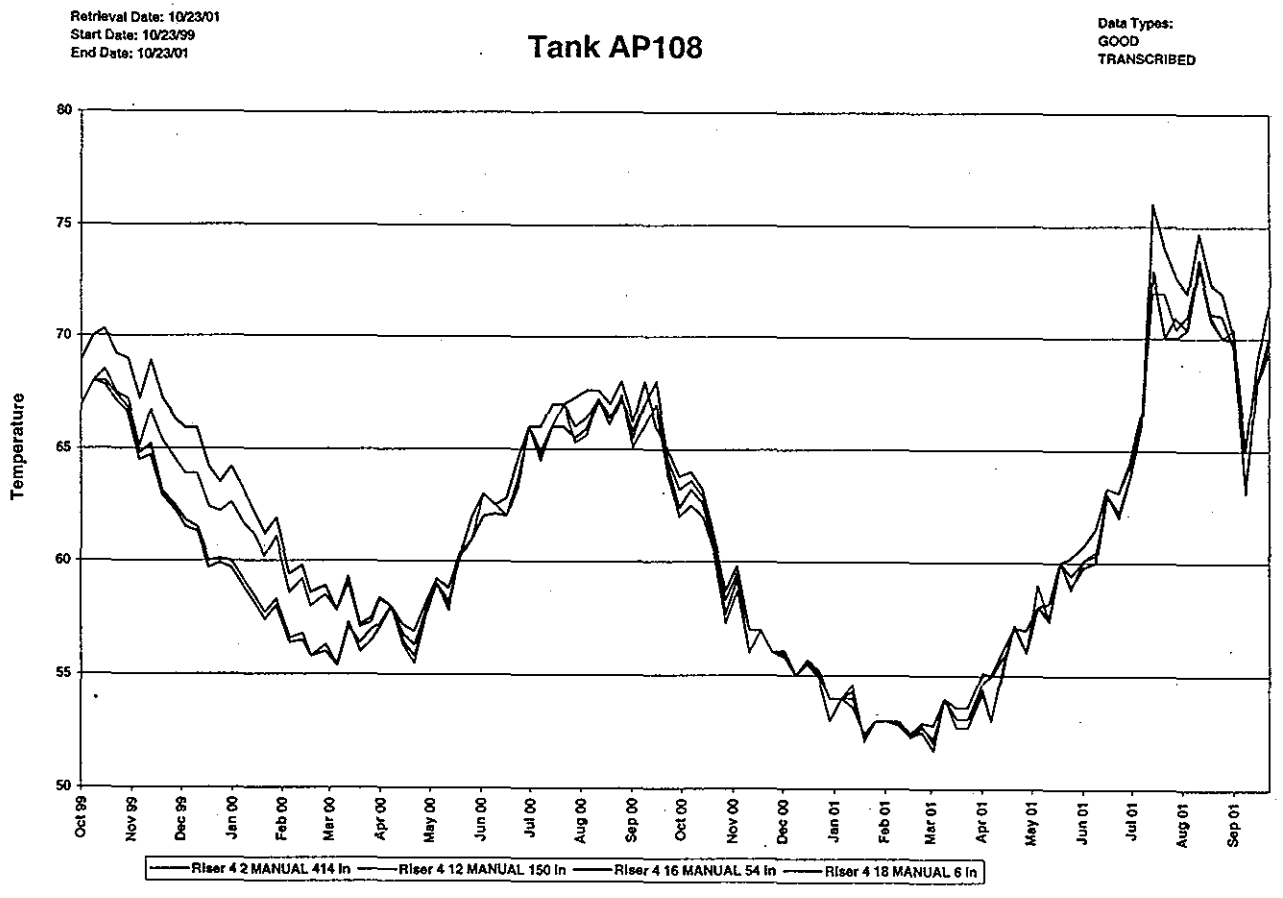

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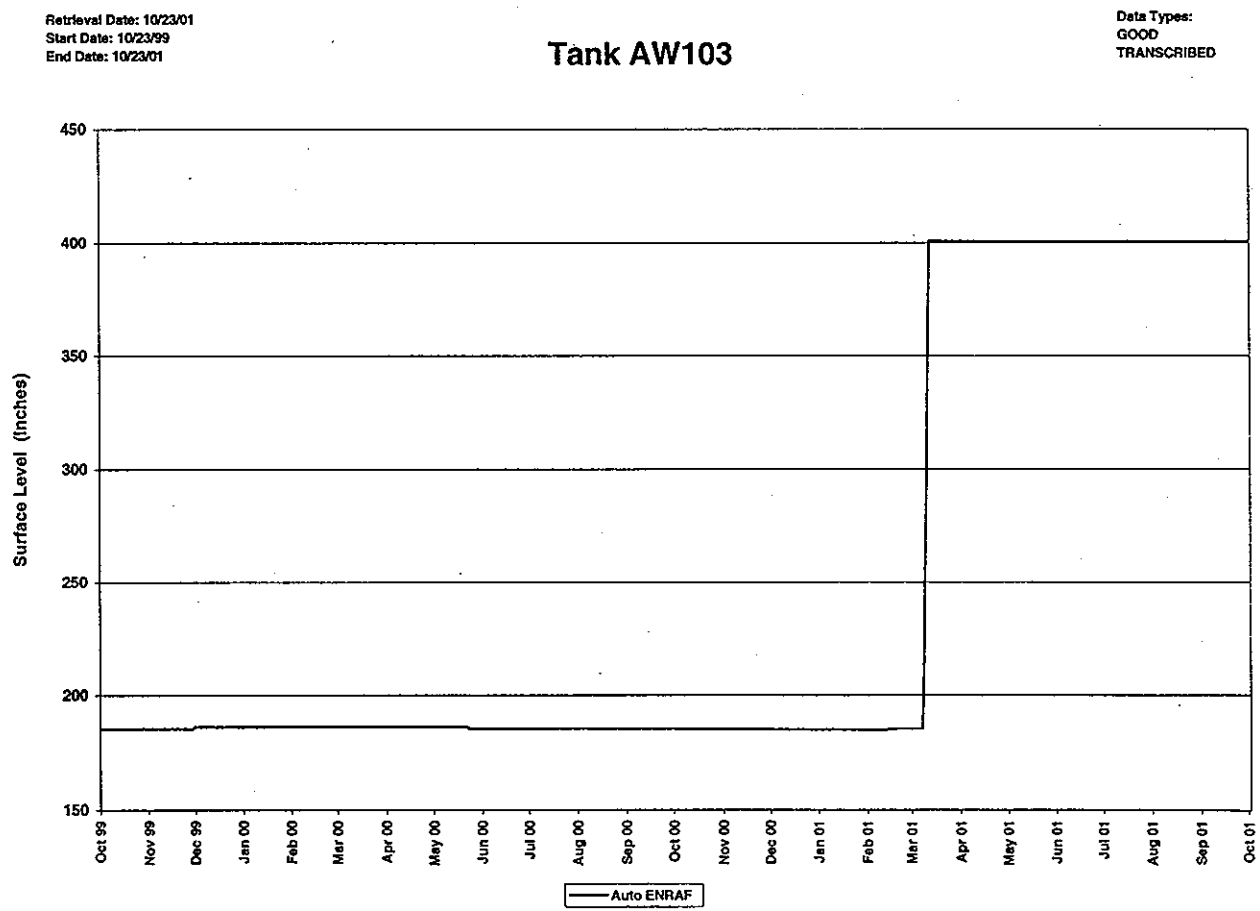

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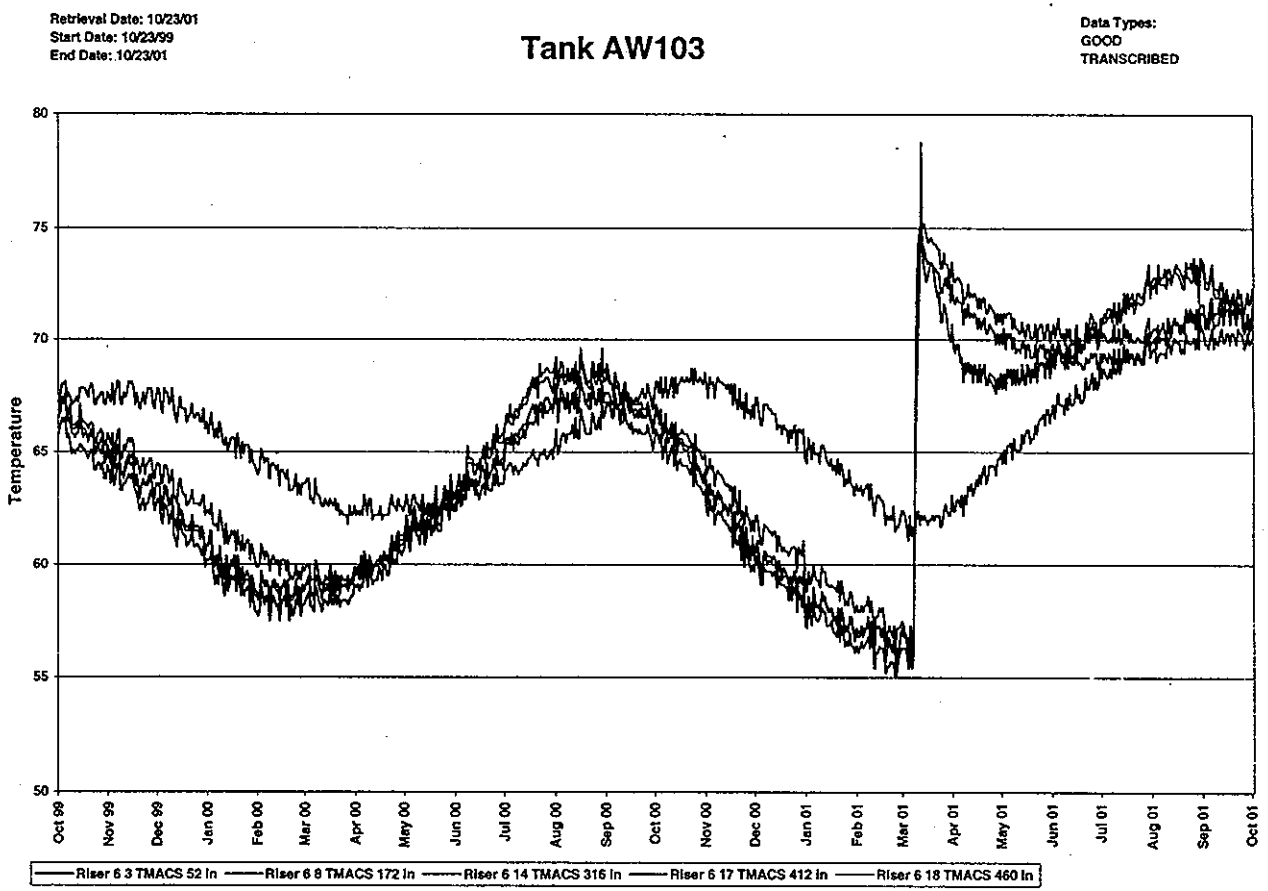

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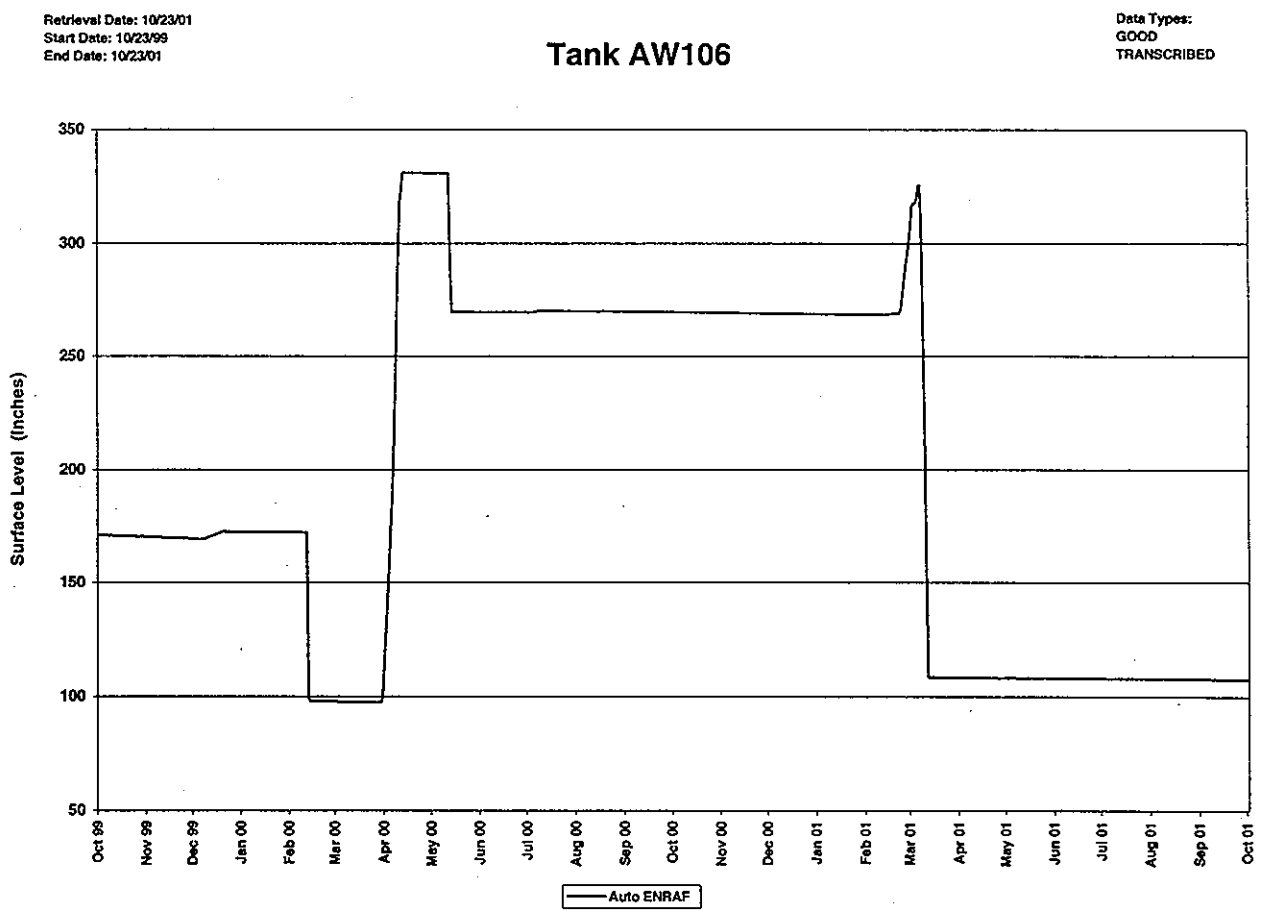

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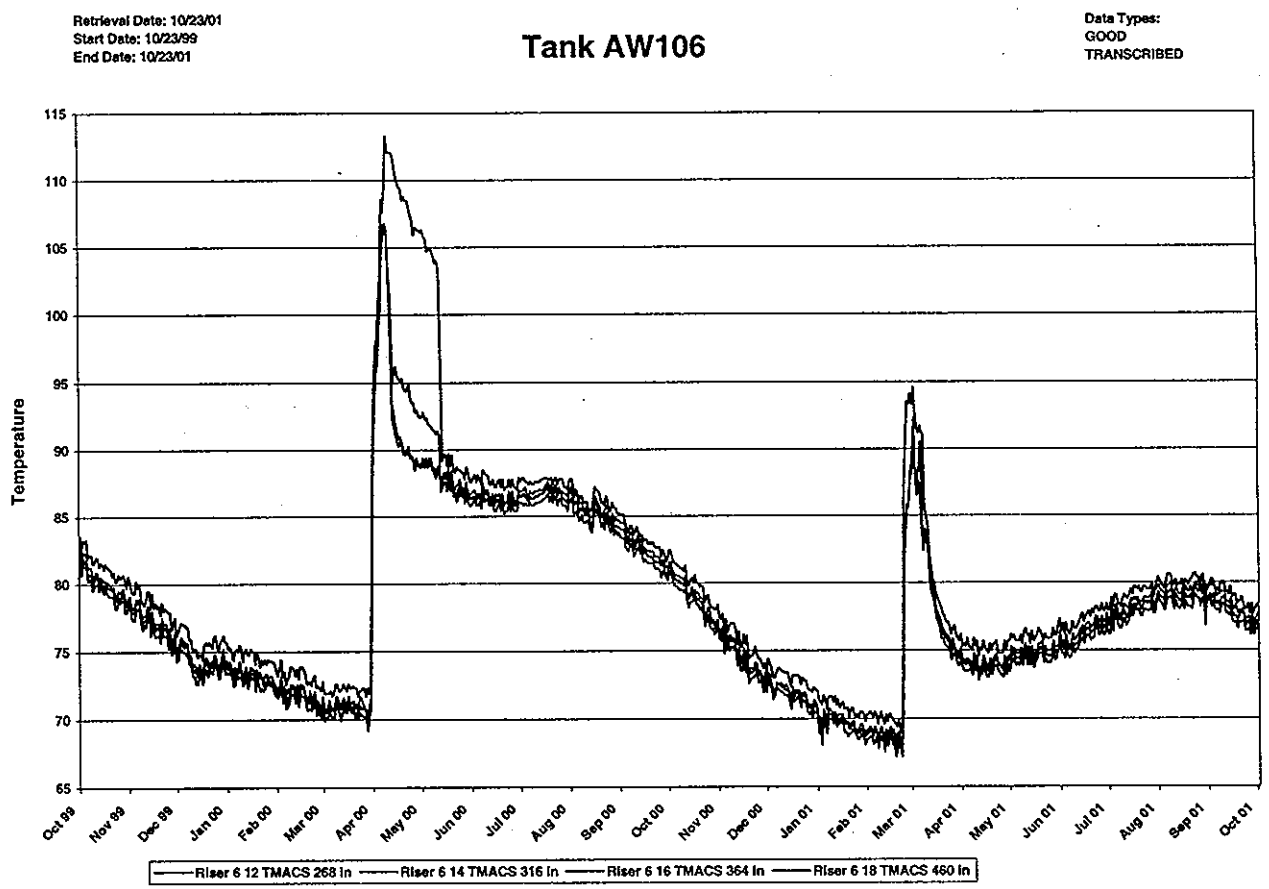

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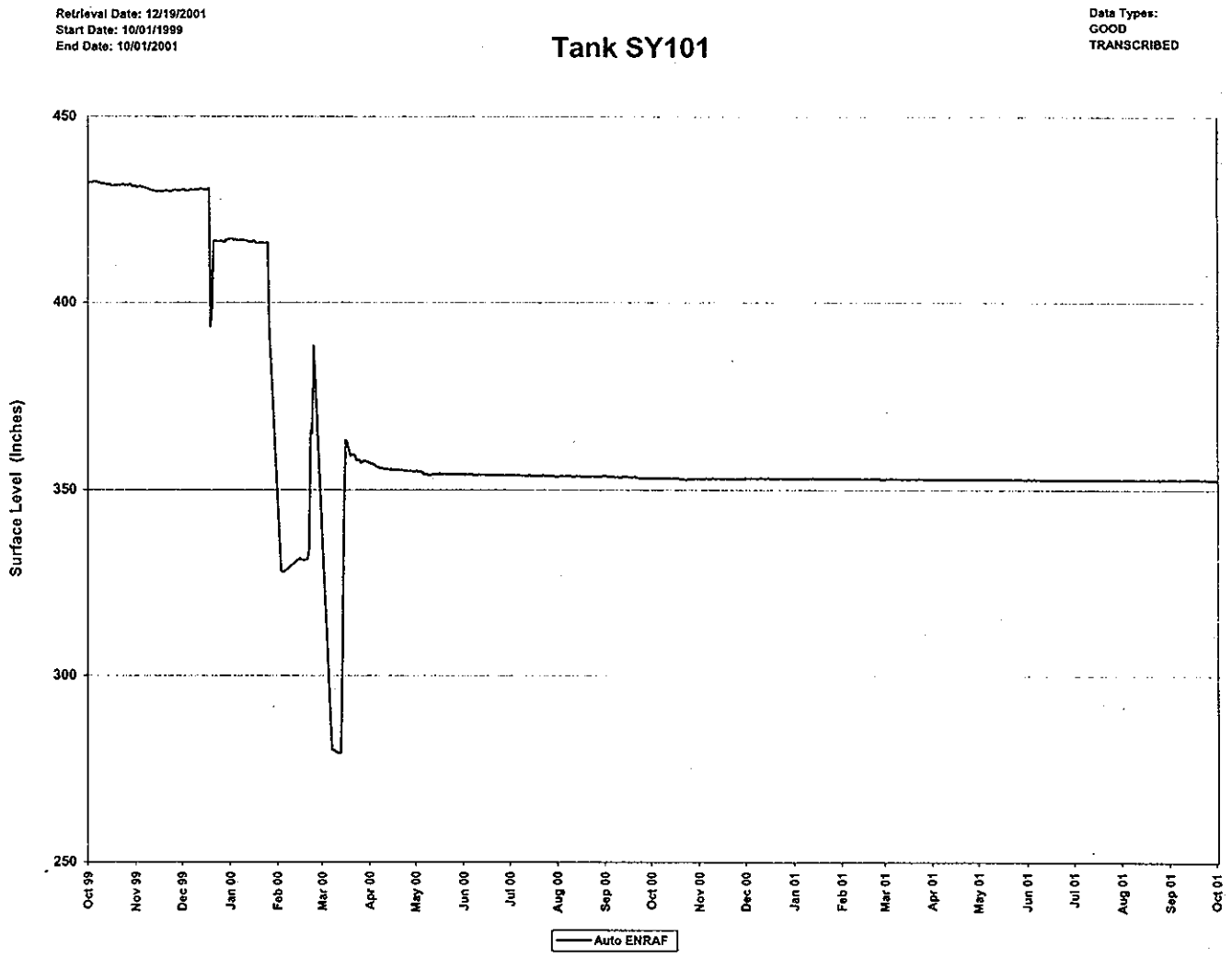

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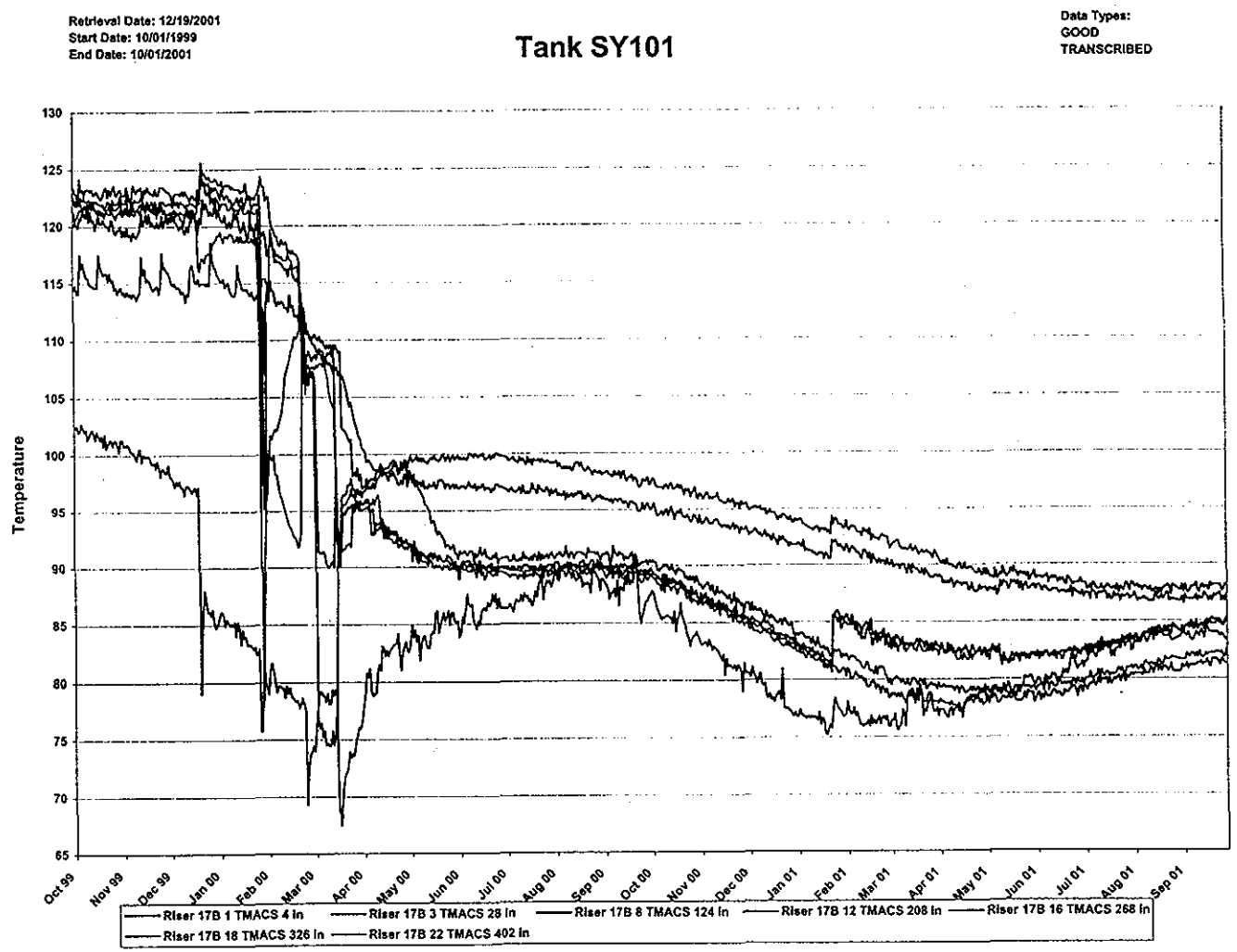

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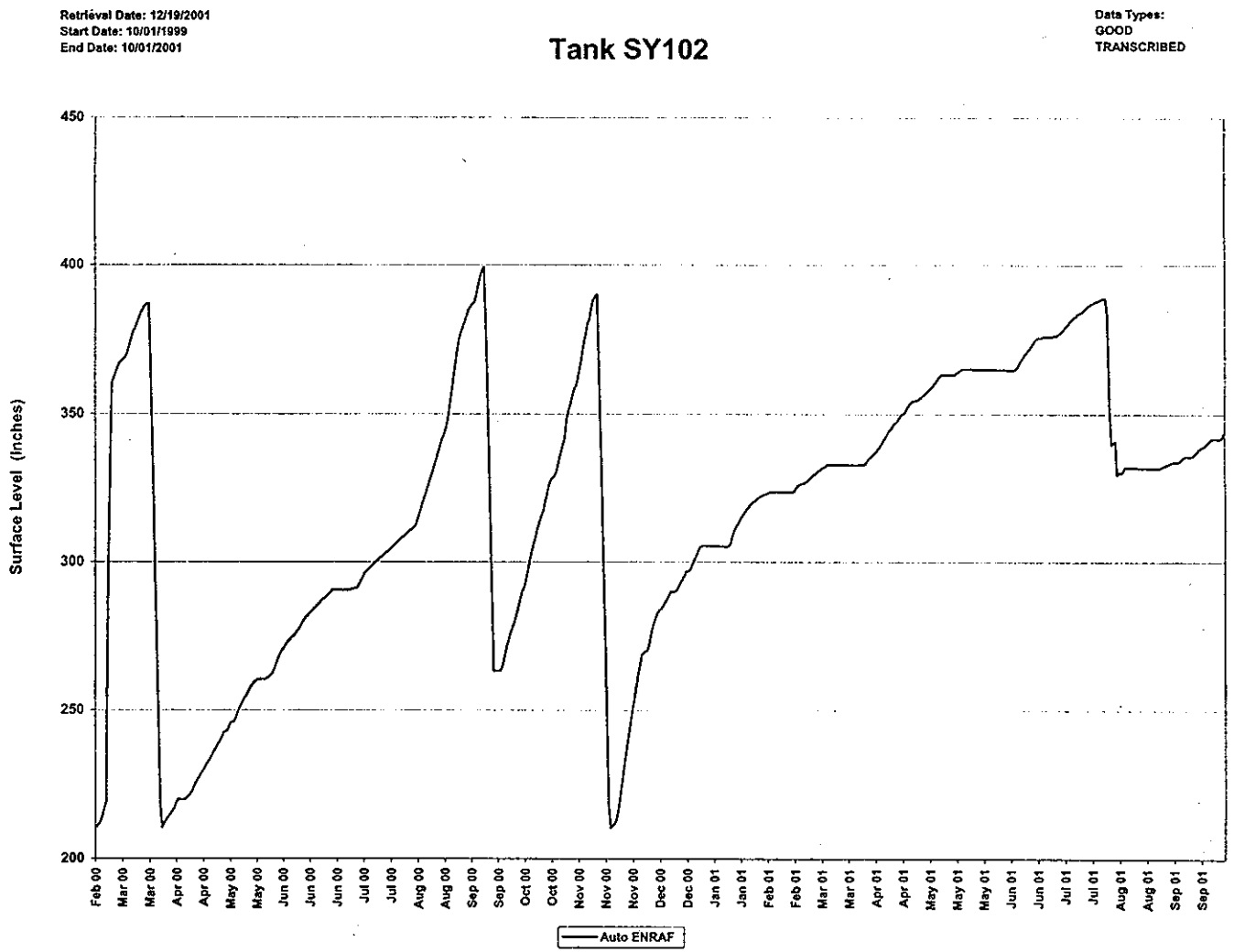

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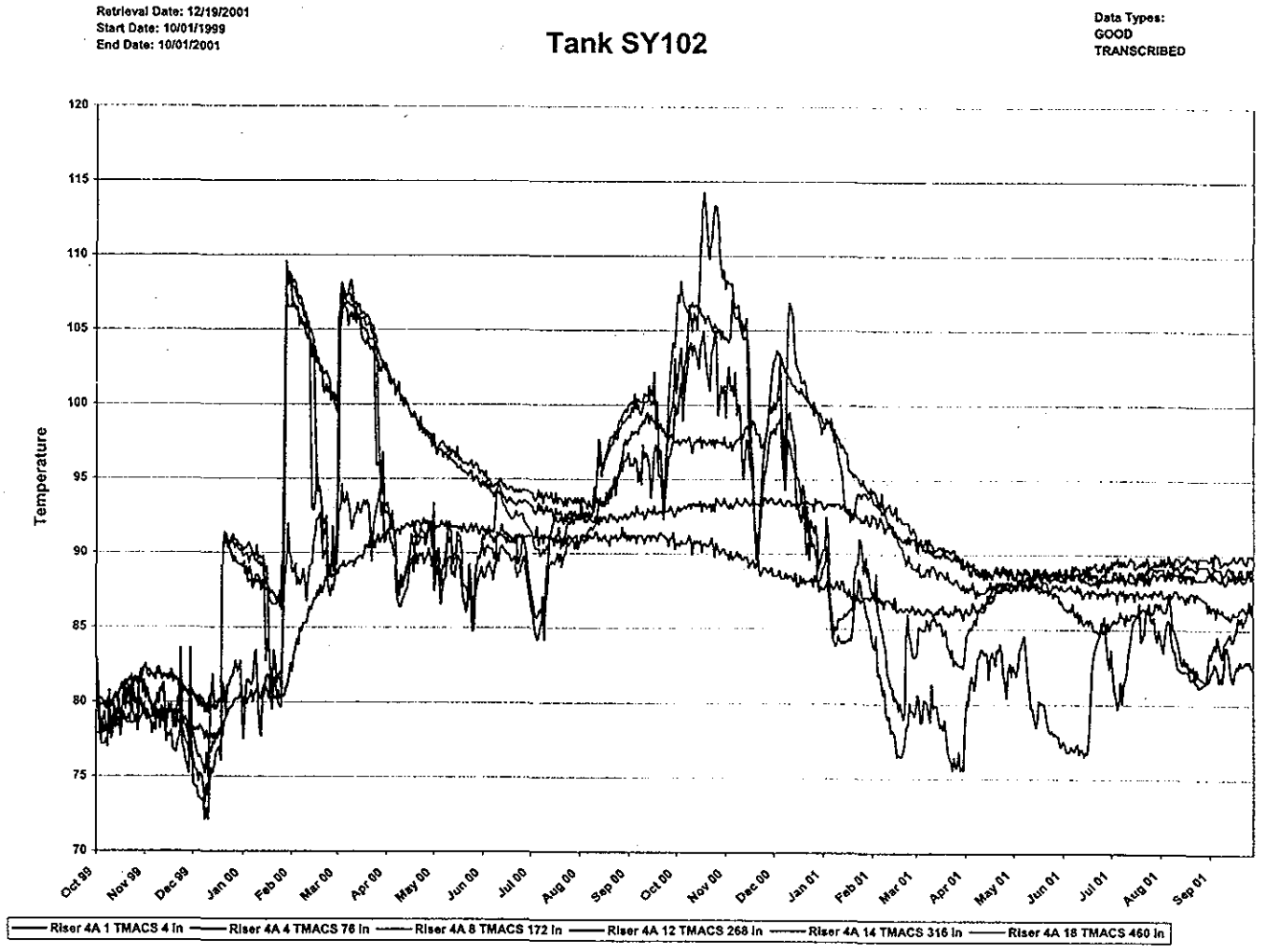

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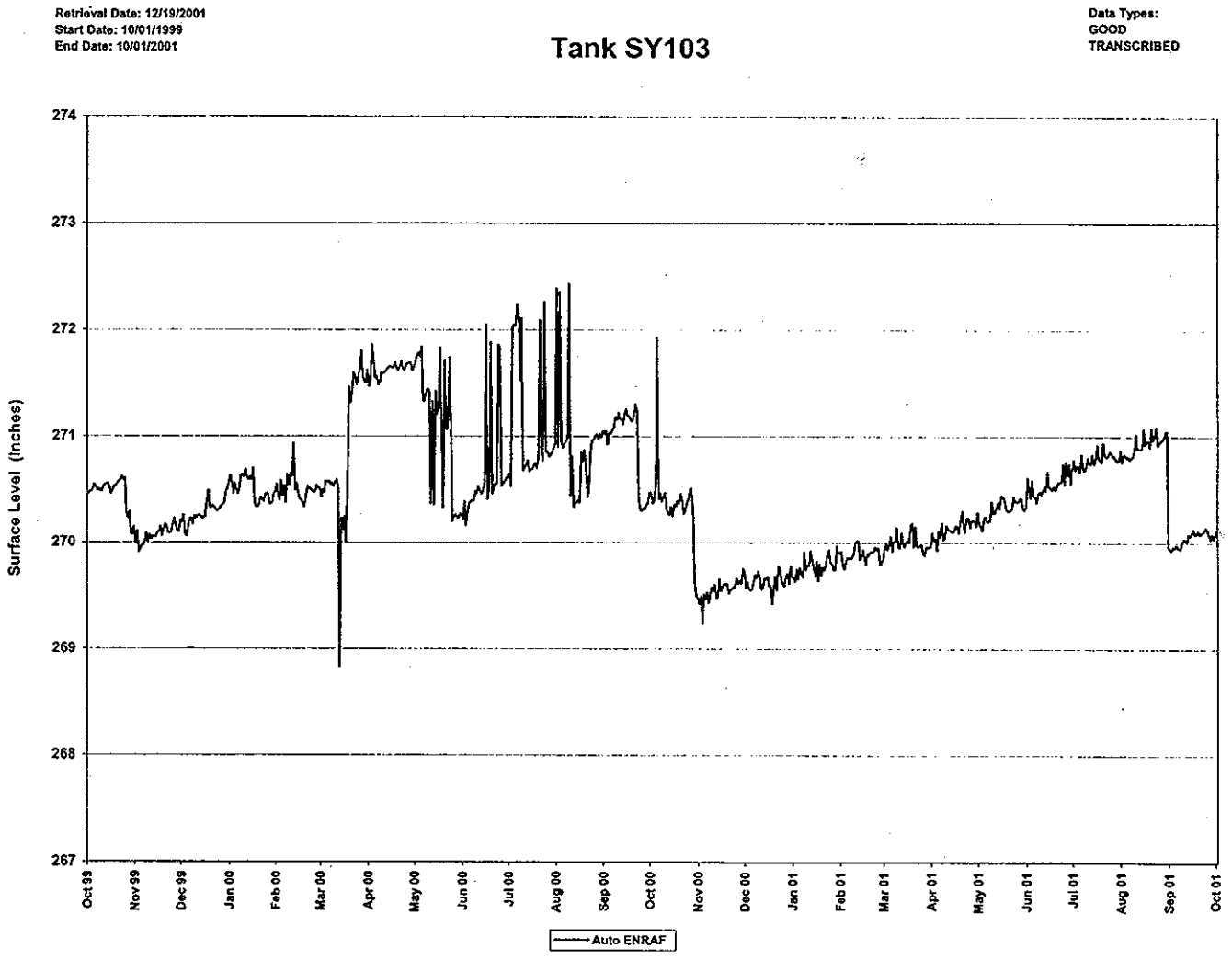

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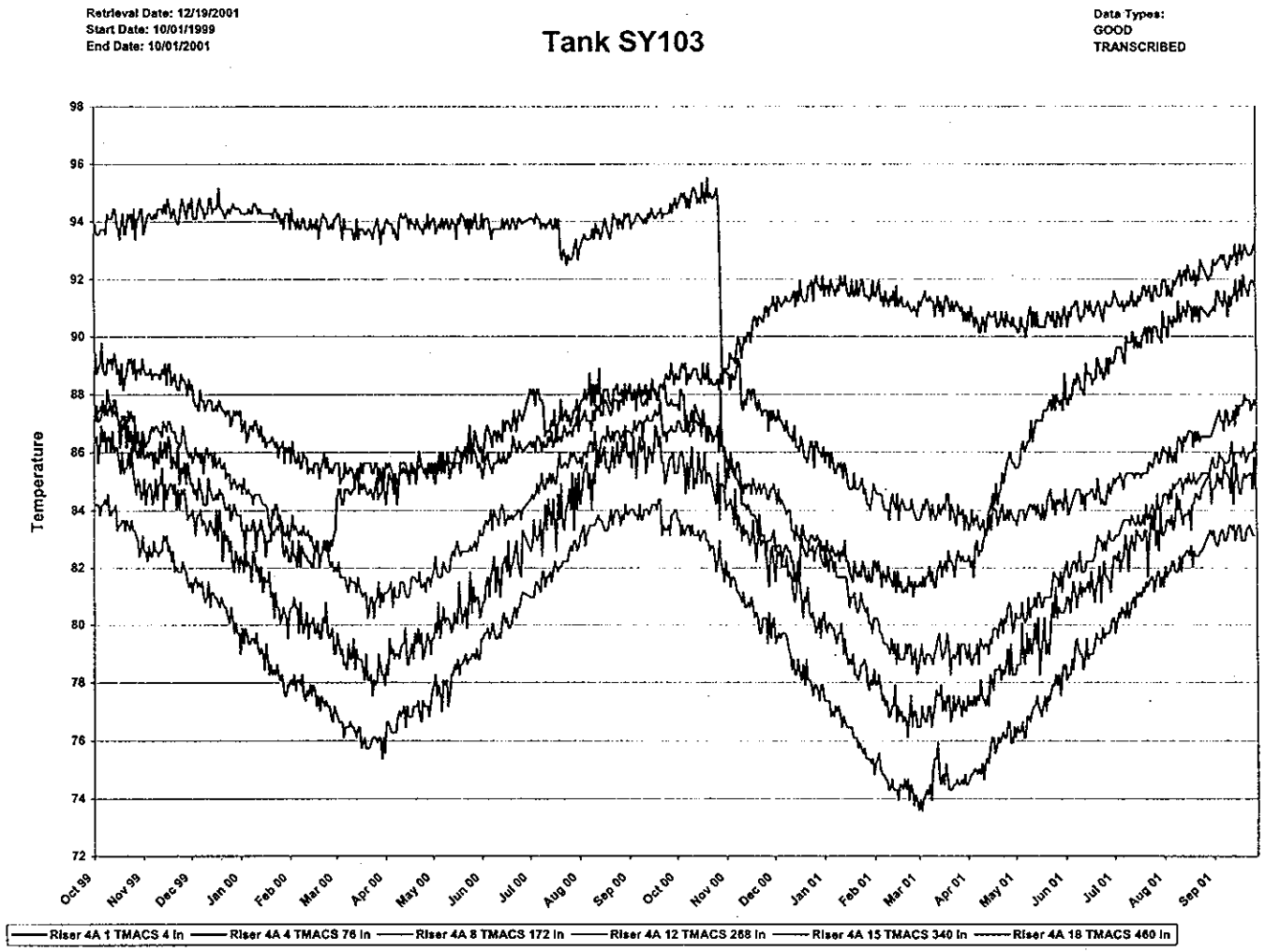

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VISTA ENGINEERING TECHNOLOGIES, L.L.C.	Attachment 3	Calc. #: VET-1084-001 Rev: 0 Page: 1 of 40
Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer	Originator: E. Stam	Date: 11/6/01
Project No. & Title: VET-1084, DST Ventilation ALARACT	Checker: RPS	Date: 1/8/02

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Pages 1 to 8 show inlet temps in the month of November, AP & AW farms.

DATE STARTING: NOV 13 2000

DAY			MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY		SATURDAY		SUNDAY	
PARAMETER	NORMAL RANGE	TSR/OSD LIMIT	D	N	D	N	D	N	D	N	D	N	D	N	D	N
K1-2 Ventilation System - Instrument Enclosure & Plenum Assembly																
TI-7 HEATER K1-2-2 INLET TEMP (°F)	35 - 150		55	55	56	55	57	56	55	55	56	54	52	53	52	53
TI-8 K1-2 FILTER BANK OUTLET TEMP (°F)	40 - 170	OSD[8] ≤ 230	72	73	70	73	68	72	71	72	71	70	68	65	58	70
TI-8 - TI-7 HEATER ΔT (°F)	<50		17	17	14	18	11	16	15	17	15	16	16	16	6	17
AP241-VTP-TDC-426 K1-2-2 HEATER CONTROLLER (°F)	5 - 25		13	13	16	13	8.5	12	12	13	13	13	9	13	5	13
DPIS-6 PREFILTER K1-3-2 (IN. H_2O)	0.0 - 1.0		.05	.1	1	.05	.1	.1	.1	.1	Ø	.1	.1	.1	.1	.1
AP241-VTP-PDIT-427 FILTER K1-4-3 (1st HEPA) (IN. H_2O)	0.3 - 5.7	OSD[5] ≤5.9 LCO[7] ≤ 5.9	.76	.746	.759	.75	.756	.754	.761	.765	.775	.764	.754	.755	.781	.763
AP241-VTP-PDIT-428 FILTER K1-4-4 (2nd HEPA) (IN. H_2O)	0.3 - 3.8	OSD[5] ≤4.0 LCO[7] ≥ 0.10	.79	.778	.783	.78	.778	.795	.807	.792	.806	.755	.786	.801	.801	.792
AP241-VTP-PDIT-429 TOTAL PRESSURE OF FILTERS K1-4-3 AND K1-4-4 (IN. H_2O)	0.3 - 5.7	OSD[5] ≤5.9	1.60	1.540	1.575	1.59	1.56	1.59	1.582	1.590	1.60	1.596	1.583	1.586	1.596	1.589
K1 FAN STATUS																
SWITCH K1 Fans (1) Monday Night only	(✓)			✓												
K1-5-1 Exhaust Fan in Operation	(✓)			✓												
K1-5-2 Exhaust Fan in Operation	(✓)		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

(1) SWITCH Operating and Standby Fans if allowed by operating conditions per TO-060-340

ENDNOTES: OSD[5]: OSD 7.3.1.A, HEPA Filters; OSD[8]: OSD 7.3.1.B, Air Inlet Temperature; LCO[7]: LCO 3.1.8, HEPA Filter Differential Pressure Interlock Systems

EDL		REMARKS: ① did not change/switch exh's due to ongoing x-sitter, per com inst.
EDL		
EDL		

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DATE STARTING:

DAY			MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY		SATURDAY		SUNDAY	
PARAMETER	NORMAL RANGE	TSR/OSD LIMIT	D	N	D	N	D	N	D	N	D	N	D	N	D	N
K-1 Ventilation System Instrument Enclosure																
DPIS-21 DE-ENTRAINER K1-1-1 (IN. H_2O)	0.05 - 2.0		.9	.85	.8	.85	.85	.8	.85	.8	.8	.85	.8	.8	.8	.8
DPIS-22 DE-ENTRAINER K1-1-2 (IN. H_2O)	0.05 - 2.0		OFF	off	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	off	OFF	OFF	OFF
K1-1 Ventilation System - Instrument Enclosure & Plenum Assembly																
TI-1 HEATER K1-2-1 INLET TEMP (°F)	35 - 150		STBY	52	52	58	52	58	52°	53	54°	54	53	55	53	54
TI-2 HEATER K1-2-1 OUTLET TEMP (°F)	45 - 170	OSD[8] ≤ 230		54	72	78	70	68	68°	73	75°	72	70	75	73	70
TI-2 - TI-1 HEATER ΔT (°F)	10 - 20			2 (1)	20	20	18	16	16	20	21 (1)	18	17	20	20	16
AP241-VTP-TDC-326 Primary Exh A Train Heater Temperature Diff Controller (°F)	5 - 25			10	20	18	13	14	12	20	18 (2)	15	15	22	22°	16
DPIS-3 PREFILTER K1-3-1 (IN. H_2O)	0.0 - 1.0			.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.15	.1
DPIS-2 FILTER K1-4-1 (1st HEPA) (IN. H_2O)	0.5 - 4.0	OSD[5] ≤ 5.9		1.0	1.0	1.0	1.0	1.0	1.05	1.05	1.05	1.0	1.0	1.0	1.05	1.0
DPIS-1 FILTER K1-4-2 (2nd HEPA) (IN. H_2O)	0.35 - 3.0	OSD[5] ≤ 4.0		.8	.8	.8	.8	.8	.8	.8	.8	.8	.8	.8	.8	.8
DPIS-1 + DPIS-2 (IN. H_2O)	0.85 - 5.0	OSD[5] ≤ 5.9		1.8	1.8	1.8	1.8	1.8	1.85	1.85	1.85	1.8	1.8	1.8	1.85	1.8

ENDNOTES: OSD[5]: OSD 7.3.1.A, HEPA Filters; OSD[8]: OSD 7.3.1.B, Air Inlet Temperature

EDL #

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REMARKS: (1) out of limit/or Range (2) cover to Heat controller Looks like its melting away

DATE STARTING: [illegible]

DAY			MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY		SATURDAY		SUNDAY	
PARAMETER	NORMAL RANGE	TSR/OSD LIMIT	D	N	D	N	D	N	D	N	D	N	D	N	D	N
K1-2 Ventilation System - Instrument Enclosure & Plenum Assembly																
TI-7 HEATER K1-2-2 INLET TEMP (°F)	35 - 150		53	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY
TI-8 K1-2 FILTER BANK OUTLET TEMP (°F)	40 - 170	OSD[8] ≤ 230	69													
TI-8 - TI-7 HEATER ΔT (°F)	10 - 20		16													
AP241-VTP-TDC-426 K1-2-2 HEATER CONTROLLER (°F)	5 - 25		11													
DPIS-6 PREFILTER K1-3-2 (IN. H_2O)	0.0 - 1.0		.2													
DPIS-5 FILTER K1-4-3 (1st HEPA) (IN. H_2O)	0.5 - 4.0	OSD[5] ≤5.9	1.0													
DPIS-4 FILTER K1-4-4 (2nd HEPA) (IN. H_2O)	0.35 - 3.0	OSD[5] ≤4.0	.8													
DPIS-4 + DPIS-5 (IN. H_2O)	0.85 - 5.0	OSD[5] ≤5.9	1.8													
K1 FAN STATUS																
SWITCH K1 Fans (1) Monday Night only	(√)			✓												
K1-5-1 Exhaust Fan in Operation	(√)			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
K1-5-2 Exhaust Fan in Operation	(√)		✓													

(1) SWITCH Operating and Standby Fans if allowed by operating conditions per IO-060-340

ENDNOTES: OSD[5]: OSD 7.3.1.A, HEPA Filters; OSD[8]: OSD 7.3.1.B, Air Inlet Temperature

DATE STARTING: NOV 6 1998

DAY			MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY		SATURDAY		SUNDAY	
PARAMETER	NORMAL RANGE	TSR/OSD LIMIT	D	N	D	N	D	N	D	N	D	N	D	N	D	N
K1-1 Ventilation System - Instrument Enclosure & Plenum Assembly																
TI-1, HEATER K1-2-1 INLET TEMP. (°F)	35 - 150		STBY	56	58°	(3) (2) 11-11-98 STBY	(5) STBY	(3) STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY
TI-2, HEATER K1-2-1 OUTLET TEMP. (°F)	45 - 180	OSD[8] ≤ 230°		63	94											
TI-2 - TI-1 HEATER ΔT (°F)	10 - 30			(1) 7	(3) 36 (2)											
DPIS-3, PREFILTER K1-3-1 (IN. H_2O)	0.1 - 1.8			.30	.30											
DPIS-2, FILTER K1-4-1 (1st HEPA) (IN. H_2O)	0.5 - 4.0	OSD[5] ≤ 5.9		.8	.75											
DPIS-1, FILTER K1-4-2 (2nd HEPA) (IN. H_2O)	0.5 - 3.0	OSD[5] ≤ 4.0		.8	.8											
DPIS-1 + DPIS-2 (IN. H_2O)	1.0 - 4.0	OSD[5] ≤ 5.9		1.6	1.55											
K1 Ventilation System - Instrument Enclosure																
AW241-VTP-PDIS-109 A-TRAIN DMST D/P AW DPIS-13 DE-ENTRAINER K1-1-1 (IN. H_2O)	0.05 - 2.0		.7	.7	.7	.7	.7	.7	.7	.7	.7	.7	.7	.7	.7	.7
AW241-VTP-PDIS-108 B-TRAIN DMST D/P AW DPIS-14 DE-ENTRAINER K1-1-2 (IN. H_2O)	0.05 - 2.0		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

ENDNOTES: OSD[5]: OSD-T-151-00007.3.1.A, HEPA Filters; OSD[8]: OSD-T-151-00007.3.1.B, Air Inlet Temperature

EDL # (1) JE-97-1483	REMARKS: (1) out of limits (2) out of Specs. JE-97-1483, Soma Re 11-16-98
EDL # 11-11-98 JF (3)	(2) Switch when Cam failure alarm came in during days. 5mo
EDL #	~~Due to AW K1 Stack Flow Maintenance Activity. Rev 11/11/98~~ Soma Re 11-11-98

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RPP-9782 Rev. 0 1-94

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Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer

Project No. & Title: VET-1084, DST Ventilation

Originator: E. Stam **Date:** 11/6/01

Checker: RB **Date:** 11/8/02

WORKING COPY

Printed on: Nov 8, 2002 10:51 am

DATE STARTING: NOV 9 2002

DAY			MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY		SATURDAY		SUNDAY	
PARAMETER	NORMAL RANGE	TSR/OSD LIMIT	D	N	D	N	D	N	D	N	D	N	D	N	D	N
K1-2 Ventilation System - Instrument Enclosure & Plenum Assembly																
TI-7, HEATER K1-2-2 INLET TEMP. (°F)	35 - 150		58	SHBT	SHBT	55 (2)	54	54	54°	(0) (1)	58°	57	56	57	58	58
TI-8, HEATER K1-2-2 OUTLET TEMP. (°F)	45 - 180	OSD[8] < 230	58			55	54	55	54°		58°	58	57	58	58	58
TI-8 - TI-7 HEATER ΔT (°F)	10 - 30		(0) (1)			(0) (1)	0 (1)	(1) (1)	(0) (1)		(0) (1)	(1) (1)	(1) (1)	(1) (1)	(0) (1)	(0) (1)
DPIS-6, PREFILTER K1-3-2 (IN. H_2O)	0.1 - 1.8		.45			.40	.42	.43	.44	.43	.40	.39	.40	.39	.40	.37
DPIS-5, FILTER K1-4-3 (1st HEPA) (IN. H_2O)	0.5 - 4.0	OSD[5] ≤ 5.9	1.2			11-10-98 1.0	1.1	1.2	1.2	1.2	1.1	1.0	1.0	1.0	1.1	1.0
DPIS-4, FILTER K1-4-2 (2nd HEPA) (IN. H_2O)	0.5 - 3.0	OSD[5] ≤ 4.0	.8			.75	.75	.8	.8	.8	.8	.8	.8	.8	.8	.8
DPIS-4 + DPIS-5 (IN. H_2O)	1.0 - 4.0	OSD[5] ≤ 5.9	2.0			1.75	1.85	2.0	2.0	2.0	1.9	1.8	1.8	1.8	1.9	1.8
241-AW K1 STACK MONITOR CABINET																
DPI-28, K1 STACK FLOW (IN. H_2O)	0.13 - 0.28		.24	.24	.24	.25	.24	.24	.24	.24	.24	.25	.25	.24	.24	.24
241-AW K1 FAN/TANK EXHAUSTER STATUS																
SWITCH K1 Fans (1) MONDAY NIGHT ONLY	(√)			✓												
K1-5-1 PRIMARY	(√)			✓	✓											
K1-5-2 PRIMARY	(√)		✓			(2) ✓	✓	(2) ✓	✓	✓	✓	✓	✓	✓	✓	✓

(1) SWITCH Operating K1 Fans if allowed by operating conditions per TO-060-104

ENDNOTES: OSD[5]: OSD-T-151-00007.3.1.A, HEPA Filters; OSD[8]: OSD-T-151-00007.3.1.B, Air Inlet Temperature.

EDL #	2E-97-01253 (1)
EDL #	
EDL #	

REMARKS: (2) Switched automatically when Cam failure alarm came in on day 11-10-98 SMO. Sam Pe 11-11-98

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DATE STARTING: NOV 13 2000

DAY			MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY		SATURDAY		SUNDAY	
PARAMETER	NORMAL RANGE	TSR/OSD LIMIT	D	N	D	N	D	N	D	N	D	N	D	N	D	N
K1-1 Ventilation System - Instrument Enclosure & Plenum Assembly																
TI-1, HEATER K1-2-1 INLET TEMP. (°F)	35 - 150		STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY
TI-2, HEATER K1-2-1 OUTLET TEMP. (°F)	45 - 180	OSD[5] ≤ 230°	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
TI-2 - TI-1 HEATER ΔT (°F)	< 50		↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
DPIS-3, PREFILTER K1-3-1 (IN. H2O)	0.1 - 1.8		↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
K-1 Ventilation System PLC Enclosure																
AW241-VTP-ENCL-120 INTERNAL ENCLOSURE TEMP (°F)	32 - 140		61	61	62°	60	61	60°	60	61	62	62	62	60	60	60
AW241-VTP-ENCL-120 Check no alarms lit	(√)	LCO[7] 3.1.8		✓		✓		✓		✓		✓		✓		✓
AW241-VTP-ENCL-120 LAMP TEST	(√)	LCO[7] 3.1.8		✓		✓		✓		✓		✓		✓		✓
AW241-VTP-ENCL-120 * & Associated Equipment Check for physical damage	(√)	LCO[7] 3.1.8		✓		✓		✓		✓		✓		✓		✓
AW241-VTP-HS-120 EXHAUSTER A&B PLC INTERLOCK FUNCTION Check in NORMAL position	(√)			✓		✓		✓		✓		✓	✓	✓	✓	✓
AW241-VTP-PDIT-327 FILTER K1-4-1 (1st HEPA) (IN. H2O)	0.3 - 5.7	OSD[5] ≤ 5.9 LCO[7] 3.1.8 ≤ 5.9	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY
AW241-VTP-PDIT-328 FILTER K1-4-2 (2nd HEPA) (IN. H2O)	0.3 - 3.8	OSD[5] ≤ 4.0 LCO[7] 3.1.8 ≥ 0.10	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
AW241-VTP-PDIT-329 TOTAL PRESSURE OF FILTERS K1-4-1 AND K1-4-2 (IN. H2O)	0.3 - 5.7	OSD[5] ≤ 5.9	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓

* The check for physical damage includes checking tubing, connections, and Yokogawa DP Instrument gauge rack

ENDNOTES: OSD[5]: OSD-T-151-00007.3.1.A, HEPA Filters; OSD[6]: OSD-T-151-00007.3.1.B, Air Inlet Temperature; LCO[7]: LCO 3.1.8, HEPA Filter Differential Pressure Interlock Systems

EDL		REMARKS:
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DATE STARTING: NOV 18 2000

DAY			MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY		SATURDAY		SUNDAY	
PARAMETER	NORMAL RANGE	TSR/OSD LIMIT	D	N	D	N	D	N	D	N	D	N	D	N	D	N
K1-2 Ventilation System - Instrument Enclosure & Plenum Assembly																
TI-7, HEATER K1-2-2 INLET TEMP. (°F)	35 - 150	OSD[4] < 230	50	50	50	51°	50°	49	50	51	50	45	50	50	48	49
TI-8, HEATER K1-2-2 OUTLET TEMP. (°F)	45 - 180	OSD[4] < 230	50	50	50	51°	52°	49	50	51	50	50	50	50	48	49
TI-8 - TI-7 HEATER ΔT (°F)	< 50		O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]
DPIS-6, PREFILTER K1-3-2 (IN. H_2O)	0.1 - 1.8		0	0	0	.40	.45	.42	.44	.45	.43	.45	.45	.45	.45	.47
AW241-VTP-PDIT-427 FILTER K1-4-3 (1st HEPA) (IN. H_2O)	0.3 - 5.7	OSD[5] ≤ 5.9 LCO[7] 3.1.8 ≤ 5.9	.77	.764	.771	.75	.775	.768	.777	.789	.785	.759	.774	.783	.787	.829
AW241-VTP-PDIT-428 FILTER K1-4-4 (2nd HEPA) (IN. H_2O)	0.3 - 3.8	OSD[5] ≤ 4.0 LCO[7] 3.1.8 ≥ 0.10	.66	.654	.656	.66	.661	.653	.664	.674	.668	.650	.663	.663	.661	.703
AW241-VTP-PDIT-429 TOTAL PRESSURE OF FILTERS K1-4-3 AND K1-4-4 (IN. H_2O)	0.3 - 5.7	OSD[5] ≤ 5.9	1.59	1.587	1.602	1.60	1.60	1.59	1.611	1.614	1.614	1.635	1.607	1.624	1.630	1.692
241-AW K1 STACK MONITOR CABINET																
DPI-28, K1 STACK FLOW (IN. H_2O)	0.13 - 0.28		.24	.245	.24	.24	.24	.24	.24	.24	.24	.24	.24	.24	.24	.25
241-AW K1 FAN/TANK EXHAUSTER STATUS																
SWITCH K1 Fans[(1)] MONDAY NIGHT ONLY	(✓)			②												
K1-5-1 PRIMARY	(✓)															
K1-5-2 PRIMARY	(✓)		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

(1) SWITCH Operating K1 Fans if allowed by operating conditions per TO-060-104

ENDNOTES: OSD[5]: OSD-T-151-00007.3.1.A, HEPA Filters; OSD[6]: OSD-T-151-00007.3.1.B, Air Inlet Temperature.; LCO[7]: LCO 3.1.8, HEPA Filter Differential Pressure Interlock Systems; O/S[1] EDL 2E-97-01253

Value for gauge found elsewhere 11/14/00

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REMARKS: ① Below Normal Range SOMA RWR written 11/8/00 @ 11-13-00 LWL 11/14/00
② Did not switch exh's due to ongoing x-site transfer, per som inst.

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DATE STARTING: NOV 1 2000

DAY			MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY		SATURDAY		SUNDAY	
PARAMETER	NORMAL RANGE	TSR/OSD LIMIT	D	N	D	N	D	N	D	N	D	N	D	N	D	N
K1-1 Ventilation System - Instrument Enclosure & Plenum Assembly																
TI-1 HEATER K1-2-1 INLET TEMP (°F)	35 - 150		STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY
TI-2 HEATER K1-2-1 OUTLET TEMP (°F)	45 - 170	OSD[8] ≤ 230	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
TI-2 - TI-1 HEATER ΔT (°F)	<50		↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
AP241-VTP-TDC-326 Primary Exh A Train Heater Temperature Diff Controller (°F)	5 - 25		↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
DPIS-3 PREFILTER K1-3-1 (IN. H_2O)	0.0 - 1.0		↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
AP241-VTP-PDIT-327 FILTER K1-4-1 (1st HEPA) (IN. H_2O)	0.3 - 5.7	OSD[5] ≤ 5.9 LCO[7] ≤ 5.9	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
AP241-VTP-PDIT-328 FILTER K1-4-2 (2nd HEPA) (IN. H_2O)	0.3 - 3.8	OSD[5] ≤ 4.0 LCO[7] ≥ 0.10	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
AP241-VTP-PDIT-329 TOTAL PRESSURE OF FILTERS K1-4-1 AND K1-4-2 (IN. H_2O)	0.3 - 5.7	OSD[5] ≤ 5.9	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓

ENDNOTES: OSD[5]: OSD 7.3.1.A, HEPA Filters; OSD[8]: OSD 7.3.1.B, Air Inlet Temperature; LCO[7]: LCO 3.1.8, HEPA Filter Differential Pressure Interlock Systems

EDL		REMARKS:
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Pages 9 to 17 show effects of a waste transfer in the AW farm.

AW TANK FARM LIQUID LEVELS (ER[1])

NOTE - TMACS is not currently hooked up to AW ENRAFS. All AW ENRAF readings shall be taken manually in the field.

- Days (0700-1900); Nights (1900-2400)

LIQUID LEVEL Enraf SPECIFICATIONS:

OP3LMT ≤ 416" OSD[9] LIMIT 6"
AC 24 HOURS
TK-102-AW MAX OPERATING LIMIT: 380"

MANUAL TAPE LIQUID LEVEL SPECIFICATIONS:

OP3LMT ≤ 34' 8" OSD[9] LIMIT 6"
AC[3] 24 HRS

DATE STARTING: APR 00

DAY		MONDAY		TUESDAY		WEDNESDAY		THURSDAY	
TANK		DAYS	NIGHTS	DAYS	NIGHTS	DAYS	NIGHTS	DAYS	NIGHTS
101		409.21	409.24	409.22	409.28	409.25	409.29	409.32	409.3
102		370.36	370.36	370.36	370.37	370.37	370.4	370.4	① 371.22
103		186.21	186.21	186.20	186.21	186.20	186.22	186.21	186.21
104		406.31	406.31	406.30	406.30	406.31	406.31	406.33	406.33
105		155.25	155.25	155.25	155.25	155.24	155.25	155.25	155.25
106		97.53	97.52	97.52	97.52	97.53	97.53	97.53	97.59

ENDNOTES: OSD[9]: OSD-T-151-00007.2.2, Liquid Level; AC[3]: BIO-AC 5.21.2.a, Monitor service water usage or tank levels at least every 24 hours to detect leaks

ADDITIONAL OPERATING REQUIREMENTS - Any liquid level changes from the previous reading by > 0.30" shall be explained in the REMARKS section. RECORD manual tape in ENRAF location when ENRAF is O/S.

ER[1]: Required by WAC 173-303-320 or WAC 173-303-640 and the Double Shell Tank System Interim Status Inspection Schedule.

EDL #		REMARKS: ① Seal Water from Cold Run at 242-A responsible for increase. 4-13-00 SOMA CBW 4/14/00
EDL #		
EDL #		

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AW TANK FARM LIQUID LEVELS (ER[1])

NOTE - TMACS is not currently hooked up to AW ENRAFS. All AW ENRAF readings shall be taken manually in the field.

- Days (0700-1200); Nights (1900-2400)

LIQUID LEVEL Enraf SPECIFICATIONS:

OP[3] LMT ≤ 416" OSD[9] LIMIT 6"
AC[3] 24 HOURS
TX-102-AW MAX OPERATING LIMIT 380"

MANUAL TAPE LIQUID LEVEL SPECIFICATIONS:

OP[3] LMT ≤ 341 8" OSD[9] LIMIT 6"
AC[3] 24 HRS

DATE STARTING: APR 10

DAY	FRIDAY		SATURDAY		SUNDAY	
TANK	Days	Nights	Days	Nights	Days	Nights
101	409.3	409.31	409.28	409.27	409.25	409.25
102	371.52 (1)	(1) 371.76	(1) 371.98	372.27 (1)(2)	372.64 (2)	372.94 (1)(2)
103	186.20	186.21	186.21	186.21	186.21	186.21
104	406.34	406.33	406.34	406.34	406.33	406.33
105	155.25	155.26	155.25	155.25	155.26	155.26
106	97.60 ~~97.60~~ fcw 4-14-00	97.59	97.58	97.56	97.52	97.51

ENDNOTES: OSD[9]: OSD-T-151-00007.2.2, Liquid Level; AC[3]: BIO-AC 5.21.2.a, Monitor service water usage or tank levels at least every 24 hours to detect leaks

- ADDITIONAL OPERATING REQUIREMENTS - Any liquid level changes from the previous reading by > 0.30" shall be explained in the REMARKS section.
- RECORD manual tape in Enraf location when ENRAF is O/S.

ER[1]: Required by WAC 173-303-320 or WAC 173-303-640 and the Double Shell Tank System Interim Status Inspection Schedule.

EDL #
EDL #
EDL #

REMARKS: (1) Sent from Cold Run at 2424 Supp responsible for increase AB 4-14-00 SmA CW 4/14/00
(2) A-350 XFER to DRAW CIAA 2123 SmA BC 4/10/00

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Printed on: Apr 14, 00 7:19 am

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AW TANK FARM LIQUID LEVELS (ER[1])

NOTE - TMACS is not currently hooked up to AW ENRAFS. All AW ENRAF readings shall be taken manually in the field.

- Days (0700-1900); Nights (1900-2400)

LIQUID LEVEL Enraf SPECIFICATIONS:

OP[3]LMT ≤ 416" OSD[9] LIMIT 6"
AC[3] 24 HOURS
TX-102-AW MAX OPERATING LIMIT 380"

MANUAL TAPE LIQUID LEVEL SPECIFICATIONS:

OP[3]LMT ≤ 34' 8" OSD[9] LIMIT 6"
AC[3] 24 HRS

DATE STARTING:

DAY		MONDAY		TUESDAY		WEDNESDAY		THURSDAY	
TANK		DAYS	NIGHTS	DAYS	NIGHTS	DAYS	NIGHTS	DAYS	NIGHTS
101		409.26	409.29	409.28	409.25	409.21	409.22	409.19	409.23
102		① ~~373.25~~ 370.75	① 373.42	① 373.65	373.99 ①	① 374.23	374.55 ①	① 374.93	371.26 ③
103		186.2	186.20	186.20	186.21	186.21	186.21	186.21	186.21
104		406.31	406.34	406.34	406.34	406.32	406.32	406.32	406.32
105		155.25	155.26	155.25	155.26	155.26	155.25	155.25	155.25
106		97.54	97.50	97.51	97.49	97.47	97.69 ②	97.68	97.68 ③

ENDNOTES: OSD[9]: OSD-T-151-00007.2.2, Liquid Level; AC[3]: BIO-AC 5.21.2.a, Monitor service water usage or tank levels at least every 24 hours to detect leaks

ADDITIONAL OPERATING REQUIREMENTS - Any liquid level changes from the previous reading by > 0.30" shall be explained in the REMARKS section. RECORD manual tape in ENRAF location when ENRAF is O/S.

ER[1]: Required by WAC 173-303-320 or WAC 173-303-640 and the Double Shell Tank System Interim Status Inspection Schedule.

EDL #		REMARKS: ① Seal Water from cold run at 242-A responsible for increase. 4/18/00 4/17/00
EDL #		② 242-A TRANSFERED 260 gallons to 106-AW on days.
EDL #		③ 242-A HOT RUN STARTED ON 4-20-00 @ ~ 1600

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AW TANK FARM LIQUID LEVELS (ER[1])

NOTE - TMACS is not currently hooked up to AW ENRAFs. All AW ENRAF readings shall be taken manually in the field.

- Days (0700-1200); Nights (1900-2400)

LIQUID LEVEL Enraf SPECIFICATIONS:

OP. LMT ≤ 416" OSD[9] LIMIT 6"
AC[3] 24 HOURS
TK-102-AW MAX OPERATING LIMIT 380"

MANUAL TAPE LIQUID LEVEL SPECIFICATIONS:

OP. LMT ≤ 34' 8" OSD[9] LIMIT 6"
AC[3] 24 HRS

DATE STARTING: 22nd

DAY	FRIDAY		SATURDAY		SUNDAY	
TANK	Days	Nights	Days	Nights	Days	Nights
101	409.24	409.31	409.31	409.20	409.16	409.17
102	361.54 ①	350.11 ①	334.36 ①	317.16 ①	299.92 ①	285.31 ①
103	186.21	186.21	186.21	186.21	186.21	186.20
104	406.32	406.33	406.33	406.33	406.32	406.31
105	155.25	155.25	155.24	155.25	155.25	155.24
106	97.69 ①	99.31 ①	106.14 ①	113.08 ①	119.89 ①	125.82 ①

ENDNOTES: OSD[9]: OSD-T-151-00007.2.2, Liquid Level; AC[3]: BIO-AC 5.21.2.a, Monitor service water usage or tank levels at least every 24 hours to detect leaks

- ADDITIONAL OPERATING REQUIREMENTS - Any liquid level changes from the previous reading by > 0.30" shall be explained in the REMARKS section.
- RECORD manual tape in Enraf location when ENRAF is O/S.

ER[1]: Required by WAC 173-303-320 or WAC 173-303-640 and the Double Shell Tank System Interim Status Inspection Schedule.

EDL #		REMARKS: ① 242-A HOT RUN ONGOING 5.mA [illegible] 4/21/00
EDL #		
EDL #		

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DATE STARTING: APR 10

DAY			MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY		SATURDAY		SUNDAY	
PARAMETER	NORMAL RANGE	TSR/OSD LIMIT	D	N	D	N	D	N	D	N	D	N	D	N	D	N
K1-2 Ventilation System - Instrument Enclosure & Plenum Assembly																
TI-7, HEATER K1-2-2 INLET TEMP. (°F)	35 - 150	OSD[8] < 230	58°	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY
TI-8, HEATER K1-2-2 OUTLET TEMP. (°F)	45 - 180	OSD[8] < 230	58°	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
TI-8 - TI-7 HEATER ΔT (°F)	< 50		O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]
DPIS-6, PREFILTER K1-3-2 (IN. H_2O)	0.1 - 1.8		.35	↓	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	↓	↓
DPIS-5, FILTER K1-4-3 (1st HEPA) (IN. H_2O)	0.5 - 4.0	OSD[5] ≤ 5.9	.8	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
DPIS-4, FILTER K1-4-2 (2nd HEPA) (IN. H_2O)	0.5 - 3.0	OSD[5] ≤ 4.0	.7	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
DPIS-4 + DPIS-5 (IN. H_2O)	1.0 - 4.0	OSD[5] ≤ 5.9	1.5	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
241-AW K1 STACK MONITOR CABINET																
DPI-28, K1 STACK FLOW (IN. H_2O)	0.13 - 0.28		.26	.28	.24	.24	.23	.23	.22	.23	.22	.23	.23	.23	.23	.23
241-AW K1 FAN/TANK EXHAUSTER STATUS																
SWITCH K1 Fans (1) MONDAY NIGHT ONLY	(√)			✓												
K1-5-1 PRIMARY	(√)			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
K1-5-2 PRIMARY	(√)		✓													

(1) SWITCH Operating K1 Fans if allowed by operating conditions per 10-060-104

ENDNOTES: OSD[5]: OSD-T-151-00007.3.1.A, HEPA Filters; OSD[8]: OSD-T-151-00007.3.1.B, Air Inlet Temperature.

O/S[1] EDL 2E-97-01253

EDL #		REMARKS:
EDL #		
EDL #		

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DATE STARTING: APR 10

DAY			MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY		SATURDAY		SUNDAY	
PARAMETER	NORMAL RANGE	TSR/OSD LIMIT	D	N	D	N	D	N	D	N	D	N	D	N	D	N
K1-1 Ventilation System - Instrument Enclosure & Plenum Assembly																
TI-1, HEATER K1-2-1 INLET TEMP. (°F)	35 - 150		stby	64°	60	64	60	62	63	63°	62°	62	60	62	66	64
TI-2, HEATER K1-2-1 OUTLET TEMP. (°F)	45 - 180	OSD[8] ≤ 230°		78°	95	100	96	105	104	103°	102°	100	100	100	104	100
TI-2 - TI-1 HEATER ΔT (°F)	< 50			14°	35	36	36	43	41	40°	40°	38	40	38	38	36
DPIS-3, PREFILTER K1-3-1 (IN. H_2O)	0.1 - 1.8			.30	.30	~~.3~~ .30	.30	.30	.3	.30	.29	.30	.30	.30	.30	.30
DPIS-2, FILTER K1-4-1 (1st HEPA) (IN. H_2O)	0.5 - 4.0	OSD[5] ≤ 5.9		.8	.8	.8	.8	.8	.8	.8	.8	.8	.8	.8	.8	.8
DPIS-1, FILTER K1-4-2 (2nd HEPA) (IN. H_2O)	0.5 - 3.0	OSD[5] ≤ 4.0		.8	.7	.7	.7	.7	.7	.7	.7	.7	.7	.7	.7	.7
DPIS-1 + DPIS-2 (IN. H_2O)	1.0 - 4.0	OSD[5] ≤ 5.9		1.6	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
K1 Ventilation System - Instrument Enclosure																
AW241-VTP-PDIS-109 A-TRAIN DMST D/P AW DPIS-13 DE-ENTRAINER K1-1-1 (IN. H_2O)	0.05 - 2.0		.7	.7	.7	.7	.7	.7	.7	.75	.65	.65	.65	.65	.7	.7
AW241-VTP-PDIS-108 B-TRAIN DMST D/P AW DPIS-14 DE-ENTRAINER K1-1-2 (IN. H_2O)	0.05 - 2.0		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

ENDNOTES: OSD[5]: OSD-T-151-00007.3.1.A, HEPA Filters; OSD[8]: OSD-T-151-00007.3.1.B, Air Inlet Temperature

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APR 17 2000

DATE STARTING:			17		18		19		20		21		22nd			
DAY			MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY		SATURDAY		SUNDAY	
PARAMETER	NORMAL RANGE	TSR/OSD LIMIT	D	N	D	N	D	N	D	N	D	N	D	N	D	N
K1-1 Ventilation System - Instrument Enclosure & Plenum Assembly																
TI-1, HEATER K1-2-1 INLET TEMP. (°F)	35 - 150		62	STBY	stby	STBY	stby	65	62	65	64	67	64	63	64	63
TI-2, HEATER K1-2-1 OUTLET TEMP. (°F)	45 - 180	OSD[8] ≤ 230°	103					98	96	100	100	103	100	100	102	100
TI-2 - TI-1 HEATER ΔT (°F)	< 50		41					33	34	35	36	36	36	37	38	37
DPIS-3, PREFILTER K1-3-1 (IN. H_2O)	0.1 - 1.8		.30					.30	.30	.30	.30	.33	.30	.31	.31	.33
DPIS-2, FILTER K1-4-1 (1st HEPA) (IN. H_2O)	0.5 - 4.0	OSD[5] ≤ 5.9	.8					.8	.75	.8	.8	.8	.8	.8	.8	.8
DPIS-1, FILTER K1-4-2 (2nd HEPA) (IN. H_2O)	0.5 - 3.0	OSD[5] ≤ 4.0	.7					.7	.7	.75	.7	.7	.7	.7	.7	.7
DPIS-1 + DPIS-2 (IN. H_2O)	1.0 - 4.0	OSD[5] ≤ 5.9	1.5					1.5	1.45	1.55	1.5	1.5	1.5	1.5	1.5	1.5
K1 Ventilation System - Instrument Enclosure																
AW241-VTP-PDIS-109 A-TRAIN DMST D/P AW DPIS-13 DE-ENTRAINER K1-1-1 (IN. H_2O)	0.05 - 2.0		.7	.7	.7	.7	.75	.7	.7	.7	.7	.75	.7	.7	.7	.7
AW241-VTP-PDIS-108 B-TRAIN DMST D/P AW DPIS-14 DE-ENTRAINER K1-1-2 (IN. H_2O)	0.05 - 2.0		OFF	OFF	off	off	off	off	off	off	OFF	OFF	OFF	OFF	OFF	OFF

ENDNOTES: OSD[5]: OSD-T-151-00007.3.1.A, HEPA Filters: OSD[8]: OSD-T-151-00007.3.1.B, Air Inlet Temperature

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DATE STARTING:																	
DAY			MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY		SATURDAY		SUNDAY		
PARAMETER	NORMAL RANGE	TSR/OSD LIMIT	D	N	D	N	D	N	D	N	D	N	D	N	D	N	
K1-2 Ventilation System - Instrument Enclosure & Plenum Assembly																	
TI-7, HEATER K1-2-2 INLET TEMP. (°F)	35 - 150	OSD[8] < 230	STBY	62	56	60	55	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	
TI-8, HEATER K1-2-2 OUTLET TEMP. (°F)	45 - 180	OSD[8] < 230	↓	62	76	60	55	↓	↓	↓	↓	↓	↓	↓	↓	↓	
TI-8 - TI-7 HEATER ΔT (°F)	< 50		O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	
DPIS-6, PREFILTER K1-3-2 (IN. H_2O)	0.1 - 1.8		STBY	.35	.35	.35	.35	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	
DPIS-5, FILTER K1-4-3 (1st HEPA) (IN. H_2O)	0.5 - 4.0	OSD[5] ≤ 5.9	↓	.8	.8	.8	.7	↓	↓	↓	↓	↓	↓	↓	↓	↓	
DPIS-4, FILTER K1-4-2 (2nd HEPA) (IN. H_2O)	0.5 - 3.0	OSD[5] ≤ 4.0	↓	.8	.8	.8	.7	↓	↓	↓	↓	↓	↓	↓	↓	↓	
DPIS-4 + DPIS-5 (IN. H_2O)	1.0 - 4.0	OSD[5] ≤ 5.9	↓	1.6	1.6	1.6	1.4	↓	↓	↓	↓	↓	↓	↓	↓	↓	
241-AW K1 STACK MONITOR CABINET																	
DPI-28, K1 STACK FLOW (IN. H_2O)	0.13 - 0.28		.23	.25	.25	.25	.25	.23	.23	.23	.235	.24	.23	.23	.24	.25	
241-AW K1 FAN/TANK EXHAUSTER STATUS																	
SWITCH K1 Fans (1) MONDAY NIGHT ONLY	(√)			✓ (2)													
K1-5-1 PRIMARY	(√)		✓					✓ (2)	✓	✓	✓	✓	✓	✓	✓	✓	
K1-5-2 PRIMARY	(√)			✓ (1)	✓ (1)	✓	✓ (1)										

(1) SWITCH Operating K1 Fans if allowed by operating conditions per TO-060-104

ENDNOTES: OSD[5]: OSD-T-151-00007.3.1.A, HEPA Filters; OSD[8]: OSD-T-151-00007.3.1.B, Air Inlet Temperature.

O/S[1] EDL 2E-97-01253

EDL #		REMARKS: (1) RED RUN LIGHT IS OUT (2) 1st switching unsuccessful 2nd went well Sam aware
EDL #		RWR written 4/18/00 [illegible] [illegible]
EDL #		(2) exhauster switched on days. 4/18/00

DATE STARTING: 4-24-00			24		25		26		27		28		29		30	
DAY			MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY		SATURDAY		SUNDAY	
PARAMETER	NORMAL RANGE	TSR/OSD LIMIT	D	N	D	N	D	N	D	N	D	N	D	N	D	N
K1-1 Ventilation System - Instrument Enclosure & Plenum Assembly																
TI-1, HEATER K1-2-1 INLET TEMP. (°F)	35 - 150		64°	64°	62°	62	65	65	64	64	65	64	67	68°	66	68°
TI-2, HEATER K1-2-1 OUTLET TEMP. (°F)	45 - 180	OSD[8] ≤ 230°	102°	100	100°	100	105	102	104	105	105	104	106	104°	104	104°
TI-2 - TI-1 HEATER ΔT (°F)	< 50		38°	36°	38°	38	40	37	40	41	40	40	39	36°	38	36°
DPIS-3, PREFILTER K1-3-1 (IN. H_2O)	0.1 - 1.8		.33	.38	.37	.32	.33	.27	.33	.32	.35	.35	0.38	.40	.40	.40
DPIS-2, FILTER K1-4-1 (1st HEPA) (IN. H_2O)	0.5 - 4.0	OSD[5] ≤ 5.9	.8	.8	.8	.8	.8	.8	.8	.8	.8	.8	0.75	.8	.8	.8
DPIS-1, FILTER K1-4-2 (2nd HEPA) (IN. H_2O)	0.5 - 3.0	OSD[5] ≤ 4.0	.7	.7	.7	.7	.7	.6	.7	.7	.7	.7	0.65	.65	.6	.6
DPIS-1 + DPIS-2 (IN. H_2O)	1.0 - 4.0	OSD[5] ≤ 5.9	1.5	1.5	1.5	1.5	1.5	1.4	1.5	1.5	1.5	1.5	1.4	1.45	1.4	1.4
K1 Ventilation System - Instrument Enclosure																
AW241-VTP-PDIS-109 A-TRAIN DMST D/P AW DPIS-13 DE-ENTRAINER K1-1-1 (IN. H_2O)	0.05 - 2.0		.75	.75	.75	.7	.7	.65	.7	.7	.7	.7	0.68	.7	.7	.7
AW241-VTP-PDIS-108 B-TRAIN DMST D/P AW DPIS-14 DE-ENTRAINER K1-1-2 (IN. H_2O)	0.05 - 2.0		off	off	off	OFF	OFF	OFF	off	OFF	OFF	off	off	OFF	OFF	OFF

ENDNOTES: OSD[5]: OSD-T-151-00007.3.1.A, HEPA Filters; OSD[8]: OSD-T-151-00007.3.1.B, Air Inlet Temperature

Poor Quality Original

Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer

Originator: E. Stam **Date:** 11/6/01

Project No. & Title: VET-1084, DST Ventilation ALARACT

Checker: RPS **Date:** 1/8/02

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DATE STARTING: [illegible] 2001 23 24 [illegible] 2001

DAY			MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY		SATURDAY		SUNDAY	
PARAMETER	NORMAL RANGE	TSR/OSD LIMIT	D	N	D	N	D	N	D	N	D	N	D	N	D	N
K1-1 Ventilation System - Instrument Enclosure & Plenum Assembly																
TI-1, HEATER K1-2-1 INLET TEMP. (°F)	35 - 150		OFF	63	61	61	63°	58 ~~48~~	67°	68	71	66°	63	62°	61°	64°
TI-2, HEATER K1-2-1 OUTLET TEMP. (°F)	45 - 180	OSD[8] ≤ 230°		80	98	100	96°	100	104	100	110	104°	104°	102°	100°	104°
TI-2 - TI-1 HEATER ΔT (°F)	< 50			17	37°	39	33°	42	37	32	41	38°	41°	40°	40°	40°
DPIS-3, PREFILTER K1-3-1 (IN. H.O)	0.1 - 1.8		✓	0.34	~~.35~~ .33	.36	.35	.35	.36	.35	.37	.37	.35	.35	.35	.35
K-1 Ventilation System PLC Enclosure																
AW241-VTP-ENCL-120 INTERNAL ENCLOSURE TEMP (°F)	32 - 140		71°	83°	73°	83	85°	95	86°	85	85.6°	79°	71°	69°	64°	74°
AW241-VTP-ENCL-120 Check no alarms lit	(✓)	LCO[7] 3.1.8		✓		✓		✓		✓		✓		✓		✓
AW241-VTP-ENCL-120 LAMP TEST	(✓)	LCO[7] 3.1.8		✓		✓		✓		✓		✓		✓		✓
AW241-VTP-ENCL-120 * & Associated Equipment Check for physical damage	(✓)	LCO[7] 3.1.8		✓		✓		✓		✓		✓		✓		✓
AW241-VTP-HS-120 EXHAUSTER A&B PLC INTERLOCK FUNCTION Check in NORMAL position	(✓)			✓		✓		✓		✓		✓	✓	✓	✓	✓
AW241-VTP-PDIT-327 FILTER K1-4-1 (1st HEPA) (IN. H.O)	0.3 - 5.7	OSD[5] ≤ 5.9 LCO[7] 3.1.8 ≤ 5.9	OFF	0.588	.6	.600	.600	.60	.601	.60	.617	.599	.606	.607	.613	.604
AW241-VTP-PDIT-328 FILTER K1-4-2 (2nd HEPA) (IN. H.O)	0.3 - 3.8	OSD[5] ≤ 4.0 LCO[7] 3.1.8 > 0.10	↓	0.057	.7	.677	.677	.68	.673	.68	.681	.677	.681	.686	.692	.679
AW241-VTP-PDIT-329 TOTAL PRESSURE OF FILTERS K1-4-1 AND K1-4-2 (IN. H.O)	0.3 - 5.7	OSD[5] ≤ 5.9	↓	1.374	1.4	1.400	1.400	1.40	1.40	1.41	1.423	1.397	1.401	1.405	1.42	1.402

* The check for physical damage includes checking tubing, connections, and Yokogawa DP Instrument gauge rack

ENDNOTES: OSD[5]: OSD-T-151-00007.3.1.A, HEPA Filters; OSD[8]: OSD-T-151-00007.3.1.B, Air Inlet Temperature; LCO[7]: LCO 3.1.8, HEPA Filter Differential Pressure Interlock Systems

ED		REMARKS:
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DATE STARTING: APR 23 2001 APR 2 2001

DAY			MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY		SATURDAY		SUNDAY	
PARAMETER	NORMAL RANGE	TSR/OSD LIMIT	D	N	D	N	D	N	D	N	D	N	D	N	D	N
K1 Ventilation System - Instrument Enclosure																
AW241-VTP-PDIS-109 A-TRAIN DMST D/P AW DPIS-13 DE-ENTRAINER K1-1-1 (IN. H_2O)	0.05 - 2.0		.6	0.55	.55	.6	.6	.6	.55	.6	.6	.55	.55	.55	.55	.55
AW241-VTP-PDIS-108 B-TRAIN DMST D/P AW DPIS-14 DE-ENTRAINER K1-1-2 (IN. H_2O)	0.05 - 2.0		OFF	off	OFF	off	OFF	off	OFF	OFF	off	off	off	off	off	off

ENDNOTES: OSD[5]: OSD-T-151-00007.3.1.A, HEPA Filters; OSD[8]: OSD-T-151-00007.3.1.B, Air Inlet Temperature; LCO[7]: LCO 3.1.8, HEPA Filter Differential Pressure Interlock Systems

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DATE STARTING: [illegible] 2001 — [illegible] 2001

DAY			MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY		SATURDAY		SUNDAY	
PARAMETER	NORMAL RANGE	TSR/OSD LIMIT	D	N	D	N	D	N	D	N	D	N	D	N	D	N
K1-2 Ventilation System - Instrument Enclosure & Plenum Assembly																
TI-7, HEATER K1-2-2 INLET TEMP. (°F)	35 - 150	OSD[7] < 230	58°	off	OFF	off	OFF	off	off	off	off	off	off	off	off	off
TI-8, HEATER K1-2-2 OUTLET TEMP. (°F)	45 - 180	OSD[8] < 230	58	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
TI-8 - TI-7 HEATER ΔT (°F)	< 50		O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]
DPIS-6, PREFILTER K1-3-2 (IN. H_2O)	0.1 - 1.8		.38	off	off	off	OFF	OFF	off	off	off	off	off	off	off	off
AW241-VTP-PDIT-427 FILTER K1-4-3 (1st HEPA) (IN. H_2O)	0.3 - 5.7	OSD[3] ≤ 5.9 LCO[7] 3.1.8 ≤ 5.9	.72	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
AW241-VTP-PDIT-428 FILTER K1-4-4 (2nd HEPA) (IN. H_2O)	0.3 - 3.8	OSD[3] ≤ 4.0 LCO[7] 3.1.8 ≥ 0.10	.64	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
AW241-VTP-PDIT-429 TOTAL PRESSURE OF FILTERS K1-4-3 AND K1-4-4 (IN. H_2O)	0.3 - 5.7	OSD[3] ≤ 5.9	1.50	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
241-AW K1 STACK MONITOR CABINET																
DPI-28, K1 STACK FLOW (IN. H_2O)	0.13 - 0.28		O/S (1)	O/S (1)	O/S (1)	O/S (1)	O/S (1)	O/S (1)	O/S (1)	O/S (1)	O/S (1)	O/S (1)	O/S (1)	O/S (1)	O/S (1)	O/S (1)
241-AW K1 FAN/TANK EXHAUSTER STATUS																
SWITCH K1 Fans (1) MONDAY NIGHT ONLY	(✓)			✓												
K1-5-1 PRIMARY,	(✓)			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
K1-5-2 PRIMARY,	(✓)		✓													

(1) SWITCH Operating K1 Fans if allowed by operating conditions per TO-060-104

ENDNOTES: OSD[3]: OSD-T-151-00007.3.1.A, HEPA Filters; OSD[8]: OSD-T-151-00007.3.1.B, Air Inlet Temperature.; LCO[7]: LCO 3.1.8, HEPA Filter Differential Pressure Interlock Systems; O/S[1] EDL 2E-97-01253

AW

ED	(1) AW-00-009	REMARKS:
ED		
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Poor Quality Original

Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer

Originator: E. Stam **Date:** 11/6/01

Project No. & Title: VET-1084, DST Ventilation ALARACT

Checker: RPS **Date:** 11/8/02

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DATE STARTING:			22		23		24		25							
DAY			MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY		SATURDAY		SUNDAY	
PARAMETER	NORMAL RANGE	TSR/OSD LIMIT	D	N	D	N	D	N	D	N	D	N	D	N	D	N
K1-1 Ventilation System - Instrument Enclosure & Plenum Assembly																
TI-1, HEATER K1-2-1 INLET TEMP. (F)	35 - 150		52	54	54	53°	52	54°	52	52°	52°	52°	52	52	52	52
TI-2, HEATER K1-2-1 OUTLET TEMP. (F)	45 - 180	OSD[4] 230	90	90	90	90°	90	92°	92	90°	90°	92	92	89	89	90
TI-2 - TI-1 HEATER T (F)	< 50		38	36	36	37°	38	38°	46	38°	38	40	40	37	37	38
DPIS-3, PREFILTER K1-3-1 (IN. H2O)	0.1 - 1.8		.35	.35	.35	.35	.35	.35	.30	.34	.35	[illegible]	.30	0.37	.33	.36
K-1 Ventilation System PLC Enclosure																
AW241-VTP-ENCL-120 INTERNAL ENCLOSURE TEMP (F)	32 - 140		61	60	59	62°	61	61°	61	62	60°	60°	61	60	60	62
AW241-VTP-ENCL-120 Check no alarms lit	( )	LCO[7] 3.1.8		✓		✓		✓		✓		✓		✓		✓
AW241-VTP-ENCL-120 LAMP TEST	( )	LCO[7] 3.1.8		✓		✓		✓		✓		✓		✓		✓
AW241-VTP-ENCL-120 * & Associated Equipment Check for physical damage	( )	LCO[7] 3.1.8		✓		✓		✓		✓		✓		✓		✓
AW241-VTP-HS-120 EXHAUSTER A&B PLC INTERLOCK FUNCTION Check in NORMAL position	( )			✓		✓		✓		✓		✓		✓	✓	✓
AW241-VTP-PDIT-327 FILTER K1-4-1 (1st HEPA) (IN. H2O)	0.3 - 5.7	OSD[5] 5.9 LCO[7] 3.1.8 5.9	.617	.60	.604	.622	.613	.606	.534	.615	.67	.51	.51	0.60	.48	.61
AW241-VTP-PDIT-328 FILTER K1-4-2 (2nd HEPA) (IN. H2O)	0.3 - 3.8	OSD[5] 4.0 LCO[7] 3.1.8 0.10	.689	.69	.691	.691	.680	.683	.614	.688	.69	.576	.58	0.687	.691	.68
AW241-VTP-PDIT-329 TOTAL PRESSURE OF FILTERS K1-4-1 AND K1-4-2 (IN. H2O)	0.3 - 5.7	OSD[5] 5.9	1.445	1.44	1.454	1.452	1.442	1.434	1.153	1.432	1.45	1.220	1.23	1.432	1.434	1.45

* The check for physical damage includes checking tubing, connections, and Yokogawa DP Instrument gauge rack

ENDNOTES: OSD[5]: OSD-T-151-00007.3.1.A, HEPA Filters; OSD[4]: OSD-T-151-00007.3.1.B, Air Inlet Temperature; LCO[7]: LCO 3.1.8, HEPA Filter Differential Pressure Interlock Systems

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DATE STARTING: JAN 08 2001																
DAY			MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY		SATURDAY		SUNDAY	
PARAMETER	NORMAL RANGE	TSR/OSD LIMIT	D	N	D	N	D	N	D	N	D	N	D	N	D	N
K1 Ventilation System - Instrument Enclosure																
AW241-VTP-PDIS-109 A-TRAIN DMST D/P AW DPIS-13 DE-ENTRAINER K1-1-1 (IN. H_2O)	0.05 - 2.0		.6	.6	.6	.6	.6	.6	.5	.6	.6	.5	.45	0.55	.55	.55
AW241-VTP-PDIS-108 B-TRAIN DMST D/P AW DPIS-14 DE-ENTRAINER K1-1-2 (IN. H_2O)	0.05 - 2.0		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

ENDNOTES: OSD[5]: OSD-T-151-00007.3.1.A, HEPA Filters; OSD[8]: OSD-T-151-00007.3.1.B, Air Inlet Temperature; LCO[7]: LCO 3.1.8, HEPA Filter Differential Pressure Interlock Systems

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DATE STARTING: [illegible]

DAY			MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY		SATURDAY		SUNDAY	
PARAMETER	NORMAL RANGE	TSR/OSD LIMIT	D	N	D	N	D	N	D	N	D	N	D	N	D	N
K1-2 Ventilation System - Instrument Enclosure & Plenum Assembly																
TI-7, HEATER K1-2-2 INLET TEMP. (F)	35 - 150	OSD[4] < 230	Stby	STBY	STBY	STBY	Stby	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY
TI-8, HEATER K1-2-2 OUTLET TEMP. (F)	45 - 180	OSD[4] < 230	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
TI-8 - TI-7 HEATER T (F)	< 50		O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]
DPIS-6, PREFILTER K1-3-2 (IN. H_2O)	0.1 - 1.8		Stby	STBY	STBY	STBY	Stby	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY
AW241-VTP-PDIT-427 FILTER K1-4-3 (1st HEPA) (IN. H_2O)	0.3 - 5.7	OSD[5] 5.9 LCO[3] 3.1.8 5.9	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
AW241-VTP-PDIT-428 FILTER K1-4-4 (2nd HEPA) (IN. H_2O)	0.3 - 3.8	OSD[5] 4.0 LCO[3] 3.1.8 0.10	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
AW241-VTP-PDIT-429 TOTAL PRESSURE OF FILTERS K1-4-3 AND K1-4-4 (IN. H_2O)	0.3 - 5.7	OSD[5] 5.9	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
241-AW K1 STACK MONITOR CABINET																
DPI-28, K1 STACK FLOW (IN. H_2O)	0.13 - 0.28		O/S (1)	O/S (1)	O/S (1)	O/S (1)	O/S (1)	O/S (1)	O/S (1)	O/S (1)	O/S (1)	O/S (1)	O/S (1)	O/S (1)	O/S (1)	O/S (1)
241-AW K1 FAN/TANK EXHAUSTER STATUS																
SWITCH K1 Fans (1) MONDAY NIGHT ONLY	( )			(3) O												
K1-5-1 PRIMARY,	( )		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
K1-5-2 PRIMARY,	( )															

(1) SWITCH Operating K1 Fans if allowed by operating conditions per TO-060-104

ENDNOTES: OSD[5]: OSD-T-151-00007.3.1.A, HEPA Filters; OSD[4]: OSD-T-151-00007.3.1.B, Air Inlet Temperature.; LCO[3]: LCO 3.1.8, HEPA Filter Differential Pressure Interlock Systems; O/S[1] EDL 2E-97-01253

EDL	(1) AW-00-009	REMARKS: (3) NO ALL SWITCH, TO PREVENT INTERRUPTION OF TRANSFER IN PROGRESS, PER MGMT REQUEST. SOMA, 1/23/01
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DATE STARTING: 4-24-00			24		25		26		27							
DAY			MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY		SATURDAY		SUNDAY	
PARAMETER	NORMAL RANGE	TSR/OSD LIMIT	D	N	D	N	D	N	D	N	D	N	D	N	D	N
K1-1 Ventilation System - Instrument Enclosure & Plenum Assembly																
TI-1, HEATER K1-2-1 INLET TEMP. (°F)	35 - 150		64°	64°	62°	62	65	65	64	64	65	64	67	68°	66	68°
TI-2, HEATER K1-2-1 OUTLET TEMP. (°F)	45 - 180	OSD[8] ≤ 230°	102°	100	100°	100	105	102	104	105	105	104	106	104°	104	104°
TI-2 - TI-1 HEATER ΔT (°F)	< 50		38°	36°	38	38	40	37	40	41	40	40	39	36°	38	36°
DPIS-3, PREFILTER K1-3-1 (IN. H_2O)	0.1 - 1.8		.33	.38	.37	.32	.33	.27	.33	.32	.35	.35	0.38	.40	.40	.40
DPIS-2, FILTER K1-4-1 (1st HEPA) (IN. H_2O)	0.5 - 4.0	OSD[5] ≤ 5.9	.8	.8	.8	.8	.8	.8	.8	.8	.8	.8	0.75	.8	.8	.8
DPIS-1, FILTER K1-4-2 (2nd HEPA) (IN. H_2O)	0.5 - 3.0	OSD[5] ≤ 4.0	.7	.7	.7	.7	.7	.6	.7	.7	.7	.7	0.65	.65	.6	.6
DPIS-1 + DPIS-2 (IN. H_2O)	1.0 - 4.0	OSD[5] ≤ 5.9	1.5	1.5	1.5	1.5	1.5	1.4	1.5	1.5	1.5	1.5	1.4	1.45	1.4	1.4
K1 Ventilation System - Instrument Enclosure																
AW241-VTP-PDIS-109 A-TRAIN DMST D/P AW DPIS-13 DE-ENTRAINER K1-1-1 (IN. H_2O)	0.05 - 2.0		.75	.75	.75	.7	.7	.65	.7	.7	.7	.7	0.68	.7	.7	.7
AW241-VTP-PDIS-108 B-TRAIN DMST D/P AW DPIS-14 DE-ENTRAINER K1-1-2 (IN. H_2O)	0.05 - 2.0		off	OFF	OFF	OFF	OFF	OFF	off	OFF	OFF	off	off	OFF	OFF	off

ENDNOTES: OSD[5]: OSD-T-151-00007.3.1.A, HEPA Filters; OSD[8]: OSD-T-151-00007.3.1.B, Air Inlet Temperature

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Printed on: Apr 21, 00 12:28 pm

DATE STARTING: 4-24-00

DAY			MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY		SATURDAY		SUNDAY	
PARAMETER	NORMAL RANGE	TSR/OSD LIMIT	D	N	D	N	D	N	D	N	D	N	D	N	D	N
K1-2 Ventilation System - Instrument Enclosure & Plenum Assembly																
TI-7, HEATER K1-2-2 INLET TEMP. (°F)	35 - 150	OSD[8] < 230	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY
TI-8, HEATER K1-2-2 OUTLET TEMP. (°F)	45 - 180	OSD[8] < 230	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	STBY		STBY
TI-8 - TI-7, HEATER ΔT (°F)	< 50		O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]
DPIS-6, PREFILTER K1-3-2 (IN. H_2O)	0.1 - 1.8		STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY		STBY
DPIS-5, FILTER K1-4-3 (1st HEPA) (IN. H_2O)	0.5 - 4.0	OSD[5] ≤ 5.9	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓		↓
DPIS-4, FILTER K1-4-2 (2nd HEPA) (IN. H_2O)	0.5 - 3.0	OSD[5] ≤ 4.0	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓		↓
DPIS-4 + DPIS-5 (IN. H_2O)	1.0 - 4.0	OSD[5] ≤ 5.9	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
241-AW K1 STACK MONITOR CABINET																
DPI-28, K1 STACK FLOW (IN. H_2O)	0.13 - 0.28		.23	.23	.23	.23	.23	.22	.24	.22	.22	.22	0.22	.21	.23	.22
241-AW K1 FAN/TANK EXHAUSTER STATUS																
SWITCH K1 Fans (1) MONDAY NIGHT ONLY	(√)			(1)												
K1-5-1 PRIMARY	(√)		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
K1-5-2 PRIMARY	(√)	4/24/00	BCD ✓													

(1) SWITCH Operating K1 Fans if allowed by operating conditions per TO-060-104

ENDNOTES: OSD[5]: OSD-T-151-00007.3.1.A, HEPA Filters; OSD[8]: OSD-T-151-00007.3.1.B, Air Inlet Temperature.

O/S[1] EDL 2E-97-01253

REMARKS: (1) Not able to Switch FANS Due to Evaporator Run. 4-24-00

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DATE STARTING: JAN 24 2000

DAY			MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY		SATURDAY		SUNDAY	
PARAMETER	NORMAL RANGE	TSR/OSD LIMIT	D	N	D	N	D	N	D	N	D	N	D	N	D	N
K1-2 Ventilation System - Instrument Enclosure & Plenum Assembly																
TI-7, HEATER K1-2-2 INLET TEMP. (°F)	35 - 150	OSD[8] < 230	40	45	65	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY
TI-8, HEATER K1-2-2 OUTLET TEMP. (°F)	45 - 180	OSD[8] < 230	140 (1)	45	65	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
TI-8 - TI-7 HEATER ΔT (°F)	< 50		O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]	O/S[1]
DPIS-6, PREFILTER K1-3-2 (IN. H_2O)	0.1 - 1.8		.45	.45	.45	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY
DPIS-5, FILTER K1-4-3 (1st HEPA) (IN. H_2O)	0.5 - 4.0	OSD[5] ≤ 5.9	1.5	1.6	1.6	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
DPIS-4, FILTER K1-4-2 (2nd HEPA) (IN. H_2O)	0.5 - 3.0	OSD[5] ≤ 4.0	.7	.7	.7	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
DPIS-4 + DPIS-5 (IN. H_2O)	1.0 - 4.0	OSD[5] ≤ 5.9	2.2	2.3	2.3	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
241-AW K1 STACK MONITOR CABINET																
DPI-28, K1 STACK FLOW (IN. H_2O)	0.13 - 0.28		.04 (2)	.17	.16	.18	.15	.15	[illegible]	.20	.20	.20	.20	0.20	.20	0.19
241-AW K1 FAN/TANK EXHAUSTER STATUS																
SWITCH K1 Fans (1) MONDAY NIGHT ONLY	(√)			(3)												
K1-5-1 PRIMARY	(√)		STBY	STBY	stby	(4) ✓	✓	✓	[illegible]	✓	✓	✓	✓	✓	✓	✓
K1-5-2 PRIMARY	(√)		✓	✓		STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY

(1) SWITCH Operating K1 Fans if allowed by operating conditions per TO-060-104

ENDNOTES: OSD[5]: OSD-T-151-00007.3.1.A, HEPA Filters; OSD[8]: OSD-T-151-00007.3.1.B, Air Inlet Temperature.

O/S[1] EDL 2E-97-01253

AW

EDL #	REMARKS: (1) BELOW NORMAL RANGE (2) BELOW RANGE - FROZEN DIST LINE SUSPECTED
EDL #	Sum aware - heater is 45 Lee 1/24/00 Sum aware and will continue to monitor. Lee 1/24/00
EDL #	Belts tightened waiting for strobe check Sum aware Ba Johnson 1/24/00

Type	Document No.	Rev/Mod	Release Date	Page
CONTINUOUS	TF-OR-A-03	E-56	11/30/99	40 of 60

(4) Switched on daily after belt adjustments.

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DATE STARTING: JAN 24 2000

DAY			MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY		SATURDAY		
			24		25		26								
PARAMETER	NORMAL RANGE	TSR/OSD LIMIT	D	N	D	N	D	N	D	N	D	N	D	N	D
K1-1 Ventilation System - Instrument Enclosure & Plenum Assembly															
TI-1, HEATER K1-2-1 INLET TEMP. (°F)	35 - 150		STBY	STBY	stby	50	50	54	52	50	45	50	50	50	50	50
TI-2, HEATER K1-2-1 OUTLET TEMP. (°F)	45 - 180	OSD[8] ≤ 230°				92	96	86	90	90	89	85	89	89	88	88
TI-2 - TI-1 HEATER ΔT (°F)	< 50					42	46	32	35	40	44	32	39	39	38	38
DPIS-3, PREFILTER K1-3-1 (IN. H_2O)	0.1 - 1.8					.28	.28	.27	.25	.28	.30	.27	.25	0.27	.25	0.27
DPIS-2, FILTER K1-4-1 (1st HEPA) (IN. H_2O)	0.5 - 4.0	OSD[5] ≤ 5.9				.8	.7	.8	.8	.8	.8	.8	.8	0.8	.8	0.8
DPIS-1, FILTER K1-4-2 (2nd HEPA) (IN. H_2O)	0.5 - 3.0	OSD[5] ≤ 4.0				.6	.6	.6	.6	.7	.6	.6	.6	0.6	.6	0.6
DPIS-1 + DPIS-2 (IN. H_2O)	1.0 - 4.0	OSD[5] ≤ 5.9				1.4	1.3	1.4	1.4	1.5	1.4	1.4	1.4	1.4	1.4	1.4
K1 Ventilation System - Instrument Enclosure															
AW241-VTP-PDIS-109 A-TRAIN DMST D/P AW DPIS-13 DE-ENTRAINER K1-1-1 (IN. H_2O)	0.05 - 2.0		.55	.55	.55	.6	.5	.6	.6	.6	.6	.6	.6	0.62	.65	0.62
AW241-VTP-PDIS-108 B-TRAIN DMST D/P AW DPIS-14 DE-ENTRAINER K1-1-2 (IN. H_2O)	0.05 - 2.0		OFF	OFF	off	off	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	off

ENDNOTES: OSD[5]: OSD-T-151-00007.3.1.A, HEPA Filters; OSD[8]: OSD-T-151-00007.3.1.B, Air Inlet Temperature

EDL #		REMARKS:
EDL #		
EDL #		

Poor Quality Original

Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer

Originator: E. Stam **Date:** 11/6/01

Project No. & Title: VET-1084, DST Ventilation ALARACT

Checker: RPS **Date:** 1/8/02

WORKING COPY

DATE STARTING: DATE ENDING: 4-30-01

PARAMETER	NORMAL RANGE	OSD TSR LIMIT	24 MON		25 TUES		26 WED		27 THURS		FRI 28		SAT 29		SUN 30	
			D	N	D	N	D	N	D	N	D	N	D	N	D	N
241-AN PRIMARY VENTILATION (Cont.)																
B TRAIN FILTER BANK																
AN241-VTP-TI-401 (TI-7), HEATER INLET TEMP (°F)	35-120	OSD[7] ≤ 230	60	60	60	60	61	62	62	63	62	64	62	63	62	62
AN241-VTP-TI-402 (TI-8), HEATER OUTLET TEMP (°F)	45-120	OSD[7] ≤ 230	74	97	88	88	78	98	70	72	78	74	88	78	82	92
(AN241-VTP-TI-402)-(AN241-VTP-TI-401), ((TI-8)-(TI-7)) HEATER ΔT (°F)	< 50		14	37	28	28	17	36	8	29	16	10	26	15	20	30
AN241-VTP-PDIS-407 (DPIS-6), PREFILTER dP (in. Wg)	0.0-1.0	(ER)	.10	.10	.10	.10	.10	.10	.10	.10	.10	.08	.10	.10	.10	.09
AN241-VTP-PDIT-427 1st HEPA FILTER dP (in. Wg)	0.3-5.8	OSD[6] ≤ 5.9 LCO[6] 3.1.8 ≤ 5.9	1.066	1.055	1.062	1.058	1.066	1.065	1.072	[illegible]	1.07	1.06	1.07	1.064	1.07	1.06
AN241-VTP-PDIT-428 2nd HEPA FILTER dP (in. Wg)	0.3-3.8	OSD[6] ≤ 4.0 LCO[6] 3.1.8 ≤ 0.1	.537	.530	.537	.542	.535	.531	.532	.51	.53	.54	.55	.526	.53	.53
AN241-VTP-PDIT-429 Filters K1-4-2 + K1-4-4 (in. WG)	0.3-5.7	OSD[6] ≤ 5.9	1.603	1.622	1.631	1.630	1.642	1.632	1.642	[illegible]	1.64	1.63	1.64	1.613	1.64	1.64
AN296-VTP-PDI-504 (DPI-28), Primary SYSTEM AIRFLOW INDICATING GAUGE (IN. WG)	0-0.5	LCO[5]	.17	.17	.17	.165	.16	.165	.16	.165	.17	.16	.16	.16	.16	.16

ENDNOTES: OSD[4] = OSD-T-151-00007.3.1.A OSD[7] = OSD-T-151-00007.3.1.B LCO[5] = LCO 3.2.1 An Active Ventilation System shall be operable
LCO[6] = LCO 3.1.8, HEPA Filter Differential Pressure Interlock System

REMARKS:

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DATE STARTING: JAN 22 2001 22 23 24 DATE ENDING: 25 26 27

PARAMETER	NORMAL RANGE	OSD TSR LIMIT	MON D	MON N	TUES D	TUES N	WED D	WED N	THURS D	THURS N	FRI D	FRI N	SAT D	SAT N	SUN D	SUN N
241-AN PRIMARY VENTILATION (Cont.)																
B TRAIN FILTER BANK																
AN241-VTP-TI-401 (TI-7), HEATER INLET TEMP (°F)	35-120	OSD[7] ≤ 230	STBY	39	46	46	46	46	46	46	46	47	48	47	48	47
AN241-VTP-TI-402 (TI-8), HEATER OUTLET TEMP (°F)	45-120	OSD[7] ≤ 230		103	102	102	102	103	102	102	102	102	94	96	98	102
(AN241-VTP-TI-402)-(AN241-VTP-TI-401), ((TI-8)-(TI-7)) HEATER ΔT (°F)	< 50			61	54 (1)	56 (1)	56 (1)	57 (1)	56 (1)	56 (1)	56 (2)	55 (2)	46	49	50 (1)	55 (1)
AN241-VTP-PDIS-407 (DPIS-6), PREFILTER dP (in. Wg)	0.0-1.0	(ER)		.05	.07	.07	.07	.07	.07	.07	.07	0.07	.06	.07	.07	.07
AN241-VTP-PDIT-427 1st HEPA FILTER dP (in. Wg)	0.3-5.8	OSD[6] ≤ 5.9 LCO[6] 3.1.8 ≤ 5.9		1.024	1.017	1.017	1.018	1.018	.957	1.021	1.02	0.886	.889	1.0	1.01	1.015
AN241-VTP-PDIT-428 2nd HEPA FILTER dP (in. Wg)	0.3-3.8	OSD[6] ≤ 4.0 LCO[6] 3.1.8 ≤ 0.1		.534	.542	.543	.542	.542	.500	.536	.544	0.525	.464	.53	.54	.541
AN241-VTP-PDIT-429 Filters K1-4-2 + K1-4-4 (in. WG)	0.3-5.7	OSD[6] ≤ 5.9	↓	1.594	1.559	1.602	1.608	1.595	1.494	1.608	1.603	1.546	1.391	1.57	1.59	1.603
AN296-VTP-PDI-504 (DPI-28), Primary SYSTEM AIRFLOW INDICATING GAUGE (IN. WG)	0-0.5	LCO[5]	.15	.16	.16	.16	.15	.15	.16	.16	.15	0.15	.12	.15	.15	.15

ENDNOTES: OSD[6] = OSD-T-151-00007.3.1.A OSD[7] = OSD-T-151-00007.3.1.B LCO[5] = LCO 3.2.1 An Active Ventilation System shall be operable
LCO[6] = LCO 3.1.8, HEPA Filter Differential Pressure Interlock System

REMARKS: (1) Above Range: fan switched just prior to reading [illegible] with minor [illegible] Sam aware and will monitor for next 24 hrs [illegible] 1/23/01

(2) TEMP CONTROLLER NOT CONTROLLING IN RANGE NEED ADJUSTMENT

Poor Quality Original

Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer

Originator: E. Stam **Date:** 11/6/01

Project No. & Title: VET-1084, DST Ventilation ALARACT

Checker: RPS **Date:** 1/8/02

WORKING COPY

DATE STARTING: JAN 22 2001 DATE ENDING:

PARAMETER	NORMAL RANGE	OSD TSR LIMIT	MON D	MON N	TUES D	TUES N	WED D	WED N	THURS D	THURS N	FRI D	FRI N	SAT D	SAT N	SUN D	SUN N
A TRAIN FILTER BANK																
AN241-VTP-TI-301 (TI-1), HEATER INLET TEMP (°F)	35-120	OSD[7] ≤ 230	40	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY
AN241-VTP-TI-302 (TI-2), HEATER OUTLET TEMP (°F)	45-120	OSD[7] ≤ 230	75													
(AN241-VTP-TI-302)-(AN241-VTP-TI-301) ((TI-2) - (TI-1)) HEATER ΔT (°F)	< 50		35													
AN241-VTP-PDIS-307 (DPIS-3), PREFILTER dP (in. Wg)	0.0-1.0	(ER)	0													
AN241-VTP-PDIT-327 1st HEPA FILTER dP (in. Wg)	0.3-5.8	OSD[6] ≤ 5.9 LCO[6] 3.1.8 ≤ 5.9	.90													
AN241-VTP-PDIT-328 2nd HEPA FILTER dP (in. Wg)	0.3-3.8	OSD[6] ≤ 4.0 LCO[6] 3.1.8 ≤ 0.1	.57													
AN241-VTP-PDIT-329 Filters K1-4-1 + K1-4-3 (in. WG)	0.3-5.7	OSD[6] ≤ 5.9	1.49													

ENDNOTES: OSD[6] = OSD-T-151-00007.3.1.A OSD[7] = OSD-T-151-00007.3.1.B LCO[6] = LCO 3.1.8, HEPA Filter Differential Pressure Interlock System

REMARKS: ① Switched fans on around noon 1/23/01

Poor Quality Original

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Printed on: Apr 21, 00 13:44 pm

DATE STARTING: 4-24-00 DATE ENDING: 4-30-00

PARAMETER	NORMAL RANGE	OSD TSR LIMIT	MON D	MON N	TUES D	TUES N	WED D	WED N	THURS D	THURS N	FRI D	FRI N	SAT D	SAT N	SUN D	SUN N
			24		25		26		27		28					
241-AN PRIMARY VENTILATION																
PRIMARY TANK DE-ENTRAINERS DIFFERENTIAL PRESSURES																
AN241-VTP-PDI-109 (DPI-31), DE-EN A (IN. Wg)	0.1-2.0		.40	.40	.375	.39	.42	.40	.42	.40	0.42	.40	.43	.40	.40	.40
AN241-VTP-PDI-108 (DPI-32), DE-EN B (IN. Wg)	0.1-2.0		off	off	OFF	OFF	OFF	OFF	OFF	OFF	off	off	OFF	OFF	OFF	OFF
A TRAIN FILTER BANK																
AN241-VTP-TI-301 (TI-1), HEATER INLET TEMP (°F)	35-120	OSD[7] ≤ 230	67	67	68	67	67	68	67	67	68	67	67	67	67	67
AN241-VTP-TI-302 (TI-2), HEATER OUTLET TEMP (°F)	45-120	OSD[7] ≤ 230	100	72	92	104	80	97	72	78	82	78	82	90	104	76
(AN241-VTP-TI-302)-(AN241-VTP-TI-301) ((TI-2) - (TI-1)) HEATER ΔT (°F)	< 50		33	5	24	37	13	29	5	11	14	11	15	23	37	9
AN241-VTP-PDIS-307 (DPIS-3), PREFILTER dP (in. Wg)	0.0-1.0	(ER)	.05	.05	.05	.03	.02	.05	.03	.05	0.05	.05	.05	.05	.05	.0
an241-VTP-PDIS-308 (DPIS-2), 1st HEPA FILTER dP (in. Wg)	0.5-4.0	OSD[6] ≤ 5.9 (ER)	.8	.8	.8	.8	.8	.5	.8	.8	0.8	.8	.8	.8	.8	.8
AN241-VTP-PDIS-309 (DPIS-1), 2nd HEPA FILTER dP (in. Wg)	0.5-3.0	OSD[6] ≤ 4.0 (ER)	.6	.6	.6	.6	.6	.6	.5	.6	0.58	.6	.6	.6	.6	.6
(AN241-VTP-PDIS-309)+(AN241-VTP-PDIS-308) ((DPIS-1) + (DPIS-2)) (in. WG)	1.0-4.0	OSD[6] ≤ 5.9 (ER)	1.4	1.4	1.4	1.4	1.4	1.4	1.3	1.4	1.38	1.4	1.4	1.4	1.4	1.

ENDNOTES: OSD[6] = OSD-T-151-00007.3.1.A OSD[7] = OSD-T-151-00007.3.1.8

REMARKS:

RPP-9782 Rev. 0 1-121

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DATE STARTING: [illegible] DATE ENDING: 4-30-01

PARAMETER	NORMAL RANGE	OSD TSR LIMIT	MON D	MON N	TUES D	TUES N	WED D	WED N	THURS D	THURS N	FRI D	FRI N	SAT D	SAT N	SUN D	SUN N
A TRAIN FILTER BANK																
AN241-VTP-TI-301 (TI-1), HEATER INLET TEMP (°F)	35-120	OSD[7] ≤ 230	[illegible]	off	off	off	off	off	off	off	off	off	off	off	off	off
AN241-VTP-TI-302 (TI-2), HEATER OUTLET TEMP (°F)	45-120	OSD[7] ≤ 230	[illegible]	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
(AN241-VTP-TI-302)-(AN241-VTP-TI-301) ((TI-2) - (TI-1)) HEATER ΔT (°F)	< 50		[illegible]	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
AN241-VTP-PDIS-307 (DPIS-3), PREFILTER dP (in. Wg)	0.0-1.0	(ER)	off	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
AN241-VTP-PDIT-327 1st HEPA FILTER dP (in. Wg)	0.3-5.8	OSD[6] ≤ 5.9 LCO[6] 3.1.8 ≤ 5.9	off	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
AN241-VTP-PDIT-328 2nd HEPA FILTER dP (in. Wg)	0.3-3.8	OSD[6] ≤ 4.0 LCO[6] 3.1.8 ≤ 0.1	off	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
AN241-VTP-PDIT-329 Filters K1-4-1 + K1-4-3 (in. WG)	0.3-5.7	OSD[6] ≤ 5.9	off	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓

ENDNOTES: OSD[6] = OSD-T-151-00007.3.1.A OSD[7] = OSD-T-151-00007.3.1.B LCO[6] = LCO 3.1.8, HEPA Filter Differential Pressure Interlock System

REMARKS:

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DATE STARTING: JAN 24 2000 24 25 26 27 24 DATE ENDING:

PARAMETER	NORMAL RANGE	OSD TSR LIMIT	MON D	MON N	TUES D	TUES N	WED D	WED N	THURS D	THURS N	FRI D	FRI N	SAT D	SAT N	SUN D	SUN N
241-AN PRIMARY VENTILATION																
PRIMARY TANK DE-ENTRAINERS DIFFERENTIAL PRESSURES																
AN241-VTP-PDI-109 (DPI-31), DE-EN A (IN. Wg)	0.1-2.0		.45	.45	.45	.45	.45	.43	.42	.43	.45	.44	.44	.44	.45	0.43
AN241-VTP-PDI-108 (DPI-32), DE-EN B (IN. Wg)	0.1-2.0		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
A TRAIN FILTER BANK																
AN241-VTP-TI-301 (TI-1), HEATER INLET TEMP (°F)	35-120	OSD[7] ≤ 230	36	35	36°	53°	53	53°	53	53°	53	53°	53	53°	52	53
AN241-VTP-TI-302 (TI-2), HEATER OUTLET TEMP (°F)	45-120	OSD[7] ≤ 230		88	100°	64°	65	102°	98	94	96	95	95	97	94	98
(AN241-VTP-TI-302)-(AN241-VTP-TI-301) ((TI-2) - (TI-1)) HEATER ΔT (°F)	< 50			53	74°	11°	12	49°	45	41°	33	45	33	44	42	45
AN241-VTP-PDIS-307 (DPIS-3), PREFILTER dP (in. Wg)	0.0-1.0	(ER)		0	Ø	.625	.02	.04	.04	.05	.04	.05	.04	.05	.05	0.05
an241-VTP-PDIS-308 (DPIS-2), 1st HEPA FILTER dP (in. Wg)	0.5-4.0	OSD[6] ≤ 5.9 (ER)		.8	.8	.8	.75	.8	.8	.8	.8	.8	.8	.8	.8	0.8
AN241-VTP-PDIS-309 (DPIS-1), 2nd HEPA FILTER dP (in. Wg)	0.5-3.0	OSD[6] ≤ 4.0 (ER)		.6	.6	.6	.6	.6	.6	.6	.6	.6	.6	.6	.6	0.6
(AN241-VTP-PDIS-309)+(AN241-VTP-PDIS-308) ((DPIS-1) + (DPIS-2)) (in. WG)	1.0-4.0	OSD[6] ≤ 5.9 (ER)		1.4	1.4	1.4	1.35	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4

ENDNOTES: OSD[6] = OSD-T-151-00007.3.1.A OSD[7] = OSD-T-151-00007.3.1.B

REMARKS: ① Above Normal Range SOMA and will monitor Sa gohm 1/24/00 RWE written 1-25-00

RPP-9782 Rev. 0 T-123

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DATE STARTING:

DAY			MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY		SATURDAY		SUNDAY	
PARAMETER	NORMAL RANGE	TSR/OSD LIMIT	D	N	D	N	D	N	D	N	D	N	D	N	D	N
K1-1 Ventilation System - Instrument Enclosure & Plenum Assembly																
TI-1 HEATER K1-2-1 INLET TEMP (°F)	35 - 150		53°	52	52°	off	① 52°	53	52°	off	off	off	off	off	off	off
TI-2 HEATER K1-2-1 OUTLET TEMP (°F)	45 - 170	OSD[8] ≤ 230	68°	70	62°		68°	54	78°							
TI-2 - TI-1 HEATER ΔT (°F)	<50		15	18	10°		16°	2	26°							
AP241-VTP-TDC-326 Primary Exh A Train Heater Temperature Diff Controller (°F)	5 - 25		17°	20	16°			②	③							
DPIS-3 PREFILTER K1-3-1 (IN. H_2O)	0.0 - 1.0		1.0	.2	.2		.2	.1	.1							
AP241-VTP-PDIT-327 FILTER K1-4-1 (1st HEPA) (IN. H_2O)	0.3 - 5.7	OSD[5] ≤ 5.9 LCO[7] ≤ 5.9	.814	.809	.824		.839	.831	.839							
AP241-VTP-PDIT-328 FILTER K1-4-2 (2nd HEPA) (IN. H_2O)	0.3 - 3.8	OSD[5] ≤ 4.0 LCO[7] ≥ 0.10	.837	.866	.844		.850	.849	.841							
AP241-VTP-PDIT-329 TOTAL PRESSURE OF FILTERS K1-4-1 AND K1-4-2 (IN. H_2O)	0.3 - 5.7	OSD[5] ≤ 5.9	1.532	1.556	1.535		1.550	1.555	1.550							

ENDNOTES: OSD[5]: OSD 7.3.1.A, HEPA Filters; OSD[8]: OSD 7.3.1.B, Air Inlet Temperature; LCO[7]: LCO 3.1.8, HEPA Filter Differential Pressure Interlock Systems

AP

EDL		REMARKS: ① PKg 2-E01-57
EDL		② Controller removed from service for maintenance modifications
EDL		

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DATE STARTING:					3		4		5		6		7		8	
DAY			MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY		SATURDAY		SUNDAY	
PARAMETER	NORMAL RANGE	TSR/OSD LIMIT	D	N	D	N	D	N	D	N	D	N	D	N	D	N
K1-2 Ventilation System - Instrument Enclosure & Plenum Assembly																
TI-7 HEATER K1-2-2 INLET TEMP (°F)	35 - 150		STBY	STBY	STBY	50	50	STBY	STBY	52	53°	52°	53°	50°	53°	54°
TI-8 K1-2 FILTER BANK OUTLET TEMP (°F)	40 - 170	OSD[8] ≤ 230				93	68			94	94°	97°	95°	95°	97°	94°
TI-8 - TI-7 HEATER ΔT (°F)	<50					43	18	✓		42	41°	45°	42°	45°	44°	40°
AP241-VTP-TDC-426 K1-2-2 HEATER CONTROLLER (°F)	5 - 25					(2)	(2)	(2)	(2)	ON (4)	ON	STATUS ON	(5) ON	ON (2)	(6) ON	(6) ON
DPIS-6 PREFILTER K1-3-2 (IN. H_2O)	0.0 - 1.0					0.05	.05	(5) STBY		0.05	.05	.1	.05	.1	.05	.05
AP241-VTP-PDIT-427 FILTER K1-4-3 (1st HEPA) (IN. H_2O)	0.3 - 5.7	OSD[5] ≤5.9 LCO[7]≤ 5.9				0.807	.815	(5)		0.798	.800	.8	.794	.5	.771	.802
AP241-VTP-PDIT-428 FILTER K1-4-4 (2nd HEPA) (IN. H_2O)	0.3 - 3.8	OSD[5] ≤4.0 LCO[7]≥ 0.10				0.786	.797			0.704	.706	.7	.713	.7	.721	.722
AP241-VTP-PDIT-429 TOTAL PRESSURE OF FILTERS K1-4-3 AND K1-4-4 (IN. H_2O)	0.3 - 5.7	OSD[5] ≤5.9	↓	↓	↓	1.614	1.673	↓	↓	1.456	1.445	1.45	1.451	1.45	1.492	1.457
K1 FAN STATUS																
SWITCH K1 Fans (1) Monday Night only	(√)			(1)												
K1-5-1 Exhaust Fan in Operation	(√)		✓	✓	✓			✓	✓							
K1-5-2 Exhaust Fan in Operation	(√)				*	✓	✓			(5) ✓	✓	✓	✓	✓	✓	✓

(1) SWITCH Operating and Standby Fans if allowed by operating conditions per TO-060-340

ENDNOTES: OSD[5]: OSD 7.3.1.A, HEPA Filters; OSD[8]: OSD 7.3.1.B, Air Inlet Temperature; LCO[7]: LCO 3.1.8, HEPA Filter Differential Pressure Interlock Systems

AP

EDL		REMARKS: (1) K1-5-1 started on Sun Day Days * locked out 4/3/01 HTX / (3) SWITCHED TO K1-5-2 ON DAYS
EDL		(2) CONTROLLER REMOVED FROM SERVICE - MAINTENANCE WORK IN PROGRESS. M
EDL		(3) Switched to the K-1-5-1 on 4-4-01 1431 (4) TESTING IN PROGRESS

Type	Document No.	Rev/Mod	Release Date	Page
CONTINUOUS	TF-OR-A-03	E-72	03/08/2001	15 of 60

(5) No numerical indicator present. Due to system change "B" train light is on and functional PCA needed to reflect change. SOMA PCA IN PROCESS CBW 4/2/01

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DATE STARTING: JAN 22 2001

DAY			MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY		SATURDAY		SUNDAY	
			22		23		24		25		26		27			
PARAMETER	NORMAL RANGE	TSR/OSD LIMIT	D	N	D	N	D	N	D	N	D	N	D	N	D	N
K1-2 Ventilation System - Instrument Enclosure & Plenum Assembly																
TI-7 HEATER K1-2-2 INLET TEMP (F)	35 - 150		48	48	48	48°	48	48°	46	48°	48	48	48	47	48	47
TI-8 K1-2 FILTER BANK OUTLET TEMP (F)	40 - 170	OSD[x] 230	64	64	64	64°	64	65°	64	64°	64	64	64	62	64	65
TI-8 - TI-7 HEATER T (F)	<50		16	16	16	16°	16	17°	16	16°	16	16	16	15	16	17
AP241-VTP-TDC-426 K1-2-2 HEATER CONTROLLER (F)	5 - 25		13	13	13	13°	13	14°	13	13°	13	13	13	13	13	13
DPIS-6 PREFILTER K1-3-2 (IN. H_2O)	0.0 - 1.0		.05	.05	.05	.05	.05	.05	.05	.05	.05	0.05	.05	0.05	.07	.07
AP241-VTP-PDIT-427 FILTER K1-4-3 (1st HEPA) (IN. H_2O)	0.3 - 5.7	OSD[5] 5.9 LCO[7] 5.9	.766	.77	.775	.767	.778	.775	.767	.781	.77	0.763	.76	0.772	.777	.76
AP241-VTP-PDIT-428 FILTER K1-4-4 (2nd HEPA) (IN. H_2O)	0.3 - 3.8	OSD[5] 4.0 LCO[7] 0.10	.793	.80	.783	.766	.792	.802	.791	.790	.80	0.782	.78	0.786	.792	.79
AP241-VTP-PDIT-429 TOTAL PRESSURE OF FILTERS K1-4-3 AND K1-4-4 (IN. H_2O)	0.3 - 5.7	OSD[5] 5.9	1.593	1.58	1.584	1.587	1.578	1.581	1.559	1.602	1.61	1.586	1.58	1.610	1.605	1.60
K1 FAN STATUS																
SWITCH K1 Fans (1) Monday Night only	( )			D O												
K1-5-1 Exhaust Fan in Operation	( )															
K1-5-2 Exhaust Fan in Operation	( )		✓	✓	✓	✓	✓	✓	-	✓	✓	✓	✓	-	✓	✓

(1) SWITCH Operating and Standby Fans if allowed by operating conditions per TO-060-340

ENDNOTES: OSD[5]: OSD 7.3.1.A, HEPA Filters; OSD[x]: OSD 7.3.1.B, Air Inlet Temperature; LCO[7]: LCO 3.1.8, HEPA Filter Differential Pressure Interlock Systems

EDL	AP-01-002	REMARKS (1) K1-5-1 Locked out For Repairs.
EDL		
EDL		

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DATE STARTING: JAN 08 2001

DAY			MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY		SATURDAY		SUNDAY	
PARAMETER	NORMAL RANGE	TSR/OSD LIMIT	D	N	D	N	D	N	D	N	D	N	D	N	D	N
K1-1 Ventilation System - Instrument Enclosure & Plenum Assembly																
TI-1 HEATER K1-2-1 INLET TEMP (F)	35 - 150		O/S (1)	O/S (1)	O/S (1)	O/S (1)	O/S (1)	O/S (1)	O/S (1)	O/S (1)	O/S (1)	O/S (1)	O/S (1)	O/S (1)	O/S (1)	O/S (1)
TI-2 HEATER K1-2-1 OUTLET TEMP (F)	45 - 170	OSD[8] 230														
TI-2 - TI-1 HEATER T (F)	<50															
AP241-VTP-TDC-326 Primary Exh A Train Heater Temperature Diff Controller (F)	5 - 25															
DPIS-3 PREFILTER K1-3-1 (IN. H_2O)	0.0 - 1.0															
AP241-VTP-PDIT-327 FILTER K1-4-1 (1st HEPA) (IN. H_2O)	0.3 - 5.7	OSD[5] 5.9 LCO[7] 5.9														
AP241-VTP-PDIT-328 FILTER K1-4-2 (2nd HEPA) (IN. H_2O)	0.3 - 3.8	OSD[5] 4.0 LCO[7] 0.10														
AP241-VTP-PDIT-329 TOTAL PRESSURE OF FILTERS K1-4-1 AND K1-4-2 (IN. H_2O)	0.3 - 5.7	OSD[5] 5.9														

ENDNOTES: OSD[5]: OSD 7.3.1.A, HEPA Filters; OSD[8]: OSD 7.3.1.B, Air Inlet Temperature; LCO[7]: LCO 3.1.8, HEPA Filter Differential Pressure Interlock Systems

AP

EDL	AP-01-002	REMARKS: (1) K1-5-1 Danger Tagged For Repairs. Sim auen Lm 1/23/01 Lm 1/24/01
EDL		
EDL		

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DATE STARTING: 4-24-00			24		25		26		27		28							
DAY			MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY		SATURDAY		SUNDAY			
PARAMETER	NORMAL RANGE	TSR/OSD LIMIT	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N
K-1 Ventilation System Instrument Enclosure																		
DPIS-21 DE-ENTRAINER K1-1-1 (IN. H_2O)	0.05 - 2.0		.85	.85	.85	.7	.7	.7	.75	.7	.7	.7	0.75	.7	.7	.7		
DPIS-22 DE-ENTRAINER K1-1-2 (IN. H_2O)	0.05 - 2.0		off	OFF	off	off	off	OFF	off	OFF	off	off	off	OFF	OFF	off		
K1-1 Ventilation System - Instrument Enclosure & Plenum Assembly																		
TI-1 HEATER K1-2-1 INLET TEMP (°F)	35 - 150		STBY	56°	55	55	54	56	56	56	55	58	54	56°	56	56°		
TI-2 HEATER K1-2-1 OUTLET TEMP (°F)	45 - 170	OSD[8] ≤ 230		74°	78	73	70	84	76	76	73°	70	75	76°	74	76°		
TI-2 - TI-1 HEATER ΔT (°F)	<50			18°	23	18	16	28	20	20	18°	12	24	20°	18	20°		
AP241-VTP-TDC-326 Primary Exh A Train Heater Temperature Diff Controller (°F)	5 - 25			13°	21	13°	11	① 14	12	12	15	15	14	12°	11	12°		
DPIS-3 PREFILTER K1-3-1 (IN. H_2O)	0.0 - 1.0			.1	.1	.1	.1	.1	.1	.1	.1	.1	0.1	.1	.1	.1		
DPIS-2 FILTER K1-4-1 (1st HEPA) (IN. H_2O)	0.5 - 4.0	OSD[5] ≤ 5.9		1.2	1.15	1.2	1.2	1.2	1.3	1.2	1.2	1.2	1.18	1.2	1.2	1.2		
DPIS-1 FILTER K1-4-2 (2nd HEPA) (IN. H_2O)	0.35 - 3.0	OSD[5] ≤ 4.0		.8	.8	.8	.8	.8	.8	.8	.8	.8	0.8	.8	.8	.8		
DPIS-1 + DPIS-2 (IN. H_2O)	0.85 - 5.0	OSD[5] ≤ 5.9		2.0	1.95	2.0	2.0	2.0	2.1	2.0	2.0	2.0	1.78	2.0	2.0	2.0		

ENDNOTES: OSD[5]: OSD 7.3.1.A, HEPA Filters; OSD[8]: OSD 7.3.1.B, Air Inlet Temperature

AP

EDL #		REMARKS: ① LABEL MISSING. - RWR written 4/26/00 [illegible]
EDL #		
EDL #		

DATE STARTING: 4-24-00

DAY			MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY		SATURDAY		SUNDAY	
PARAMETER	NORMAL RANGE	TSR/OSD LIMIT	D	N	D	N	D	N	D	N	D	N	D	N	D	N
K1-2 Ventilation System - Instrument Enclosure & Plenum Assembly																
TI-7 HEATER K1-2-2 INLET TEMP (°F)	35 - 150		54°	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY	STBY
TI-8 K1-2 FILTER BANK OUTLET TEMP (°F)	40 - 170	OSD[8] ≤ 230	69°													
TI-8 - TI-7 HEATER ΔT (°F)	<50		15°													
AP241-VTP-TDC-426 K1-2-2 HEATER CONTROLLER (°F)	5 - 25		7°													
DPIS-6 PREFILTER K1-3-2 (IN. H_2O)	0.0 - 1.0		.2													
DPIS-5 FILTER K1-4-3 (1st HEPA) (IN. H_2O)	0.5 - 4.0	OSD[5] ≤5.9	1.15													
DPIS-4 FILTER K1-4-4 (2nd HEPA) (IN. H_2O)	0.35 - 3.0	OSD[5] ≤4.0	.85													
DPIS-4 + DPIS-5 (IN. H_2O)	0.85 - 5.0	OSD[5] ≤5.9	2.0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
K1 FAN STATUS																
SWITCH K1 Fans (1) Monday Night only	(√)			✓												
K1-5-1 Exhaust Fan in Operation	(√)			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
K1-5-2 Exhaust Fan in Operation	(√)		✓													

(1) SWITCH Operating and Standby Fans if allowed by operating conditions per TO-060-340

ENDNOTES: OSD[5]: OSD 7.3.1.A, HEPA Filters; OSD[8]: OSD 7.3.1.B, Air Inlet Temperature

AP

EDL #		REMARKS:
EDL #		
EDL #		

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Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer

Project No. & Title: VET-1084, DST Ventilation ALARACT

Originator: E. Stam — Date: 11/6/01

Checker: BPS — Date: 1/8/02

WORKING COPY — Printed on: Jan 21, 00 9:38 am

DATE STARTING: JAN 24 2000

DAY			24 MONDAY		25 TUESDAY		26 WEDNESDAY		27 THURSDAY		28 FRIDAY		SATURDAY		SU	
PARAMETER	NORMAL RANGE	TSR/OSD LIMIT	D	N	D	N	D	N	D	N	D	N	D	N	D	
K-1 Ventilation System Instrument Enclosure																
DPIS-21 DE-ENTRAINER K1-1-1 (IN. H_2O)	0.05 - 2.0		.85	.8	.7	.8	.7	.8	.8	.8	.75	.8	.75	0.75	.75	0.
DPIS-22 DE-ENTRAINER K1-1-2 (IN. H_2O)	0.05 - 2.0		OFF	OFF	off	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	of
K1-1 Ventilation System - Instrument Enclosure & Plenum Assembly																
TI-1 HEATER K1-2-1 INLET TEMP (°F)	35 - 150		STBY	44	46	48	48	46	45	48	45	46	45	45	45	4
TI-2 HEATER K1-2-1 OUTLET TEMP (°F)	45 - 170	OSD[8] ≤ 230		50	65	62	62	64	62	68	62	64	63	67	61	6
TI-2 - TI-1 HEATER ΔT (°F)	<50			6	19	14	14	18	14	20	17	18	18	22	16	2
AP241-VTP-TDC-326 Primary Exh A Train Heater Temperature Diff Controller (°F)	5 - 25			8	19	12	18	15	16	19	13	14	18	22	15	2
DPIS-3 PREFILTER K1-3-1 (IN. H_2O)	0.0 - 1.0			.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	0.1	.1	0
DPIS-2 FILTER K1-4-1 (1st HEPA) (IN. H_2O)	0.5 - 4.0	OSD[5] ≤ 5.9		1.1	1.15	1.15	1.15	1.15	1.15	1.15	1.2	1.15	1.15	1.15	1.15	1.
DPIS-1 FILTER K1-4-2 (2nd HEPA) (IN. H_2O)	0.35 - 3.0	OSD[5] ≤ 4.0		.8	.8	.8	.8	.8	.8	.8	.8	.8	.8	0.8	.8	0.
DPIS-1 + DPIS-2 (IN. H_2O)	0.85 - 5.0	OSD[5] ≤ 5.9		1.9	1.95	1.95	1.95	1.95	1.95	1.95	2.0	1.95	1.95	1.95	1.95	1.

ENDNOTES: OSD[5]: OSD 7.3.1.A, HEPA Filters; OSD[8]: OSD 7.3.1.B, Air Inlet Temperature

AP

EDL #		REMARKS:
EDL #		
EDL #		

RPP-9782 Rev. 0 1-130

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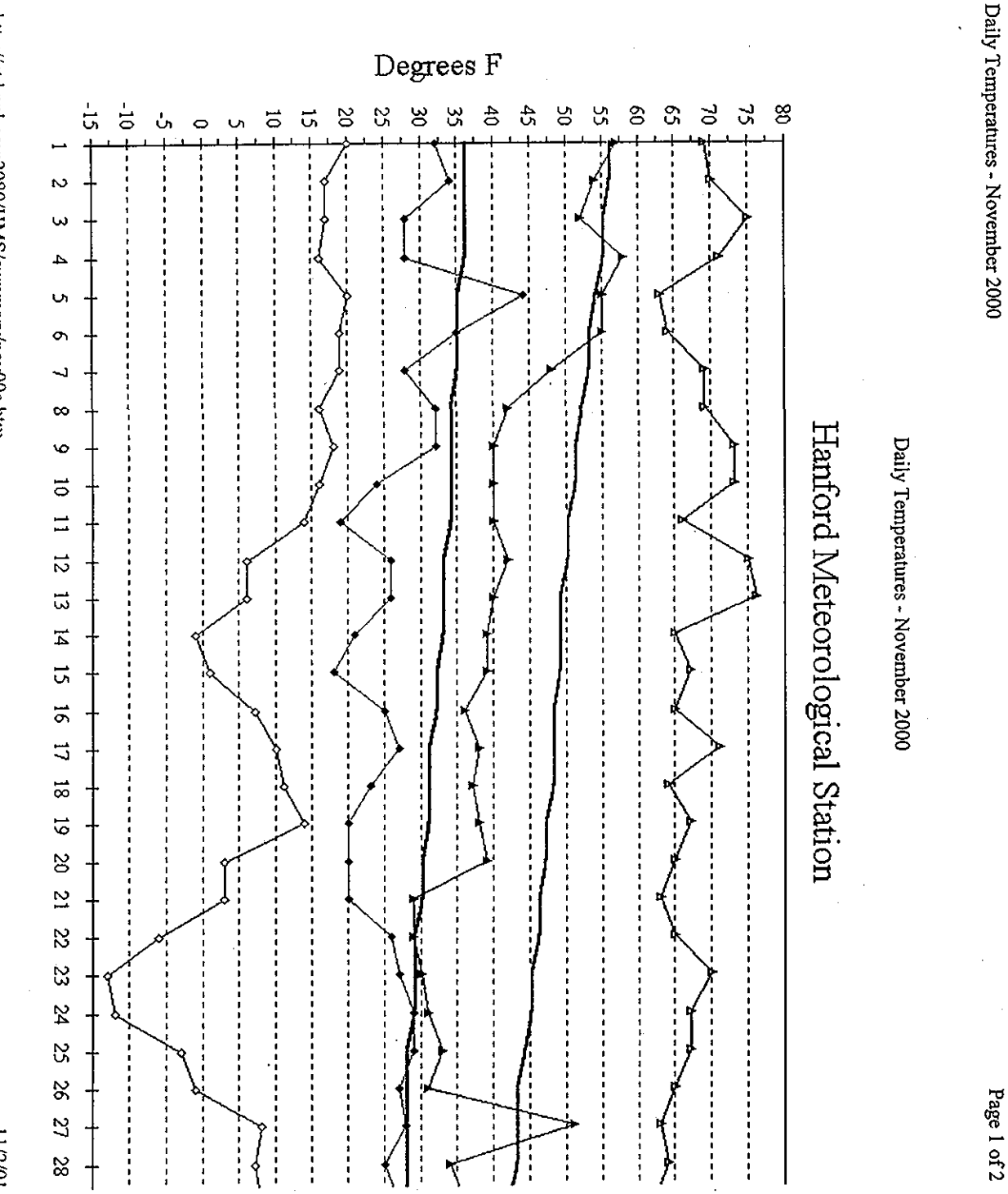
VISTA ENGINEERING TECHNOLOGIES, L.L.C. Attachment 4	Calc. #: VET-1084-001 Rev: 0 Page: 1 of 9	
Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer	**Originator:** E. Stam	**Date:** 11/6/01
Project No. & Title: VET-1084, DST Ventilation ALARACT	**Checker:** RPS	**Date:** 1/8/02



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VISTA ENGINEERING TECHNOLOGIES, L.L.C. Attachment 4	Calc. #: VET-1084-001 Rev: 0 Page: 2 of 9	
Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer	**Originator:** E. Stam	**Date:** 11/6/01
Project No. & Title: VET-1084, DST Ventilation ALARACT	**Checker:** RPS	**Date:** 1/8/02

CLIMATOLOGICAL DATA

HANFORD METEOROLOGY STATION

25 MILES N.W. OF RICHLAND, WA
LATITUDE 46° 34'N, LONGITUDE 119° 36'W
ELEVATION (GROUND) 733 FEET

MONTH: April 2001

	TEMPERATURE (°F) (3-FT LEVEL)						PRECIPITATION			WIND (50-FT LEVEL)							FRONTS & MISC PHENOM
DATE	MAXIMUM	MINIMUM	AVERAGE	DEPARTURE	HDD 65 °F	CDD 65 °F	TOTAL IN.	SNOW IN.	SNOW ON GRND AT 0400 IN.	PREVAIL DIR	AVE SPD MPH	PK GUST SPD MPH	PK GUST DIR	AVE RH %	SOLARAD	SKY CVR SRTOSS	NOTE TYPES AND TIMES OF FRONTAL PASSAGES "KFR"(COLD) "WFR"(WARM)
1	57	38	48	-2	17	0				NW	8.5	28	NW	45	407	7	
2	52	36	44	-6	21	0	0.04			SW	8.1	23	SW	58	148	10	
3	53	33	43	-7	22	0	T			W	6.2	24	NE	61	320	10	
4	55	34	44	-7	21	0				NW	6.0	17	WNW	60	355	5	
5	59	28	44	-7	21	0	0.01			SW	8.8	32	S	56	304	9	
6	58	41	50	-1	15	0				W	9.7	28	WSW	48	Msg	10	
7	55	40	48	-3	17	0				W	9.0	20	WSW	38	Msg	10	
8	58	33	46	-5	19	0				SW	9.0	22	WNW	41	Msg	4	
9	63	28	46	-5	19	0				W	9.3	30	NW	44	481	3	
10	57	39	48	-4	17	0	0.26			W	7.3	22	WSW	63	170	10	KFR 2330
11	53	35	44	-8	21	0	0.25			N	10.8	30	N	76	201	9	AU
12	56	30	43	-9	22	0				SW	9.1	30	SSW	61	364	8	
13	55	35	45	-8	20	0				W	9.9	23	NW	43	352	10	
14	57	28	42	-11	23	0				W	4.7	13	SSE	49	425	4	
15	67	41	54	0	11	0				NW	6.8	19	NE	41	445	7	
16	72	46	59	+5	6	0				NW	7.9	30	WSW	38	412	8	KFR 2215
17	69	50	60	+6	5	0				SW	14.2	48	WSW	38	391	9	BD
18	61	41	51	-3	14	0	0.04			SE	7.4	22	S	72	213	9	T
19	64	39	52	-2	13	0				W	6.2	26	SSE	50	349	5	
20	67	43	55	0	10	0				NW	9.8	25	NNE	47	304	9	
21	68	41	54	-1	11	0				NW	8.1	35	SW	46	391	0	
22	65	41	53	-2	12	0				W	8.2	28	WSW	44	332	7	
23	67	41	54	-1	11	0	T			W	6.0	20	WSW	55	231	10	
24	77	37	57	+2	8	0				SE	5.4	15	SE	55	439	3	
25	83	49	66	+10	0	1				W	4.8	15	NE	48	439	7	
26	83	56	70	+14	0	5	T			W	6.3	21	SSE	43	241	8	DL
27	81	52	66	+10	0	1	0.09			W	7.7	31	WSW	48	356	8	T,WFR 2315
28	66	43	54	-3	11	0	0.12			SW	14.8	50	WSW	54	425	7	BD,KFR 0500
29	64	39	52	-5	13	0				SW	16.1	41	SW	49	214	10	
30	64	44	54	-4	11	0	0.02			SW	11.6	48	SW	55	216	7	BD,KFR 1200

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VISTA ENGINEERING TECHNOLOGIES, L.L.C. Attachment 4	Calc. #: VET-1084-001 Rev: 0 Page: 3 of 9	
Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer	**Originator:** E. Stam	**Date:** 11/6/01
Project No. & Title: *VET-1084, DST Ventilation ALARACT*	**Checker:** RPS	**Date:** 1/8/02

HMS Monthly Summary - April 2001 Page 2 of 2

SUM		411	7	0.83	0				
AVG	63.5	39.4	51.4			8.6			7.4

NOTES:	PRECIPITATION (IN.)				MISC. PHENOM. KEY
Daily summary period is midnight to midnight PST	TOTAL FOR THE MONTH			0.83	A-Hail, BD-Blowing Dust, BS-Blowing Snow
"T" in columns 7-9 denotes a trace	DEPARTURE FROM NORM			+0.39	D-Dust, AU-Aurora, DL-Distant Lightning
Snow in columns 8-9 is all frozen precipitation	24HR MAX	0.51	ON	10-11	F-Fog, IC-Ice Crystals, K-Smoke
Solrad in column 15 is in Langleys; g-cal/sq. cm	NUMBER OF DAYS WITH:				GL-Glaze, T-Thunderstorm, DS-Drifting Snow

TEMPERATURE (°F) (3-FT LEVEL)			>= T	11	>= 0.25	2	BAROMETRIC PRESSURE (IN.)			
AVERAGE FOR THE MONTH		51.4	>= 0.01	8	>= 0.50	0	AVERAGE STATION			29.163
DEPARTURE FROM NORMAL		-2.1	>= 0.10	3	>= 1.00	0	MAX SEA-LEVEL	30.30	ON	24
HIGHEST	83	ON 26+	SNOW (FROZEN PRECIP.) (IN.)				MIN SEA-LEVEL	29.61	ON	6
LOWEST	28	ON 14+	TOTAL FOR THE MONTH			0	SOLAR RADIATION (LANGLEYS)			
NUMBER OF DAYS WITH:			24HR MAX	na	ON	na	AVERAGE DAILY TOTAL			330.5
MAXIMUM 32 OR BELOW		0	MAX ON GRND	na	ON	na	MAX DAILY	481	ON	9
MAXIMUM 90 OR ABOVE		0	WIND (50-FT LEVEL)				MIN DAILY	148	ON	2
MINIMUM 32 OR BELOW		4	AVERAGE SPEED (MPH)			8.6	MISCELLANEOUS NUMBER OF DAYS			
MINIMUM 0 OR BELOW		0	DEPARTURE FROM NORM			-0.2	CLEAR	3	FOG	0
HEATING DEGREE DAYS (BASE 65°F)			PEAK GUST	WSW @ 50	ON	28	PARTLY CLOUDY	10	THDR	2
TOTAL FOR THE MONTH		411	AVERAGE PSYCHROMETRIC DATA				CLOUDY	17	DUST	3
DEPARTURE FROM NORMAL		+61	DRY BULB (°F)	51.7	WET BULB (°F)	43.1	RELATIVE HUMIDITY EXTREMES (%)			
SEASON TOTAL (SINCE JULY 1)		5322	REL. HUM (%)	50.8	DEW PT (°F)	32.7	HIGHEST	98	ON	10
SEASON DEPARTURE FROM NORM		+337	+ DENOTES LATEST OF MULTIPLE DAYS				LOWEST	20	ON	9

Poor Quality Original

VISTA ENGINEERING TECHNOLOGIES, L.L.C. Attachment 4	Calc. #: VET-1084-001 Rev: 0 Page: 4 of 9	
Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer	**Originator:** E. Stam	**Date:** 11/6/01
Project No. & Title: *VET-1084, DST Ventilation ALARACT*	**Checker:** RPS	**Date:** 1/8/02

CLIMATOLOGICAL DATA

HANFORD METEOROLOGY STATION

25 MILES N.W. OF RICHLAND, WA
LATITUDE 46° 34'N, LONGITUDE 119° 36'W
ELEVATION (GROUND) 733 FEET

MONTH: January 2001

	TEMPERATURE (°F) (5-FT LEVEL)						PRECIPITATION			WIND (50-FT LEVEL)							FRONTS & MISC PHENOM
DATE	MAXIMUM	MINIMUM	AVERAGE	DEPARTURE	HDD 65 °F	CDD 65 °F	TOTAL IN.	SNOW IN.	SNOW ON GRND AT 0400 IN.	PREVAIL DIR	AVE SPD MPH	PK GUST SPD MPH	PK GUST DIR	AVE RH %	SOLAR AD	SKY COVR SRTOSS	NOTE:TYPES AND TIMES OF FRONTAL PASSAGES "KFR"(COLD) "WFR"(WARM)
1	35	30	32	+4	33	0			1	SW	3.2	7	W	94	20	10	F
2	38	32	35	+7	30	0			T	NW	3.1	8	WNW	88	50	10	
3	35	26	30	+2	35	0			T	NW	2.9	8	SSE	92	57	10	F
4	37	30	34	+6	31	0			T	NW	5.3	15	WNW	88	61	10	F
5	56	30	43	+15	22	0			T	SW	9.2	35	SW	75	135	0	F, KFR 0415
6	47	25	36	+8	29	0				NW	7.7	16	WNW	76	145	0	
7	38	27	32	+3	33	0				NW	8.2	19	WNW	75	110	8	
8	37	27	32	+3	33	0	T			SE	3.3	10	SSE	85	41	10	
9	36	22	29	0	36	0	T			NW	7.9	19	WNW	88	104	8	F
10	38	25	32	+3	33	0				NW	6.8	22	WNW	93	28	10	F
11	41	36	38	+8	27	0	0.02			NW	6.3	19	NW	81	37	10	F
12	42	32	37	+6	28	0				NW	2.5	7	S	85	54	10	
13	38	34	36	+4	29	0	0.11			NW	4.8	12	WNW	96	32	10	KFR 2100
14	45	29	37	+4	28	0				NW	4.3	14	WNW	86	142	1	
15	40	20	30	-3	35	0	0.01			NE	5.6	17	NNE	79	159	1	F
16	28	24	26	-8	39	0				NW	4.9	13	NW	92	43	10	F
17	29	27	28	-6	37	0	0.04	0.5		NW	3.7	10	NNW	87	22	10	F
18	32	26	29	-5	36	0	T		1	NW	4.6	11	NW	89	50	10	F
19	32	27	30	-4	35	0	0.02	0.2	T	W	2.4	9	ESE	91	51	10	F
20	37	30	34	0	31	0			T	NW	6.8	16	WNW	84	83	10	F
21	34	31	32	-2	33	0	0.06	0.9		NW	4.1	12	WNW	94	46	10	F, KFR 1400
22	39	31	35	+1	30	0				NW	6.9	14	WNW	83	37	10	
23	38	30	34	0	31	0				N	5.3	14	NNE	80	50	9	
24	40	28	34	0	31	0	T	T	T	NW	4.7	12	WNW	81	67	10	F
25	36	28	32	-2	33	0				NW	5.6	18	WNW	94	38	10	F
26	41	24	32	-2	33	0				E	5.3	12	NW	82	174	10	F
27	30	23	26	-7	39	0				NW	3.6	13	NNE	97	28	10	F
28	31	28	30	-3	35	0	T	T		NE	2.6	7	ENE	93	45	10	F, GL
29	47	26	36	+3	29	0	0.03	0.7	1	W	7.8	31	WSW	76	169	4	F, KFR 0700
30	46	31	38	+5	27	0				SW	9.3	26	SW	61	56	10	

Poor Quality Original

VISTA ENGINEERING TECHNOLOGIES, L.L.C.	Attachment 4	Calc. #: VET-1084-001 Rev: 0 Page: 5 of 9	
Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer		**Originator:** E. Stam	**Date:** 11/6/01
Project No. & Title: *VET-1084, DST Ventilation ALARACT*		**Checker:** RPS	**Date:** 1/8/02

31	56	34	45	+12	20	0			NW	5.2	15	W	66	182	8
SUM					981	0	0.29	2.3							
AVG	38.7	28.2	33.4							5.3				8.0	

NOTES	PRECIPITATION (IN.)				MISC PHENOM KEY
Daily summary period is midnight to midnight PST	TOTAL FOR THE MONTH			0.29	A-Hail, BD-Blowing Dust, BS-Blowing Snow
"T" in columns 7-9 denotes a trace	DEPARTURE FROM NORM			-0.58	D-Dust, AU-Aurora, DL-Distant Lightning
Snow in columns 8-9 is all frozen precipitation	24HR MAX	0.11	ON	13	F-Fog, IC-Ice Crystals, K-Smoke
Solrad in column 15 is in Langleys; g-cal/sq. cm	NUMBER OF DAYS WITH:				GL-Glaze, T-Thunderstorm, DS-Drifting Snow

TEMPERATURE (°F) (3-FT LEVEL)			>= T	12	>= 0.25	0	BAROMETRIC PRESSURE (IN.)			
AVERAGE FOR THE MONTH		33.4	>= 0.01	7	>= 0.50	0	AVERAGE STATION			29.418
DEPARTURE FROM NORMAL		+1.6	>= 0.10	1	>= 1.00	0	MAX SEA-LEVEL	30.59	ON	17
HIGHEST	56	ON 31+	SNOW (FROZEN PRECIP.) (IN.)				MIN SEA-LEVEL	29.75	ON	9
LOWEST	20	ON 15	TOTAL FOR THE MONTH			2.3	SOLAR RADIATION (LANGLEYS)			
NUMBER OF DAYS WITH:			24HR MAX	0.9	ON	21	AVERAGE DAILY TOTAL			74.7
MAXIMUM 32 OR BELOW		6	MAX ON GRND	0.9	ON	21	MAX DAILY	182	ON	31
MAXIMUM 90 OR ABOVE		0	WIND (50-FT LEVEL)				MIN DAILY	20	ON	1
MINIMUM 32 OR BELOW		28	AVERAGE SPEED (MPH)			5.3	MISCELLANEOUS NUMBER OF DAYS			
MINIMUM 0 OR BELOW		0	DEPARTURE FROM NORM			-1.0	CLEAR	5	FOG	20
HEATING DEGREE DAYS (BASE 65°F)			PEAK GUST	SW @ 35	ON	5	PARTLY CLOUDY	1	THDR	0
TOTAL FOR THE MONTH		981	AVERAGE PSYCHROMETRIC DATA				CLOUDY	25	DUST	0
DEPARTURE FROM NORMAL		-47	DRY BULB (°F)	33.6	WET BULB (°F)	31.9	RELATIVE HUMIDITY EXTREMES (%)			
SEASON TOTAL (SINCE JULY 1)		3529	REL. HUM. (%)	84.8	DEW PT.(°F)	29.3	HIGHEST	100	ON	27+
SEASON DEPARTURE FROM NORM		+248	+ DENOTES LATEST OF MULTIPLE DAYS				LOWEST	43	ON	31

Poor Quality Original

VISTA ENGINEERING TECHNOLOGIES, L.L.C. Attachment 4	Calc. #: VET-1084-001 Rev: 0 Page: 6 of 9	
Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer	**Originator:** E. Stam	**Date:** 11/6/01
Project No. & Title: VET-1084, DST Ventilation ALARACT	**Checker:** RPS	**Date:** 1/8/02

HMS Monthly Summary - April 2000

CLIMATOLOGICAL DATA — HANFORD METEOROLOGY STATION — MONTH: April 2000

25 MILES N.W. OF RICHLAND, WA
LATITUDE 46° 34'N, LONGITUDE 119° 36'W
ELEVATION (GROUND) 733 FEET

	TEMPERATURE (°F) (3-FT LEVEL)					PRECIPITATION				WIND (50-FT LEVEL)						FRONTS & MISC PHENOM
DATE	MAXIMUM	MINIMUM	AVERAGE	DEPARTURE	HDD 65 °F	CDD 65 °F	TOTAL IN.	SNOW IN.	SNOW ON GRND AT 0400 IN.	PREVAIL DIR	AVE SPD MPH	PK GUST SPD MPH	PK GUST DIR	AVE RH %	SOLARAD	SKY COVR SRTOSS	NOTE:TYPES AND TIMES OF FRONTAL PASSAGES "KFR"(COLD) "WFR"(WARM)
1	79	38	58	+8	7	0				NW	10.2	34	NW	46	451	9	
2	74	48	61	+11	4	0				NW	7.1	24	WNW	44	483	0	
3	76	40	58	+8	7	0				NE	4.4	15	W	55	468	3	
4	73	41	57	+6	8	0				W	12.6	43	WSW	47	423	7	KFR 1320
5	58	29	44	-7	21	0				SW	6.6	20	SW	45	380	10	
6	58	37	48	-3	17	0	T			NW	7.9	32	NW	50	250	9	
7	63	30	46	-6	19	0				W	4.8	15	SE	45	515	2	
8	70	37	54	+2	11	0				W	8.3	17	NNW	38	471	4	
9	76	41	58	+6	7	0				W	5.7	22	WNW	41	507	2	
10	75	37	56	+4	9	0				W	4.4	13	E	47	523	2	
11	76	39	58	+6	7	0				E	4.0	12	E	44	434	8	
12	82	49	66	+14	0	1				W	7.1	26	W	37	422	7	
13	64	49	56	+4	9	0	0.54			NW	7.5	39	WSW	75	103	10	KFR 1800
14	65	48	56	+4	9	0	T			SW	11.0	31	SW	64	272	10	
15	64	47	56	+4	9	0				SW	8.0	24	SW	57	284	10	
16	63	46	54	+2	11	0	0.03			NW	6.3	17	NW	71	346	10	
17	68	45	56	+4	9	0				NW	6.5	13	WNW	66	367	8	
18	77	51	64	+12	1	0				NW	10.9	35	NW	47	506	4	
19	73	38	56	+4	9	0				W	6.9	33	WNW	41	568	0	
20	72	48	60	+7	5	0	T			SE	4.6	16	E	53	399	6	
21	78	41	60	+7	5	0				SW	6.8	36	WSW	54	532	1	KFR 2130
22	67	44	56	+2	9	0				NW	14.2	39	SW	46	490	6	
23	64	34	49	-5	16	0				SW	10.3	36	WSW	49	520	8	
24	60	36	48	-6	17	0				SW	6.9	23	W	33	551	5	
25	62	42	52	-3	13	0	T			W	10.2	34	WSW	44	301	10	KFR 0500
26	67	34	50	-5	15	0				E	6.3	18	E	49	531	7	
27	72	50	61	+6	4	0				NW	12.3	39	W	47	339	9	KFR 1545
28	64	44	54	-2	11	0				W	13.6	33	WSW	41	571	4	
29	68	33	50	-6	15	0				SW	6.0	23	WNW	41	590	0	
30	78	44	61	+4	4	0				W	6.3	21	WNW	35	541	7	

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VISTA ENGINEERING TECHNOLOGIES, L.L.C.	Attachment 4	Calc. #: VET-1084-001 Rev: 0 Page: 7 of 9	
Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer		**Originator:** E. Stam	**Date:** 11/6/01
Project No. & Title: *VET-1084, DST Ventilation ALARACT*		**Checker:** RPS	**Date:** 11/8/01

HMS Monthly Summary - April 2000 Page 2 of 2

SUM			288	1	0.57	0					
AVG	69.5	41.3	55.4					7.9			5.9

NOTES	PRECIPITATION (IN.)				MISC PHENOM. KEY
Daily summary period is midnight to midnight PST	TOTAL FOR THE MONTH			0.57	A-Hail, BD-Blowing Dust, BS-Blowing Snow
"T" in columns 7-9 denotes a trace	DEPARTURE FROM NORM			+0.16	D-Dust, AU-Aurora, DL-Distant Lightning
Snow in columns 8-9 is all frozen precipitation	24HR MAX	0.54	ON	13	F-Fog, IC-Ice Crystals, K-Smoke
Solrad in column 15 is in Langleys; g-cal/sq. cm	NUMBER OF DAYS WITH:				GL-Glaze, T-Thunderstorm, DS-Drifting Snow
TEMPERATURE (°F) (3-FT LEVEL)	>= T	6	>= 0.25	1	BAROMETRIC PRESSURE (IN.)
AVERAGE FOR THE MONTH 55.4	>= 0.01	2	>= 0.50	1	AVERAGE STATION 29.206
DEPARTURE FROM NORMAL +2.7	>= 0.10	1	>= 1.00	0	MAX SEA-LEVEL 30.47 ON 7
HIGHEST 82 ON 12	SNOW (FROZEN PRECIP.) (IN.)				MIN SEA-LEVEL 29.61 ON 27
LOWEST 29 ON 5	TOTAL FOR THE MONTH			0	SOLAR RADIATION (LANGLEYS)
NUMBER OF DAYS WITH:	24HR MAX	na	ON	na	AVERAGE DAILY TOTAL 437.9
MAXIMUM 32 OR BELOW 0	MAX ON GRND	na	ON	na	MAX DAILY 590 ON 29
MAXIMUM 90 OR ABOVE 0	WIND (50-FT LEVEL)				MIN DAILY 103 ON 13
MINIMUM 32 OR BELOW 2	AVERAGE SPEED (MPH)			7.9	MISCELLANEOUS NUMBER OF DAYS
MINIMUM 0 OR BELOW 0	DEPARTURE FROM NORM			-1.1	CLEAR 8 FOG 0
HEATING DEGREE DAYS (BASE 65°F)	PEAK GUST	WSW @ 43	ON	4	PARTLY CLOUDY 11 THDR 0
TOTAL FOR THE MONTH 288	*AVERAGE PSYCHROMETRIC DATA*				*CLOUDY 11 DUST 0*
DEPARTURE FROM NORMAL -84	DRY BULB (°F)	56.1	WET BULB (°F)	46.2	RELATIVE HUMIDITY EXTREMES (%)
SEASON TOTAL (SINCE JULY 1) 4592	REL. HUM. (%)	48.3	DEW PT (°F)	35.2	HIGHEST 94 ON 13
SEASON DEPARTURE FROM NORM -443	+ DENOTES LATEST OF MULTIPLE DAYS				LOWEST 17 ON 24

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VISTA ENGINEERING TECHNOLOGIES, L.L.C. Attachment 4	Calc. #: VET-1084-001 Rev: 0 Page: 8 of 9	
Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer	**Originator:** E. Stam	**Date:** 11/6/01
Project No. & Title: *VET-1084, DST Ventilation ALARACT*	**Checker:** RPS	**Date:** 1/8/02

HMS Monthly Summary - January 2000 Page 1 of 2

CLIMATOLOGICAL DATA — HANFORD METEOROLOGY STATION — MONTH: January 2000

25 MILES N.W. OF RICHLAND, WA
LATITUDE 46° 34'N, LONGITUDE 119° 36'W
ELEVATION (GROUND) 733 FEET

	TEMPERATURE (°F) (3-FT LEVEL)						PRECIPITATION			WIND (50-FT LEVEL)							FRONTS & MISC PHENOM
DATE	MAXIMUM	MINIMUM	AVERAGE	DEPARTURE	HDD 65 °F	CDD 65 °F	TOTAL IN.	SNOW IN.	SNOW ON GRND AT 0400 IN.	PREVAIL DIR	AVE SPD MPH	PK GUST SPD MPH	PK GUST DIR	AVE RH %	SOLARAD	SKY COVER SRTOSS	NOTE TYPES AND TIMES OF FRONTAL PASSAGES "KFR"(COLD) "WFR"(WARM)
1	45	26	36	+8	29	0				W	4.9	19	WSW	87	88	8	F,KFR 1500
2	46	27	36	+8	29	0				W	9.1	24	WNW	64	96	6	
3	32	24	28	0	37	0	0.03	0.2		NW	4.8	12	W	87	25	10	F
4	55	32	44	+15	21	0				SW	14.2	37	SSW	60	127	5	F,KFR 1230
5	50	26	38	+9	27	0				W	10.5	28	W	55	131	7	
6	35	19	27	-2	38	0	T			NW	4.4	13	WNW	86	62	10	KFR 2015
7	44	20	32	+3	33	0				NW	3.5	12	SE	86	134	9	F
8	55	33	44	+15	21	0	0.01			W	10.3	43	W	56	94	6	KFR 0145
9	53	27	40	+11	25	0				W	14.1	53	SW	56	111	5	KFR 0930
10	36	27	32	+2	33	0	0.06	0.6		NW	5.5	13	NW	85	29	10	F,KFR 2130
11	32	20	26	-4	39	0	0.06	0.5	0.6	NW	3.7	18	WSW	96	47	10	F
12	42	31	36	+5	29	0	T		0.9	SW	7.7	37	SW	70	93	9	
13	37	33	35	+4	30	0	0.11			NW	6.8	16	NW	92	35	10	
14	48	32	40	+8	25	0	0.01			SW	10.3	38	SW	80	60	8	KFR 1330
15	39	25	32	-1	33	0	0.06			NW	8.0	24	SW	72	91	9	
16	47	31	39	+6	26	0	0.20	2.2	1.9	S	10.6	34	SSW	78	155	7	F,KFR 0810
17	45	25	35	+2	30	0			T	W	7.3	20	SSW	68	140	3	
18	37	24	30	-3	35	0			T	NW	6.9	16	WNW	80	101	9	
19	33	18	26	-7	39	0	T	T	T	NW	7.6	18	WNW	72	134	6	
20	34	19	26	-7	39	0	0.02	0.4	0.4	NW	4.9	13	N	90	76	8	F
21	33	29	31	-2	34	0			T	NW	2.8	8	N	88	41	10	F
22	34	30	32	-1	33	0	T	T	T	NW	3.6	9	NNW	81	50	10	F
23	33	29	31	-1	34	0	0.10	2.2		NW	8.0	16	WNW	90	28	10	F
24	34	32	33	+1	32	0	0.17	0.5	2.0	NW	9.0	15	WNW	96	38	10	F
25	38	32	35	+3	30	0	0.15	0.1	1.1	NW	4.0	15	WNW	96	65	10	F
26	46	25	36	+4	29	0				W	7.8	21	WSW	76	194	0	F
27	43	21	32	0	33	0				S	4.1	13	W	77	201	0	
28	32	20	26	-6	39	0				NW	7.4	16	WNW	86	45	10	F
29	33	23	28	-4	37	0				NW	5.3	17	NW	82	120	9	
30	33	18	26	-6	39	0	0.01	0.2		W	5.9	16	WNW	85	89	7	F

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VISTA ENGINEERING TECHNOLOGIES, L.L.C. Attachment 4	Calc. #: VET-1084-001 Rev: 0 Page: 9 of 9	
Design Calculation Title: Condensation in the DST Primary Ventilation System due to Waste Transfer	**Originator:** E. Stam	**Date:** 11/6/01
Project No. & Title: VET-1084, DST Ventilation ALARACT	**Checker:** RPJ	**Date:** 1/8/02

HMS Monthly Summary - January 2000

31	32	24	28	-4	37	0	0.10	1.3	0.3	NW	3.8	10	W	94	66	10	F	
SUM					995	0	1.09	8.2										
AVG	39.9	25.9	32.9								7.0					7.8		

NOTES:				PRECIPITATION (IN.)					MISC. PHENOM. KEY				
Daily summary period is midnight to midnight PST				TOTAL FOR THE MONTH				1.09	A-Hail, BD-Blowing Dust, BS-Blowing Snow				
"T" in columns 7-9 denotes a trace				DEPARTURE FROM NORM				+0.30	D-Dust, AU-Aurora, DL-Distant Lightning				
Snow in columns 8-9 is all frozen precipitation				24HR MAX	0.26	ON		15-16	F-Fog, IC-Ice Crystals, K-Smoke				
Solrad in column 15 is in Langleys, g-cal/sq. cm				NUMBER OF DAYS WITH:					GL-Glaze, T-Thunderstorm, DS-Drifting Snow				
TEMPERATURE (°F) (3-FT LEVEL)				>= T	18	>= 0.25		0	BAROMETRIC PRESSURE (IN.)				
AVERAGE FOR THE MONTH			32.9	>= 0.01	14	>= 0.50		0	AVERAGE STATION				29.296
DEPARTURE FROM NORMAL			+1.6	>= 0.10	6	>= 1.00		0	MAX SEA-LEVEL	30.52	ON		28+
HIGHEST	55	ON	8+	SNOW (FROZEN PRECIP.) (IN.)					MIN SEA-LEVEL	29.56	ON		16
LOWEST	18	ON	30+	TOTAL FOR THE MONTH				8.2	SOLAR RADIATION (LANGLEYS)				
NUMBER OF DAYS WITH:				24HR MAX	2.7	ON		23-24	AVERAGE DAILY TOTAL				89.4
MAXIMUM 32 OR BELOW			4	MAX ON GRND	2.3	ON		24	MAX DAILY	201	ON		27
MAXIMUM 90 OR ABOVE			0	WIND (50-FT LEVEL)					MIN DAILY	25	ON		3
MINIMUM 32 OR BELOW			29	AVERAGE SPEED (MPH)				7.0	MISCELLANEOUS NUMBER OF DAYS				
MINIMUM 0 OR BELOW			0	DEPARTURE FROM NORM				+0.5	CLEAR	3	FOG		17
HEATING DEGREE DAYS (BASE 65°F)				PEAK GUST	SW @ 53	ON		9	PARTLY CLOUDY	8	THDR		0
TOTAL FOR THE MONTH			995	AVERAGE PSYCHROMETRIC DATA					CLOUDY	20	DUST		0
DEPARTURE FROM NORMAL			-49	DRY BULB (°F)	33.4	WET BULB (°F)		31.1	RELATIVE HUMIDITY EXTREMES (%)				
SEASON TOTAL (SINCE JULY 1)			2914	REL. HUM. (%)	79.7	DEW PT. (°F)		27.2	HIGHEST	100	ON		26+
SEASON DEPARTURE FROM NORM			-383	+ DENOTES LATEST OF MULTIPLE DAYS					LOWEST	29	ON		8

Poor Quality Original

VISTA ENGINEERING TECHNOLOGIES, L.L.C. Attachment 5	Calc. #: VET-1084-001 Rev: 0 Page: 1 of 7	
Design Calculation Title: Affects of Saltwell Waste Transfers on the DST Ventilation System Emission Control Technologies	**Originator:** E. Stam	**Date:** 12/31/01
Project No. & Title: VET-1084, DST Ventilation ALARACT	**Checker:** RPS	**Date:** 1/8/02

Erik Stam

From: Scott_M_Werry@rl.gov
Sent: Wednesday, October 24, 2001 6:13 PM
To: Stam@vistaengr.com
Cc: Scott_M_Werry@rl.gov

Erik,

My observations in regard to visible condensate within dome space is of course limited to the areas I have actually seen. Air borne condensate, if I recall correctly is clearly visible in a number tanks in a numbers of farms (i.e. SY farm, AY farm, AZ farm, U farm). Equipment may be a part of the visible "on screen" condensate at times in that often OPS does not acclimate the camera assembly prior to insertion. This tends to "fog" the lens housing for a time until the in tank equipment temp. equalizes enough to allow the condensate build up to yield to a viewable level.

S. M. Werry
TF Imaging Systems TPOC
RPP Equip./Maint. & Reliability Eng.
CH2MHill Hanford Group, Inc.

Poor Quality Original

VISTA ENGINEERING TECHNOLOGIES, L.L.C. Attachment 5	Calc. #: VET-1084-001 Rev: 0 Page: 2 of 7	
Design Calculation Title: Affects of Saltwell Waste Transfers on the DST Ventilation System Emission Control Technologies	**Originator:** E. Stam	**Date:** 12/31/01
Project No. & Title: VET-1084, DST Ventilation ALARACT	**Checker:** RPD	**Date:** 7/8/02

~~Erik Stam~~

From: Stephen_L_Swaney@rl.gov
Sent: Thursday, November 08, 2001 2:38 AM
To: stam@vistaengr.com
Subject: RE: Waste transfer velocities and saltwell temperatures

See comments below...

Steve Swaney
IS Engineering
373-3472

-----Original Message-----
From: Erik Stam [mailto:stam@vistaengr.com]
Sent: Monday, November 05, 2001 9:36 AM
To: Stephen_L_Swaney@RL.gov
Subject: Waste transfer velocities and saltwell temperatures

Stephen:

Thanks for your input last Friday regarding the saltwell transfers.

I have been thinking about our conversion and how to better define the input I need. Here are some thoughts and a summary of our conversion on Friday.

I am evaluating the AP, AN, and AW ventilation systems as they relate to waste stabilization (and not waste retrieval).

As I understand the system, saltwell waste can be transferred into these farms through three sources; from SSTs directly, the DCRT, and by the cross site transfer line (is the cross site transfer line part of waste retrieval and stabilization?) The answer is yes. The cross site line transfer saltwell waste from west to east and will eventually do the same for waste retrieved during retrieval. Most of the tanks will receive waste directly from SSTs. (Only) Tank AP-102 can receive waste from the DCRT and the cross site
transfer line (a possible worst case condition). This is the current configuration, but eventually the cross site will move back to AP-108. The DCRT will most likely continue to AP-102 for a year or so before we're through using it.

To estimate the amount of aerosols generated by the falling waste in the DST vapor space, I need the velocity of the waste being transferred. Of course, the pipeline velocity may be obtained from the transfer rate and pipe size.

All of the transfer lines into the DSTs are 3-inch NPS. SN-650 to AP-102 from 241-AB valve pit is a 3" line. I can't speak to the rest of them.

The transfer rate from the SSTs is approximately 6 to 8 gpm. This is worst case PER TANK. You will have up to 2 tanks running into AP-102 at any given time. The pump in
the DCRT is rated at 100 gpm and would be the worst case (again, is the DCRT considered waste stabilization or retrieval?). Currently it is stabilization waste, but like the cross site, it could be used for future retrieval activities relating to B-complex.

As a final part of the analysis, I need temperatures of the waste being transferred into the tanks. A worst case would be acceptable.

Here are examples: All temps are degrees F.

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VISTA ENGINEERING TECHNOLOGIES, L.L.C. Attachment 5	Calc. #: VET-1084-001 Rev: 0 Page: 3 of 7	
Design Calculation Title: Affects of Saltwell Waste Transfers on the DST Ventilation System Emission Control Technologies	**Originator:** E. Stam	**Date:** 12/31/01
Project No. & Title: VET-1084, DST Ventilation ALARACT	**Checker:** RPS	**Date:** 1/8/02

A-101	115-142	
AX-101	100-125	
BY-105	81-103	Makes up DCRT waste
BY-106	78-109	Makes up DCRT waste
SY-102	82-90	Cross Site transfer waste from tanks:U-107, U-108, SX-101, SX-103, S-111, S-102

I have some data that I am using in regards to the temperature in the ventilation system. To summarize, I am looking at "extending" the high temperatures usually seen in the tanks in Sept/Aug into November. All temp ranges were based on PCSACS data taken from 8/01/01 to present. I then combine the high waste temperatures with a "fast" temperature change. Based on this scenario, can you provide insight into the "high" temperatures that can exist in the applicable saltwell waste in the Sept/Aug time frame.

I hope I'm not too far off-base with this information. I would like to talk again to clarify some of these statements.

Erik Stam
Vista Engineering Tech.
Tel: 373-1377

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VISTA ENGINEERING TECHNOLOGIES, L.L.C. Attachment 5	Calc. #: VET-1084-001 Rev: 0 Page: 4 of 7	
Design Calculation Title: Affects of Saltwell Waste Transfers on the DST Ventilation System Emission Control Technologies	Originator: E. Stam	Date: 12/31/01
Project No. & Title: VET-1084, DST Ventilation ALARACT	Checker: RPS	Date: 1/8/02

Erik Stam

From: Daniel_M_Dan_Stenkamp@rl.gov
Sent: Thursday, November 08, 2001 8:52 AM
To: stam@vistaengr.com
Subject: RE: Summary of phone conversion regarding ventilation system heaters

This is the current condition of the heaters in question as to the best of my knowledge.

Dan

-----Original Message-----
From: Erik Stam [mailto:stam@vistaengr.com]
Sent: Thursday, November 08, 2001 8:45 AM
To: Daniel_M_Dan_Stenkamp@RL.gov
Subject: Summary of phone conversion regarding ventilation system heaters

Dan:

Thank you for your input on the primary ventilation system heaters at the AN, AP, and AW farms.

To summarize our conversion,

The heaters at the AP farm are controlled by a manual "on/off" switch.

The heaters at the AW farm are controlled by automatic thermostats. These thermostats are set to provide a minimum 10°F delta across the temperature sensors.

In addition, one of the AW heaters is currently not working. However, a work package is being prepared to replace/repair this heater.

The heater at AN farm is controlled by a manually adjusted thermostat.

If you would send a response confirm the above statements, it will help my ALARACT evaluation.

Thanks.

Erik Stam
Vista Engineering Tech.
Tel: 373-1377

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VISTA ENGINEERING TECHNOLOGIES, L.L.C. Attachment 5	Calc. #: VET-1084-001 Rev: 0 Page: 5 of 7	
Design Calculation Title: Affects of Saltwell Waste Transfers on the DST Ventilation System Emission Control Technologies	**Originator:** E. Stam	**Date:** 12/31/01
Project No. & Title: VET-1084, DST Ventilation ALARACT	**Checker:** RPS	**Date:** 1/8/02

Erik Stam

From: Kathleen_S_Tollefson@rl.gov
Sent: *Thursday, December 13, 2001 12:02 PM*
To: Jeffrey_J_Luke@rl.gov; Gary_M_Crummel@rl.gov; STAM@vistaengr.com
Cc: Kathleen_S_Tollefson@rl.gov
Subject: FW: Comments on Alaract demo for AN/AP/AW primary vent systems

Could you two take these comments with you when you meet with Eric.
> -----Original Message-----
> From: Scott, Delmer Jr
> Sent: Thursday, December 13, 2001 10:24 AM
> To: Tollefson, Kathleen S
> Cc: Miller, Phillip C (Phil)
> Subject: Comments on Alaract demo for AN/AP/AW primary vent systems
>
> Kathy-
> 1. Where is the description of the alaract controls? This appeared to
> be an in depth engineering study with recommendations but no hard controls
> described upfront.
> 2. page three, third paragraph. Please add statement that not all of
> the inlet filters for AN/AW are on line at any one time. We must ensure
> that doesn't become a "requirement".
> 3. page three, fourth paragraph. Description of the AP primary heater
> controller is incorrect. Indeed, there is an on/off switch but that is
> just for power on. When the power is on, the heater is controlled via
> pressure switches that show flow. Switch closed due to fan being on,
> heater is on. Switch open due to fan being off, heater is off. When the
> heater is on, it fluctuates between a high temp setpoint and a low
> setpoint. Please change description. contact Randy Swift in DST electrical
> shop for further help.
> 4. page fifteen, under recommendations. Obviously rethink the
> recommendation with AP against the accurate description in #3 above.
> Further, AN farm will not directly receive saltwell transfers due to the
> failure of SN247. Rather, the only fluid going into An may be cross site
> transfers but not until 2003 or 2004. AND... 314 will have new HVAC units
> in place in An farm prior to receipt of cross site transfers, deleting the
> requirement for recommendation #2, second paragraph.
>
> questions, just call...
>
>
> del scott
> 3-5480/85-3095/531-7909

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VISTA ENGINEERING TECHNOLOGIES, L.L.C. Attachment 5	Calc. #: VET-1084-001 Rev: 0 Page: 6 of 7	
Design Calculation Title: Affects of Saltwell Waste Transfers on the DST Ventilation System Emission Control Technologies	**Originator:** E. Stam	**Date:** 12/31/01
Project No. & Title: VET-1084, DST Ventilation ALARACT	**Checker:** RPS	**Date:** 1/8/02

Erik Stam

From: Robert_D_Gustavson@rl.gov
Sent: Friday, December 28, 2001 11:03 AM
To: stam@vistaengr.com
Subject: FW: Relative Humidity in SY-102

> -----Original Message-----
> From: Reynolds, Daniel A
> Sent: Thursday, March 15, 2001 1:02 PM
> To: Kirch, Nicholas W (Nick); Knight, Mark A; Anderson, Kenneth J;
> Gustavson, Robert D; Dalpiaz, Edwin L
> Subject: Relative Humidity in SY-102
>
> Under winter conditions the exhaust of SY-102 is at 100% relative
> humidity.
>
> I looked at two time periods when no transfers were being made in SY-102.
> These time periods were Jan 5 to 15 and Feb 9 to 15. The average
> evaporation rate was a little over -.02 inches per day or about 500 lbs of
> water per day.
>
> The dome space is 81 F and the vent flow used was 230 cfm. The
> psychrometric chart shows that at 81 F and 100% RH, the specific volume is
> about 14 ft3 per lb of air. Therefore, the flow rate is about 24,000 lbs
> air per day.
>
> 500 lb water in 24,000 lb air is an absolute humidity of 0.023 lb water/lb
> air. The psychrometric chart shows that, at 81 F and 0.023 lb/lb, the
> relative humidity is 100% within accuracy of the data.
>
> The finer calculations are on MathCad. If I can be of further help, please
> contact me.
>
> Dan Reynolds

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VISTA ENGINEERING TECHNOLOGIES, L.L.C. Attachment 5		Calc. #: VET-1084-001 Rev: 0 Page: 7 of 7
Design Calculation Title: Affects of Saltwell Waste Transfers on the DST Ventilation System Emission Control Technologies	**Originator:** E. Stam	**Date:** 12/31/01
Project No. & Title: VET-1084, DST Ventilation ALARACT	**Checker:** RPS	**Date:** 1/8/02

Page 1 of 1

Erik Stam

From: Terry_D_Kaiser@rl.gov

Sent: Monday, December 31, 2001 7:56 AM

To: stam@vistaengr.com; Robert_D_Gustavson@rl.gov; Gary_M_Crummel@rl.gov; Kathleen_S_Tollefson@rl.gov; James_R_Kriskovich@rl.gov; Jeffrey_J_Luke@rl.gov

Cc: Terry_D_Kaiser@rl.gov; Roger_D_Rick_Freeman@rl.gov; William_E_Willingham@rl.gov

Subject: RE: Status of ALARACT and K1-A exhauster

The K1A is insulated

Terry Kaiser
SST System Engineering

-----Original Message-----
From: Erik Stam [mailto:stam@vistaengr.com]
Sent: Sunday, December 30, 2001 5:12 PM
To: Robert_D_Gustavson@rl.gov; Gary_M_Crummel@rl.gov; Kathleen_S_Tollefson@rl.gov; James_R_Kriskovich@rl.gov; Jeffrey_J_Luke@rl.gov
Cc: Terry_D_Kaiser@rl.gov; Roger_D_Rick_Freeman@rl.gov; William_E_Willingham@rl.gov
Subject: Status of ALARACT and K1-A exhauster

Terry, Rick, Bob or Will:

Can you please confirm for me that the stack on the K1-A exhauster **is or is-not** insulated? The drawings are not clear on this subject (and I need an email reference).

I have updated the calculation. The calculation now addresses the K1-A exhauster and SY farm data! (I still need to "clean-up" the calc (i.e. update the assumptions, references, conclusions and add SY farm data to attachments)).

The K1-A demister will handle the aerosol mass loading from saltwell transfers. In addition, I calculate that the heater will prevent condensation in the filter housing (using my very conservative methods).

A big thanks to Terry, Bob and Gary for their help in getting information on the K1-A system for me.

I will finish the calc tomorrow and revise the ALARACT write-up to reflect the changes.

I will proceed forward with the updates for the K1-A system. If time remains, I will address the P28 system (as we discussed).

Erik Stam
Vista Engineering

Tel: 737-1377
Fax: 737-1383

This document was too large to scan as a single document. It has been divided into smaller sections.

SECTION 2

Document Information			
Document #	**RPP-9782**	**Revision**	**0**
Title	**ALARACT DEMONSTRATION FOR THE PRIMARY VENTILATION SYS AT THE DST TANK FARMS FOR THE INTERIM STABILIZATION PROJECT (SALTWELL PUMPING)**		
Date	**01/08/02**		
Originator	**EC STAM**	**Originator Co.**	**VISTA**
Recipient		**Recipient Co.**	
References	**EDT-633307**		
Keywords			
Projects			
Other Information	ATT 2 - ASME AG-1 Sec A-A Compliance Matrix ATT 3 - ASME AG-1 Sec BA Compliance Matrix ATT 4 - ASME AG-1 Sec DA, Compliance matrix ATT 5 - " " " SA " " ATT 6 - " " " HA " " ATT 7 - " " " RA " " ATT 8 - " " " CA " "		

Attachment 2

ASME AG-1 Section AA

Compliance Matrix

Rqmt No./Ops. Step	Division I – General Requirements Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
	SECTION AA: Common Articles	AA					
	Applicability: This code provides minimum requirements for the performance, design, construction, acceptance testing, and quality assurance of equipment used as components in nuclear safety-related air and gas treatment systems in nuclear facilities. This code is to assure that equipment used in nuclear facilities for nuclear safety-related air and gas treatment systems is acceptable in all aspects of performance, design, construction, and testing. This code applies only to individual components in a system. It does not cover any functional system design requirements or sizing of complete systems, or any operating characteristics of these systems. The responsibility for meeting each requirement of this code shall be assigned to the owner or assigned designee.	AA-1100 AA-1110 AA-1120					
	MATERIALS	AA-3000					
1 (D,P)	General: Each section of this Code delineates material requirements applicable to that section. In addition, the materials listed in Section III of the ASME Boiler Pressure Vessel Code (hereafter referred to as the ASME Code) are acceptable materials. The ASME or ASTM numbers for acceptable materials designate a chemical composition and a material thickness limit. A grade designation is usually required to determine the minimum strength of the material. If the specific *grade material has an assigned minimum yield and tensile strength*, these values shall be used for design purposes. If values have not been established and assigned, then tests in accordance with the procedures outlined in ASTM A 370 shall be performed to obtain these values. Results of mill certified tests performed as above designating these values shall be calculated by the procedures in AA-4000.	AA-3000	See "Materials" sub-sections in each section of AG-1 for compliance to this requirement.	NA	NA	NA	NA
	STRUCTURAL DESIGN	AA-4000					
2 (D)	General: This article contains the minimum requirements for design of equipment for which this Code is applicable.	AA-4100	See the following section for compliance to the requirements for structural design.	NA	NA	NA	NA

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Rqmt No./Ops. Step	Division I – General Requirements Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
3 (D)	Environmental Qualifications: Electrical equipment shall be qualified to meet the environmental conditions specified for the equipment in Divisions II and III of this Code.	AA-4110	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
4 (D)	Design Criteria: This Sub-article contains the load, stress, deflection, and other criteria for the design of equipment. Verification of equipment design shall be based on calculations or tests, or a combination of both.	AA-4220	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
5 (D)	Load Criteria: All loads as specified in the Design Specification or the applicable equipment section of this Code shall be taken in account in designing equipment and shall include, but not be limited to, the loads listed in AA-4211.	AA-4210	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
6 (D)	Loads: Additional dynamic loads (ADL), constraint of free end displacement loads (T), dead weight (DW), design pressure differential (DPD), design wind (W), external loads (EL), fluid momentum loads (FML), live load (L), normal loads (N), normal operating pressure differential (NOPD), seismic load – operating basis earthquake (OBE) or safe shutdown earthquake (SSE), system operational pressure transient (SOPT).	AA-4211	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
7 (D)	Load Combinations: The load combinations to be considered for equipment design are given in Table AA-4212.	AA-4212	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No./Ops. Step	Division I – General Requirements Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key)			
				AN	AP	AW	SY
8 (D)	Service Conditions: The equipment Design Specification or the applicable equipment section of this Code shall identify the loads and shall designate the appropriate design and service limits for design of equipment systems. The design and service loads shall be established considering all plant and system operating conditions anticipated or postulated to occur during the intended service life of the equipment systems.	AA-4213	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
9 (D)	Stress Limits: The maximum normal stress limits for the service levels defined in AA-4212 are stipulated in AA-4320 and AA-4330.	AA-4221	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
10 (D)	Deflection Limits: *The maximum deflection $d_{max.}$, including all equipment tolerances,* that may be sustained so that equipment function is not impaired shall be determined.	AA-4231	This requirement could not be verified by a *review of the documentation that was* available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
11 (D)	Vibration Isolation: Types of vibration isolation devices and their efficiencies shall be as specified in the equipment Design Specification or the applicable equipment section of this code. Vibration isolation devices shall be designed with adequate restraints to resist the loads generated under any service level.	AA-4241	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
12 (D)	Provisions for Relative Movement: Consideration shall be given to the relative motion between equipment systems and their supporting elements, as this will affect ability to function. When clearances or travel ranges, or both, are required to accommodate movements of equipment systems and their supporting elements, sufficient design margins shall be *introduced to allow for fabrication and installation tolerances.*	AA-4242	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system *complied with this requirement completely.*	DR	DR	DR	CC

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Rqmt No./Ops. Step	Division I – General Requirements Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
13 (D)	Structural Attachments: Structural attachments may be of either the integral or non-integral type.	AA-4243	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	DESIGN OF EQUIPMENT SYSTEMS AND THEIR SUPPORTING ELEMENTS	AA-4300					
14 (D)	The design shall be such that the allowable stresses will not exceed the limits given in this Subarticle. Design stress values S, yield strength S_y, and ultimate strength S_u, are given in AA-3000 references. These values form the basis for determining allowable stress, depending on analysis type.	AA-4311.1	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
15 (D)	For self-limiting loads under Service Level D, localized material yielding is permitted, provided that yielding does not form a mechanism that would result in collapse of the structure.	AA-4311.2	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
16 (D)	For configurations where compressive stresses occur, critical buckling shall be considered.	AA-4311.3	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	BASIS FOR DETERMINING STRESSES IN DESIGN BY ANALYSIS	AA-4312					

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Rqmt No./Ops. Step	Division I – General Requirements *Requirement Text*	Rqmt Source / Sec #	*Rqmt Compliance*	Status Indicators: (See Legend for Key) AN	AP	AW	SY
17 (D)	Plate and Shell Type Components-Analysis Procedures: The analysis procedures for plate- and shell-type systems shall be in accordance with the rules of AA-4320. Consideration shall be given to the governing mode of failure. Several analyses that might include, but are not necessarily limited to, the following my be required to determine the limiting case: (a) elastic analysis based on maximum stress theory; (b) elastic analysis based on maximum deflection; (c) elastic analysis based on allowable buckling stress (see AA-4323).	AA-4312.1	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
18 (D)	*Linear Type Systems and Supports-Analysis Procedures:* Elastic analysis based on maximum stress theory in accordance with the rules of AA-4330 shall be used for the design of linear-type systems.	AA-4312.2	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
19 (D)	Applicability of Mathematical Analysis: The design procedure that may be used shall be either analysis or test, or a combination, and is dependent upon the nature of the structural system under consideration. The choice shall be based on the practicality of the method for the type, size, shape, and complexity of the equipment, and the reliability of the conclusions. The analysis method is not recommended for complex equipment that cannot be modeled to correctly describe the static and dynamic structural characteristic of the equipment. Furthermore, analysis without testing may be acceptable only If structural integrity alone can assure the design intended function. If mathematical analysis is inadequate for all or part of the design verification, a suitable test program shall be implemented in accordance with the rules of AA-4350.	AA-4312.3	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	DESIGN VERIFICATION OF PLATE- AND SHELL-TYPE COMPONENTS AND THEIR SUPPORTING ELEMENTS	AA-4320					
20 (D)	Stress Analysis: *A detailed stress analysis of all major structural plate and shell-type* components and their supporting elements shall be prepared in sufficient detail to show that each of the stress limitations of Table AA-4321 is satisfied when the component and its supporting elements are subjected to the load combinations of AA-412.	AA-4321	This requirement could not be verified by a *review of the documentation that was* available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	STRESS LIMITS	AA-4322					

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Rqmt No./Ops. Step	Division I -- General Requirements Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
21 (D)	Design Loads: The maximum normal stress limits are satisfied for the design loading combinations as stipulated in AA-4212, or as stated in the equipment Design Specification if the requirements of Eq. (1) and (2) are met. $\sigma_1 \leq 1.0S$ (1) $\sigma_1 + \sigma_2 \leq 1.5S$ (2) where S = design stress value from AA 3000 references, σ_1 = membrane stress, σ_2 = bending stress.	AA-4322.1	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
22 (D)	Service Loads: The maximum normal stress limits for Service Levels A through D are as stipulated below. (a) Level A service limits are satisfied for the service conditions of AA-4214.2(a) for which these limits are designated in the equipment Design Specification if the requirements of Eqs. (1) and (2) are met. (b) Level B service limits are satisfied for the service conditions of AA-4214.2(b) for which these limits are designated in the equipment Design Specification if the requirements of Eqs. (1) and (2) are met. (c) Level C service limits are satisfied for the service conditions of AA-4214.2(c) for which these limits are designated in the equipment Design Specification if the requirements of Eqs. (1) and (2) are not exceeded by more than 20%. (d) Level D service limits are satisfied for the service conditions of AA-4214.2(d) for which these limits are designated in the equipment Design Specification if the requirements of Eqs. (3) and (4) are met. $\sigma_1 \leq$ lesser of $1.5S$ or $0.4\ S_u$ (3) $\sigma_1 + \sigma_2 \leq$ lesser of $2.25S$ or $0.6\ S_u$ (4) where S_u = specified minimum ultimate tensile strength.	AA-4322.2	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No./Ops. Step	Division I – General Requirements *Requirement Text*	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
23 (D)	Buckling and Stress Limits Set by Buckling Stress Criteria: The allowable deflection due to compressive loads shall be limited to prevent post-buckling failure in the plate. Buckling stresses shall be verified against Service Level D allowable values of Table AA-4332.	AA-4323	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
24 (D)	Local Yielding and Buckling: The maximum stress for the load carrying capacity of plates shall be based on the post-buckling behavior of the plate. (a) When buckling governs, deflections shall be computed based on effective width concept. (b) When local yielding governs, deflections shall be computed based on the average or reduced section.	AA-4323.1	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
25 (D)	Lateral Buckling: Critical lateral buckling stresses shall be computed-based moment resisting capacity.	AA-4323.2	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
26 (D)	Flexural Buckling: Maximum stresses shall be computed based on stability considerations.	AA-4323.3	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
27 (D)	Torsional Buckling: Maximum shear stresses shall be computed based on the torsional capacity of the section.	AA-4323.4	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	DESIGN VERIFICATION OF LINEAR-TYPE SYSTEMS BY ANALYSIS	AA-4330					

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Rqmt No./Ops. Step	Division I – General Requirements Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
28 (D)	Stress Analysis: A detailed stress analysis of all major linear-type equipment shall be prepared n sufficient detail to show that each of the stress limitations of AA-4332 is satisfied when the equipment is satisfied when the equipment is subjected to the load combinations of AA-4212.	AA-4331	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
29 (D)	Design Level A and B Limits: Design Level A and Level B limits are identical and are given in the ASME Code, Section III, Appendix XVII. The allowable stress for the combined mechanical loads and effects that result from constraint of free end displacements (see AA-4313.6) but not thermal or peak stresses, shall be limited to three times the stress limits of the ASME Code, Section III, Appendix XVII, XVII-2000.	AA-4332.1	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
30 (D)	Level C Limits: The stress values for Level C limits may be increased by 50% over the values given in the ASME Code, Section III, Appendix XVII, XVII-2000. Constrained free end displacement and differential support motion effects need not be considered. Primary stresses shall not exceed 0.67 times the critical buckling strength of the primary framing system. In such analysis, local instabilities, such as compression, flange, and web buckling shall be evaluated.	AA-4332.2	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
31 (D)	Level D Limits: If the equipment Design Specification specifies service loads for which level D limits are designated, the following rules shall be used in evaluating them independently of all other design and service loadings. (a) The allowable stresses in the ASME Code, Section III, Appendix XVII, XVII-2000, may be increased by a factor of 1.2 (S_y/F_t), but not to exceed a factor of 0.7 (S_u/F_t), where S_y is the specified minimum yield strength of the material, F_t is the allowable tensile stress, and S_u is the ultimate tensile stress. (b) Primary stresses shall not exceed 0.67 times the critical buckling strength of the primary framing system. Local instabilities such as compression, flange, and web buckling shall be evaluated. *Overall buckling in compression members shall also be* evaluated.	AA-4332.3	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	FUNCTIONABILITY REQUIREMENTS	AA-4340					

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Rqmt No./Ops. Step	Division I – General Requirements Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
32 (D)	Functionability of Mechanical Systems: The methods of AA-4341.2, AA-4341.2, or AA-4341.2 shall be used to assure operability of mechanical systems and their supporting elements.	AA-4341	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
33 (D)	The Service Levels C and D stress limits of AA-4322 and AA-4332 shall be reduced to the Levels B and C limits, respectively.	AA-4341.1	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
34 (D)	The deflections at all critical locations shall be calculated and assured to be within the allowable values in AA-4230. These critical locations shall be given in the applicable equipment section of this Code or by the equipment Design Specification, or by both. For equipment where buckling is of concern, deflection checks shall be performed for he component or support load condition as specified in AA-4323.	AA-4341.2	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
35 (D)	The functionability of the equipment shall be verified experimentally.	AA-4341.3	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
36 (D)	Functionability of Electrical Systems: Operability of electrical systems and their supporting elements shall be assured using the method outlined in AA-4350.	AA-4342	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	DESIGN VERIFICATION BY TESTING	AA-4350					

Best Available Image

Rqmt No./Ops. Step	Division I – General Requirements *Requirement Text*	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key)			
				AN	AP	AW	SY
37 (D,T)	General: Design verification by testing shall be in accordance with the rules of this Subarticle. Seismic tests are to be performed by subjecting the equipment to vibratory motion that conservatively simulates that postulated at the equipment mounting during the OBE and an SSE. Other loads that may occur concurrently with the seismic event shall be accounted for (see AA-4212). The rules of this Subarticle are consistent with and complementary to ANSI/IEEE 344.	AA-4351	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
38 (D,T)	Equipment Mounting: The equipment to be tested shall be mounted on the test machine in *a manner that simulates the intended service mounting. The* mounting method shall be the same as that recommended for actual service, which includes the recommended bolt size and configuration, weld pattern, and type. The effect of all attached hardware such as electrical connections, conduit, sensing lines, piping, and ductwork shall be considered. The method of mounting the equipment to the *test machine shall be documented and shall include a description of* any interposing fixtures and connections. Effect of such fixtures and connections shall be evaluated if they are only used during qualification and not for in-service mounting. Equipment orientation shall be along the major and minor axes for each test condition unless specified otherwise by the equipment Design Specification or the applicable equipment section of this Code.	AA-4351.1	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
39 (D,T)	Equipment Monitoring: Sufficient monitoring equipment shall be used to evaluate the performance of the safety function of the equipment before, during, and after the test. In addition, sufficient vibration monitoring equipment shall be used to allow determination of the applied vibration levels. In addition to the monitoring of the test machine, as many points of the equipment shall be monitored as needed to provide information that shall be used in evaluating the test results.	AA-4351.2	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No./Ops. Step	Division I – General Requirements Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key)			
				AN	AP	AW	SY
40 (D,T)	Exploratory Tests: Exploratory vibration tests required for all qualification tests except multiple frequency tests (see AA-4356) shall be run on equipment to aid in the determination of the test method that will best qualify or determine the dynamic characteristics of the equipment. As per AA-4352, the type of test required to qualify equipment for various applications shall be dependent on the mature and dynamic characteristics of the equipment and the required response spectrum (RRS). If it can be shown that the equipment is not in resonance at any frequency within the frequency range of interest, it shall be considered to act as a rigid body and analyzed or tested accordingly. If there are resonances, one of the various methods of AA-4352 or other justifiable methods shall be used. The exploratory test shall be in the form of a low level (the level shall be chosen to give a usable signal to noise ratio on the vibration sensing equipment) continuous sinusoidal sweep at a rate no greater than 2 octaves per minute over *the frequency range equal to or greater than that to which the* equipment is to be qualified. If the configuration of the equipment is such that critical natural frequencies cannot be ascertained due to either the complexity of the equipment or the inaccessibility of critical parts, the exploratory test is not adequate. If the configuration of the equipment is such that critical natural frequencies cannot be ascertained, seismic qualification shall be accomplished by proof testing with a random input motion that shall generate a test response spectrum (TRS) to envelop the RRS. An acceptable alternative shall be to qualify the equipment by a fragility test as described in AA-4351.7…	AA-4351.3	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
41 (D,T)	Seismic Qualification Tests: Seismic qualification tests designed to show acceptable performance of equipment during and following an SSE shall be preceded by one or more OBE tests. The number of OBE tests shall be given in the equipment Design Specification and shall be followed by one SSE test. Each minimum test duration shall be given in the equipment Design Specification.	AA-4351.4	Seismic Qualification Tests are not applicable to these systems.	NA	NA	NA	NA
42 (D,T)	Equipment Loads During Testing: *Seismic qualification tests of equipment shall be performed with the* equipment subjected to the combined loads identified in AA-4212. These loads shall be simulated and shown to be equal to or greater than those expected. If any load is not included during these tests, justification for the absence of the load shall be provided.	AA-4351.5	Seismic Qualification Tests are not applicable to these systems.	NA	NA	NA	NA

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Rqmt No./Ops. Step	Division I – General Requirements *Requirement Text*	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
43 (D,T)	Proof Testing: Proof testing is used to qualify the equipment for a particular application or to a particular requirement. A proof test requires that the equipment be subjected to one of the tests described in AA-4352 to the particular response spectrum or time history defined for the mounting location of the equipment. A proof test requires that the equipment be subjected to one of the tests described in AA-4352 to the particular response spectrum or time history defined for the mounting location of the equipment. An attempt to determine the failure threshold of the equipment need not be made. The equipment shall be tested to the performance requirement of the equipment Design Specification and need not be tested to its ultimate capability.	AA-4351.6	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
44 (D,T)	Fragility Testing: Fragility testing shall be used to qualify the equipment by determining its ultimate capability for performing its safety function. Equipment fragility shall be demonstrated by using sine beat, continuous sine, transient, or multi-frequency excitation to random-type waveforms. A measurement of the equipment's fragility level for a particular excitation demonstrates its ultimate capability to perform its safety function while subject to that motion.	AA-4351.7	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
45 (D,T)	Device Testing: Devices shall be tested under simulated operating conditions to either the levels dictated by expected service requirements or to their ultimate capability. The devices shall be mounted on the shake table in a manner that dynamically simulates the in-service mounting conditions. If a device is intended to be mounted on a panel, the panel shall be included in the test setup, or the response at the device mounting location shall be monitored in the assembly test, (see AA-4351.9) in which case, the device shall be mounted directly to the shake table, if the in-service excitation can be simulated. Devices shall be tested using the methods described in AA-4352.	AA-4351.8	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No./Ops. Step	Division I – General Requirements Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
46 (D,T)	Assembly Testing: Large complex assemblies shall be tested under simulated operating conditions and monitored for proper functional performance; however, it may not always be practical to simulate all system simultaneously. It is acceptable, therefore, to test such equipment in an inoperative mode with the actual or simulated devices installed, including any nonsafety-related devices. The test shall determine the vibration response at the device location by either direct measurement at full excitation or by determination of the transfer function from the assembly mounting points to the device mounting point. The resulting vibration response of the device at its location in the assembly shall be less than the vibration to which the device is qualified. The test methods described in AA-4352 shall be used.	AA-4351.9	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
47 (D,T)	Test Methods: Present test methods fall into two major categories: proof testing (AA-4351.6) and fragility testing (AA-4351.7). The choice of method will depend upon the nature of the equipment and the expected vibration environment. Consideration shall be given to the choice of single axis or multiple axis testing as described in AA-4358. A proof test seismic simulation waveform shall: (a) produce a test response spectrum (TRS) that closely envelops the RRS or the applicable portions thereof, using single or multiple frequency input motion; (b) have a peak amplitude equal to or greater than the zero period acceleration (ZPA) of the required response spectrum (RRS); (c) have a test duration in accordance with the requirements of AA-4357.	AA-4352	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
48 (D,T)	Artificial Broadening Required Response Spectra: If single frequency tests are to be conducted to artificially broadened response spectra, test shall be conducted at frequency intervals on either side of the center frequency of the response spectra. If the center frequency in the broadened area is f_c, testing shall be conducted at this frequency and also at the frequencies f_c +/- Δf_c … where Δf_c corresponds to a 1/6 to 1/3 octave interval, until the entire broadened area has been covered. The TRS generated during each individual test shall have at least the same amplitude as the original narrow-band response spectrum.	AA-4353	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

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49 (D,T)	Damping Selection: The damping value used in analyzing the test machine motions that generate the TRS shall be the same damping value as that of the RRS.	AA-4354	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
50 (D,T)	Single Frequency Tests: If it can be shown that the equipment has no resonances, only one resonance, or distinct resonances which are widely spaced such that the resonance interaction does not reduce the fragility level, single frequency testing may be used to qualify the equipment.	AA-4355	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
51 (D,T)	Derivation of Test Input Motion: For any input waveform, the shake table motion shall produce a TRS acceleration at the test frequency that is at least equal to that given by the RRS. Additionally, the input motion shall be adjusted to produce a TRS that envelops the RRS at all frequencies, as described in AA-4353. Also, the maximum acceleration of the shake table motion shall be at least equal to the ZPA value of the RRS.	AA-4355.1	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
52 (D,T)	Continuous Sine Test: A test at any frequency shall consist of the application of a continuous sinusoidal motion corresponding to the maximum acceleration to which the equipment is to be qualified for the appropriate duration (see AA 4357). The selection of the peak input acceleration and the length of time the test is to be run shall produce at least the maximum response acceleration given in AA-4355.1. The peak input acceleration must be at least equal to the ZPA of the RRS, except at low frequencies where the RRS is below the ZPA for which the value of the RRS must be met (see AA-4358 for requirements on the axial relationships for the test).	AA-4355.2	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No./Ops. Step	Division I – General Requirements Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key)			
				AN	AP	AW	SY
53 (D,T)	Sine Beat Test: A test at any frequency shall consist of the application of sine beats of peak acceleration corresponding to that for which the equipment is to be qualified. The sine beats consist of a sinusoid at the frequency and amplitude of interest, as shown in Fig. AA-4355.3. The number of cycles per beat and the peak amplitude of the beat are chosen in accordance with the criteria of AA-4355.1. The peak amplitude of the beat must be at least equal to the ZPA of the RRS, except at low frequencies where the RRS is below the ZPA for which the value of the RRS must be met. For a test at any frequency, a series of beats are used to represent low cycle fatigue effects, with a sufficient pause between the bets so that there is no significant superposition of equipment response motion (see AA-4358 for requirements on the axial relationships for the test).	AA-4355.3	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
54 (D,T)	Decaying Sine Test: A test at any frequency shall consist of decaying sinusoids of peak acceleration corresponding to that for which the equipment is to be qualified. The decaying sinusoids consist of a single frequency of exponentially decaying amplitude, as shown in Fig. AA-4355.4. The peak amplitude and decay rate are chosen to obtain a TRS from the shake table motion that envelops the RRS (see AA-4355.1). The peak amplitude of the sinusoid shall at least be equal to the ZPA of the RRS, except at low frequencies where the RRS is below the ZPA for which the value of the RRS must be met. For a test at any frequency, a series of decaying sinusoids are used with a sufficient pause between the sinusoids so that there is no significant superposition of equipment response motion. The frequencies of interest are the natural frequencies of the equipment being tested (see AA-4358 for requirements on the axial relationships for the test).	AA-4355.4	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
55 (D,T)	Multiple Frequency Tests: When the seismic ground motion has not been strongly filtered, the floor motion retains the broadband characteristic. In that case multiple frequency testing shall be used for qualification. It is used as a general qualification method as long as the TRS envelopes the RRS. Specific input excitation to the test machine shall include a time history motion consisting of random and complex wave shapes. The test machine input excitation waveforms described in the following subparagraphs shall be employed to test to an RRS level. Other inputs that are not specifically referenced here may also be employed, provided that they envelope the RRS.	AA-4356	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No./Ops. Step	Division I – General Requirements Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
56 (D,T)	Derivation of Test Input Motion. For any waveform, the test machine motion must be adjusted so that the TRS envelopes the RRS over the frequency range for which the particular test is designed; and, as a minimum, the test machine acceleration must equal the ZPA of the RRS. This comparison must be made using equivalent values of damping. The adjustment of the input motion to produce an envelope spectrum shall be made considering the following factors: (a) the RRS may have motion amplification over a narrow or broad band of frequencies; (b) the input excitation waveform may be one of several multiple frequency types; (c) the equipment being tested may have one of many possible dynamic characteristics. For assemblies or devices where the dynamic response results from numerous interacting modes, the shake table input excitation must be adjusted so that the TRS envelops the RRS over a frequency range that includes all natural frequencies of the equipment up to the ZPA.	AA-4356.1	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
57 (D,T)	Time History Test. A test may be performed by applying to the equipment a specified time history that has been synthesized to simulate the required input to the equipment. It shall be demonstrated that the actual test machine motion was equal to or greater than the required motion. A time history record may be synthesized to match the RRS using simulation techniques. The duration of the input excitation must be sufficient to simulate the effects of a seismic event. Alternatively, the equipment Design Specification may contain time history data for use in testing.	AA-4356.2	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
58 (D,T)	Random Motion Test. A test shall be performed by applying to the equipment random excitation, the amplitude of which is controlled in 1/3 octave, or narrower, frequency bandwidth filters with individual output gain controls. The excitation shall be controlled to provide a TRS that equals or exceeds the RRS. The peak value of the input excitation shall equal or exceed the ZPA of the RRS. The duration of the random excitation shall be as described in AA-4357.	AA-4356.3	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No./Ops. Step	Division I – General Requirements Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key)			
				AN	AP	AW	SY
59 (D,T)	Random Motion With Sine Beat Test. To meet an RRS that includes a moderately high peak random excitation, it is acceptable to adjust the random input, as described in AA-4356.3, to equal or exceed as much of the RRS as possible without using a peak input acceleration substantially greater than the ZPA. A sine beat or beats shall be superimposed with random input motion to provide a composite excitation, so that the TRS equals or exceeds the entire RRS over a frequency range that includes the natural frequencies of the equipment up to the ZPA frequency [see Fig. AA-4356.4(a)]. The optimum number of oscillations per beat shall be determined from a plot showing the ratio between the 1/2% and 5% spectrum damping values and the oscillations per beat, as shown in Fig. AA-4356.4(b). When more than one frequency of sine beats is required to meet the bandwidth of a spectrum, the beats shall be initiated simultaneously. However, if the bandwidth of the peak value of the RRS has been widened to account for uncertainty due to *building frequency analysis, the beats shall be applied in sequence or* the techniques of AA-4353 shall be applied.	AA-4356.4	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
60 (D,T)	Complex Wave Test. This Test may be performed by subjecting the equipment to a motion that has been generated by summing a group of sine beats or decaying sinusoids. The frequencies of the component signals shall be spaced at 1/3 octave or narrower frequency intervals to cover the range required by the RRS. The decaying sinusoids shall have individual decay rate controls covering the range of 1/2% to 10%. Each frequency must have individual amplitude and phase controls. All frequencies shall be initiated simultaneously with the phase controls set to shape the peak amplitude of the composite waveform. The decay rate shall be varied, and the amplitude of each frequency shall be varied to optimize the fit of the TRS to the RRS. The peak acceleration of the test table during composite waveform excitation shall be greater than or equal to the ZPA of the RRS. The test shall consist of several applications of the motion spaced apart in time so that no significant superposition of response motion occurs. The number of applications of the motion must be justified as being representative of the strong motion portion of the SSE. The number of application shall be such that the total duration of the middle-frequency components equals the duration of the SSE (see AA-4357).	AA-4356.5	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No./Ops. Step	Division I – General Requirements Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key)			
				AN	AP	AW	SY
61 (D,T)	Other Tests. The following factors shall be considered to justify the test method employed to qualify equipment: (a) band width of the RRS compared to that of the TRS and equipment characteristics and responses; (b) duration of the test compared to the defined seismic event; (c) peak acceleration of the test input and the amplification observed; (d) natural modes and frequencies of vibration of the equipment; (e) typical damping of the equipment; (f) fragility levels; and (g) total number of cycles and the simulation of fatigue failure.	AA-4356.6	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
62 (D,T)	Test Duration: The number of required OBE events per 40-year plant life shall be a minimum of five unless stated otherwise in the equipment Design Specification. The number of tests run as proof tests (see AA-4351.6) shall have an *appropriate input level to fulfill the requirements of* AA-4351.4. *The* OBE tests shall be followed by at least one SSE test. The duration of each test shall at least equal the strong motion portion of the original time history used to obtain the RRS for the SSE and shall be a minimum of 30 sec for a multi-frequency test, and a minimum of 15 sec for a single frequency test. Credit may be taken for any test preceding the SSE test if it is shown to be greater than or equal in severity to the required OBEs. Fragility test durations shall be least equal the time duration for the strong motion portion of the SSE in order to properly account for vibration buildup.	AA-4357	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are *considered acceptable as-is. SY system* complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No./Ops. Step	Division I – General Requirements Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
63 (D,T)	Single and Multi-axis Tests: Single axis tests are permitted if the tests are designed to reflect conservatively the seismic event at the equipment mounting locations, or if the equipment being tested can be shown to respond independently in each of the three orthogonal axes or otherwise withstand the seismic event at its mounting location. This is the case if equipment axis coupling is zero or very low. For example, if a device is normally mounted on a panel that amplifies motion in one direction, or if a device is restrained to have motion in one direction, single axis testing of the device is permitted. If the preceding considerations do not apply, multi-axis testing shall be used. The minimum is biaxial testing with simultaneous inputs in a principal horizontal axis and the vertical axis. Independent random inputs are preferred and, if used, the test shall be performed in two steps with the equipment rotated 90 deg. in the horizontal plane for the second step. If independent random inputs are not used (such as with single *frequency tests), four tests shall be run. First, with the inputs in* phase; second, with one input 180 deg. out of phase; third, with the equipment rotated 90 deg. horizontally and the inputs in phase; and fourth, with the same equipment orientation as in the third step but with one input 180 deg. out of phase.	AA-4358	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
64 (D)	Design of Bolts: The number and cross-sectional area of bolts required for the load combinations of AA-4212 shall be determined in accordance with the ASME Code, Section III, Appendix XVII, Bolted joint design shall be in accordance with Appendix XVII, XVII-2460.	AA-4360	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	DOCUMENTATION REQIUREMENTS	AA-4400					
65 (D,QA)	General: The equipment design verification shall be documented by a certified Design Verification Report (DVR), in accordance with the rules given in this Section. This document may be based on one of three types of verification, or a combination of these: (a) design verification stress report; *(b) design verification test report; or* (c) design verification by comparative evaluation. Factors considered in choosing a particular type of design verification shall be included in the DVR.	AA-4400	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system *complied with this requirement completely.*	DR	DR	DR	CC

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Rqmt No./Ops. Step	Division I – General Requirements Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
66 (D,QA)	Certification of Design Verification: A Certificate of Design Verification shall be provided with the DVR. This Certificate shall include: (a) description and identification of equipment covered by the DVR, including the name of the plant, the plant location, the Owner, location of the equipment in the plant, and its function; (b) statement of compliance with AA-4000 and the equipment Design Specification requirements; (c) date, revision, and report identification number of the analysis or test program; and (d) names and signatures of responsible persons performing, reviewing, and approving the design verification.	AA-4410	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
67 (D)	Equipment Description: The DVR shall include a detailed description of the equipment being qualified. Outline drawings showing equipment interface points, anchor locations, weights, and locations of major components shall be included. In addition, plant specific information such as building location and elevation shall be reported if appropriate. Any appropriate tag numbers and equipment model numbers, where applicable, shall be included.	AA-4420	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	SAFETY RELATED FEATURES	AA-4430					
68 (D)	Safety Related Functions: Equipment safety-related functions in all modes of operation shall be fully described in the DVR.	AA-4431	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
69 (D)	Critical Components: All components critical to the performance of the safety-related functions of the equipment shall be identified in the DVR.	AA-4432	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No./Ops. Step	Division I -- General Requirements Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
70 (D)	Failure Modes and Evaluation Criteria: For all critical components listed, the potential failure modes being considered in the design shall be described in the DVR. In addition, the evaluation criteria used to verify that the critical components will not enter a failure mode shall be defined in the DVR.	AA-4433	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	REPORT CONTENT	AA-4440					
71 (D,QA)	Design Verification Report: The DVR shall address all items listed in this paragraph: (a) description of analytical method used; (b) description of mathematical model in sufficient detail to allow reconstruction of the model by referring only to the report content; (c) list of the static loads considered; (d) method of developing dynamic loadings, including: (1) *identification of response spectra and damping used;* (2) method of combining modes; (3) method of combining spatial components of dynamic loads; & (4) assurance that rigid body motions are included; (e) load combinations considered, including interface loading effects and differential movement of multiple equipment supports; (f) evidence of verification of all computer programs used; (g) *justification of methods and assumptions used for manual calculations;* (1) failure mode analysis; (2) description of significant mode shapes and natural frequencies; (3) location and value of maximum stresses; (4) location and value of maximum deformations; (5) allowable interface loads; (1) reaction data at equipment supports; these data may be reported in a summary form only if foundation loads are to be included. Otherwise, detailed listings of individual support reactions for each load case considered shall be included; (7) summary of maximum anchor bolt or anchor weld stresses compared to allowable limits.	AA-4441	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

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				AN	AP	AW	SY
72 (D,T)	Design Verification Test: The DVR shall address all items listed in this paragraph: (a) detailed test procedure used for the equipment design verification test (DVT); (b) identification of the test facility performing the test and the test dates; (c) list of test equipment used and certified calibration records for each; (d) laboratory mounting details for the equipment test and a comparison of this to inservice mounting; justification for all differences must be addressed; (e) method used to simulate significant inservice interface loads, if applicable; (f) variable to be measured during and after dynamic motion and the accuracy required for each measurement; (g) number, type, and location of each sensor used to measure *important equipment function and motion*; (h) description of vibration input to the test equipment including: (1) single or multiaxis; (2) single or multifrequency; (3) if multifrequency, type used (sine beat, random); (i) evidence that all significant modes were adequately excited; (j) evidence that, for multifrequency tests, the test response spectra (TRS) enveloped the required response spectra (RRS); (k) data showing that the safety-related functions as defined in AA-4431 were not compromised during or after the simulated dynamic loading; (l) results of measurements performed to verify equipment functionability; (m) maximum equipment response (displacement) during most violent tests; (n) maximum reactions at equipment supports (measured or calculated); (o) list of all anomalies during the DVT and the resolution of each; (p) equipment modifications made during the DVT, if any, and *justification for using test data without retesting*, or full report of any retesting accomplished; (q) summary of results of DVT and conclusions drawn.	AA-4442	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No./Ops. Step	Division I – General Requirements Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
73 (D)	Design Verification by Comparative Evaluation Report: If the equipment design being verified has been previously verified to different criteria, or if the equipment design is similar to a design previously verified, it may be acceptable to verify the current design by comparative evaluation. Whether the basis for design verification is analysis or test, all of the points required by AA-4441 or AA-4442 must be addressed. In addition, any differences between the previous design verification method and the requirements of AA-4000 must be identified and justified as conservative. Any differences in equipment design between the previously verified design and the design being considered must be shown to be conservative.	AA-4443	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	INSPECTION AND TESTING	AA-5000					
74 (I,T)	General: This Article contains general requirements for the examination, inspection, and testing of materials and equipment.	AA5110	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
75 (I,T)	Responsibility for Procedures: When an inspection or test is required by AA-5000 or by any other section, written inspection or testing procedures shall be developed by the parties performing the test or inspection subject to the specific requirements of this Code. The inspection or testing shall be performed by personnel qualified in accordance with AA-8000 and with applicable portions of the other sections.	AA-5120	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
76 (I,T,QA)	Measuring and Test Equipment: Control and calibration of Measuring and Test Equipment (M&TE) shall be in accordance with ASME NQA-1, including Supplement 12S-1.	AA-5130	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	VISUAL INSPECTION	AA-5200					

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Rqmt No./Ops. Step	Division I – General Requirements *Requirement Text*	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
77 (I)	Direct Visual Examination: Direct visual examination usually may be made when access is sufficient to place the eye within 24 in. of the surface to be inspected and at an angle not less than 30 deg. to the surface to be examined. Mirrors and magnifying lens may be used to assist inspections. The specific part, component, vessel, or section to be inspected shall be illuminated to a minimum of 15 fc (160 lx) for general inspection and to a minimum of 50 fc (540 lx) for the detection or study of small anomalies. Visual inspection personnel shall successfully pass an annual visual examination to assure natural or corrected near distance acuity so that they are capable of reading standard J-1 letters on standard Jaeger-type test charts for near vision.	AA-5221	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
78 (I)	Remote Visual Inspection: Remote visual inspection may use visual aids such as mirrors, telescopes, borescopes, fiber optics, cameras, or other instruments. Such systems shall have a resolution capability at least equivalent to that obtainable by direct visual observation.	AA-5222	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
79 (I)	Requirements: When required by the referencing Code section, visual inspections shall be performed.	AA-5230	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
80 (I,QA)	Inspection Checklist: When required by the referencing Code section, a checklist shall be used to plan visual inspections and to verify that the required observations were performed. This checklist shall establish minimum inspection requirements to be followed by the Manufacturer.	AA-5240	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No./Ops. Step	Division I – General Requirements Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
81 (I,QA)	Reports: When required by another section of this Code, a written report shall be provided and shall contain the following as a minimum: (a) the inspection procedure used, date of the inspection results, and inspector's signature; (b) identification of instruments, equipment, tools, and documents to the extent that they or their equivalents can be identified for future examinations; (c) observations and dimensional checks specified by the respective test data and reports developed during inspection and testing; (d) conclusion and recommendation by visual inspection and testing personnel; (e) reference to previous reports if this report is for re-inspection and testing.	AA-5250	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
82 (I,T)	Welded Connections: Examination, inspection, and testing of welds shall be in accordance with AA-6000 and other sections of this Code.	AA-5300	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	BOLTED CONNECTIONS	AA-5400					
83 (I)	Before Bolting: Flange seating surfaces shall be visually examined for cleanliness and acceptable surface finish. Flange faces shall be examined for compliance with tolerances for mutual parallelism and axial alignment, as will as for planarity of each flange. Gaskets shall be visually examined to assure conformance with specified dimensional tolerances and freedom from tears, breaks, or other defects.	AA-5410	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
84 (I,T)	After Bolting: Bolts in all bolted connections shall be examined to ensure bolts are in place. A uniform sampling of 25% of all bolts in a bolted connection shall be tested with a calibrated torque wrench. Torquing requirements shall be established for each bolted connection. If any bolt in the sample fails to meet torque requirements, all bolts in the connection shall be re-torqued. Gaskets in bolted connections shall be visually examined for uniform compression.	AA-5420	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No./Ops. Step	Division I – General Requirements Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
85 (I)	Fabrication Tolerances: Equipment and components shall be examined for conformance to tolerances required by this Code and by the Design Specification. Refer to other Code sections for specific requirements.	AA-5500	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
86 (T)	Pressure and Leak Testing: Pressure and leak testing of equipment and components shall be performed in accordance with the requirements of this Code. Refer to the other Code sections for specific testing requirements.	AA-5600	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
87 (T)	Performance and Functional Testing: Testing shall be performed to ensure that prototype and production equipment possess dynamic and functional characteristics that meet requirements of this Code and of the Design Specification. Among the characteristics that may be determined by testing are fluid flow rates and pressures, air filter performance, electrical quantities, bearing operation, rotor balance, and sound power level.	AA-5700	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
88 (T)	Seismic Testing: Refer to AA-4350 for the requirements of structural design verification by testing.	AA-5800	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	FABRICATION, JOINING, WELDING, BRAZING, PROTECTIVE COATING, AND INSTALLATION	AA-6000					
89 (F)	General: This Article contains general requirements for the fabrication, joining, welding, brazing, protective coating, and installation of components, parts, and equipment.	AA-6110	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No./Ops. Step	Division I – General Requirements Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
90 (D,F,P)	Material Selection: Materials to be used in the fabrication of components, parts, and appurtenances shall conform to the requirements of Article 3000 of each Code section.	AA-6121	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
91 (D,F,P)	Material Identification: Materials to be used in the fabrication of components, parts, and appurtenances shall be identified on fabrication and installation plans and specifications as required in AA-8000.	AA-6122	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
92 (F)	Repair of Material with Defects: Material with defects that are discovered or produced during the fabrication and installation processes may be used, provided the defects are repaired in accordance with the requirements of AA-8000, and for weld repairs, in accordance with AA-6300.	AA-6123	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
93 (QA,F)	Control of Fabrication and Installation Processes: Quality control procedures shall be prepared and maintained current for all fabrication and installation processes in accordance with the requirements of AA-8000.	AA-6130	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	FABRICATION PROCESSES	AA-6200					
94 (F)	Cutting, forming, and Bending: Material may be cut to shape and size by any means that does not degrade the mechanical or chemical properties of the material below the minimum specified values. The method or methods selected shall not create critical stress areas, such as less than accepted corner radii. When thermal cutting is used, consideration shall be given to preheating the material. Forming and bending of pressure retaining parts that are to meet requirements of Section III or Section VIII of the ASME Code shall conform to the applicable article or articles of the applicable section of this Code.	AA-6210	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No./Ops. Step	Division I – General Requirements Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
95 (F)	Forming Tolerances: Forming tolerances shall be defined in the Design Specification, drawings, and Manufacturer's design documents. Formed parts outside the tolerances specified after the completion of all forming, assembly, and welding operations shall be rejected. Repairs may be made to formed parts to correct unacceptable tolerances in accordance with AA-6123.	AA-6220	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
96 (F)	Fitting and Aligning: Parts that are to be assembled or joined by mechanical means (e.g., bolts) or welding shall be fitted, aligned, and when necessary, retained in position during assembly. Attachments that are welded to the component during construction, but are not incorporated into the final component, such as alignment lugs or straps, tie straps, braces, preheat equipment, and post-weld heat treatment equipment, are permitted provided the following requirements are met: (a) attachment material shall be identified by ASTM or ASME *specification number and shall be certified when required by* another Code section; (b) the temporary material is compatible for welding to the component material and the attachment and subsequent removal does not reduce the component's structural integrity below the minimum specified value; (c) the welder and welding procedure shall be in accordance with AA-6300; (d) the immediate area around the temporary attachment shall be marked in an acceptable manner so that, after attachment removal, the area can be examined in accordance with the requirements of AA-5000; (e) The temporary attachment shall be completely removed by mechanical means such as machining, shearing, clipping, or grinding, or by thermal cutting, in accordance with AA-6210.	AA-6230	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
97 (F)	Welded joints: Manufacturer's fabrication drawings shall provide complete information regarding location, type, size, and extent of all welds, Field and shop welds shall be clearly identified. Members to be joined by welding shall be brought into correct alignment when necessary and held in position by bolts, clamps, or temporary weld attachments meeting the requirements of AA-6230, until the welding is completed. Welding shall conform to the requirements of AA-6300.	AA-6240	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	MECHANICAL JOINTS	AA-6250					

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98 (F)	Fasteners and Threaded Joints: Fasteners and threaded joints shall be provided with locking devices or other means to prevent loosening under the vibratory loads expected during system operation. The threads of all bolts or studs shall be engaged for the full length of the thread in the nut unless specified otherwise on Manufacturer's design drawings or specifications. Thread engagement of all bolts and studs shall be as specified on the drawings.	AA-6251	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
99 (F)	Structural and Pressure Boundary Fasteners: Type, size, and spacing of structural and pressure boundary fasteners shall be selected to meet the maximum stresses anticipated for the worst load combination and shall be documented by calculations	AA-6252	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
100 (F)	Thread Lubricants: Any lubricant or compound used in threaded joints shall be acceptable for the service conditions and shall not react unfavorably with any contact material. Contact surfaces within friction-type joints shall be free of oil, paint, lacquer, galvanizing, or other plating.	AA-6253	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
101 (F)	Removal of Thread Lubricants: All thread lubricants or compounds shall be removed from surfaces that are to be welded.	AA-6254	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
102 (F)	Bolted Connections: Surfaces of bolted parts in contact with the bolt head and nut shall not have a slope of more than 1:20 with respect to a plane normal to the bolt axis. Where the surface of a high strength bolted part has a slope of more than 1:20, a beveled washer shall be used to compensate for the lack of parallelism. Bolts loaded in pure shear shall not have threads located in the load bearing part of the shank unless permitted by the Design Specification or Manufacturer's specification.	AA-6255	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

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103 (F)	Precautions Before Bolting: All parts assembled for bolting shall have contact surfaces free from scale, chips, or other deleterious material. Surfaces and edges to be joined shall be smooth, uniform, and free from fins, tears, cracks, and other defects that would degrade the strength of the joint.	AA-6256	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
104 (F)	Bolt Tension: All high strength structural bolts shall be tightened to a bolt torque equal to that given in the Design Specification or Manufacturer's specification. Tightening shall be done by the turn of nut method or with properly calibrated wrenches. Bolts tightened by means of a calibrated wrench shall be installed with a hardened washer under the nut or bolt head, whichever is the element turned in tightening. Hardened washers are not required when bolts are tightened by turn of the nut method, except that hardened washers are required under the nut and bolt head when the bolts are used to connect material having a specified yield point less than 40.0 ksi.	AA-6257	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
105 (F)	Locking Devices: Threaded fasteners, except high strength bolts, shall be provided with locking devices to prevent loosening during service. Elastic stop nuts (when compatible with service temperature), lock nuts, jam nuts, and drilled and wired nuts are all acceptable locking devices. Upset threads may service as locking devices.	AA-6258	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	WELDING REQUIREMENTS	AA-6300					

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106 (F,QA)	General: (a) *Scope:* The requirements of AA-6300 apply to the preparation of welding procedure specifications, qualification of welding procedures, welders, and welding operators for all types of manual and machine welding processes, and to the workmanship, weld quality, and inspection of weldments produced during the manufacture of equipment and components. The requirements of this Subarticle are applicable to the extent they are invoked by the other sections. Unique requirements are given in each section. (b) *Responsibility:* Each Manufacturer is responsible for the welding done by its organization and shall conduct the tests required in this Code to qualify the welding procedures used in the construction of the weldments built under this Code, the performance of welders and welding operators who apply these procedures, and the inspection required for workmanship and weld quality verification. (c) *Records:* Each Manufacturer shall maintain a record of the *results obtained in welding procedure and welder and welding* operator performance qualifications. These records shall be certified by the Manufacturer and shall be accessible for review. (d) *Base Metal:* (1) Base metals to be joined by welding shall be one or a combination of those listed in Article 3000 of each Code section. (2) Rust inhibitive coatings, galvanized coatings, or antispatter compounds may remain on the metal to be joined provided the welding procedure is qualified with these materials present. (e) *Filler Metals:* Filler metals selected shall be one or a combination of those listed in the ASME Code, Section II, Part C, and shall be compatible with the wielding process used and the base metal designated on the Manufacturer's drawings. (f) *Processes:* Joining processes under this specification shall include oxyfuel gas welding (OFW), shielded metal-arc welding (SMAW), submerged-arc welding (SAW), gas meta-arc welding (GMAW), flux-cored arc welding (FCAW), gas tungsten-arc welding (GTAW), plasma-arc welding (PAW), resistance welding (RW), stud-arc welding, (SW), and carbon-arc welding (CAW). (g) *Terms and Definitions:* Terms and definitions shall be interpreted in accordance with ANSI/AWS A3.0. (h) *Symbols:* Symbols used on the Manufacturer's drawings shall be in accordance with ANSI/AWS A2.4.	AA-6310	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

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	Continued (i) *Safety Precautions:* Safety precautions shall conform to the latest edition of ANSI/ASC Z49.1. (j) *Standard Units of Measurement:* The values stated in U.S. customary units are to be regarded as the standard. The metric (SI) equivalents of U.S. customary units as given are approximate. (k) *Welding Procedure and Performance Qualification:* (1) Qualification of the Manufacturer's welding procedure specifications and welder and welding operator performance shall be in accordance with the requirements of one or more of the following, as defined in each Code section. (a) ASME Code, Section IX (b) ANSI/AWS D1.1 (c) ANSI/AWS D9.1 (d) AWS C1.1 (e) AWS C1.3 (f) ANSI/AWS D1.3 (2) Welding of performance qualification test samples shall be performed in accordance with the Manufacturer's qualified welding procedure for the process used. (3) Welding procedure qualification of coated base metals qualifies the procedure for uncoated base metals, but not vice versa. (4) Base metal sensitization shall be considered in selecting the welding process and filler metals for welding procedures developed for welding stainless steel.	AA-6310	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	WORKMANSHIP	AA-6320					
	Preparation of Base Material	AA-6321					
107 (F)	Surfaces and edges to be welded shall be free from fins, tears, cracks, and discontinuities that would adversely affect the quality or strength of the weld, Surfaces to be welded and surfaces adjacent to a weld shall also be free from loose mill scale, slag, rust, moisture, grease, and foreign material that would prevent proper welding. Mill scale that can withstand wire brushing, a thin rust-inhibitive coating, or anti-spatter compound may remain.	AA-6321.1	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

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108 (F)	Galvanized surfaces need not have the zinc coating removed before welding, provided the welding procedure is qualified with the galvanizing present.	AA-6321.2	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	Joint Fit-Up	AA-6322					
109 (F)	Joints to be welded shall be brought into correct alignment within the tolerances required by the qualified welding procedure.	AA-6322.1	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
110 (F)	When tack welds are used to assemble the joint for welding and are incorporated into the final weld, they shall be made with electrodes meeting the requirements of the final welds.	AA-6322.2	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
111 (F)	Tack welds not incorporated into the final welds shall be removed.	AA-6322.3	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	Weld Cleaning	AA-6323					
112 (F)	Where cleaning of base metals is required, it shall be accomplished by wire brushing, grinding, blasting, solvents, or other suitable means that are noninjurious to the material or weld quality.	AA-6323.1	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

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113 (F)	Before welding over previously deposited metal, slag, if present, shall be removed and the weld and adjacent base metal shall be brushed clean. This requirement shall apply not only to successive layers, but also to successive beads and to the crater area when welding is resumed after any interruption.	AA-6323.2	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
114 (F)	Upon completion, the weld and adjacent areas shall be cleaned of all slag excessive spatter, soot, dirt, or any residue from welding. Welds shall be left in a condition ready for subsequent inspection.	AA6323.3	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	Weld Quality	AA-6324					
115 (F)	The sizes and lengths of welds shall be no less than those specified by design requirements and detail drawings.	AA-6324.1	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
116 (F)	Weld profiles shall be in accordance with the acceptable weld profiles shown in Fig. AA-6300-1.	AA-6324.2	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
117 (F)	The faces of fillet welds may be slightly convex, flat, or slightly concave, as shown in fir. AA-6300-1, sketches (a) and (b), with none of the unacceptable profiles shown in sketch (c).	AA-6324.3	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

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118 (F)	Groove welds shall preferably be made with slight or minimum reinforcement except as may be otherwise provided. In the case of butt and corner joints, the reinforcement shall not exceed 1/8 in. (3.2 mm), in height and shall have a gradual transition to the plane of the base metal surface. See fig. AA-6300-1, sketch (d). They shall be free of the discontinuities shown for butt joints in sketch (e).	AA-6324.4	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	INSPECTION AND TESTING OF WELDS	AA-6330					
	Butt and Fillet Welds	AA-6331					
119 (I,T)	Production welds shall be inspected. As a minimum, visual inspection shall be made. Welds that conform to the following criteria shall be acceptable: (a) fusion: complete fusion is required; (b) penetration: required joint penetration as specified for the application; (c) reinforcement of welds in butt joints: a maximum of 0.125 in. face reinforcement and 0.125 in. root reinforcement; (d) throat and convexity of fillet welds: a minimum weld leg size, as required on the design drawings, with maximum convexity not to exceed 0.125 in; (e) porosity or slag inclusion: a maximum of three visible pores or slag inclusions, or both, that do not exceed 0.25t/in. of weld, and a maximum o one visible pore or slag inclusion that does not exceed *0.25t/in. of weld, where t is the thinner base metal thickness;* (f) undercut: no undercut exceeding 0.15t where t is 0.125 in. or thinner, or exceeding 1/32 in. where t exceeds 0.125 in; (g) cracks: no cracks are permitted.	AA-6331.1	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
120 (I)	Completed welds shall be visually inspected for location, size, and length in accordance with the requirements of applicable Manufacturer's drawings and specifications.	AA-6331.2	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

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121 (I,T)	When specified by the Engineer, the weld acceptance criteria of NCIG-01 may be used in lieu of the criteria of AA-6324 and AA-6331.1 for structures and supports fabricated to the requirements of the AISC specification and AWS D1.1.	AA-6331.3	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
122 (I,T)	Resistant Spot-Welds: The diameter of the spot and cross section of the nugget shall be in accordance with the sizes specified on detail drawings and in Welding *Procedure Specifications.*	AA-6332	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	Stud Welding	AA-6333					
123 (D,F,I)	The design of studs shall be suitable for arc welding to steel members with automatically timed stud welding equipment. An arc shield shall be furnished for all studs and pins over 10 gage diameter. At the time of welding, the studs shall be free from rust, rust pits, scale, oil, paint, galvanizing, or plating, and other deleterious material that would adversely affect the wilding operation. After welding, stud ferrules shall be broken free for visual inspection.	AA-6333.1	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
124 (D,F)	Stud weld reinforcement shall be as specified by the Manufacturer's drawings and procedure.	AA-6333.2	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	Nondestructive Testing (NDT) Methods and Acceptance Criteria	AA-6334					
125 (T)	When nondestructive testing other than visual inspection is required, it shall be so stated in the Manufacturer's drawings and specifications.	AA-6334.1	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW *however based on past operating* performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

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126 (I,T)	Surface inspection, when required, shall be performed using the dye penetrant method. The standard methods set forth in ASTM E 165 shall be used for dye penetrant inspection, and the acceptance criteria shall be in accordance with AA-6331.	AA-6334.2	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
127 (I,T)	For detecting surface or subsurface discontinuities, radiographic or ultrasonic inspection may be used. Radiographic or ultrasonic inspection shall be used only when joint designs require multiple pass welds. The standard methods set forth in Section V of the ASME Code shall be used for inspection and acceptance criteria and shall be in accordance with the following: (a) no cracks are permitted; (b) not more than three individual discontinuities, with the greatest dimension being less than 0.25 times the base metal thickness per linear inch of weld.	AA-6334.3	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	Inspector Qualifications	AA-6335					
128 (QA,I,T)	Personnel performing visual inspections shall meet the requirements of ANSI/ASME NQA-1, including Supplements 2S-1 and 2S-2, to a Level I capability and be working under the supervision of a Level I or III individual, or shall be Level II or III individuals.	AA-6335.1	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
129 (QA,I,T)	Personnel performing nondestructive testing shall be qualified in accordance with SNT-TC-1A. Only individuals qualified for NDT Level I and working under an NDT Level II or III individual, or individuals qualified for NDT Level II or III, may perform nondestructive testing.	AA-6335.2	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
130 (QA,I,T)	Personnel performing visual inspections to the requirements of AA-6331.3 shall be trained in accordance with NCIG-03 with regard to the acceptance criteria of NCIG-01.	AA-6335.3	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

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131 (F,I,T)	Repairs: Defects in welds or base metals may be repaired in accordance with the applicable equipment section of this Code. Weld repairs shall be performed by qualified welders using qualified procedures and inspected to the original acceptance criteria.	AA-6336	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	BRAZING	AA-6400					
132 (F)	General: (a) *Scope:* The requirements of AA-6400 apply to the preparation of *brazing procedure specifications, the qualifications of brazing* procedures, brazers, and brazing operators for all types of manual and machine brazing processes, and the workmanship, braze quality, and inspection of brazements produced during the manufacture of equipment and components. Brazing shall be in accordance with this Subarticle unless specific requirements are given in the applicable equipment section of this code. (b) *Responsibility:* Each Manufacturer is responsible for the brazing done by its organization and shall conduct the tests required in this Code to qualify the brazing procedures used in the construction of the brazements built under this Code, the performance of brazers and brazing operators who apply these procedures, and the inspection required for workmanship and braze quality verification. (c) *Records:* Each Manufacturer shall maintain a record of the results obtained in brazing procedure and brazer and brazing operator performance qualifications. These records shall be certified by the Manufacturer and shall be accessible for review. (d) *Base Metals:* Base metals to be joined by brazing shall be as listed in each section of this Code and applicable to that section. (e) *Filler Metals:* Filler metals selected shall be one or a combination of those listed in the ASME Code, Section II, Part C, or ANSI/AWS A5.8 and shall be compatible with the brazing process used and the base metal designated on the Manufacturer's drawings. (f) *Processes: Joining processes under this specification shall* include torch brazing (TB), furnace brazing (FB), induction brazing (IB), resistance brazing (RB), and dip brazing (DB). (g) *Terms and Definitions:* Terms and definitions shall be interpreted in accordance with ANSI/AWS A3.0. (h) *Symbols:* Symbols used on the Manufacturer's drawings shall be in accordance with ANSI/AWS A2.4.	AA-6410	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

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	Continued (i) *Safety Precautions:* Safety precautions shall conform to the latest edition of ANSI/ASC Z49.1. (j) *Standard Units of Measurement:* The values stated in U.S. customary units are to be regarded as the standard. The metric (SI) equivalents of U.S. customary units as given are approximate. (k) *Brazing Procedure and Performance Qualification:* (1) Qualification of the Manufacturer's brazing procedure specifications and brazer and brazing operator performance shall be in accordance with the requirements of one or more of the following. (a) ASME Code, Section IX (b) ANSI/AWS C3.3 (2) Brazing of performance qualification test samples shall be performed in accordance with the Manufacturer's qualified brazing procedure for the process used.	AA-6410	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	Workmanship	AA-6420					
133 (F)	Preparation of Base Metal: Surfaces and edges to be brazed shall be free from fins, tears, cracks, and discontinuities that would adversely affect the quality or strength of the brazement, Surfaces to be brazed and surfaces adjacent to a brazement shall also be free from loose mill scale, slag, rust, moisture, grease, and foreign material that would prevent proper brazing.	AA-6421	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
134 (F)	Joint Fit-Up: Joints to be brazed shall be brought into correct alignment within the tolerances required by the qualified brazing procedure.	AA-6422	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	Cleaning	AA-6423					
135 (F)	Where cleaning of base metals is required, it shall be accomplished by wire brushing, grinding, blasting, solvents, pickling, or other suitable means.	AA-6423.1	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

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136 (F)	Upon completion, the brazement and adjacent areas shall be cleaned of flux residues and oxide scale formed during the brazing process.	AA6423.2	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	INSPECTION AND TESTING	AA-6430					
	Visual Examination	AA-6431					
137 (I)	Visual examination of brazed joints is used for estimating the soundness by external appearance, such as continuity of the brazing filler metal, size, contour, and wetting of filler along the joint, and where appropriate, to determine if filler metal flowed through the joint from the side of application to the opposite side.	AA-6431.1	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
138 (I,T)	Brazed joints shall be inspected by visual means prior to mechanical or section tests. As a minimum, visual inspection shall be made. The results of the visual examination shall meet the following requirements: (a) braze metal shall be present at all edges of the joint; (b) no unfused brazing filler metal shall be present; (c) undercutting shall have a maximum depth of 5% of the base metal thickness, or 0.010 in, which ever is less; (d) individual pores shall have a maximum diameter of 0.015 in, and the minimum space between such pores shall be 0.5 in; (e) the sum of all pore diameters shall be a maximum of 0.030 in. in each linear inch of joint; (f) no cracks are permitted.	AA-6431.2	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
139 (T)	Mechanical or section tests, when required, shall be accomplished in accordance with the applicable code specified in AA-6410.	AA-6431.3	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	NDT Methods and Acceptance Criteria	AA-6432					

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140 (D,T)	When nondestructive testing other than visual inspection is required, it shall be so stated in the Manufacturer's drawings and specifications.	AA-6432.1	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
141 (I,T)	Surface inspection, when required, shall be performed using the dye penetrant method. The standard methods set forth in ASTM E 165 shall be used for dye penetrant inspection, and the acceptance criteria shall be in accordance with AA-6431.	AA-6334.2	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
142 (I,T)	For detecting surface or subsurface discontinuities, other nondestructive methods may be used. The standard methods set forth in Section V of the ASME Code shall be used for NDT inspection. The extent of examination and acceptance criteria shall be stipulated in the procurement documents.	AA-6432.3	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	Inspector Qualifications	AA-6433					
143 (QA,I)	Personnel performing visual inspections shall meet the requirements of ANSI/ASME NQA-1, including Supplements 2S-1 and 2S-2, to a Level I capability and be working under the supervision of a Level I or III individual, or shall be Level II or III individuals.	AA-6433.1	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
144 (QA,I,T)	Personnel performing NDT shall be qualified in accordance with SNT-TC-1A. Only individuals qualified for NDT Level I and working under an NDT Level II or III individual, or individuals qualified for NDT Level II or III, may perform NDT.	AA-6433.2	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	Repairs	AA6434					

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145 (F,I)	Defects in base metal or brazed joints may be repaired in accordance with written repair procedures mutually agreed upon between the manufacturer and purchaser. Repairs shall be performed by qualified brazers in accordance with the qualified Brazing Procedure Specification. Repairs shall be inspected to the original acceptance criteria.	AA-6434.1	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	CLEANING AND COATING	AA-6500					
146 (D,F)	General: The design specification shall specify the required coating service levels for both internal and external surfaces of the equipment. Coating level designation shall be determined based on equipment location, function, and effect of coating system on intended component or system performance.	AA-6510	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
147 (D,F)	Service Level 1 Areas: These areas require coating systems that are essential to the attainment of the accident mitigating performance of structures, systems, and components that are essential to the prevention of , or mitigation of the consequences of, postulated accidents that could cause undue risk to the health and safety of the public. A Service Level I protective coating system shall conform to the Service Level I coating requirements specified in ANSI N512 and ANSI N101.2. In addition, quality assurance requirements and documentation specified in ANSI N101.4 shall also be provided. Galvanized steel and stainless steel surfaces do not require an additional protective coating system, and therefore are not subject to the requirements of this paragraph.	AA-6511	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
148 (D,F)	Service Level II Areas: These areas require coating systems that are essential to the attainment of the intended normal operating performance of structures, systems, or components. Service Level II protective coating systems may conform to Service Level I coating specified by ANSI N512 quality assurance requirements, except that documentation required may be defined in the Design Specification or Manufacturer's specification. (Documentation specified in ANSI N101.4 is not required for Level II coating systems.) The coating systems shall be designed for the applicable post-accident service conditions for the specific surfaces, but not for the in-containment post-accident service conditions.	AA-6512	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

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149 (D,F)	Service Level III Areas: These areas require coating systems that are not essential to either the normal or accident operating performance of a structure, system, or component. Coating systems designated as Coating Level III shall conform to the specific equipment Manufacturer's specifications. Documentation shall be defined in the Design Specification or Manufacturer's specification. (ANSI N101.4 documentation is not required.)	AA-6513	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
150 (D,F)	Stainless Steel Surfaces: Stainless steel surfaces shall not be coated.	AA-6514	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
151 (D,F)	Surface Preparation: Surface preparation for carbon steel shall meet the requirements specified in Section 8 of ANSI N512. Carbon steel surface preparation for Service Level I coatings systems must be blast cleaned to the requirements of SSPS SP10.	AA-6520	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	COATING	AA-6530					
152 (D,F)	Scope of Work: Outline the areas to be coated or otherwise protected in the Design Specification.	AA-6531	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
153 (D,F,T)	Coating System Selection and Evaluation: Provide specific guidelines and requirements for coating system tests and required criteria for tested material evaluation in the Design Specification.	AA-6532	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

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154 (QA)	Quality Assurance Manual: The quality assurance manual must address the 10 CFR 50, Appendix B, requirements and pertinent requirements of ANSI N101.4.	AA-6533	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
155 (QA,I,T)	Coating Inspector's Qualifications: The inspector's qualifications must meet the requirements of ANSI/ASME NQA-1, including supplements of 2S-1 and 2S-2.	AA-6534	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
156 (QA,F)	Coating Applicator's Qualifications: These requirements must be established in application procedures for each specific substrate and material to be used prior to allowing the applicator to apply any material to surfaces installed in Service Level I areas.	AA-6535	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
157 (QA,F)	Safety and Environmental Control: Ventilation, temperature, and humidity must meet the coating Manufacturer's requirements. Proper illumination, safe equipment, scaffolding, and procedures regarding work practices must be followed.	AA-6536	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
158 (QA,D)	Quality Control Procedures: These procedures must be developed by the coating applicator and approved by the Owner or his authorized representative.	AA-6537	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No./Ops. Step	Division I – General Requirements Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
159 (D,QA)	Coating Material Certification: The coating Manufacturer must provide product identity certification that the material meets the requirements of ANSI N101.2, ANSI N101.4, and ANSI N512, or any other specific requirements.	AA-6538	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
160 (F)	Surface Preparation: Surface preparation must be defined as to the degree of cleanliness and required anchor profile in the steel surface. The blast abrasives to be used and cleaning residual contaminants from blast abrasives must be addressed. The time elapsed between surface preparation and the first coat of coating material application should be indicated to prevent any rust bloom appearing on the blasted surface.	AA-6539	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
161 (F)	Coating Application and Curing Requirements should be address for each coat of specific material used.	AA-6539.1	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
162 (D,F)	For carbon steel, the Design Specification or Manufacturer's specifications shall state the requirements for prime coat and finish coat thicknesses. Galvanized steel surfaces from which the coating has been removed during fabrication shall be coated with an appropriate qualified material per ANSI N101.2 to a thickness equivalent to the original coating.	AA-6539.2	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	REPAIR OF COATING SYSTEM	AA-6540					
163 (F)	Repair of Coating System: (a) Service Level I and Service Level II coating systems that require repair due to damage or defects in the original coating system shall be repaired in accordance Chapter 11 or Chapter 12 (if coating has been in place for several moths or years) of *Manual of Coating Work*. (b) Galvanized surfaces that have been damaged shall be repaired with an appropriate qualified material per ANSI N101.2. Thickness of coating shall be equivalent to the original coating.	AA-6540	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	INSPECTION	AA-6560					

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Rqmt No./Ops. Step	Division I – General Requirements *Requirement Text*	Rqmt Source / Sec #	*Rqmt Compliance*	Status Indicators: (See Legend for Key) AN	AP	AW	SY
164 (D,I)	General: Inspection for shop and field work on Level I and II coating systems shall conform to Section 10 of ANSI N512. The Design Specification or Manufacturer's specifications shall include the acceptance criteria for the degree of continuity of coating.	AA-6560	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	QUALITY ASSURANCE REQUIREMENTS AND DOCUMENTATION	AA-6560					
165 (QA)	General: (a) Coating level I systems shall conform to the quality assurance *requirements of ANSI N101.2, ANSI N101.4. Level II and III* coating system documentation shall conform to Manufacturer's or Design Specification requirements. (b) Coating Level I documentation in accordance with the requirements of ANSI N101.2, ANSI N101.4, and ANSI N512 shall be maintained on file. Documentation shall be provided to *the Owner in accordance with the requirements of AA-8000.*	AA-6560	This requirement could not be verified by a review of the documentation that was *available for systems* AN, AP, *and* AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	INSTALLATION REQUIREMENTS	AA-6600					
166 (O)	Handling and Rigging: (a) Handling and rigging requirements for assembled components or subassemblies shall be identified in Manufacturer's installation procedures in accordance with AA-7000. Manufacturer's procedures shall include the classification of the item to be handled as defined in ANSI/ASME, NQA-2. (b) Items that will be handled or supported during installation by a crane or other lifting device shall be equipped with lifting eyes or other means to maintain the item in proper orientation without exceeding structural design integrity of the assembly while being handled or supported. The design specification shall identify any special rigging requirements or restrictions for final erection.	AA-6610	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

Best Available Image

Rqmt No./Ops. Step	Division I – General Requirements Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key)			
				AN	AP	AW	SY
167 (F)	Field Assembly: (a) Where equipment requires component assembly during final installation, the equipment manufacturer shall provide detailed written procedures for making the proper final assemble. Installation procedures shall include requirements for al other interfacing services, such as electrical, piping, supports, and ductwork. Installation procedures shall also address assembling, setting, erecting, leveling, aligning, securing, doweling, connecting, cleaning, lubricating, final adjusting, inspecting, and all other operation necessary to make the equipment operable. (b) The equipment Manufacturer shall be responsible for advising the Owner or his designee of field connections or services required for the proper and safe operation of the equipment as specified in the Design specification. These requirements shall be explained in the installation procedures. The equipment Manufacturer shall make provisions in the design of his *equipment for the required field connections.* (c) Alignment markings where required for the proper field positioning and connection of parts or subassemblies shall be shown on the Manufacturers installation drawings.	AA-6620	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

Best Available Image

Rqmt No./Ops. Step	Division I -- General Requirements Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
168 (F)	Temporary Field Attachments: (a) Field attachments and ducts not specified in the design drawings, the Design Specification, or this Code are permitted only when authorized in writing by the equipment Manufacturer, Owner, or his designee. The method of attachment shall meet the requirements of the drawings, specifications, or this Code, as applicable, and neither the attachment nor the method of attachment shall adversely affect present or future performance, reliability or structural integrity or the item or the installed system. Temporary attachments shall be removed before delivery or final acceptance of the installed system, whichever is applicable. (b) Unauthorized attachments shall not be made to equipment or ducts and, when discovered, shall be removed in a manner hat will not affect the immediate or future performance, reliability, or structural integrity of the item or the system. The equipment Manufacturer, or the Owner or his designee, as applicable, shall be advised of the unauthorized attachment and shall review the impact of such attachment. The method of removal or repair, or both, if necessary, shall be authorized by the equipment Manufacturer or the Owner or the Owner's designee. If the attachment does adversely affect immediate or future performance or reliability, and removal of the attachment or repair dies not eliminate the adverse result, the item affected shall be replaced.	AA-6630	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	PACKAGING, SHIPPING, RECEIVING, STORAGE, AND HANDLING	AA-7000					
169 (O)	General: This Article contains general requirements for packaging, shipping, receiving, storage, and handling of components, parts, and equipment.	AA-7110	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
170 (O)	Responsibility: The establishment of practices and procedures and providing the resources in terms of personnel, equipment, and services necessary to implement the requirements of this Code may be delegated to other organizations, and such delegation shall be documented.	AA-7120	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

Best Available Image

Rqmt No./Ops. Step	Division I – General Requirements Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
171 (O)	General Requirements: This Article (AA-7000) is intended to supplement ANSI/ASME NQA-2, Part 2.2. The provisions of this Article shall replace these respective sections and subsections of ANSI/ASME NQA-2, Part 2.2. The balance of ANSI/ASME NQA-2, Part 2.2, shall apply and be part of this code.	AA-7200	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
172 (O)	Planning, Procedures, and Instructions: The Design Specification and drawings for air and gas treatment items shall include provisions for accomplishing the packaging, shipping, receiving, storage, and handling activities described in this Code. The preparation and control of procedures and work instructions for these activities shall be provided. Sufficient details shall be included to assure compliance with the provisions of AA-7000 and each Code section.	AA-7210	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
173 (QA,O)	Personnel Qualifications: Those personnel who perform inspection, examination, and testing activities at the job site to assure compliance to this Code shall be qualified in accordance with ANSI/ASME NQA-1, Supplement 2S-1 and 2S-2. Offsite inspection, examination, or testing shall be audited and monitored by personnel who are qualified in accordance with ANSI/ASME NQA-1, Supplements 2S-1 and 2S-2.	AA-7220	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
174 (D,QA,O)	Classification of Items: The requirements for activities covered by this Article (AA-7000) are divided into four levels with respect to protective measures to prevent damage, deterioration, or contamination of the items, based upon the important functional characteristics of the item with respect to safety, reliability, and operation. It should be recognized, however, that within the scope of each level there may be a range of controls and that the detailed requirements for an item are dependent on the importance of the item to safety or reliability. Items, once classified, shall be restricted to that level or higher for each of the packaging, shipping, receiving, storage, and handling operations. Any package unit or assembly made up of items of different levels shall be classified to the highest level designated for any respective parts, *unless the higher level subassembly or part can be packaged to its* respective level while still attached to the total assembly or is totally protected within the assembly. The balance of the unit or assembly may be classified to a lower level. If unit is disassembled, a level shall be indicated for each part.	AA-7230	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No./Ops. Step	Division I – General Requirements Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
	PACKAGING	AA-7300					
175 (QA,O)	General: Implementation of Sub-article AA-7300 shall be accomplished by applying the appropriate criteria contained in ANSI/ASME NQA-2, Part 2.2, concerning cleaning, preservatives, desiccants, inert gas blankets, cushioning, caps and plugs, barriers and wrapping materials, tapes, blocking and bracing, containers, marking, other quality assurance provisions, and documentation.	AA-7310	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	SHIPPING	AA-7400					
176 (O)	General: The mode of transportation used shall be consistent with the protection classification of the item and with the packaging method employed.	AA-7410	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	QUALITY ASSURANCE	AA-8000					
177 (QA)	General: This article contains general requirements for the quality assurance of components, parts, and equipment. The requirements of ANSI/ASME NQA-1 apply to the components, parts, and equipment covered by this Code.	AA-8110	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
178 (QA)	Responsibility: The organization invoking this Code for the design, construction, and acceptance testing of equipment, parts, and components used in nuclear safety-related air and gas treatment systems in nuclear facilities shall be responsible for specifying any additional requirements and appropriately relating them to specific items or services.	AA-8120	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No./Ops. Step	Division I – General Requirements Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
179 (QA)	Responsibility of Fabricators, Material Suppliers, and Material Manufacturers: Some or all of the responsibilities of lower tier organizations may be assumed by any higher tier organization (e.g., the Owner may *assume some of the responsibilities, such as certifying* test results, of the Material Manufacturer.) The organization assuming lower tier responsibility shall meet the requirements noted herein for that organization. In addition to the specific responsibilities delegated to the Fabricator, Material Supplier, and Material Manufacturer by the Owner of designee, the following shall apply: (1) *Each member of the chain depicted in Figure AA-8130 shall be* responsible for evaluating and qualifying the suppliers of contracted services or material from the next level down (i.e., Fabricator shall be responsible for evaluating and qualifying the Material Supplier's quality assurance program, and so forth.) (2) Each member of the chain depicted in Figure AA-8130 shall be responsible for notifying the party that qualified their program of planned modifications that might affect the quality of the delivered product. (3) The Fabricator, Material Supplier, and Material Manufacturer shall be responsible for establishing and maintaining and identification and verification program for the traceability of material while under his control. (4) The Fabricator, Material Supplier, and Material Manufacturer shall be responsible for controlling quality during manufacture and fabrication, including control of manufacturing processes, testing, examination, repair, and treatment of the material, including subcontracted services.	AA-8130	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	IDENTIFICATION AND CONTROL OF ITEMS	AA-8200					

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Rqmt No./Ops. Step	Division I – General Requirements Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
180 (QA)	Documentation: Documents for procurement of material and subcontracted services shall include requirements to the extent necessary to assure their compliance with ANSI/ASME NQA-1 and the additional requirements of this paragraph. Measures shall be established to assure that all purchased and fabricated material and services conform to the requirements of this paragraph. Measures shall be established for identification and control of material, including partially processed material, throughout manufacturing, fabrication, and the shipping processes. These measures shall assure that identification is maintained either on the material or on records traceable to the material through manufacture and fabrication. Welding filler metal for use in repair of the material shall also be controlled in accordance with this paragraph.	AA-8210	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
181 (QA)	Identification and Completed Material: (a) Identification of material from the Material Manufacturer shall consist of marking the material with the applicable specification and grade of material, heat number or heat code of the material, and any additional marking required by this Section to facilitate traceability of the reports of the results of all tests and examinations performed on the material; except that, for those materials for which the Material Manufacturer's Certificates of Compliance are allowed, heat numbers or heat code identification need not be indicated either on the material or the Certificates. Alternatively, a marking symbol or code that identifies the material with the material certification may be used, and such symbol or code shall be explained in the Certified Material Test Report or Certificate of Compliance, as applicable. (b) Physical identification on individual material used in the assembly of a component by heat number or code or specification and grade need not be done provided the completed assembly is marked with a unique identification number that is traceable to documentation that identifies the material used in the assembly by the requirements of AA-8220(a).	AA-8220	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No./Ops. Step	Division I – General Requirements Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
182 (QA)	Marking Requirements for Small Products: Except as required by the material specification, small parts need not be individually marked provided they are packed in packages or containers that shall be clearly identified by legible marking to ensure positive identification of the material up to the point of use. Welding and brazing materials shall be clearly identified by marking on the package or container to ensure positive identification of the material. The package or container marking shall include the heat or lot number as applicable, a control marking code that identifies the materials with the Certified Material Test Report, and other information such as specification, grade, classification number, supplier's name, and trade designation.	AA-8230	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
183 (D,QA)	Certified Material Test Reports: The Certified Material Test Report, when required, shall include the actual results of all required chemical analyses, mechanical tests, and examinations.	AA-8240	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
184 (QA,I,T)	Records of Examinations and Tests: All characteristics required to be reported by the material specification and by this Section shall be traceable to the results recorded. Records shall identify the procedure and revision to which an examination or test was performed and include the recorded results of examinations and tests. Measures shall be established so that the status and results of any required examinations and tests can be determined for the material.	AA-8250	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
185 (QA)	Quality Assurance Records: Documentation required by this Section and each of the other sections shall be prepared, maintained, and submitted to the Owner for recording as required by the applicable section and ANSI/ASME NQA-1.	AA-8300	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	NAMEPLATES AND STAMPING	AA-9000					

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Rqmt No./Ops. Step	Division I – General Requirements Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
186 (O)	General: This Article contains the general requirements of nameplates for components and equipment. Stamping is required only for those components constructed in accordance with the ASME Code. No other third party inspection or certification is required by this Code.	AA-9110	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
187 (O)	Requirements: Each item shall have a nameplate, except as otherwise permitted by this Code. Nameplate information shall be as required by (a) through (e) below: (a) Manufacturer's name; (b) Manufacturer's serial number and, if applicable, model number; (c) Capacity in appropriate units; (d) Operating temperature and pressure; (e) Other data prescribed by the specific equipment section of this Code. The data shall be in characters not less that 3/32 in. (2.4 mm) high. All nameplate markings shall be stamped, etched, cast, or impressed on the nameplate. Nameplates shall be of a non-corrosive material. Stamping directly on items, where permitted by the respective equipment section of this Code and used in lieu of a nameplate, shall be done with blunt nose continuous or blunt nosed interrupted dot die stamps. The selected marking method shall not result in any harmful contamination or sharp discontinuities.	AA-9120	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
188 (O)	Attachment of Nameplates: If the nameplate is marked before it is affixed to the item, the Manufacturer shall ensure that the nameplate with a correct marking has been applied to the appropriate item. The nameplate shall be attached by a method that will not affect the structural or operational integrity of the item and that shall assure permanent attachment during the life expectancy of the component.	AA-9130	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
189 (O)	Location of Nameplates: The location of the nameplate shall be shown on the as-constructed drawing. It should be readily visible when the component is installed. *Nameplates shall be located so insulation does not obscure* nameplate data.	AA-9140	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW *however based on past operating* performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

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Attachment 3

ASME AG-1 Section BA

Compliance Matrix

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key)			
				AN	AP	AW	SY
	SECTION BA: Fans and Blowers	BA					
	Applicability: This Section provides minimum requirements for the performance, design, construction, acceptance testing, and quality assurance for fans, fan drivers, drives, and related fan accessories used as components in nuclear safety-related air or gas treatment systems in nuclear facilities.	BA-1100					
	MATERIALS	BA-3000					
1 (D,P)	General: Fan materials, components, and accessories shall be capable of meeting all requirements of BA-4133. As a minimum, materials shall be in conformance with the ASME or ASTM materials listed in Table BA-3100. Substitute materials shall be equivalent to or exceed the requirements in Table BA-3100.	BA-3100	A review of the CVI data and Project Files data was performed for compliance to this requirement. CMTR's were located in the Project Files, however, they were not specifically traceable back to the materials used for the HVAC systems for AN, AP, and AW Farms. Based on past operating performance however, these systems are acceptable as-is. SY System met this requirement completely.	DR	DR	DR	CC
2 (D)	Material Stress Values: The ASME or ASTM numbers in Table BA-3100 designate a chemical composition and a material thickness limit. A grade designation is *usually required to determine the minimum strength of the material. If* the specific grade material has an assigned minimum yield and tensile strength, these values shall be used for design purposes. If values have not been established and assigned, then tests in accordance with the procedures outlined in ASTM A 370 and AA-5000 shall be performed to obtain these values. Results of mill certified tests performed as above designating these values may be used. *Maximum allowable design stress values shall be calculated* by the procedures in AA-4000. These procedures require the use of an allowable stress for normal structural requirements, and correction of allowable stress for conditions where buckling can take place and for the several service levels. When the minimum yield values have been established by test or by ASTM minimums, then the allowable stress S or S_u used in AA-4000 shall be 60% of yield.	BA-3110	ASTM or ASME numbers for materials were identified on CMTR's that were reviewed for Systems AN, AP, and AW *however, the CMTR's were not specifically* traceable back to the material used on these HVAC system. Based on past operating performance however, these systems are acceptable as-is. SY System met this requirement completely.	DR	DR	DR	CC
3 (D,F)	Special Limitations on Materials: Aluminum and zinc shall not be used in the presence of corrosive vapors. All materials shall be compatible with operating environmental conditions.	BA-3200	Aluminum housing and fan blades were used on Systems AN, AP, and AW resulting in the deterioration of the fan wheel. (See CVI #21441 Supp. 4). SY System complied completely with this requirement.	NC	NC	NC	CC

Best Available Image

Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
4 (D)	Designation of Materials: The ASME or ASTM material numbers and grade for the fan components selected from BA-3410 and BA-3420 shall be identified.	BA-3300	CMTR's were located in the Project Files, however, they were not specifically traceable back to the materials used for the HVAC systems on AN, AP, and AW. Based on past operating performance however, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
5 (D,P,QA)	Certification of Materials: The manufacturer shall make available, as a minimum, certified test reports of chemical and physical properties of material and hardware used for all stress components of fans and related accessories, including fan wheel components, fan shafts, and driver support plate, but excluding fan drivers, drives, and bearings. Fan components, listed in BA-3410 and BA-3420, shall be provided with a *Manufacturer's Certificate of Compliance covering the ASME or* ASTM material specification, grade, and class.	BA-3400	CMTR's were located in the Project Files, however, they were not specifically traceable back to the materials used for the HVAC systems on AN, AP, and AW. Based on past operating performance however, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
6 (D,P,QA)	Centrifugal Fans: A manufacturer's Certificate of Compliance shall be provided for scroll, housing side sheets, inlets, side plates, back (center) plate, weld filler materials, and support framing integral to the fan.	BA-3410	C of C's were not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
7 (D,P,QA)	Axial Fans: A manufacturer's Certificate of Compliance shall be provided for fan casing, guide vanes, weld filler materials, and driver support components.	BA-3420	There are no Axial Fans in these HVAC systems. Only Centrifugal Fans.	NA	NA	NA	NA
8 (D,P)	Purchased Materials: All purchased items shall meet the requirements of BA-3100, BA-3200, BA-3300, and BA-3400.	BA-3500	Purchase Order documentation was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
9 (D,P)	Driver Materials: Driver materials shall be selected such that the drivers meet the electrical and mechanical requirements of ANSI/IEEE 323, ANSI/IEEE 334, ANSI/IEEE 344, and NEMA MG-1, as required by the Design Specification.	BA-3600	This requirement could not be verified based on a review of the documentation that was available for review for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
	DESIGN	BA-4000					

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
10 (D)	General: Design of fans shall be in accordance with the requirements of Section BA and of those portions of Section AA invoked in Section BA. Refer to Nonmandatory Appendix BA-A for fan system considerations.	BA-4000	See the following sub-sections for compliance to the design criteria.				
11 (D)	Performance: Fans shall be selected to provide the specified volume and pressure requirements while operating in the stable region of the fan curve. Fans shall not be selected to operate in the stall or unstable region of the fan curve. Details of fan inlet and discharge conditions shall be considered and documented in support of fan sizing and selection. Fans shall be sized with consideration of dynamic losses that may be encountered. System characteristics shall be considered using AMCA 210. The following fan data shall be established in support of the fan selection: (a) *fan type and blade shape;* (b) air flow, actual; (c) total pressure to be developed; (d) maximum allowable discharge velocity; (e) air density at which the fan is to be rated; (f) maximum air density expected; (g) operating temperatures; (h) details of intake and discharge transitions that affect fan performance; (i) parallel fan operation, if required; (j) peak design temperature; (k) fan operating range, if required.	BA-4110	Based on the review of the CVI data for Systems AN, AP, and AW, this requirement complies completely. (See CVI 20520, 20502, and 21441 supp. 1). SY System also complies completely with this requirement.	CC	CC	CC	CC
12 (D)	Environmental Conditions – General: Fans, including drivers, drives, bearings, and accessories, shall be designed to operate continuously for a period of at least 30 days, or for a period of time during which access for maintenance cannot be provided, while exposed to the environmental conditions caused by a postulated accident. This applies to fans used during normal plant operation and to fans on standby status intended for operation under accident conditions only. The 30 days of continuous operation is in addition to the projected life of the plant for fans used during normal plant operation and in addition to expected operation, including operation during periodic testing and maintenance for fans on standby status.	BA-4121	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC

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13 (D)	Aging: The aging mechanisms listed in BA-4123 shall be applied to the equipment and components, Design qualification shall be specified in accordance with ANSI/IEEE 627. A list of recommended spare parts and their expected life shall be provided for the equipment and components that are not expected to last for the life of the plant under specific environmental conditions.	BA-4122	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
14 (D)	Environmental Considerations: The following aging mechanisms affecting life expectancy shall be *considered as a minimum*: (a) radiation (b) temperature variation range (c) pressure variation range (d) corrosive chemicals and moisture conditions (e) erosive particles in air streams (f) *duty cycles*	BA-4123	These environmental conditions were considered when designing systems AN, AP, and AW however, it is unsure whether the correct materials were selected based on the contaminants in the air stream because the fan wheels deteriorated in the AN and AW systems and needed to be replaced. Based on replacement of the fan *wheels and the past operating performance* of these systems, they are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
15 (D)	Loading: Loads applicable for fan design are described in AA-4211 and AA-4212. Specific conditions listed in BA-4131.1 through BA-4131.4 shall be considered.	BA-4130 BA-4131	See the following sub-sections for compliance and applicability.				
16 (D)	Normal Loads. The following normal loads shall be considered: (a) positive or negative pressure differential transients imposed on the fan housing by: (1) sudden closure of air dampers in the fan or system in which the fan is installed, or (2) maximum normal fan pressure differential: (b) dead weight of fan, driver, drive, and related fan accessories; (c) forces imposed on the fan in any of its modes of operation, including a single failure of any interacting component; (d) *loads imposed on fan inlet and outlet by duct connections;* (e) loads imposed on fan, driver, or both, by electrical conduit connections; and (f) loads imposed on the fan bearings.	BA-4131.1	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
17 (D)	Loads Due to Constraint of Free End Displacement. Loads due to constraint of free end displacement may be caused by thermal expansion and contraction.	BA-4131.2	Not applicable to these components.	NA	NA	NA	NA

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				AN	AP	AW	SY
18 (D)	Design Pressure Differential Loads. Design pressure differential loads may be cause by hurricane, tornado, and design basis accident or pipe break.	BA-4131.3	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
19 (D)	Loads Imposed on Driver and Fan When Starting. Loads imposed on the driver and fan may be caused by fan pinwheeling (inadvertent reverse rotation) caused by backflow of air while on standby status.	BA-4131.4	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
20 (D)	Missile Protection: Fans shall be designed to prevent any internally generated missiles from penetrating the fan housing unless other external protection is provided. *Consideration shall be given to the orientation of the fan* inlet and outlet openings with respect to the protection of other safety-related equipment that is to occupy the adjoining space.	BA-4132	This requirement has been considered but is not applicable to these designs.	NA	NA	NA	NA
21 (D,C)	Construction: As a minimum, the fan construction shall be capable of meeting the maximum conditions in which fan pressure and outlet velocity are specified. Fans shall be designed in accordance with the structural requirements given in AA-4000. Structural requirements, load definitions, and structural design verification specific to fans are given in BA-4131, BA-4431, BA-4432, and BA-4433. Construction shall comply with the stress and deflection criteria associated with the loads given by BA-4433.	BA-4133	This requirement is acceptable based on a review of the CVI data and applicable drawings for each system.	CC	CC	CC	CC
22 (D,F,T)	Fan Leakage: Fans are subject to the leakage criteria when the location of the fan and direction of leakage impose a contamination burden on the space housing the fan or the space supplied with air by the fan. Leakage testing shall be as given in BA-5142.	BA-4142	This requirement has been considered and evaluated. Fan leakage is not a concern because the fan assembly is located down stream of the HEPA filters in a radiation area.	NA	NA	NA	NA
23 (D,F)	*Fan Housing Leakage:* Housings subject to the leakage criteria, including penetrations such as cable connections of axial fans, shall be made air tight, according to the method outlined in BA-5142.1.	BA-4142.1	*This requirement has been considered and* evaluated. Fan housing leakage is not a concern because the fan assembly is located down stream of the HEPA filters in a radiation area.	NA	NA	NA	NA
24 (D)	Shaft Leakage: Shafts subject to leakage criteria shall be limited to 0.01% of the normal air flow per inch of fan operating pressure, or 0.5 SCFM (0.0142 m^3/min), whichever is greater.	BA-4142.2	This requirement has been considered and evaluated. *Fan shaft leakage is not a* concern because the fan assembly is located down stream of the HEPA filters in a radiation area.	NA	NA	NA	NA

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25 (D)	Support Boundary: The support boundary for the fan shall be the point of attachment of the fan housing or mount to its foundation.	BA-4150	Fans are bolted to the concrete pad as a means of support.	CC	CC	CC	CC
26 (D)	Centrifugal Fan Support Boundary: The support boundary for a centrifugal fan is the attachment point for the fan housing to the building foundation, or the structural members of an air handling unit, or structural steel within the building. The following data shall be specified: (a) size and type of anchorage attachment; (b) anchorage loads to be imposed on the attachment points.	BA-4151	This requirement could not be verified based on a review of the documentation that was available. Calculations were not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completlely.	DR	DR	DR	CC
27 (D)	Axial Fan Support Boundary: The support boundary for an axial fan is located at the inlet and outlet mounting flanges, unless the axial fan is base mounted. The following data shall be specified: (a) *size and type of anchorage attachment;* (b) anchorage loads to be imposed on the attachment points.	BA-4152	There are no Axial Fans as components to these systems.	NA	NA	NA	NA
28 (D)	Vibration – General: Fan wheels shall be dynamically balanced prior to fan assembly. Final balancing shall be performed after assembly. All test results shall be documented. After installation, fans shall be checked and re-balanced if necessary to correct changes due to handling, shipping, and final support structure conditions.	BA-4160 BA-4161	Fan vibration data was not available for review for Systems AN, AP, and AW however, based on a verbal conversation with Mark Jennings, he stated that he does not use the AG-1 criteria, but uses the criteria from industrial standards instead. Based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
29 (D)	Centrifugal Fans: The double amplitude radial displacement measured on the bearing caps at the designated fan speed shall not exceed the values listed in Table BA-4612-1, measured with a meter filtered to the fan rotational speed.	BA-4162	Fan vibration data was not available for review for Systems AN, AP, and AW however, based on a verbal conversation with Mark Jennings, he stated that he does not use the AG-1 criteria, but uses the criteria from industrial standards instead. Based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
30 (D)	Axial Fans: The double amplitude radial displacement measured on the fan housing at both the inlet and discharge locations at the designated speed shall not exceed 1.0 mil (0.025 mm), measured with a meter filtered to the fan rotational speed.	BA-4163	There are no Axial Fans as components in these systems.	NA	NA	NA	NA

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	Fan Selection	BA-4200					
31 (D,P)	General—Application: Each fan shall have a title and numbering system that uniquely identifies that fan.	BA-4211.1	This requirement is acceptable based on a review of the associated CVI data and applicable drawings for each system.	CC	CC	CC	CC
32 (D)	Duty: The duty of the fan shall be described by the operating and idle time periods, their frequency, and the corresponding fan load characteristics.	BA-4211.2	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
33 (D,F)	Fan Location: The fan orientation, elevation above sea level, type of foundation, and means of support shall be included in the Design Specification.	BA-4211.3	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY System complied with *this requirement completely.*	DR	DR	DR	CC
34 (D)	Fan Environment: The environmental conditions, including air stream and gas stream contaminants, of BA-4120 that can affect the operability service life, maintainability, or need for special features as to construction or materials of the fan shall be included on the Design Specification.	BA-4211.4	Unsure whether the environmental conditions were correctly specified in the Design Specification because the fan wheel deteriorated on systems AN and AW and had to be replaced. Based on replacement and past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	NC	NC	NC	CC
35 (D)	Fan Drive Arrangement: The fan drive arrangement shall be included in the Design Specification.	BA-4211.5	This requirement was acceptable based on a review of the CVI data and associated drawings for each system.	CC	CC	CC	CC
36 (D)	Special Limitations: Special limitations, such as space, weight, outlet velocity, fan speed, sound power level, and driver nameplate horsepower, that influence fan selection shall be considered and included in the Design Specification.	BA-4211.6	These special limitations were considered and deemed to be unimportant at the time of procurement.	NA	NA	NA	NA
37 (D)	Performance Rating: Fan performance rating shall consist of the following information for *all fan operating points, as a minimum:* (a) flow rate at fan inlet, actual; (b) fan total and fan static pressure; (c) fan air density; (d) fan air temperature; (e) fan operating speed; (f) fan power input.	BA-4212	This requirement is acceptable based on the fan curve data supplied for each fan. *Also, based on past operating performance,* these systems are acceptable as-is.	CC	CC	CC	CC

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38 (D)	Pressure Relationships: Fans shall be rated using both fan static pressure and fan total pressure. Fan pressure relationships are illustrated in AMCA 201.	BA-4213	This requirement is acceptable based on the fan curve data supplied for each fan.	CC	CC	CC	CC
39 (D)	Operation At Reduced Flow: Fans shall be selected to satisfy the maximum performance requirement. Operation at reduced flow shall be evaluated during the initial fan selection to ensure stable fan operation over the entire range of expected fan operation.	BA-4214	This requirement is acceptable based on a review of the CVI data for systems AN, AP, and AW. Also, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	CC	CC	CC	CC
40 (D,C)	Construction Information: The following design and construction information shall be identified in selecting the fan (see BA-4300): (a) fan arrangement and orientation (b) peak design and operating temperatures (c) special critical speeds or safe speeds (d) type of bearings (e) type of drive (f) accessories (g) leakage considerations (h) seismic required response spectra (RRS)	BA-4215	Acceptable based on review of the CVI data and associated drawings for each system.	CC	CC	CC	CC
41 (D,T)	Bases for Fan Rating Data: Fan performance shall be based on tests of a full size fan, or on test results of a smaller, geometrically similar fan, in accordance with BA-5111. Performance ratings shall not be based on calculations alone. Geometric similarity requires linear proportionality and angular similarity with no omission or addition of parts. Performance ratings from reduced size fans shall be obtained by tests complying with the requirements of AMCA 210.	BA-4216	This requirement cannot be verified. Aladdin Heating Corporations is no longer in business, however, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
42 (D,T)	Sound Power Level: Fan sound shall be expressed as sound power level in dB (referenced to 10^{-12} watt) for eight octave bands. Data shall be obtained from tests of the actual fan or by calculation from test data from a similar fan. Data shall be provided in accordance with BA-4420.	BA-4217.1	Sound Power Level data was not available for review and verification for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
43 (D,T)	*Test Data From Actual Fan:* Fan sound power level data shall be provided in accordance with BA-5130.	BA-4217.2	Sound Power Level data was not available for review and verification for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC

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44 (D,T)	Test Data From Fan Model: A fan model of the same Manufacturer's generic design shall be selected to obtain sound test data per BA-4217.2. Scaling of the test data shall be performed in accordance with AMCA 301.	BA-4217.3	Sound Power Level data was not available for review and verification for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
	Drivers	BA-4220					
45 (D)	Information Required for Driver Selection: Information required for driver selection shall consist of the following, as a minimum: (a) fan speed torque curve with operating brake horsepower point identified; (b) fan inertia applied to the driver shaft; (c) external forces acting on the driver shaft; (d) driver rated electrical power source; (e) *environmental requirements*; (f) driver and fan physical orientation; (g) applicable standards such as IEEE and NEMA requirements; (h) space heater requirements; (i) minimum air velocity over driver when required.	BA-4221	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
46 (D)	Special Limitations – Centrifugal Fans: Belt drives shall be permitted only in areas that are accessible for maintenance during normal or accident conditions. The number of belts selected shall allow for a single belt failure without loss of function. In use of either direct or belt drives, the equipment shall be capable of operating under the specified conditions while performing its intended safety-related function. Drives in which gear reducers are used shall not be allowed. Systems that are air balanced using variable pitch diameter sheaves shall be provided with fixed diameter sheaves for longterm operation.	BA-4222.1	This requirement is acceptable based on the review of the CVI data, the associated drawings, and the physical inspection of the systems. It is also assumed that these requirements were considered during the design and selection of the belt drives for the Centrifugal Fans. Also, these systems are acceptable as-is based on past operating performance. SY System complied with this requirement completely.	CC	CC	CC	CC
47 (D)	Special Limitations – Axial Fans: Axial fans shall be selected for direct connected operation, similar to AMCA 99-2410 for tubular centrifugal fans, designated arrangement No. 4.	BA-4222.2	There are no Axial Fans as components to these systems.	NA	NA	NA	NA
	Fan Construction	BA-4300					

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48 (D,P,C)	Centrifugal Fans—General: The housing materials and design shall meet the requirements of BA-4100 and BA-4200. Spark resistant construction, where specified shall meet the requirements of AMCA 99-401.	BA-4311.1	Housing material for the fans for systems AN, AP, and AW is made out of aluminum, which may cause deterioration by the contaminants in the air stream however, these systems are considered acceptable as-is based on past operating performance. SY System complied with this requirement completely.	NC	NC	NC	CC
49 (C)	Centrifugal Fans—Bearings: *Bearings shall be self-aligning, anti-friction, and shall have an L-10* service rating life of at least 100,000 hr in accordance with the load and speed conditions. Bearing rating life shall be established in accordance with ANSI/AFBMA 9 or 11. When the driver bearings are also the fan bearings, an L-10 life less than 100,000 hr is permissible. This limitation shall be documented. Bearings shall be *provided with grease fittings, useable in accessible areas without* interrupting fan operation.	BA-4311.2	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
50 (C)	Axial Fans—General: The fan construction shall include adjustable pitch bladed wheels mounted upon the driver's extended shaft and located inside the flanged fan casing. The shall meet the requirements of BA-4220 and BA-4320. When required by BA-4142, electric cables penetrating the fan housing shall meet the requirements of BA-4220 and BA-4320.	BA-4312.1	There are no Axial Fans as components in these systems.	NA	NA	NA	NA
51 (D,P,C)	Axial Fans—Fan Housing: The fan housing materials and design shall meet the requirements of BA-4100 and BA-4200.	BA-4312.2	There are no Axial Fans as components in these systems.	NA	NA	NA	NA
52 (D,C)	Axial Fans—Blade Angle: Adjustable pitch blades shall have corresponding blade angles indicated on the fan performance curve. Blade position designations appearing on the fan curve shall bear a correspondence with a permanent index located at the blade hub connection. After setting the blades, the locking device shall be torqued and secured in place.	BA-4312.3	There are no Axial Fans as components in these systems.	NA	NA	NA	NA
53 (D,C)	*Axial Fans—Bearings:* Bearings shall be anti-friction type. Bearing L-10 life under actual operating conditions shall be at least 100,000 hr. Bearing life shall be established in accordance with ANSI/AFBMA 9 or 11. When the bearing size is limited by driver dimensional constraints and the driver bearings are also the fan bearings, an L-10 life less than 100,000 hr is permissible. *This limitation shall be documented. Bearings shall* be provided with grease fittings. For drivers within the fan casing, both supply and purge lines shall be extended to outside the fan casing to permit bearing lubrication without interrupting fan operation.	BA-4312.4	*There are no Axial Fans as components in* these systems.	NA	NA	NA	NA

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				AN	AP	AW	SY
	Drivers and Drives	BA-4320					
54 (D)	Types of Drives: The drives shall be subject to the limitation of BA-4222.	BA-4321	This requirement is acceptable based on a review of the associated CVI data for each system.	CC	CC	CC	CC
55 (D,C)	Drive Alignment and Adjustment: Direct drives shall make use of metal shims to provide final alignments. Belt drives shall be provided with an adjustable driver base to allow a full range of belt tension adjustment.	BA-4322	This requirement is acceptable base on review of the CVI data for each system.	CC	CC	CC	CC
56 (D,C)	Mechanical Design Requirements for Drivers: (a) Bearings shall be anti-friction type. Bearing L-10 life under actual operating conditions shall be at least 100,000 hr. An L-10 life of less than 100,000 hr may be used when limited by driver constraints. Bearing life expectancy shall be documented. Bearings shall be provided with grease fittings. For drivers located within fan casing, both supply and purge grease lines shall be extended to outside the fan casing to permit bearing lubrication without interrupting fan operation. (b) Maximum sheave arrangement shall be limited per NEMA MG-1. (c) Drivers shall conform to NEMA MG-1.	BA-4323	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
57 (D)	Electrical Design Requirements: (a) All drivers shall be designed for single voltage supply. (b) Drivers shall conform to NEMA MG-1. (c) Provision shall be made for solid grounding of the driver.	BA-4324	Acceptable based on a review of the CVI data and the associated drawings for each system.	CC	CC	CC	CC
58 (D)	Application: All fan drivers shall be designed to operate at maximum load brake horsepower without encroaching on the driver service factor. Drivers shall be selected to come to speed under reduced voltage conditions peculiar to the specific accident requirement, as detailed in the Design Specification.	BA-4325	This requirement is acceptable based on a review of the associated CVI data for each system.	CC	CC	CC	CC
	Accessories	BA-4330					

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59 (D)	Accessories Common to Centrifugal and Axial Fans: (a) Fan lifting lugs or eyebolts shall be provided on fans and drivers 50 lb and heavier. (b) Inspection panels shall be provided in fan housings having wheels 12 in. and larger in diameter. Panels shall be of a size that will allow maintenance on components located within the fan housing. Quick opening latches shall normally be used, except that when leakage criteria are required per BA-4142, bolted and gasketed seals shall be used, Latches shall be retainable on the panel or fan to prevent loss of latches in the fan housing. (c) Arrows clearly indicating the direction of fan rotation and air flow shall be permanently displayed on each fan housing. (d) All gaskets used shall be of a material that is capable of withstanding the normal and accident aging mechanisms of BA-4123 without loss of function for a minimum predetermined *qualified life, and capable of withstanding the environmental* conditions of BA-4121. (e) Bearing lubricants shall be selected to withstand the accident aging mechanisms of BA-4123 for a minimum predetermined qualified life consistent with the term provided by provisions of accessibility and the environmental conditions of BA-4121. (f) Provisions shall be made for the installation of thermocouples on fan and driver bearings of fans that are inaccessible for unscheduled inspection.	BA-4331	Documentation to verify all these requirements were acceptable was not available for review for systems AN, AP, and AW. The associated CVI data identified some of the requirements such as item (d) and (f) but not all the attributes listed in this requirement. However, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
60 (D)	Centrifugal Fans – Variable Inlet Vanes: Variable inlet vanes, when used, shall be capable of reducing the rate flow to at least 30% of design, and shall be flanged and bolted to, or built as an integral part of the fan inlet. Manual actuation shall be with a locking quadrant. Electric, pneumatic, or noncombustible electrohydraulic actuators for remote or automatic operation of variable inlet vanes shall be mounted on the fan housing or shall be provided with a common structural support base. When remote inaccessible actuation is required, the vane actuation position shall be displayed at an accessible location. Fan performance characteristics with inlet vanes shall be determined in accordance with BA-5000. Vance assemblies for double inlet fans shall be connected through a common control shaft for simultaneous operation.	BA-4332.1	Variable inlet vanes were not used on the Centrifugal Fans.	NA	NA	NA	NA
61 (D,P)	Centrifugal Fans – Inlet Screen Guards: Guards for bolting to the fan inlet or outlet shall meet the material requirements of BA-3100.	BA-4332.2	Screen guards were not used on the Centrifugal Fans.	NA	NA	NA	NA

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				AN	AP	AW	SY
62 (D,C)	Centrifugal Fans –Vibration Isolators: Vibration isolators shall not be used and fans shall be mounted rigidly unless provisions are made to withstand the forces generated or amplified during a seismic event.	BA-4332.3	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
63 (D)	Centrifugal Fans – Guards: Shaft and bearing guards and V-belt drive guards shall be of the quick removal design type. V-belt guards shall permit checking the fan speed without guard removal.	BA-4332.4	Acceptable based on a review of the CVI data and the associated drawings for each system.	CC	CC	CC	CC
64 (D,C)	Centrifugal Fans –Inlet Transitions: The inlet and outlet connections shall be flanged. The housing connected flange shall be drilled to match the fan inlet flange, the other flange shall be drilled using the same bolt spacing.	BA-4332.5	Acceptable based on a review of the CVI data and the associated drawings for each system.	CC	CC	CC	CC
65 (D)	Centrifugal Fans – Shaft Seals: *Shaft seals, when required, shall meet the leakage criteria of BA-4142.2.*	BA-4332.6	Shaft seals were not required for these *particular design applications.*	NA	NA	NA	NA
66 (D,C)	Axial Fans – Inlet/Outlet Cones: Flanged inlet/outlet cones shall be fabricated of the same material as the fan housing. The housing connected flange of the cone(s) shall be drilled to match the fan inlet/outlet flanges(s). The other cone flanges shall be drilled using a similar symmetrical bolt pattern.	BA-4333.1	There are no Axial Fans as components in these systems.	NA	NA	NA	NA
67 (D,C)	Axial Fans – Inlet Bells: Flanged inlet bells, drilled to match the fan housing inlet flange, shall meet the requirements of BA-3100. Inlet bells should always be provided for fans with non-ducted inlets.	BA-4333.2	There are no Axial Fans as components in these systems.	NA	NA	NA	NA
68 (D,P,C)	Axial Fans – Inlet and Outlet Screen Guards: Guards for bolting to the fan inlet or outlet shall meet the material requirements of BA-3100.	BA-4333.3	There are no Axial Fans as components in these systems.	NA	NA	NA	NA
69 (D,C)	Axial Fans – Mounts: Fan mounts shall be welded to the casing and shall be designed to support the weight of the fan and drier in the specified mounting arrangement and in consideration of all internal and external dynamic forces.	BA-4333.4	There are no Axial Fans as components in these systems.	NA	NA	NA	NA
70 (D,C)	Axial Fans – Vibration Isolators: Vibration isolators shall not be used and fans shall be mounted rigidly unless provisions are made to withstand a seismic event.	BA-4333.5	*There are no Axial Fans as components in* these systems.	NA	NA	NA	NA
71 (D,C)	Axial Fans – Variable Inlet Vanes: Variable inlet vanes shall not be used for axial fans unless provisions are made to prevent overloading the driver.	BA-4333.6	There are no Axial Fans as components in these systems.	NA	NA	NA	NA
	Reports and Calculations	BA-4400					

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
72 (D,T)	Rating Calculations: Calculations and tests used to obtain fan ratings shall include the effects on performance of all shaft and bearing blockages, accessories, and other means of control associated with the fan. Fan power requirements shall include the effects of bearing friction and any other losses due to the drives that are supplied as an integral part of the fan.	BA-4411	Calculations and test reports were not available for review to verify this requirement on systems AN, AP, and AW however, based on past operating performance, these systems are determined to be acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
73 (D,T)	Documentation of Final Rating Data: As a minimum, the rating data and the bases identified in BA-4212 and BA-4216 shall be included. In addition, a constant speed performance curve shall be prepared, which contains complete identification information such as fan size, type, inlet and outlet area, system and fan duty, fan speed, and fan air density. The performance curve shall show fan total pressure, fan static pressure, and fan horsepower versus flow rate from free delivery to shutoff. The operation point of rating as well as the permissible operating range over which stable operation will occur shall be clearly identified. Unstable portions of the performance curve shall be clearly labeled.	BA-4412	Documentation for final rating of the fan was not available for review for Systems AN, AP, and AW however, base on past operating performance, these systems are considered acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
	Equipment Sound Production	BA-4420					
74 (O)	Sound Level Data Report: When required, a sound level data report shall be prepared. The sound level data in the report shall be expressed as sound power level in dB (referenced to 10^{-12} watt) for eight octave bands. The report shall state whether the data were obtained from tests of the actual fan or by calculation from test data of a similar fan (see BA-4217)	BA-4421	Sound Power Level data was not available for review and verification for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
	Structural Verification Considerations	BA-4430					

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75 (D)	Structural Verification by Analysis: When verification of design by analysis is selected, the results of the analysis shall be in the form of a Design Verification Report (DVR). The DVR shall comply with AA-4441. Equipment shall be deemed to be designed verified if the stress conditions and deflections identified in BA-4131 and AA-4341.2 are not exceeded under the applicable load combinations. The DVR shall address, as a minimum the stress and deflection of the following fan components in both the normal and accident conditions: (a) housings, including flanges and mounting supports (b) wheel blades (c) wheel hub (d) shaft (e) bearing supports (f) driver supports (g) weld filler material (h) driver Maximum shaft deflection shall not exceed 90% of the radial clearance between blade and housing. No deflection shall be allowed to exceed the limits of AA-4341.2.	BA-4431	Design Verification Report was unavailable for review for systems AN, AP, and AW however, these systems are determined to be acceptable as-is based on past operating performance. SY System complied with this requirement completely.	DR	DR	DR	CC
76 (T)	Structural Verification by Testing: When verification by testing is selected, a design verification test procedure (DVTP) shall be established. The test procedure, as a minimum, shall identify the specific components to be tested and the respective test methods and acceptance values. Upon completion of the tests, a DVR shall be prepared. The DVR shall comply with AA-4442. Equipment shall be deemed to have successfully passed the tests if the equipment meets the acceptance requirements identified in AA-4442 when subjected to the selected load combinations.	BA-4432	Structural verification by testing was not applicable to these systems.	NA	NA	NA	NA
77 (D)	Structural Special Considerations: (a) The maximum deflection that may be sustained without loss of equipment function during normal or accident conditions shall be determined by analysis or test. The allowable deflections in any plane for the load combinations of BA-4131 shall not exceed the limits expressed by and measured according to BA-4162 and BA-4163. (b) Fan supports shall be designed to withstand the loads described in BA-4131. Foundation and supports shall be designed so that the natural frequency of vibration of the overall supporting structure is at least 25% lower or 25% higher than the rotational frequency of the fan or driver.	BA-4433	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
	FAN INSPECTION AND TESTING	BA-5100					

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				AN	AP	AW	SY
78 (T)	Fans Requiring Testing: Performance ratings may be based on test results of a fan that is identical as to type and size, of a small, geometrically similar fan, in accordance with BA-4216. Performance ratings established for a fan may be applied to several identical fans of the same type and size, with the same nominal dimensions, irrespective of fan orientation.	BA-5111	Compliance to this requirement is based on the review of the fan curve data for each system.	CC	CC	CC	CC
79 (T)	Test Facilities: Equipment shall be tested in a facility that provides for testing in accordance with the requirements of this Code.	BA-5112	These systems were built in the late 70's and early 80's and the documentation to verify this requirement for systems AN, AP, and AW was not available for review. However, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
80 (T)	Facilities: The facility shall have the space, power, and instrumentation to conduct full-scale performance or mechanical operating tests without compromising the data or intent of the test.	BA-5112.1	These systems were built in the late 70's and early 80's and the documentation to verify this requirement for systems AN, AP, and AW was not available for review. However, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
81 (T)	Instrument Calibration: An updated listing of all test instrumentation and equipment shall be maintained along with a description of methods used to calibrate each instrument, the calibration interval, and the date of the last calibration. Calibration intervals shall be a maximum of 1 year or the Manufacturer's minimum requirement, whichever is less. Calibration of instruments shall be traceable to the National Bureau of Standards.	BA-5112.2	These systems were built in the late 70's and early 80's and the documentation to verify this requirement for systems AN, AP, and AW was not available for review. However, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
82 (T,QA)	Qualification Records: Records shall be maintained in the test facility to verify that all test facility qualification requirements are met.	BA-5112.3	These systems were built in the late 70's and early 80's and the documentation to verify this requirement for systems AN, AP, and AW was not available for review. However, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC

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83 (T,QA)	Documentation: Documentation shall be required for all performance testing, including a report that details witness test procedures and test setups.	BA-5113	These systems were built in the late 70's and early 80's and the documentation to verify this requirement for systems AN, AP, and AW was not available for review. However, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
84 (T)	Performance Acceptance Tests: Performance tests to determine a fan's flow rate, pressure, and power consumption shall be conducted.	BA-5120	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
85 (T)	Test Codes: *All performance tests shall be conducted in accordance with AMCA* 210. These tests shall include the effects of the drive, fan, and accessories.	BA-5121	Documentation to verify this requirement *was not available for review for systems* AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
86 (T)	Test Setups: Prior to testing, a test procedure containing details of all test setups and test methods shall be established based on AMCA 210.	BA-5122	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
87 (T)	Measurements: Test measurements shall be in accordance with AMCA 210 and yield results within the limits set by AMCA 210, Appendix D. A fan performance test shall consist of the following measurements.	BA-5123	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
88 (T)	Flow Rate: The fan flow rate shall be determined in accordance with AMCA 210 by either pitot tube traverse or AMCA nozzle method.	BA-5123.1	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC

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89 (T)	Pressure: Pressure shall be measured by AMCA 210 pitot tube or by piezometer rings.	BA-5123.2	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
90 (T)	Power: Measurements shall be made to determine shaft input power to the fan in accordance with AMCA 210. For the purposes of this Code, a driver with complete test results in accordance with IEEE 112A meets requirements of a calibrated driver.	BA-5123.3	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
91 (T)	Fan Speed: The fan speed shall be measured in accordance with AMCA 210.	BA-5123.4	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
92 (T)	Other: Measurements such as temperature and barometric pressure associated with intermediate calculations shall be made in accordance with AMCA 210.	BA-5123.5	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
93 (T)	Sound tests: Sound test data shall be obtained in accordance with either of the following methods. Semi-reverberant Room Method – Sound power level ratings shall be taken in accordance with AMCA 300. Induct Method – Sound Power level ratings shall be taken in accordance with ASHRAE 68.	BA-5130 BA-5131 BA-5132	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
94 (T)	Mechanical Tests: Mechanical tests shall be conducted to verify the basic integrity and function of mechanical parts. These tests include the following.	BA-5140	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC

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				AN	AP	AW	SY
95 (T)	Overspeed Tests: The impeller of each fan shall be overspeed tested to a minimum of 15% above its maximum operating speed for a 10 minute duration without increased vibration. Visual inspection shall serve to further verify that no deformation or cracks have occurred.	BA-5141	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
96 (T)	Leakage Tests—Housing: Housing leakage tests required by BA-4142 shall be conducted in the fan housing, pressurized to a level at least 1.25 times the fan operation pressure, using a soap solution at all welds and joints. The acceptance criteria shall call for the absence of any visible bubble formation.	BA-5142.1	This requirement has been considered and evaluated. Fan housing leakage is not a concern because the fan assembly is located down stream of the HEPA filters in a radiation area.	NA	NA	NA	NA
97 (T)	Leakage Tests—Shaft: Shaft leakage tests required by BA-4142 shall be conducted on the fan with the shaft and seal assembled, the shaft rotating at the normal fan operating speed, the fan openings sealed closed, and the fan subjected to the normal fan operating pressure. The fan wheel shall be removed prior to the shaft leakage test, or provision shall be made to account for the increase in air temperature if the fan wheel is left in place.	BA-5142.2	This requirement has been considered and evaluated. Fan shaft leakage is not a concern because the fan assembly is located down stream of the HEPA filters in a radiation area.	NA	NA	NA	NA
98 (T)	Fan Vibration Test: Fans shall be given a vibration test as required by BA-4160. Prior to taking the vibration measurements, the fans shall be operated at the formal operating speed for a run in period of time until the bearings reach a stable equilibrium temperature, at which point the temperature no longer rises. Vibration readings taken on the bearing caps on centrifugal fans, and on the fan housing on axial fans shall be no greater than those given in BA-4162 and BA-4163, respectively.	BA-5143	Per a verbal conversation with Mark Jennings, he used the industrial standards criteria for performance of these tests instead of the AG-1 criteria however, based on past operating performance, these systems are considered acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
99 (T)	Mechanical Running Test: All fans shall be given a mechanical running test for at least 1hr, after which all parts and accessories shall be inspected to determine any sign of excessive wear or mechanical defect.	BA-5144	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
100 (T)	Seismic Test: Seismic testing, when required, shall be performed in accordance with AA-4350.	BA-5145	Seismic testing of these systems is not applicable.	NA	NA	NA	NA

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101 (T,QA)	Test Results and Reports: All test results and reports shall be certified and documented.	BA-5150	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
	Driver Inspection and Testing	BA-5200					
102 (T)	First Unit of a Design: First units of a design shall be given a complete test per IEEE 112A. For a totally enclosed, air over (TEAO) driver, the full load heat run shall be taken. Test data shall be documented.	BA-5210	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
103 (T)	Succeeding Units of a Design: Each subsequent driver shall be given a complete test per IEEE 112A. Test data shall be documented.	BA-5220	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
	FABRICATION AND INSTALLATION	BA-6000					
104 (F)	General: Fabrication shall be in accordance with the requirements of Section BA and of AA-6000.	BA-6000	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
105 (F)	Fabrication: Written fabrication procedures shall be established and used during the fan manufacture. All heat treating requirements shall be indicated on drawings or in the fabrication procedures.	BA-6100	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
106 (D,P,F)	Selection of Materials: Materials shall conform to the requirements of BA-3000. The material designations shall be provided on the fabrication drawings.	BA-6110	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
	PACKAGING, SHIPPING, AND STORAGE	BA-7000					

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107 (O)	General: Packaging, shipping, and storage of fans shall be in accordance with the requirements of Section BA and of AA-7000.	BA-7000	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
108 (O)	Fans: Fans shall be prepared for shipment in accordance with ASME NQA-2, Protection Level C, when shipped direct without the driver, or when shipped with the driver installed to a supplier who will assemble the fan with another piece of equipment. When the fan is to be shipped to the job-site with the driver installed, preparation shall be in accordance with Protection Level B.	BA-7100	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
109 (O)	Storage: Fans shall be stored in accordance with ASME NQA-2. When the fans are packaged to Protection Level C, they shall be stored in accordance with Storage Level 3. When packaging is Protection Level B, the fans, drivers, and accessories shall be stored in accordance with Storage Level 2.	BA-7110	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
110 (O,QA)	Documentation: One copy of the storage procedure shall be attached to the equipment or crate at the time of shipment. The storage procedure shall cover both short term and long term (over 6 months) storage maintenance programs.	BA-7120	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
111 (O)	Drivers Shipped Separately--Short Term: Any driver that is to be used within 6 months of shipment shall be packaged according to good commercial practice, shipped within an enclosed carrier, and stored in a weather-tight, ventilated and heated building, equivalent to ASME NQA-2, Storage Level 2.	BA-7210	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
112 (O)	Drivers Shipped Separately--Long Term: Any driver that is to be stored for a period of 6 months or longer must be packaged per ASME NQA-2, Protection Level B. If the driver is equipped with space heaters, the space heaters may be energized in storage, in lieu of providing moisture barrier wrapping and internal desiccant.	BA-7220	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
	QUALITY ASSURANCE	BA-8000					

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113 (QA)	General: Quality Assurance of fans shall be in accordance with the requirements of Section BA and of AA-8000.	BA-8000	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past *operating performance, these systems are* acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
114 (T,QA)	Certified Fan Performance Curves: *Documentation shall be established to verify that the certified fan* performance curves were generated in accordance with AMCA 210. The certified fan performance data shall include a description of the test setup, instruments used, calibration data, and personnel qualifications.	BA-8110	This requirement is acceptable based on a review of the Fan Performance Curve data that was submitted into the CVI files for each system.	CC	CC	CC	CC
115 (P,QA)	Material Certifications: Material test reports are required in accordance with BA-3400. Permanent documentation shall be established and shall include as a minimum: procurement records, receiving reports, manufacturing records, inspection reports, material control records, and Certified Material Test Reports for which certification is required. Permanent documentation shall be maintained for the life of the plant.	BA-8120	CMTR's for the materials used for fabrication of systems AN, AP, and AW were located in the Project Files, however the CMTR's were not specifically traceable to all the materials used.	DR	DR	DR	CC
116 (F,QA)	Quality Assurance for Drivers: Each driver shall be manufactured under a quality assurance program that conforms to ASME NQA-2 as applied to fan drivers. Each driver shall be qualified in accordance with ANSI/IEEE 323 Class 1E qualification standards.	BA-8200	Documentation to verify this requirement was not available for review for Systems AN, AP, and AW since these systems were designed and built in the late 70's and early 80's however, based on past operating performance, these systems are considered acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
	NAMEPLATES AND OPERATING AND MAINTENANCE MANUALS	BA-9000					
117 (O)	Required Nameplate Data: Each fan assembly shall be provided with a legibly marked nameplate giving the identifying name, normal fan capacity, manufacturer, fan type, size, rotation, rating, maximum speed, and mark numbers, as applicable to Section BA and AA-9000.	BA-9110	Documentation to verify the requirements associated with Nameplates and Marking of fans and driver was not available for Systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

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118 (O)	Drivers: Each driver shall have one or more engraved or embossed nameplates of stainless steel, which as a minimum, shall convey the data required by NEMA MG-1.	BA-9120	Documentation to verify the requirements associated with Nameplates and Marking of fans and driver was not available for Systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
119 (O)	Acceptable Marking Methods: Each accessory shall be marked with the name of the Manufacturer or a distinctive marking, which may be in code, by which it is identified as the product of a particular manufacturer.	BA-9210	Documentation to verify the requirements associated with Nameplates and Marking of fans and driver was not available for Systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC
120 (O,QA)	Operating and Maintenance Manuals: The manufacturer shall provide an operating and maintenance manual for the equipment furnished. The manual shall include: (a) recommended spare parts list, including a description of each part and a drawing that identifies the location of each part; and (b) recommended maintenance procedure, including a periodic servicing schedule.	BA-9310	Operating and Maintenance manuals were reviewed as part of the CVI data information for systems AN, AP, and AW. However, not all of the applicable information for these systems was included in the CVI data. Based on past operating performance, these systems are considered acceptable as-is. SY System complied with this requirement completely.	DR	DR	DR	CC

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Attachment 4

ASME AG-1 Section DA

Compliance Matrix

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
	SECTION DA: Dampers and Louvers	DA					
	MATERIALS	DA-3000					
1 (D,P)	Exclusion of Items: Valves whose design, manufacture, test, and installation are covered by the ASME Code, Section III, or ASME B31.1, are excluded from this Section even though they may be used to perform the function of a damper.	DA-1210	Valve design and fabrication for systems AN, AP, and AW meet the requirements of ASME B31.1. (See Tyco Valve Letter for Keystone Butterfly Valves). The valves for the SY exhaust train also comply with ASME B31.1 requirements but the valves associated with the ductwork from the tanks could not be verified as meeting this requirement. These systems are acceptable as-is based on past operating performance.	CC	CC	CC	CC
2 (D,P)	Materials of Construction: Materials used in the construction of frames, blades, shafts, and linkages shall conform to requirements of specifications for materials given in Table DA-3100.	DA-3110	This requirement is acceptable base on a review of the CVI data and associated drawings.	CC	CC	CC	CC
3 (D)	Allowable Stress: Allowable stress values for the design of frames, blades, shafts, and linkages are specified in AA-4000. At temperatures above 650 degrees F for ferrous material or 200 degrees F for nonferrous material, the special limitations cited in DA-3211 shall apply.	DA-3120	Special limitation requirements do not apply to the dampers that are specified for these systems.	NA	NA	NA	NA
4 (D,P)	Bearing Material: Bearing materials shall conform to the requirements of DA-4250.	DA-3130	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
5 (D,P)	Seal Material: Seal materials shall conform to the requirements of DA-4260.	DA-3140	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
	Special Limitations on Materials	DA-3200					
6 (D)	Physical Properties Reduction: The reduction in the physical properties of metals at higher temperatures must be recognized and factored into the design of dampers used in high temperature application, particularly where fire hazard is involved.	DA-3211	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA

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7 (D,F)	Galvanic Corrosion: The possibility of galvanic corrosion due to the relative potentials of aluminum, copper, and their alloys should be considered when used in conjunction with each other, or with steel or other metals and their alloys.	DA-3212	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
8 (D,F)	Corrosive Vapors: Aluminum and zinc shall not be used in the presence of corrosive vapors unless protected by coatings or other suitable means designed to prevent deterioration of the metal.	DA-3213	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
9 (D,F)	Nonmetallic Materials: The use of nonmetallic materials such as plastics, elastomers, and similar substances is permitted in the construction of components provided consideration is given to: (a) destruction where fire hazards exist, including toxicity; (b) degradation of properties caused by temperature increase, radiation exposure, chemical exposure, and aging; and (c) maintainability.	DA-3220	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
10 (D,P)	Deterioration of Materials in Service: It is the responsibility of the Owner or his designee to identify the environment in which the components must operate so that the Manufacturer can select the grade of materials to meet the conditions stated in the Design Specification.	DA-3230	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
11 (D,P,T)	Certification of Materials: The manufacturer shall make available, as a minimum, certified test reports of chemical and physical properties of material and hardware for stress components such as related accessories including frames, blades, shafts, and linkages. For those ASTM materials which do not have physical testing required by the ASTM specification, testing should be performed per ASTM A 370. All other components used in the construction of the damper shall be provided with a Manufacturer's Certificate of Compliance covering the ASME or ASTM material specification, grade, and class, if applicable.	DA-3300	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
	DESIGN	DA-4000					
12 (D)	General Design: Design of dampers and louvers shall be in accordance with the requirements of Section DA and of those portions of Section AA invoked in Section DA.	DA-4100	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
13 (D)	Requirements of the Design Specifications: Design specifications prepared by the Owner or his designee in sufficient detail to provide a complete basis for design and manufacturer in accordance with this Code shall include, as applicable: (a) reference to this Code (b) function, as defined in DA-1320 (c) configuration, as defined in DA-1330 (d) maximum allowable seat and frame leakage and the specific differential pressures, ad defined in DA-1340 and Mandatory Appendix DA-I (e) pressures, as defined in DA-1350 (f) temperatures, as defined in DA-1360 (g) volumetric flow rate at defined temperature, pressure, and density (h) *maximum relative humidity of the air or gas stream* (i) maximum design pressure drop at design volumetric flow rate (j) composition, concentration, and nature of the entrained contaminants in the air or gas stream (k) normal operating position and failsafe position of blades (l) installation parameters (m) mounting configuration and support, i.e., flange mounted, inside-of-duct mounted, wall or cantilevered mounting (n) orientation of damper and direction of airflow (o) blade orientation relative to frame (p) maximum closure and opening time (q) actuator data, as required by DA-4300 (r) anticipated number of operating cycles (e.g., specify number for two-position or state "continuous operation" for modulating service) (s) allowable materials per DA-3000 (t) special requirements for blades, frames, linkages, seals, and bearings (u) accessories required and mounting location (v) any and all anticipated internal and external loadings other than pressures (w) combination of loading conditions, seismic requirements, and the design transients applicable to the appropriate service level per AA-4000 (x) radiation integrated life dose and maximum dose rate (rad/unit time)	DA-4110	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA

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	Continued (y) finish and coating requirements (z) fire resistance rating as 11/2 or 3 hr	DA-4110	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
14 (D)	Requirements of the Manufacturer: When required by the Design Specifications, documentation provided by the Manufacturer to the Owner or his designee shall include the following, as applicable: (a) mounting connection details (b) weight and center of gravity (c) service connections, size, type, and locations (d) pressure drop at rated flow (e) maximum seat and frame leakage at design pressures (f) maximum closure and opening time at stated conditions (g) materials of construction (h) bearing design life (i) seal design life (j) actuator torque supplied (k) damper or louver torque required (l) actuator environmental and seismic qualifications (m) verification of structural integrity, performance, and qualification in accordance with AA-4000 (n) actuator position or orientation (o) UL fire resistance rating and UL installation instructions	DA-4120	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
	Performance Requirements	DA-4130					
15 (D)	Seat Leakage: Seat leakage shall be equal to or less than the amount shown in Mandatory Appendix DA-I for the class specified in the Design Specification.	DA-4131	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
16 (D)	Frame Leakage: Frame leakage shall be equal to less than the amount shown in Mandatory Appendix DA-I for the class specified in the Design Specification	DA-4132	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
17 (D)	Pressure Drop: Pressure drop shall be less than or equal to that stated in the Design Specification at the design volumetric flow rate.	DA-4133	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
18 (D)	Fire Ratings: Fire Dampers shall have a 11/2 or 3 hr rating in accordance with UL-555 as determined by NFPA 90A and NFPA 803.	DA-4134	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA

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Rqmt No./Ops. Step	Division II -- Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key)			
				AN	AP	AW	SY
19 (D)	Fire Damper Closure: The fire damper shall close against the specified volumetric flow rate and specified operating pressure.	DA-4135	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
20 (D)	Cycle Time: The damper must cycle full open to full closed or full closed to full open within the time specified in the Design Specification.	DA-4136	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
	Technical Requirements	DA-4200					
21 (D)	General: Dampers or louvers shall be designed in accordance with the structural requirements given in AA-4000. Structural requirements and load definitions are given in DA-4212 through DA-4214.	DA-4211	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
22 (D,F)	Methods of Support: A damper or louver assembly may be supported by one or more of several methods... (a) Line Supported Assembly. The support boundary for this case shall be the interface flanges or other mechanical connections designed to transfer all components of loads across the joints. (b) Bulkhead of End Supported Assembly. The support boundary for this case shall also be the interface flanges or other mechanical connections or structural connections designed to transfer all components of load. (c) Side, Top, or Bottom Supported Assembly. . The support boundary for this case shall be the attachment point for the assembly...	DA-4212.1	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air *Conditioning* Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: *(See Legend for Key)* AN	AP	AW	SY
23 (D,QA)	Documentation: The damper or louver Manufacturer shall be responsible for providing all information necessary to define the support boundary interfaces. The interface control information to be specified shall include but not necessarily be limited to the following: (a) identification of any special support requirements as well as the configuration and size of the damper flanges; (b) magnitudes and directions of all loads imposed on the anchorage points, including all static, dynamic, and operational loads resulting from the installed assembly. Load data shall be provided in a form which shall allow combinations to be considered as required in AA-4000; (c) other information, such as bending moments, shear forces, axial loads, torsional moments or stiffness requirements necessary to assure that the damper or louver can perform its required safety function under all design conditions.	DA-4212.2	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
24 (D)	Loads: Loads to be considered are as given in AA-4211 and AA-4212 with the following clarifications	DA-4213	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
25 (D)	Normal Loads: Normal loads *N* shall include: (a) Deadweight load – the load imposed by the weight of all components of the assembly. (b) Operating pressure load – the load resulting from the maximum positive or negative differential pressure which may occur during normal operation… (c) Actuator load – the load or loads imposed by the actuator to a specific area of the assembly. (d) Normal equipment interface load – the normal externally applied load or loads from other equipment attached to the assembly. (e) externally concentrated load - the load or loads imposed by the application of an external force to a limited area of the assembly.	DA-4213.1	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
26 (D)	Thermal Loads: Thermal loads *T* shall include loads resulting from constraint of forces and displacements caused by temperature variations.	DA-4213.2	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
27 (D)	Other Loads: Other specific load conditions such as shock loads due to pressure transients shall be provided in the Design Specification to allow loads to be combined for the service levels as required under AA-4212 and compared to the applicable service limits required under AA-4214 and AA-4230 and other criteria imposed under AA-4240 and stress limits of this Section.	DA-4213.3	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
28 (D)	Structural Verification: The technical and documentation requirements of AA-4000 shall apply to verification of design by analysis, test, or comparison.	DA-4214	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
29 (D)	Special Considerations: (a) Frame deflection under normal and upset plant conditions (Service Levels A and B) shall not exceed 1/360 of the span in any direction, or 1/8 in., whichever is less. (b) Blade edge or center line deflection under normal and upset plant conditions (Service Levels A and B) shall not exceed 1/360 of the blade length (or diameter) or 1/8 in., whichever is less. (c) The blade edge and center line deflection under loads due to normal plant conditions shall not allow the leakage criteria to be exceeded. (d) Fire damper design shall be based on loads imposed on damper blades when closing with design volumetric flow rate and pressures present.	DA-4215	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
30 (D)	Thermal Expansion: To prevent binding and restraint of free movement, the design shall provide for the relative motions that occur between components due to variations of temperature and coefficients of expansion. Such provisions for differential expansion shall include, as a minimum: (a) blade end clearances (b) bearing clearances (c) longitudinal movement of the shafts (d) sealing capabilities	DA-4220	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA

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31 (D)	Torque Determinations: In determining the torque required to actuate the blades, the Manufacturer shall consider the blade position and direction of the applied torque to produce the desired movement. At the maximum specified operating pressure this determination shall include, as a minimum, the following torque components: (a) breakaway torque (b) dynamic torque (c) friction torque (d) seating torque	DA-4231	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
32 (D)	Actuator Torque: The actuator and associated linkage shall deliver to the damper or louver a minimum of 1.5 times the maximum torque as determined in DA-4231, except for self-contained actuators used to counterbalance a specific force, and must be designed to match the required torque. Actuators shall be evaluated in both directions for the maximum torque, at the beginning of the blade movement, while stroking the blades through the full range of movement.	DA-4232	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
33 (D)	Linkage Design: Linkage design shall include the following minimum requirements. (a) Brackets, arms, and levers shall be of a length and stiffness to provide stable operation of the blades at the maximum specified operating pressure and airflow without flutter or binding at all blade positions. (b) The linkage system shall be designed to transmit sufficient torque to each blade to set the seals of each and every blade at the maximum specified operating pressure and airflow to limit leakage to less than the specified leakage. (c) All linkage components shall be designed to transmit a minimum of 1.5 times the torque required by DA-4231 without exceeding the allowable stress listed in AA-4000. (d) If a linkage system is designed to be field adjustable, suitable locking devices such as jam nuts, etc., shall be provided. (e) The linkage system shall be designed to be compatible with the actuator selected for the application.	DA-4242	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA

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34 (D,P)	Bearings—General Application: (a) Bearings shall permit axial shaft movement to provide for operating clearances and differential expansion in both vertical and horizontal installations. (b) Bearing materials shall be selected for the loading and environment conditions to which the bearing will be subjected.	DA-4251	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
	Bearing Types	DA-4252					
35 (D,P)	Metallic Sleeve Bearings: Sintered sleeve bearing material shall be lubricant-impregnated bronze or stainless steel and shall be lubricated prior to shipment, and provisions should be made for lubrication in the field.	DA-4252.1	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
36 (D,P)	Nonmetallic Sleeve Bearings: Nonmetallic sleeve bearings, (i.e., phenolic, nylon, and similar materials) may be used subject to the limitations of DA-3220.	DA-4252.2	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
37 (D,F)	Rolling Element Bearings: Pre-mounted bearing assemblies, flanges, or pillow blocks shall be self-aligning and mounted in such a manner as to be replaceable. Grease fittings shall be provided when the lubricant must be periodically renewed. Flanges and pillow blocks are to be made of steel, malleable iron. or cast iron.	DA-4252.3	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
38 (D)	Bearing Design: (a) Bearing running surfaces of sleeve bearings shall have a finish as recommended by the bearing Manufacturer. (b) Sleeve bearings shall be contained to prevent rotational movement except between the intended bearing surfaces. (c) Sleeve bearings shall have a bearing load surface diameter difference as recommended by the bearing Manufacturer to provide rotational clearance. (d) Sleeve bearing wall thickness shall be as recommended by the bearing Manufacturer. (e) Rolling element bearings shall be sized to allow bearings to be slipped onto the shaft. The maximum clearance in shaft diameter shall be as recommended by the bearing Manufacturer, plus clearance for thermal expansion.	DA-4253	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA

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39 (D)	Bearing Loading: (a) Sleeve bearing loading on the radial and thrust load areas shall not exceed 67% of the bearing Manufacturer's recommended static load rating. (b) Sleeve bearing radial load area shall, as a minimum, be equal to one –quarter of the diameter times the length supported jby the bearing housing or damper/louver frame. (c) When sleeve bearings are subjected to thrust loads, a thrust washer shall be used to transmit the load to the bearing, or the load transmitting member shall meet the requirement of DA-4252.1. (d) Maximum radial or thrust loading on rolling element bearings shall not exceed the bearing Manufacturer's recommended static load rating. (e) The calculated load on each bearing shall consist of all design forces applied to that bearing, including that of the actuator and linkage.	DA-4254	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
	Seals	DA-4260					
40 (D)	Design: The seal design shall maintain the specified leakage limits during the design life of the seal. Where the design life of the assembly exceeds the life expectancy of the seal material, the seals shall be replaceable, and the means of attaching the seal or installing the packing in a stuffing box shall be so designed to facilitate their replacement…	DA-4262	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
41 (D,P)	Material: Selection of seal material by the damper Manufacturer shall be based on specific system design performance requirements and environmental conditions to which it is exposed…	DA-4263	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
42 (D)	Frame Construction Class A or B: Dampers requiring frame construction to Leakage Rate Classes A or B (see Mandatory Appendix DA-I) shall be provided with stuffing boxes, gasketted cover plates, or other sealing devices to reduce frame leakage to less than or equal to that stated in the Design Specification.	DA-4271	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
43 (D)	Gasket and Packaging Material Requirements: Gasket and packing materials shall conform to the requirements of DA-3220, DA-3230, and DA-4263.	DA-4272	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA

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44 (D)	Mounting Structure: Each actuator and/or accessory shall be provided with a rigid structure suitable for mounting such devices.	DA-4281	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
45 (D)	Accessibility: The arrangement of actuators and accessories shall provide accessibility for removal and replacement of each component.	DA-4282	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
46 (D,P)	Mounting Structure Material: The structure for mounting actuators and accessories shall be fabricated of material listed in Table DA-3100. Structures shall be designed as required by AA-4000.	DA-4283	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
47 (D)	Attachment of Actuators and Accessories: Actuators and accessories shall be attached to the mounting structure with removable fasteners, of material listed in Table DA-3100, sized to conform to the stress limitations stated in AA-4000.	BA-4284	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
48 (D)	Linkage Adjustability: The actuator mounting or linkage shall permit adjustment to achieve the required positioning of the blades at each end of the actuator movement.	DA-4285	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
	Actuators	DA-4300					
49 (D)	Torque Required: The actuator shall be capably of providing the torque required by DA-4232.	DA-4311	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
50 (D)	Forces and Loads On Actuators: Determination of actuator capability shall include consideration of forces transmitted to the actuator directly, through the mounting, and through the linkage; especially side loads on extended rods, and impact loads caused by acceleration and deceleration of blades.	DA-4312	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
51 (D)	Acceleration and Deceleration of Loads: Actuator design shall include consideration of loads caused by acceleration and deceleration of connected components such as blades, springs, and counterbalances.	DA-4313	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
52 (D)	Actuator Voltage or Pressure Load Rating: The actuator rating shall be based on the minimum specified voltage or pressure.	DA-4314	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA

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53 (D)	Power Actuator Specification Requirements: The Design Specification shall include the following as a minimum to establish requirements for actuator performance: (a) function (1) two-position or modulating (2) fail open, closed, or last position (3) power to open or power to close (b) power source (1) type (such as electric, pneumatic, hydraulic) (2) characteristics (such as voltage, pressure, and their ranges) (c) control signal characteristics (d) frequency of actuation (e) damper opening and closing time (f) environmental conditions (g) mounting location and any limitations on space and orientation (h) manual override requirements (i) accumulator sizing requirements (j) actuator environmental and seismic qualifications (k) type of motion (linear or rotary)	DA-4315	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
54 (D)	Manual Actuators: Manual actuators should be equipped with locking devices and position indicators.	DA-4320	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
55 (D)	Torque Requirements: Manual actuators shall be capable of delivering the torque required by DA-4232. Manual actuator components shall be sized as required by AA-4000.	DA-4321	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
56 (D)	Forces and Loads on Actuators: Determination of manual actuator capability shall include consideration of forces transmitted to the actuator directly and through the linkage, including side loads on extended rods.	DA-4322	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
57 (D)	Maximum Input Forces: Input force required to operate manual actuators shall not exceed 25 lb.	DA-4323	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
58 (D)	Self-contained Actuators: Self-contained actuators shall be capable of delivering the torque required by DA-4231.	DA-4330	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
59 (D)	Heat or Temperature Operated Actuators: Heat or temperature operated actuators such as fusible links shall be in accordance with NFPA 90A.	DA-4340	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA

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	Accessories	DA-4400					
60 (D)	Accessory Requirements: As required by the Design Specification, the damper or louver assembly shall be provided with appropriate accessory equipment to provide proper function and performance of the assembly.	DA-4410	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
61 (D)	Auxiliary Energy Source: When required by the Design Specification, actuators shall be provided with an auxiliary energy source, such as springs, counterweights, or accumulators.	DA-4420	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
62 (D)	Modulating Actuator Requirements: When required by the Design Specification, actuators for modulating service shall be provided with a pilot positioner or similar device to assure controlled positioning of the damper in response to the control signal.	DA-4430	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
63 (D)	Position Indicators: When required by the Design Specification, local position indicators shall be provided to enable surveillance and operability verification.	DA-4440	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
64 (D)	Environmental Design Requirements: Electrical devices such as position indicating switches, limit switches, and all other electrical components, shall comply with the Applicable IEEE Standard(s) stated in the Design Specification. All other pneumatic, hydraulic, or other type of accessories shall be suitable for the environment specified in the Design Specification.	DA-4450	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
65 (D)	Piping of Pneumatic Actuators: For pneumatic actuated dampers or louvers, the pneumatic piping system required for the operation of the assembly shall be arranged to provide a single field connection for each supply, or a control signal source for each assembly. Pneumatic piping system materials and installation shall conform to the requirements of the Design Specification...	DA-4460	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
66 (D)	Electrical Wiring Requirements: For electrically actuated dampers or louvers, interconnecting electrical wiring required for the operation of the actuators and accessories shall not be installed, unless specifically required by the Design Specification...	DA-4470	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
	INSPECTION AND TESTING	DA-5000					

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67 (I,T)	General: Inspection and testing of louvers and dampers shall be in accordance with the requirements of this article and of AA-5100, AA-5200, AA-5300, AA-5410, AA-5500, and AA-5800. The manufacturer shall be responsible for establishing the written visual examination procedures and necessary tolerances to assure that the products are built to the Manufacturer's drawings…	DA-5000	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
68 (T)	Testing: The purpose of this Sub-article is to ensure the performance of the damper or louver prior to its installation. Acceptance shall be based on the performance requirements of DA-4140. The use of the test shall be at the discretion of the Engineer as related to the service requirements. Specific tests required by the Engineer shall be specified in the Design Specification.	DA-5700	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
69 (T)	Pressure Drop Testing: Pressure drop data shall be based on tests performed in accordance with AMCA Standard 500. The AMCA Standard figure number used shall be stated with the pressure drop data.	DA-5710	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
70 (T)	Required Cycles: The damper or louver assembly, as applicable, shall be cycled a minimum of 10 times from the full open to the full closed position to verify the free operation of all parts and the correct adjustment, positioning, and seating of all blades.		Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
71 (T)	Pneumatic Air Pressure: The minimum specified air pressure shall be used for pneumatic operators during cycling.	DA-5722	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
72 (T)	Cycle Time: The maximum time for operation of any of the cycles shall be compared with the allowable specified cycle time. If the specified time is exceeded, the necessary correction shall be made and the cycle test repeated.	DA-5723	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
73 (T)	Operational Requirements: Ensure that movement of the blades, actuators, and linkage shall be smooth and without hesitation, and limit switches operate in their intended position.	DA-5724	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA

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74 (T)	Frame Leakage Testing for Frame Leakage Classes A and B: Pressure plates shall be bolted to the inlet and outlet side of the damper. The chamber created shall be pressurized to the specified frame design pressure with the blades partially open. Testing for Leakage Class A shall be in accordance with the bubble method of DA-5741, with the bubble solution applied to the frame. Testing for Leakage Class B shall use a calibrated flowmeter outlined in DA-5743. Leakage shall be equal to or less than the amount shown in Mandatory Appendix DA-I for the leakage class specified in the Design Specification.	DA-5730	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
75 (T)	Seat Leakage Testing: Seat leakage testing shall be performed or verified after cycling time and cycle repetition testing and frame leakage testing. Leakage shall be equal to or less than that stated in Mandatory Appendix DA-I.	DA-5740	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
76 (T)	Seat Leakage Test for Leakage Class 0 Dampers (Bubble Method): The damper shall be bolted to a pressure chamber, which is then pressurized to the specified blade design pressure. A bubble solution (a commercial test solution or...) shall be applied to the damper seat area to be tested... Unless otherwise specified, a leak indication is any bubble 1/16in. diameter that forms in I sec, or a bubble 9/32 in. that forms in 1 min.	DA-5741	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
77 (T)	Seat Leakage Test for Leakage Class II or III Dampers or Louvers: Leakage data shall be based on tests performed in accordance with AMCA 500 or other approved methods.	DA-5742	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
78 (T)	Seat Leakage Test for Leakage Class I Dampers: The damper shall be bolted to a pressure chamber, which is then pressurized to the specified blade design pressure using compressed air of instrument air quality. The inlet compressed air line shall have a calibrated flow meter having capability of resolving flow to within +/- 10% of allowable leakage in the line to measure all air passing through the damper.	DA-5743	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
79 (T)	Fire Damper Closure Test: The fire dampers shall be tested in accordance with AMCA 500-83 using Fig. 5.4, 5.5, or 5.7 for wall or floor transfer applications; and Fig. 5.1, 5.2, or 5.3 for applications of the damper in ducts with dampers installed in their intended position. For closure under dynamic airflow conditions, the damper shall be tested at the specified volumetric flow rate when open and to the maximum operating pressure when closed.	DA-5744	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA

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	FABRICATION AND INSTALLATION	DA-6000					
80 (F)	General: Article AA-6000 shall apply for fabrication, finishing, and installation, except that the design and seismic qualifications of the damper assembly are based on the damper assembly being adequately supported for the appropriate loads.	DA-6000	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
81 (F)	General: The owner or his designee shall provide supports for the damper assembly to ensure that the damper is adequately supported as required by the Manufacturer's requirements and DA-4212.	DA-6000	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
82 (F)	General: All of the welding codes or standards listed are allowed.	DA-6000	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
83 (F)	General: Installation of UL fire dampers shall be in accordance with the Manufacturer's UL Installation Instructions.	DA-6000	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
84 (F)	Welding and Brazing: Specific welding and brazing parameters shall conform to the requirements of AA-6000.	DA-6100	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
	PACKAGING, SHIPPING, AND STORAGE:	DA-7000					
85 (O)	General: Packaging, shipping, and storage of damper and louver assemblies shall be in accordance with the requirements of AA-7000. Implementation requires an ANSI/ASME NQA-2 classification level for packaging, shipping, storage, and handling of all items. Such classification is as follows: (a) dampers and louvers only—Level C (b) electric actuator—Level B (c) actuator, other than electric—Level C (d) accessories—Level B (e) dampers and louvers with electric actuators or accessories—Level B	DA-7000	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
	QUALITY ASSURANCE	DA-8000					
86 (QA)	General: Quality assurance of dampers and louvers shall be in accordance with the requirements of Section DA and AA-8000.	DA-8000	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
87 (QA)	Damper and Louver Performance: Documentation shall be established to verify that damper and louver performance complies with the testing criteria of DA-5000.	DA-8100	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA

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88 (QA)	Quality Assurance Records: Documentation shall be prepared, maintained, and submitted to the Owner for record in accordance with the requirements of DA-9000.	DA-8300	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
	NAMEPLATES, STAMPINGS, AND MANUALS	DA-9000					
89 (O)	General: Article AA-9000 requirements for nameplates, stampings, and manuals shall apply, except that the nameplate shall require only the following information: (a) Manufacturer's name (b) Equipment, tag, or mark number information as supplied by the purchaser (c) Size	DA-9000	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
90 (O)	Nameplates and Stampings: In those instances when the damper or louver assembly consists of several frames which may be independently removable, each such frame shall bear required piece part markings. Actuators and accessories included in the assembly shall be marked with the name of the Manufacturer or a distinctive marking, which may be in code, by which it is identified as a product of a particular Manufacturer.	DA-9100	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
91 (QA,O)	Manuals: The Manufacturer shall provide a manual or manuals for the equipment furnished. The manual shall include a recommended spare parts list and recommended installation, maintenance, and operational procedures.	DA-9200	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA
	DAMPER AND LOUVER CONFIGURATIONS	Mandatory Appendix DA-II	Valves were designed, fabricated, tested, and installed per ASME B31.1. (See item # 1 of this Matrix Table.)	NA	NA	NA	NA

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Attachment 5

ASME AG-1 Section SA

Compliance Matrix

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
	SECTION SA: Ductwork	SA					
	MATERIALS	SA-3000					
1 (D,P)	General: For components of ductwork and ductwork supports, the supplier shall make available, as a minimum, certified test reports of chemical and physical properties. For those ASTM materials, which do not have physical testing required by the ASTM specification, tensile testing shall be performed per ASTM A370. All other components used in the construction of ductwork shall be provided with a manufacturer's Certificate of Compliance covering the ASME, ASTM, or other material specification, grade, and class, if applicable.	SA-3100	CMTR's were available for review, however, they were not specifically traceable back to the material used for the ductwork for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
2 (D,P)	Material Substitution: Measures shall be established for controlling and identifying material substitutions throughout the manufacturing and installation process.	SA-3200	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
3 (D,P,T)	Material Testing: When required by the Design Specification, material shall be tested in accordance with the applicable material specification. Supplemental material testing, when required, shall be performed in accordance with Article AA-3000.	SA-3300	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR

Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
4 (D,P)	Material Specifications: Material for ductwork and ductwork supports shall be capable of meeting all requirements of Article SA-4000. Materials shall be in conformance with the ASTM materials listed in Table SA-3400-1. Substitute materials shall be equivalent, or exceed the requirements of Table SA-3400-1, as determined by the Engineer. Materials selected shall be evaluated for suitability with service conditions and compatibility with other materials used in duct construction. The ASTM numbers in Table SA-3400-1 designate a chemical composition and a material thickness limit. A grade designation is usually required to determine the minimum strength of the material. If the specific grade material has an assigned minimum yield and tensile strength, these values shall be used for design purposes. If values have not been established and assigned, then tests in accordance with the procedures outlined in Article AA-3000 shall be performed to ensure that the strength of the material meets the required design stress values. Materials listed in Table SA-3400-1 under "Carbon Steel Plates and Sheets" when coated in Accordance with "Zinc Coatings," shall be allowable under "Galvanized Steel Plates and Sheets." Materials listed under "Carbon Steel Structural Members" and "Carbon Steel Bolts and Nuts" shall be coated in Accordance with "Zinc Coatings" when used in conjunction with materials listed under "Galvanized Steel Plates and Sheets."	SA-3400	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
5 (D,P)	Material listed in Table SA-3400-1 under "Carbon Steel Plates and Sheets" when coated in accordance with "Zinc Coatings" shall be allowable under "Galvanized Steel Plates and Sheets." Materials listed under "Carbon Steel Structural Members" and "Carbon Steel Bolts and Nuts" shall be coated in accordance with Zinc Coatings" when used in conjunction with materials listed under "Galvanized Steel Plates and Sheets."	SA-3400	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
	DESIGN	SA-4000					
6 (D)	General: Ductwork and ductwork supports shall be designed in accordance with the requirements of Article AA-4000 and this Section.	SA-4100	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
	Design Criteria—Load Criteria	SA-4200					

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7 (D)	Additional dynamic loads (ADL), dead weight (DW), design pressure differential (DPD), design wind (W), external loads (EL), normal operating differential pressure (NOPD), and system operational pressure transient (SOPT) as defined in AA-4211	SA-4211	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
8 (D)	Constraints of free end displacement load (T): These are loads caused by thermal movement. When duct construction utilizes gasketed companion angle construction, effects of T for normal operations may be ignored. For postulated accident conditions, a review of the effect of T is necessary.	SA-4211	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
9 (D)	Fluid momentum load (FML): This is as defined in AA-4211 with the following clarification: Ductwork shall be designed to withstand the FML resulting from air turbulence, often found in sections following fan discharges, and certain dampers and duct fittings. The termination of such sections is marked by the length of straight ductwork required to regain uniform airflow as given by AMCA 201 Fig 20:...	SA-4211	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
10 (D)	Live load (L): Live loads shall be defined in the Design Specification. The live load shall not be less than a construction manload of 250 pounds. The load shall be applied at the mid-span of the duct, or midpoint of a stiffener, or within a panel. When applied to a panel, the load shall be assumed to be distributed over 10 square inches.	SA-4211	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
11 (D)	Normal Operating Pressure Differential (NOPD): For ease of design, a duct system may be designed using one pressure value that envelopes NOPD and SOPT (AA-4211). NOPD and SOPT may be positive or negative pressures. Worse case shall be considered in the design.	SA-4211	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR

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12 (D)	Seismic loads (SL): Loads that are the result of the envelop of the operating basis earthquake (OBE) and the safe shutdown earthquake (SSE). As overall system functionalism is not generally compromised by loads from the OBE, the SSE will govern the design. As an option, the OBE, and SSE may be considered separately with the OBE loads used for the Level B load combination. The horizontal and vertical components of the seismic excitation shall be applied simultaneously in the direction that will produce worst-case stresses and deflections. These components may be combined by the square root of the sum of the squares (SRSS) method.	SA-4211	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
13 (D)	Hydrostatic loads from accumulated condensate, water deluge systems, or moisture separators: The hydrostatic load shall be conservatively established by documented analysis base on ductwork configuration, accessories, and component function. Hydrostatic load shall be added to the dead weight as applicable.	SA-4211	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
14 (D)	Design Pressure Differential (DPD): The dynamic pressure loads resulting from a design basis accident (DBA), intermediate break accident (IBA), or small break accident (SBA). Generally, HVAC should be routed outside the local pipe break affected area. If HVAC is subjected to these loads, the Design Specification (SA-4600) shall address the station specific design requirements considering a Service Level D combination.	SA-4211	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
15 (D)	For component load criteria see the following sections: (1) HEPA filters – FC-4300 (2) Mounting frames – FG-4200 (3) Fans – BA-4000 (4) Dampers – DA-4000 (5) Refrigeration equipment – RA-4000 (6) Conditioning – CA-4000 (7) Moisture separators – FA-4000 (8) Pre-filters – FB-4000 (9) Instrumentation – IA-4000	SA-4211	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR

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16 (D)	Ductwork Load Combinations: The applicable component loading shall be combined in accordance with Table SA-4212.	SA-4212	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
17 (D)	Design and Service Limits: The requirements of AA-4214 apply.	SA-4214	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
18 (D)	Ductwork Support Loads: Loads per SA-4211 for L, NOPD, SL DW, EL, and ADL shall also be used for duct supports. Hydrostatic loads shall be treated as DW load when the loads have an effect on the supports. Hydrostatic loads as defined in para. SA-4211 (g) shall be treated as a DW load when the loads have an effect on the supports. The fluid momentum load as defined in para. SA-4211 (c) is not typically a significant load for supports and may be neglected.	SA-4215	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
19 (D)	Ductwork Support Load Combinations: The applicable support shall be combined in accordance with Table SA-4216.	SA-4216	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
20 (D)	Stress Criteria: The ductwork stress shall be based upon the AISI "Specifications for the Design of Cold Formed Steel Structural Members." The ductwork support stress shall be based upon the AISC "Specification for the Design, Fabrication and erection of Structural Steel for Buildings."	SA-4220	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR

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21 (D)	Stress Criteria: The basic general membrane design stress for the Service Level A condition shall not exceed 0.6 *Fy* and shall be reduced as appropriate to consider lateral-torsional buckling of bending members and effective lengths of compression members. The basic general membrane design stress for the Service Level C condition shall not exceed 1.2 X 0.6 *Fy* per AA-4321.	SA-4220	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
22 (D)	Stress Criteria: The combined and bending design stress for Service Level C shall not exceed 0.9 *Fy* and shall be reduced as appropriate to consider lateral-torsional buckling of bending members and effective lengths of compression members. The combined and bending design stress for Service Level A shall not exceed 1.8 X 0.6 *Fy* per AA-4321.	SA-4220	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
23 (D)	Deflection Limits: The maximum deflection (dmax), may be sustained so that the duct function is not impaired shall be determined by analysis, test or both. The allowable deflections are as defined in AA-4231 for various Service level conditions.	SA-4231	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR

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24 (D)	Deflection Limits for Panels, Flanges, and Stiffeners: The maximum deflection (d), which occurs as the result of the applicable load combinations of SA-4212 is the lesser of two values derived from the following: Criterion No. 1 – Deflection shall not exceed the following criteria : (a) Plate or sheet: 1/8 in. per ft. of the maximum unsupported panel span in direction of airflow but not more than ¾ in. (b) Stiffeners and flange connections: Not to exceed 1/8 in. per foot of span but not more than ¾ in. (c) Flange connection to components: 1/360th of the span but not to exceed 1/8 in. Criterion No. 2 – Deflections shall be limited to assure that the following will not occur: (a) Distortion of air flow path cross-section in excess of tolerances specified on SA-6400. (b) Damage to safety related items such as instrumentation or accessories. (c) Impingement of deflected elements on adjacent services, such as equipment, pipe, cables, tubing, etc. (d) Loss of leaktightness in excess of leakage limit. See SA-4500. (e) Functional failure of components attached to the duct (e.g., instrument lines).	SA-4232	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
25 (D)	Deflection Limits for Mounting Frames and Equipment Interfaces: (a) See FG-4310 for mounting frame deflection limits. (b) See applicable equipment section for other deflection limits.	SA-4233	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
26 (D)	Vibration Isolation: The vibration isolation type and efficiencies, primarily between duct and equipment, shall be as designated in the Design Specification. The vibration isolation equipment shall be designed with restraints to resist the loads generated under any Service Condition.	SA-4241	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR

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27 (D)	Provisions for Relative Movement: Clearances shall be provided to allow for the relative motion between equipment, ductwork, and supports. When clearances or travel ranges or both are required to accommodate movements of ductwork or supports, design margins shall be introduced to allow for variations due to fabrication and installation. Design clearances and travel ranges shall be based on the maximum range that might occur between two operating conditions and not necessarily the maximum cold to hot range. All parts of support shall be disengaged by the movements of ductwork.	SA-4242	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
28 (D)	Tolerances: Installation and fabrication tolerances for duct-work shall be accounted for in the design of the ductwork and supports. Fabrication tolerances shall comply with SA-6400.	SA-4243	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
29 (D)	Permanent Attachments: The attachment design shall include all Service Conditions and Load combinations set forth in SA-4212 and SA-4213, or as required by the Design Specification. The permissible types of welded joints shall be in accordance with AWS D1.1, or AWS D1.3, as applicable. Attachments may be either the welded or bolted type and shall be considered as follows:	SA-4244	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
30 (D)	Welded Attachments: Consideration shall be given to local stresses induced in the ductwork by integral attachments as defined in AA-4243. For items used as part of an assembly for the support or guiding of ductwork, the materials shall be compatible for welding, see Article AA-6000.	SA-4244	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
31 (D)	Bolted Attachments: Consideration shall be given to the mechanical connection and local stresses induced in the ductwork by nonintegral attachments as defined in paragraph AA-4243. The design of bolts for structural supports shall meet the requirements of Sub-article AA-4360.	SA-4244	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR

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32 (D)	Ductwork Joints and Seams—General: Selection of joints and seams used in the assembly of ductwork sections shall be based on the required structural integrity, leaktightness, and the fluid flow within the system. Duct-housing interconnections shall be designed with consideration of the air distribution uniformity.	SA-4310	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
	Duct Joints and Seams	SA-4320					
33 (D)	The following longitudinal seams are acceptable for use in ductwork sections subject to the limitations of SA-4324. (a) groove weld (b) lock type (c) Pittsburgh lock (d) Fillet weld	SA-4321	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
34 (D)	The following longitudinal types of transverse joints are acceptable for use in ductwork sections: (a) welded flange (b) companion angle (c) Vanstone flange (d) Welded coupling	SA-4322	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
35 (D,T)	Other types of rigid transverse connections may be acceptable provided that the structural characteristics are documented by engineering evaluation and tested per SA-5400	SA-4323	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
	Limitations of Ductwork Joints and Seams	SA-4324					

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36 (D)	Longitudinal seams and transverse joints whose structural integrity is dependent on the folded or punched metal, shall be pressure tested. Test pressure shall be the structural capability pressure.	SA-4324	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
37 (D)	Longitudinal seams using sealants or elastomers to meet the leakage requirements shall be qualified by test, analysis, or test and analysis to assure meeting the design criteria of SA-4600. Brazed welding may be used for sealing purposes.	SA-4324	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
38 (D)	Bolts and Fasteners: Requirements for bolted connections of duct-to-duct and duct-to-housing, with a design pressure differential less than 15 in. w.g. shall be as follows: (a) Maximum bolt spacing shall be four inches on center unless otherwise specified by the Design Specification. The adequacy of bolt spacing greater than four inches on center, for pressure boundary integrity, shall be documented by calculation or testing. (b) Minimum bolt diameter shall be three-eighths inches unless otherwise specified by the Design Specification. The adequacy of bolt diameters less than three-eighths shall be documented by calculations or testing.	SA-4325	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
39 (D)	Requirements for bolted connections for duct with design pressure differentials exceeding 15 in. w.g. shall be determined by calculations or testing.	SA-4325	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR

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40 (D)	Nonbolted, nonwelded type fastening devices (e.g., screws, rivets, etc.) shall have their adequacy demonstrated for the load combinations of SA-4212 and documented by calculation or testing.	SA-4325	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
41 (D)	Bolted connections shall be verified as being capable of sustaining all loading combinations by using an appropriate stress intensification factor.	SA-4325	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
	Components	SA-4400					
42 (D)	Flexible Connections: Flexible connections shall be designed to meet the requirements for design given by SA-4212, SA-4500, and NFPA 90A. Allowable leakage (fabric leakage and joint leakage) shall be determined in accordance with SA-4500.	SA-4410	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
43 (D)	Flexible connections shall be rated by pressure and qualified life. The qualified life shall be determined by testing, or calculation, or both and be based on the environmental conditions provided by the Design Specification. Minimum physical properties (i.e., tensile strength), subject to degradation due to the environments required to satisfy design, shall be the basis of qualified life.	SA-4410	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
44 (D)	Flexible connection pressure rating shall be determined by an ultimate strength test. The pressure rating of the connection shall be no greater than 50% of burst pressure. Calculation of burst pressure can be done in lieu of the test. Burst pressure shall exceed structural capability pressure.	SA-4410	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR

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45 (D)	If adhesive is used in fabrication or installation of flexible connections, it shall be environmentally qualified for use in expected environmental conditions.	SA-4410	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
46 (D)	Gaskets: Gaskets shall be made of materials which are compatible with the Service Conditions (see SA-4600). Gasket material dimensions shall be based on joint design. An acceptable criterion for compression of gasket material shall be established on the basis of the gasket chosen. This acceptance criterion and the service life of the gasket material shall be documented by an engineering evaluation or testing.	SA-4420	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster *skid out to the first 90 degrees elbow.*	DR	DR	DR	DR
47 (D)	Access Doors and Panels: Construction of doors/panels and door frames shall be selected to meet the allowable leakage determined in SA-4500. Sealing surfaces between the door/panel frame shall be designed for compression sealing. The design shall incorporate means for adjusting compression forces, gasket compression, and alignment.	SA-4430	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
48 (D)	Spacing of hinges, latches, and bolts shall be determined by calculation or test to ensure a uniform compression of the gasket. Spacing shall enable a compression of at least 50% of nominal gasket thickness and provide a gasket compression uniformity of +/- 20%.	SA-4430	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
49 (D)	Door hinges shall be designed to minimize damage to compression seals due to friction and shear forces during opening and closing of *the doors.*	SA-4430	Documentation to verify this requirement was not available for review for systems AN, AP, *and AW however, based on past* operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR

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50 (D)	Dogs, hinges, latches, etc. shall be designed such that lubrication materials shall not enter the interior of the ductwork.	SA-4430	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
51 (D)	Provisions for Testing and Maintenance—Test Ports: The engineer shall evaluate the design function of the equipment to determine where test ports (including injection and sampling ports) are required.	SA-4441	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster *skid out to the first 90 degrees elbow.*	DR	DR	DR	DR
52 (D)	Miscellaneous—Drains: (a) Consideration shall be given to drains depending on requirements, services, or components within ductwork. (b) Drains form as integral part of the ductwork system pressure boundary and are subject to air leakage requirements established in SA-4500.	SA-4451	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
53 (D)	Insulation: (a) Insulation shall be provided as required to ensure air conditioning function, limit condensation, or provide acoustic noise reduction. (b) Acoustic lining and thermal insulation shall not be applied to the inside of ducts which may become contaminated during normal plant operations. (c) Insulation applied to the outside of ducts shall not prevent access to doors, access hatches, or other components requiring adjustment or maintenance. (d) The fire hazard classification of applied insulation, adhesive, and *sealer shall not exceed a flame spread of 25 and smoke* developed of 50 in accordance with NFPA-90A (e) Insulation shall be attached to ductwork using a method which will not adversely affect the system/component safety function.	SA-4452	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR

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54 (D)	Air Distribution Devices: Design of air distribution devices and their attachments shall comply with SA-4200 and AA-4300. The performance rating of air distribution devices shall be determined by actual tests performed in accordance with the Air Diffusion Council standard listed in SA-2000.	SA-4453	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
55 (D)	Security Barriers: The requirements for internal and bullet resistant barriers installed for the purpose of security shall be consistent with appropriate federal regulations. Consideration shall be given to the impact (pressure, noise, etc.) the installation of security and bullet resistant barriers will have on the overall performance of the air treatment system in which they are installed. The dead weight of the security and bullet resistant barriers shall be included in the design of ductwork supports.	SA-4454	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
56 (D)	Pressure Boundary Leakage—General: Pressure boundary leakage shall be limited that allowed by the system functional and environmental design requirements. Allowable leakage for a system, or portion of a system, shall be determined considering the following factors (as a minimum): (a) control of airborne contamination (b) control of space pressure (c) control of space temperature (d) control of space humidity	SA-4510	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
57 (D)	Applicability: Pressure boundary leakage shall apply to air cleaning, air cooling, and ventilation systems. Each system's pressure boundary shall include, but not be limited to, the following items as applicable: (a) ductwork as defined I Subarticle SA-1130; (b) fan housings; (c) damper frames and valve bodies (and seats, where used for pressure boundary isolation); (d) heating and cooling coil housings (or frames for duct mounted coils); (e) mounting frames for components used for the reduction of radioactive contamination; (f) instrumentation or other components connected to the ductwork; (g) air cleaning unit housings.	SA-4520	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR

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58 (D)	Evaluation—Responsibility: The Engineer shall evaluate each system to establish the allowable leakage to assure its design ventilation, temperature, and contamination control function is achievable.	SA-4531	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
59 (D)	Allowable Leakage Determination: The following criteria shall be utilized in the determination of allowable leakage: (a) application of governing codes, regulations, and plant specific requirements; (b) consideration of each system's operating mode, including anticipated system upset conditions such as rapid closure of dampers; (c) normal and maximum operating static pressures throughout the pressure boundary; and (d) system internal and external environmental conditions.	SA-4532	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster *skid out to the first 90 degrees elbow.*	DR	DR	DR	DR
60 (D)	Exceptions to Leakage Requirements (however, all audible leaks shall be sealed): (a) all ducts serving the protected space and located within a protected space, regardless of length; (b) plant vent stacks or ducts outside plant buildings, when high level or mixed mode release credit is not required to meet off-site dose limits; (c) systems which provide air cooling or heating function only located entirely in a clean interspace; (d) other exceptions to quantitative measurement of leakage requirements shall be technically justified and specifically documented with basis by the Owner or his agent.	SA-4533	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
61 (D,QA)	Documentation: Evaluation for allowable leakage of each system, or portion thereof, shall be documented. This documentation shall include the following: (a) *identification of system or portion of system* (b) governing codes, regulations, and plant specific requirements (c) purpose of leakage control; see SA-4510 (d) system modes of operation (e) normal operating pressure differential (NOPD) and system operating pressure transient (SOPT) (f) method of derivation of allowable leakage (g) test pressures and associated allowable leakage	SA-4534	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past *operating performance, these systems are considered acceptable as-is.* System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR

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62 (D,T)	Leakage Testing: When specified for a system, shall be performed in accordance with SA-5300 and Section TA of this Code.	SA-4540	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
63 (D)	Design Specification: A Design Specification shall be prepared which consists, as a minimum, of the following information which is relevant to the ductwork and ductwork supports covered by this Section: (a) loads as defined by SA-4211; (b) environmental conditions (1) ductwork external design environmental conditions including pressure, temperature, relative humidity, radiation exposure, and hostile environmental factors for all plant conditions; (2) ductwork internal design environmental conditions for all system operating conditions; (c) service conditions as defined by AA-4213; (d) design and service limits as defined by AA-4214; (e) allowable ductwork leakage, as defined by SA-4500; and (f) system safety related function: Identify the function of the ductwork system for each plant condition. The function shall consist of purpose and operational parameters (i.e., flow, leakage, pressure, temperature.) Plant conditions and service limits are defined by AA-4213 and AA-4214.	SA-4600	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
	INSPECTION AND TESTING	SA-5000					
64 (I,T)	General: Inspection and testing shall be in accordance with the requirements of Sub-articles AA-5100, AA-5200, AA-5300, TA-3300, and the additional requirements of this Section.	SA-5100	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR

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65 (I,T)	Responsibility for Procedures: When an inspection or test is required herein, written inspection or testing procedures shall be developed, by the parties performing the test or inspection, to the specified requirements of this Section. The inspection or testing shall be performed by personnel qualified in accordance with ASNT SNT-TC-1A as amended by ASME NQA-1 and AA-6433.	SA-5120	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
66 (I)	Visual Inspection—General Requirements: Visual inspections shall be performed in accordance with AA-5200 and TA-3510.	SA-5210	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
67 (I,T)	Welded Connections: Inspection and testing of welds shall be performed in accordance with AA-5300 and AA-6000.	SA-5220	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
68 (I)	Ductwork: Ductwork shall be visually inspected for proper dimensions including tolerances, as required by SA-6500 and governing construction documents. Ductwork fabrication shall meet the applicable requirements of SA-6000.	SA-5230	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR

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69 (I)	Joints and Seams: Joints and Seams shall be visually inspected. Acceptance criteria shall be as follows: (a) Joints and seams shall comply with the requirements of SA-6400 and SA-6500. (b) Gasketed joints shall provided uniform gasket compression. Gaskets shall be installed per construction documents. (c) Brazed joints shall comply with the requirements of AA-6430. (d) Longitudinal or transverse welded joints shall comply with the requirements of SA-5220. (e) Threaded fasteners shall be provided with locking devices in accordance with AA-6258.	SA-5231	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
70 (I)	Stiffeners: Stiffeners shall be visually inspected to ensure compliance with the following acceptance criteria: (a) *Stiffeners shall comply with the fabrication and installation* requirements of SA-6000. (b) Welds shall comply with the requirements of SA-5220. (c) Threaded fasteners shall be provided with locking devices in accordance with AA-6258. (d) Removal of temporary attachments shall be confirmed.	SA-5240	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past *operating performance, these systems are* considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
71 (I)	Ductwork Supports: Supports shall be visually inspected during installation, after installation, or both in accordance with the following acceptance criteria: (a) Supports shall comply with the fabrication and installation requirements of SA-6400 and SA-6500. (b) Welded joints shall comply with the requirements of SA-5220. (c) Threaded fasteners shall be provided with locking devices in accordance with AA-6258. (d) Removal of temporary attachments shall be confirmed.	SA-5240	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
72 (T)	Pressure Boundary Leakage Testing—General: The ductwork system shall be tested to demonstrate compliance with the design leakage requirements identified in SA-4500, unless exempted by SA-4533.	SA-5300 SA-5310	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR

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73 (T)	Systems Completeness: Prior to testing, the system shall be complete including all pressure boundary items identified in SA-4520, with the following exceptions: (a) Terminal air distribution devices may be excluded from the test. (b) Pressure boundary items not yet installed may be excluded from the testing with the approval of the Engineer. In such cases, prototype testing shall be performed to determine the typical leakage rate for the installation method. Detailed procedures shall be prepared to control installation of items not tested with the system. Procedures shall specify any hold points, special surface preparation or finish, and final inspection requirements to ensure that the item is installed similar to the prototype. Typical leak test values shall be increased by a factor of 10 percent and added to the actual leakage in the test report, and noted as such. (c) Systems may be testes in sections, if necessary, as allowed by SA-5330. *Testing shall be in accordance with SA-5300.*	SA-5320	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
74 (T)	Allowances for Testing System Leakage Rates by Sections: Temporary isolation at a transverse joint shall be allowed subject to the following requirements: (a) Traverse joints not subjected to a quantitative leak test shall be companion angle type or other types which enable visual inspection of the sealing mechanism between mating ductwork *sections*. (b) Assembled joints utilizing mastic or liquid sealant shall be visually inspected to ensure uniformity of gasket compression. (c) Assembled joints utilizing mastic or liquid sealant shall be visually inspected to ensure that such material has been applied in accordance with the procedure approved by the Engineer. (d) The reduced allowable leakage (L_r) of ductwork sections shall be as follows: $L_r = L_s - R$….	SA-5330	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
75 (T)	Testing Procedures: Prior to pressure boundary leakage testing, test procedures shall be developed in accordance with TA-3400. All test equipment shall be specified with the proper range and required accuracy. Test procedures shall include acceptance criteria determined by SA-4500, and SA-5320 and SA-5330.	SA-5340	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR

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76 (T,QA)	Documentation: A test report shall be prepared to document the pressure boundary leakage test. This report shall include, as a minimum, the following information: (a) system or portion of system tested; (b) specified allowable leakage and test pressure; (c) calculations for ductwork square footage for systems tested by sections; (d) adjustments to allowable leakage per SA-5330 (d); (e) measured leak rates; (f) list of pressure boundary components which were not installed during the pressure boundary leakage test; (g) test equipment used; including Model No., Serial No., and evidence of calibration; (h) names of test personnel; (i) date of test.	SA-5350	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
77 (T)	Quantitative Leakage Tests: Acceptance criteria for quantitative leakage tests shall comply with SA-4500 and SA-5350(d).	SA-5361	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
78 (T)	Nonquantitative Leakage Tests: For nonquantitative leakage tests allowed by SA-4533, the acceptance criteria shall be that audible leaks have been sealed.	SA-5362	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
79 (T)	Ductwork Pressure Test: A pressure test shall be performed at the structural capability pressure per TA-3522. This test pressure shall be maintained for the duration of the inspection. Upon completion of this pressure test, duct-work and equipment exhibiting permanent distortion or breach of integrity shall be repaired or replaced. The pressure test shall be repeated after repair or replacement until no permanent distortion or breach of integrity is observed. This test is not required if duct construction allowed in the SMACNA standards listed in Article SA-2000 for the system operational pressure transient (SOPT).	SA-5410	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR

Best Available Image

Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
80 (T)	Longitudinal Seam Qualification Test: Ductwork utilizing folded or punched metal longitudinal seams, shall be pressure tested to qualify the structural design capability of those seams. This pressure test shall be conducted at the beginning of fabrication and before any ductwork with these seams is installed in the facility. The pressure test shall be conducted on each sheet metal gauge utilizing these seams. Seams shall be tested at the structural capability pressure for the system(s).	SA-5420	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
	FABRICATION AND INSTALLATION	SA-6000					
81 (F)	General: Ductwork and supports shall be fabricated and installed in accordance with this Section and Article AA-6000.	SA-6100	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
82 (D,F,P)	Material Selection: Materials used in fabrication and installation performed under this Section shall conform to the requirements of SA-3000	SA-6121	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
83 (D,F)	Material Identification: Materials to be utilized in the fabrication and installation of components, parts, and appurtenances shall be identified on fabrication or installation plans, or both and in the specifications, as required in AA-8000.	SA-6122	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
84 (F)	Repair of Material With Defects: Material with defects that are discovered or produced during the fabrication and installation process may be used, provided the defects are repaired in accordance with the requirements of AA-8000, and for weld repairs, in accordance with AA-6300.	SA-6123	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR

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85 (F,QA)	Control of Installation and Fabrication Process: Quality control procedures shall be prepared and maintained current for all fabrication and installation processes in accordance with the requirements of AA-8000.	SA-6130	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
86 (F)	Welding: The welding of ductwork and ductwork supports shall comply with the requirements of AWS D1.1, AWS D1.3, AWS-D9.1 and ASME Code, Section IX, as applicable. Welding and brazing performed in accordance with this Section shall meet the requirements of AA-6300 and AA-6400.	SA-6140	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR

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87 (F)	Fabrication Process--Cutting, Forming, Bending, Aligning, and Fitting: (a) Uncoated metal may be cut, formed, or bent by any means that does not degrade the mechanical or chemical properties of the material. (b) Coated metal may be cut, formed, or bent as described in SA-6211. Coating damaged by scratches, gouge marks or the removal of coating shall be repaired in accordance with AA-6540. (c) Inside bend radii shall not be less than the values given in the appropriate ASTM standard for the material grade. (d) Parts that are to be joined may be fitted, aligned and retained in position during the joining by the use of bars, jacks, clamps, drift pins, tack welds or other temporary attachment. The fitting and alignment process shall not cause damage to the joined parts, or their surfaces, or cause enlargement of bolt holes greater than 20% of hole diameter, or 1/8 in., whichever is greater. (e) *Temporary welded attachments shall be completely removed* after each use. They are subject to the following requirements: (1) Material shall be suitable for welding with no reduction in the structural integrity of the member to which the attachment is secured. (2) Attachment material shall be identified as required by SA-3000 (3) The welder and welding procedure shall be qualified in accordance with SA-6140. (4) The immediate area around and including the temporary attachment shall be marked in a suitable manner so that after attachment removal, the area con be examined in accordance with SA-5000. (f) Access doors and access panels shall be fabricated and designed to meet the design requirements of SA-4000. (g) Grilles, registers, diffusers and their accessories shall be designed to meet the design requirements of SA-4000.	SA-6210	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR

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88 (F)	Mechanical Fastening—General: (a) Nuts for all bolts and studs shall be engaged for the full length of the nut thread, Margin shall be allotted to prevent nut from engaging the unthreaded portion of bolt or stud. (b) High strength bolts, used in making bolted joints, shall be installed in accordance with the requirements of the "Specification for Structural Joints Using A325 or A490 Bolts" AISC Code. Standard bolts used in making bolted joints shall be installed in accordance with the requirements of paras. 1.4.4 and 1.5.2 of the "Specification or the Design, Fabrication and Erection of Structural Steel for Buildings" AISC Code. (c) Self-drillling or self-threading screws are permissible if they are qualified in accordance with the design criteria in SA-4000. (d) Rivets must be qualified in accordance with SA-4000. (e) Pins for securing insulation should be secured to the metal surface by welding. *Other attachment methods are acceptable, if* allowed by the Design Specification. Justification of the method of attachment used shall be supported by evaluation or calculation, considering the requirements of Subarticle SA-4600. (f) Flange faces shall be free of joint crevices at corners. These defects shall be eliminated by welding and grinding.	SA-6300 SA-6310	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR

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89 (D,F)	Fabrication Tolerances—General: The fabrication of ductwork shall be accomplished within tolerances detailed in the following tables. These fabrication tolerances provide a method of quality control. Installation tolerances listed below are maximum deviations permitted from design dimensions. Greater deviations, due to rolling mill tolerances are not permitted. (a) Rectangular ducts, measured inside the duct at the joint end or stiffener, shall conform to Table SA-6400-1. (b) Circular ducts, measured by outside circumference or two interior diameters at 90 deg. (+/- 5) to each other, shall conform to Table SA-6400-2. (c) After fabrication is complete, flat sheet or plate surfaces shall not have a waviness, or bulge, greater than the flatness tolerance given in Table SA-6400-3. (d) The tolerances given in Tables SA-6400-1, 2, and 3 are for manufacturing. Maximum operating deflections are given SA-4230. (e) Holes prepared for joining mating flanges shall not exceed the required bolt diameter by more than 20%, or 1/8 in., whichever is larger, of bolt diameter. The center-to-center alignment of holes must be held to meet this tolerance or one flange must be drilled. Hole spacing shall be a maximum of 4 in. center-to-center, with holes at corners of the flange. (f) Grilles, registers, and diffusers shall be fabricated to manufacturer's dimensions and tolerances.	SA-6400 SA-6410	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
90 (D,F)	Installation Tolerances: Ductwork and their supports shall be installed within the tolerance specified by approved construction documents. These tolerances shall comply with the design requirements of SA-4000.	SA-6500	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
91 (F)	Cleaning, Finishing, and Coating: Galvanized surfaces shall be free of damage which impairs the effectiveness of the coating. Surfaces shall be repaired in accordance with AA-6540. Painted surfaces shall be prepared and finished as described in AA-6000. Painted surfaces shall be free of scratches and welding damage. Surfaces shall be repaired and repainted in accordance with AA-6000. Required marking, for identification, shall be on the exterior of each section.	SA-6600	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR

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	PACKAGING, SHIPPING, RECEIVING, STORAGE, AND HANDLING:	SA-7000					
92 (O)	General: Packaging, shipping, receiving, storage, and handling requirements shall be in accordance with Article AA-7000 and this Section.	SA-7100	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
93 (O)	Packaging—General: Ductwork and accessory items packaging requirements are dependent upon the protection level as described by Sub-article AA-7230. Additional clarification or exceptions are provided below: (a) Individual duct sections, assembled or unassembled, shall not require special packaging or end closures. These individually identified items may be pelletized for convenience. Protection equal to level "D" of NQA-2, Part 2.2, paragraph 2.2.4, is required. (b) Acoustically lined or insulated duct sections shall have protective wrapping to prevent water damage. Protection equal to level "C" of NQA-2, Part 2.2, paragraph2.2.4, is required. (c) Grilles, registers, and diffusers shall be packaged individually by the Manufacturer to prevent any degradation. Protection equal to level "C" of NQA-2, Part 2.2, paragraph 2.2.4, is required. (d) Extractors, turning vanes, and splitter dampers shall be packaged individually by the Manufacturer to prevent damage and degradation until installation. Protection equal to level "C" of NQA-2, is required. Should these devices be installed into the ductwork sections before shipment, all moving parts shall be secured and all sliding or operation points shall be protected from degradation by methods equal to level "C." The basic duct section level shall remain "D" of NQA-2, Part 2.2, paragraph 2.2.4.	SA-7210	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
94 (O)	Shipping: This section relates to all transportation methods from the original manufacturer, or supplier, to the job site. In addition to the applicable Federal and State transport regulations, the provisions of Article AA-7000 shall also apply.	SA-7300	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR

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95 (O)	Receiving: Receiving at the job site or intermediate location, where additional work is to be performed or for long term storage, shall be accomplished in accordance with the provisions of Article AA-7000. It shall be the requirement, at any receiving point, to have adequate descriptions of items to permit suitable inspection for conformance, damage acknowledgement, and proper documentation. Records of such inspections shall be maintained until the item is reshipped or installed.	SA-7400	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
96 (O)	Storage—General: Ductwork and accessory item storage requirements are dependent upon the protection level described by Sub-article AA-7230. These levels shall be the required storage requirements except in certain circumstances as listed below: (a) Duct sections shall be stored, on adequate dunnage, in accordance with level "D" requirements. Lined or insulated ductwork, unless water-proofed at time of fabrication, shall be stored in accordance with level "C" requirements. Extractor and splitter dampers shall have moving parts protected in accordance with level "C" requirements. (b) Extractors, turning vanes, and splitter dampers shall be stored in accordance with the applicable levels in paragraph SA-7214. (c) Ductwork supports shall be stored in accordance with level "C" requirements for uncoated carbon steel and level "D" requirements for other ductwork support materials. (d) Components covered by others sections of this Code, that are installed into an integral assembly which is covered by this Section, shall be stored in accordance with Sub-article AA-7230.	SA-7510	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
	QUALITY ASSURANCE:	SA-8000					
97 (QA)	General: Equipment and material covered under this Section shall be manufactured, fabricated, installed, inspected, and tested in accordance with the provisions of a Quality Assurance Program meeting the requirements of Article AA-8000.	SA-8100	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR

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98 (QA,P)	Material Identification: Measures shall be established for controlling and identifying material throughout the manufacturing process and during shipment in accordance with Article AA-8000.	SA-8200	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
99 (D,QA)	Drawings and Documentation: As a minimum, the following drawings and documentation shall be provided to the Owner: (a) design parameters (b) material certifications (c) maximum operating pressure (d) structural capability pressure (e) test pressures (f) basis and quantity for maximum allowable leakage (g) system layout drawings (h) welding procedures (i) visual inspection reports (j) test acceptance criteria (k) leak test reports (l) environmental qualification reports (m) ductwork and ductwork support fabrication details	SA-8300	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
	NAMEPLATE AND STAMPING:	SA-9000					
100 (O)	General: All items manufactured under the requirements of this Section shall be identified to assure compliance with the requirements of Sub-article AA-8200, and Sub-subarticles AA-9130 and AA-9140. Records, as necessary to assure compliance with Sub-article AA-8200, shall be maintained by the responsible organization in accordance with the approved quality assurance program.	SA-9100	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR
101 (O)	Ducts: Each duct section shall have noncorrosive, permanent identification markings. Identification markings shall relate each duct section to the applicable design and fabrication documents. Markings shall be located on the exterior of the duct. Markings need not be visible after installation is complete; however, markings shall be retrievable. It is recommended that the identification markings be placed on the "incoming air" end of the duct joint, as close to the end of the joint as possible, and not in such position as to be hidden or nonreadable.	SA-9111	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR

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102 (O)	Ductwork Supports: Each duct support shall have noncorrosive, permanent identification markings. Identification markings shall relate each ductwork support to the applicable design and fabrication documents.	SA-9112	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the *ductwork from the inlet to the exhauster* skid out to the first 90 degrees elbow.	DR	DR	DR	DR
103 (O)	Air Distribution Accessories: Air distribution devices (i.e., grilles, registers, diffusers, louvers, etc.) shall be marked, stamped or provided with a nameplate which shall relate to the design and fabrication documents. Identification shall be retrievable after completed installation.	SA-9113	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement only for the ductwork from the inlet to the exhauster skid out to the first 90 degrees elbow.	DR	DR	DR	DR

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Attachment 6

ASME AG-1 Section HA

Compliance Matrix

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	SECTION HA: Housings	HA					
	Scope: This Section provides requirements for the design, construction, performance, fabrication, inspection, acceptance testing, and quality assurance for housings and housing supports in nuclear-safety related air treatment systems.	HA-1100					
	MATERIALS	HA-3000					
1 (D,P)	Allowable Materials (General Requirements): (a) Material used shall have properties and composition suitable for the application as defined by the Design Specification and the service conditions, as defined in AA-4213. Materials shall be in conformance with the ASME and the ASTM materials listed in Table HA-3100. Substitute materials shall be approved by the Owner or designee. (b) Materials that are part of the pressure boundary or equipment support shall meet the structural requirement of HA-4000. (c) Materials expressly prohibited or limited shall be explicitly described in the Design Specification.	HA-3100 HA-3110	This requirement is acceptable based on a review of the associated CVI data and applicable drawings for each system. Also, the vendor who manufactured the housings was a qualified supplier and was on the evaluated supplier's list.	CC	CC	CC	CC
2 (D,P)	Protective Coatings: All carbon steel surfaces shall be painted to protect against corrosion and to facilitate cleaning and decontamination. Coatings shall comply with the requirements of Section AA-6500 and ASTM D5144. Coatings shall meet radiation resistance, chemical resistance, and decontamination requirements in accordance with the Design Specification. Stainless steel (galvanized), bronze, copper, aluminum, and glass surfaces are not required to be coated.	HA-3111	This requirement is acceptable based on a review of the associated CVI data and applicable drawings for each system. Also, the vendor who manufactured the housings was a qualified supplier and was on the evaluated supplier's list.	CC	CC	CC	CC
3 (D)	Special Limitations on Materials (Metals): Physical Properties: Changes in the physical properties of metals at minimum and maximum design temperatures must be recognized and factored into the design of housings.	HA-3200 HA-3210 HA-3211	This requirement is acceptable based on a review of the associated CVI data and applicable drawings for each system. Also, the vendor who manufactured the housings was a qualified supplier and was on the evaluated supplier's list.	CC	CC	CC	CC
4 (D,P)	Galvanic Corrosion: The possibility of galvanic corrosion due to the relative potentials of aluminum, copper, and their alloys should be considered when used in conjunction with each other, or with steel or other metals and their alloys.	HA-3212	This requirement is acceptable based on a review of the associated CVI data and applicable drawings for each system. Also, the vendor who manufactured the housings was a qualified supplier and was on the evaluated supplier's list.	CC	CC	CC	CC

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5 (D,P,C)	Corrosive Vapors: Aluminum and zinc shall not be used in the presence of corrosive vapors unless protected by coatings designed to prevent deterioration of the metal. Protective measures other than coating shall be approved by the Owner or designee.	HA-3213	This requirement is acceptable based on a review of the associated CVI data and applicable drawings for each system. Also, the vendor who manufactured the housings was a qualified supplier and was on the evaluated supplier's list.	CC	CC	CC	CC
6 (D,P,C)	Nonmetallic Materials: The use of nonmetallic materials such as plastics, elastomers, and similar substances is permitted in the construction of housings provided that in the selection of these materials, consideration is given to: (a) emission of toxic vapors; (b) degradation of properties caused by temperature extremes, radiation exposure, chemical exposure, and aging; and (c) maintainability.	HA-3214	This requirement is acceptable based on a review of the associated CVI data and applicable drawings for each system. Also, the vendor who manufactured the housings was a qualified supplier and was on the evaluated supplier's list.	CC	CC	CC	CC
7 (D,P)	Deterioration of Materials in Service: It is the responsibility of the Owner or designee to identify the environment in which housings must operate so that the Manufacturer can select the grade of materials to meet the conditions stated in the Design Specification.	HA-3215	This requirement is acceptable based on a review of the associated CVI data and applicable drawings for each system. Also, the vendor who manufactured the housings was a qualified supplier and was on the evaluated supplier's list.	CC	CC	CC	CC
8 (P,T)	Certification of Material: *For structural and pressure boundary materials, the supplier shall* make available certified test reports of chemical and physical properties. For those ASTM materials which do not have physical testing required by the ASTM specification, tensile testing shall be performed per ASTM A370. All other materials used in the construction of housings shall be provided with a manufacturer's Certificate of Compliance covering the ASME, ASTM, or other material specification, grade, and class, if applicable.	HA-3300	CMTR's were available for review for systems AN, AP, and AW, but they could not be specifically traceable back to the material used for the manufacture of the housings. Based of past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
	DESIGN	HA-4000					
9 (D)	General Design: Housings shall be designed in accordance with the requirements of AA-4000 and this Section. The design shall incorporate requirements for structural strength, rigidity, and sealing surfaces to provide leak-tightness of internal mounting frames to the housing. Decontamination requirements shall be specified by the Owner or designee in the Design Specification.	HA-4100	This requirement is acceptable based on a review of the associated CVI data and applicable drawings for each system. Also, the vendor who manufactured the housings was a qualified supplier and was on the evaluated supplier's list.	CC	CC	CC	CC

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10 (D)	Design Criteria (Load Criteria): Loads: Loads to be considered in the structural design of housings are listed in AA-4211 with the following additions and clarifications.	HA-4200 HA-4210 HA-4211	Documentation to verify the requirements for loading was not available for review and verification for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
11 (D)	Dead weight (DW): the weight of the lousing members excluding the dead weight of internal equipment such as HEPA filters and their respective mounting frames. DW includes sheet metal panels, door panels, frame members, and stiffeners.	HA-4211	Documentation to verify the requirements for loading was not available for review and verification for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
12 (D)	Component load (CL): The force of the internally mounted components imposed on the housing. CL is separated into four portions: dead weight, normal operating pressure differential (NOPD) for the particular component, OBE, and SSE. Additional dynamic loades (ADL) will be provided by the Design Specification as applicable.	HA-4211	Documentation to verify the requirements for loading was not available for review and verification for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
13 (D)	External load (EL): as defined in AA-4211.	HA-4211	Documentation to verify the requirements for loading was not available for review and verification for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
14 (D)	Fluid momentum load (FML): as defined in AA-4211. Housing internal components shall be designed to withstand the FML resulting from air turbulence, from fan discharges into the housing. The housing portion where this load is significant is determined by the length required to regain uniform airflow as given by AMCA 201 Fig 3-3.	HA-4211	Documentation to verify the requirements for loading was not available for review and verification for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
15 (D)	Hydrostatic load (HL): shall be added to the dead weight (DW) as applicable. Hydrostatic loads from accumulated condensate, water deluge systems, moisture separators, and associated housing flooding. The hydrostatic load shall be established by documented analysis base on housing internal and component function.	HA-4211	Documentation to verify the requirements for loading was not available for review and verification for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air *Conditioning* Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: *(See Legend for Key)* AN	AP	AW	SY
16 (D)	Live load (L): includes a construction mainload of 250 lb on the roof of the housing. Housing sheet metal floors shall be designed for at least a 50 psf live load when no other floor system is provided (e.g., grating, concrete slab).	HA-4211	Documentation to verify the requirements for loading was not available for review and verification for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
17 (D)	Normal operating pressure differential (component) ($NOPD_C$): the opening pressure differential across the component from upstream to downstream of the component included in the housing. See applicable Division II component sections for all component NOPD's.	HA-4211	Documentation to verify the requirements for loading was not available for review and verification for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
18 (D)	Normal operating pressure differential (housing) ($NOPD_h$): The *maximum pressure differential between inside the housing and* external to the housings. For ease of design, a housing may be designed using one pressure value that envelopes SOPT and NOPD.	HA-4211	Documentation to verify the requirements *for loading was not available for review and* verification for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
19 (D)	System operational pressure transient (SOPT): as defined in AA-4211 or may be enveloped with $NOPD_h$ and $NOPD_C$.	HA-4211	Documentation to verify the requirements for loading was not available for review and verification for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
20 (D)	Seismic loads (SL): Loads that are the result of the envelop of the operating basis earthquake (OBE) and the safe shutdown earthquake (SSE). As an option, the OBE, and SSE may be considered separately with the OBE loads used for the Level B load combination. Both orthogonal components of horizontal and vertical components of the seismic excitation shall be applied simultaneously in the direction *that will produce worst-case stresses and deflections. These* components may be combined by the square root of the sum of the squares (SRSS) method.	HA-4211	Documentation to verify the requirements for loading was not available for review and verification for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY *complied with this requirement completely.*	DR	DR	DR	CC

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21 (D)	T and N: defined in AA-4211	HA-4211	Documentation to verify the requirements for loading was not available for review and verification for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
22 (D)	Design pressure differential (DPD): The dynamic pressure loads resulting from a design basis accident (DBA), intermediate break accident (IBA), or small break accident (SBA). Housings should be located outside the local pipe break affected area. If housings are subjected to these loads, the Design Specification (HA-4600) shall address the specific design requirements considering a Service Level D combination.	HA-4211	Documentation to verify the requirements for loading was not available for review and verification for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
23 (D)	For other component load criteria see the following sections: (1) HEPA filters – FC-4300 (2) Type II adsorbers – FD-4400 (3) Type III adsorbers – FE-4400 (4) Mounting frames – FG-4200 (5) Dampers – DA-4000 (6) Moisture separators – FA-4000 (7) Pre-filters – FB-4000 (8) Coils – CA-4000 (9) Fans – BA-4000 (10) Ductwork – SA – 4200 (11) Type IV adsorbers – FH-4300		These requirements will be addressed in the applicable sections of this matrix.	NA	NA	NA	NA
24 (D)	Load Combinations: The applicable loads are given in Table HA-4212.	HA-4212	Documentation to verify the requirements for loading was not available for review and verification for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
25 (D)	Service Conditions: The requirements of AA-4213 apply.	HA-4213	Documentation to verify the requirements for loading was not available for review and verification for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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26 (D)	Design and Service Limits: The requirements of AA-4214 apply.	HA-4214	Documentation to verify the requirements for loading was not available for review and verification for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
27 (D)	Housing Supports: Housing supports shall be designed per the loads and load combinations in HA-4211 and HA-4212. The stress criteria for each load combination shall be per HA-4220. Floor mounted housing supports shall be designed to act as an integral base of the housing. Anchorage to the floor shall be designed to transfer the lateral forces without overturning or deformation of the housing unit. Units with internal mounting frames where leakage is a design consideration, shall have floor anchorages near the junction of the mounting frame and base. Small units which are typically provided with the base from the vendor's facility shall be designed for the installation/erection loads associated with a package unit. Larger units that are installed using modular construction need only consider the installation loads associated with each piece.	HA-4215	Documentation to verify the requirements for loading was not available for review and verification for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
28 (D)	Stress Criteria: The allowable stresses for housing sheet metal material and cold formed members shall be as defined in the AISI "Specification for the Design of Cold Formed Steel Structural Members." The allowable stresses for hot rolled shapes and plates shall be as defined in the AISC "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings." The basic general membrane design stress for the Service Level A condition shall not exceed 0.6 F_y and shall be reduced as appropriate to consider lateral-torsional buckling of bending members and effective lengths of compression members. The basic general membrane design stress for the Level C condition shall not exceed 1.2 x 0.6 F_y per AA-4321. The combined membrane and bending design stress for Service Level A shall not exceed 1.5 x 0.6 F_y and shall be reduced as appropriate to consider lateral-torsional buckling of bending members and effective lengths of compression members. The combined membrane and bending design stress for the Level C condition shall not exceed 1.8 x 0.6 F_y per AA-4321.	HA-4220	Documentation to verify the requirements for stresses was not available for review and verification for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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29 (D)	Deflection Criteria (Deflection Limits): The deflection limits shall be specified in the Design Specification and shall be in accordance with AA-4231.	HA-4230 HA-4231	Documentation to verify the requirements for deflection limits was not available for review and verification for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
30 (D)	Deflection Limits for Mounting Frames and Equipment Interfaces: For walk-in housings, the deflection limits for the mounting frames *shall also be considered at the interface between the frame and the* housing. For deflection limitations of other equipment (e.g., fans, dampers, ductwork) see the applicable Division II Code Sections.	HA-4232	Documentation to verify the requirements for deflection limits was not available for review and verification for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
31 (D)	Other Criteria: *Vibration Isolation: Vibration isolation requirements shall be specified* by the Owner or designee in the Design Specification.	HA-4240 HA-4241	Documentation to verify this requirement *was not available for review for systems* AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
32 (D)	Provisions for Relative Movement: Clearance shall be provided to allow for relative movement of the internal equipment during operation and during maintenance of the equipment.	HA-4242	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
33 (D)	Tolerances: Tolerances shall be specified for all external and internal interface boundaries. Tolerances shall be specified in the design documents. Tolerances shall be accounted for in applicable design analysis (e.g., location of applied load).	HA-4243	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
34 (D)	*Housing Attachments:* Housing attachment design shall include all Service Links and Load Combinations set forth in HA-4212 and HA-4213, or as required by the Design Specification. Attachments shall be either the welded or bolted type.	HA-4244	*Documentation to verify this requirement* was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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35 (D,P)	Welded Attachments: Consideration shall be given to local stresses induced in the housing wall by integral attachments as defined in AA-4243. Attachment and housing material shall be compatible for welding. See AA-6000. The permissible types of welded joints shall be in accordance with AWS D1.1, AWS D9.1, AWS D1.3, or ASME Section IX, as applicable.	HA-4245	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
36 (D)	Bolted Attachments: Consideration shall be given to bolting and local stresses induced in the housing wall by integral attachments as defined in AA-4243. The design of bolts for structural supports shall meet the requirements of AISC Specification for the Design, Fabrication, and Erection of Structural Steel, Ninth Edition, Part 4.	HA-4246	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
37 (D)	Fatigue Considerations: Internal housing components subjected FML should be designed for fatigue based on cyclic loading of the element. See HA-4211 to determine the portion of the affected internal housing components. The appropriate reductions in allowable stresses are given in Section 5, Appendix B of the AISC Specification for the Design, Fabrication, and Erection of Structural Steel, Ninth Edition, Part 4.	HA-4247	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
38 (D)	Fire Protection: Fire protection requirements shall be specified by the Owner or designee commensurate with individual component requirements. Fire protection for Type III adsorbers shall be provided per FE-4620.	HA-4248	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
39 (D)	Housing Joints and Seams (General Requirements): Selection of joints and seams used in the assembly of housing sections shall be based on the required structural integrity, leak-tightness, and the fluid flow within the system. Duct-housing interconnections shall be designed with consideration of the air distribution uniformity.	HA-4300 HA-4310	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
40 (D,F)	Housing Joints and Seams: Acceptable Longitudinal Seams and Joints: The following longitudinal seams and joints are acceptable for use in housing sections subject to limitations of HA-4330, -4340, -4500: (a) welded lap joint (b) welded butt joint (c) welded flange (d) fillet corner welds	HA-4320 HA-4321	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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41 (D,F)	Acceptable Transverse Joints: The following types of transverse joints are acceptable for use in housing sections subject to limitations of HA-4330, -4340, -4500: (a) welded lap joint (b) welded butt joint (c) welded flange (d) companion angle: gasketed & bolted	HA-4322	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
42 (D,F)	Other types of Connections: Other types of rigid longitudinal and transverse connections may be acceptable provided that the design structural characteristics are qualified. Qualification shall be documented by engineering evaluation or test as specified by the Owner or designee. Qualification test shall demonstrate the joint's ability to withstand load combinations in HA-4212. Joint design qualification shall be completed prior to the start of fabrication.	HA-4323	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
43 (D)	Bolts and Fasteners: Connections shall be designed to sustain all loading combinations. Bolted connection and joint design shall be designed to meet allowable leakage of HA-4500.	HA-4324	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
44 (D,F)	Air Cleaning Units Joints and Seams: The pressure boundary joints and seams for all air cleaning unit housings shall be continuously welded.	HA-4330 HA-4331	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
45 (D,F)	Seals: Penetrations on housings shall be sealed by welding, with a sealant qualified for the housing's environment, or with adjustable compression or gland-type seals. Gland-type seals include but are not limited to "O" rings, gaskets, and other nonmetallic materials.	HA-4332	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
46 (D,F)	Electrical Conduits and Drains: All penetrations by electrical conduit and drains shall be arranged and individually sealed or valved so that bypassing of HEPA filter banks or adsorber banks cannot take place. Electrical conduit open to the inside shall be internally sealed to meet allowable leakage determined in HA-4500.	HA-4333	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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47 (D,F)	Separate Mounting Frames: Where separate mounting frames for HEPA filters and adsorbers are required, they shall be continuously seal welded to the housing.	HA-4334	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
48 (D,F)	Air Conditioning and Air Handling Units Housing Joints and Seams: These unit joints and Seams shall be of either welded or bolted construction or other types meeting the requirements of HA-4323 and the allowable leakage criteria specified in the Design Specification.	HA-4340	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
49 (D,F)	Penetrations: Penetrations on housings shall be sealed by welding, adjustable compression, gland-type seals, or other method capable of meeting allowable leakage criteria for the housing as determined in HA-4500.	HA-4341	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
50 (D,P,F)	Accessories: Gaskets shall be made of materials which are compatible with the conditions of HA-4600. Gasket dimensions shall be based on joint design. An Acceptable criterion for compression of gasket material shall be established on the basis of the gasket chosen. This acceptance criterion and the service life of the gasket and joint shall be documented by evaluation or testing as determined by the Owner or designee.	HA-4400 HA-4410	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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51 (D,C)	Access Doors and Panels: Construction of doors/panels and door frames shall be selected to meet the allowable leakage determined in HA-4500. Sealing surfaces between the door/panel and frame shall be designed for compression sealing. The design shall incorporate means for adjusting compression forces, gasket compression, and alignment. Spacing of hinges, latches, and bots shall be determined by calculation or test to ensure a uniform compression of the gasket. Spacing shall enable a compression tight enough to assure leakage requirements are met (HA-4500) and provide a gasket compression uniformity of +/-20 deg. Hinged, if specified, shall be designed to minimize damage to compression seals due to friction and shear forces during opening and closing of the doors. Doors shall be designed for ease of operation by one person. Man entry housing doors shall be operable from both inside and outside the housing and be clearly labeled for open and closed latch position. Hinges and latches shall be designed such that lubrication materials shall not enter the interior of the housing. See Nonmandatory Appendix HA-B (B-1110) for additional guidance on the design of access doors.	HA-4420	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
52 (D,T)	Provisions for Testing and Maintenance: Test Ports: The Owner or designee shall evaluate the design function of the equipment to determine where test ports (including injection and sampling ports) are required. The penetration shall comply with HA-4332, and have a cap or plug that is suitable to meet the pressure requirements of the housing.	HA-4430 HA-4431	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
53 (D,T)	Manifolds: The Owner or designee shall determine where injection and sampling manifolds are required. Injection and sampling manifolds shall be constructed of metal to minimize damage potential and to maintain manifold qualification. Sampling and injection manifolds which are required to be installed within the filter housing should be designed for permanent installation within the housing. If permanently installed manifolds cannot be provided, then manifolds shall be designed to be removable, with each manifold piece numbered, tagged, and marked for reinstalling prior to each test. Permanent manifold installation is recommended to obtain better repeatability of test results. When an air cleaning unit contains two or more HEPA filter banks or adsorber banks in series, or both, injection and sampling manifolds for the respective test agents are required for each of the filter and/or adsorber banks. General guidance for manifolds is given in Nonmandatory Appendix HA-C. Injection manifolds shall be qualified in accordance with HA-5800.	HA-4432	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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54 (D)	Housing Access: Walk-in housings shall be protected and braced to prevent damage by personnel entering for inspection and maintenance. Walk-in access doors (20 in. wide by 50 in. high, minimum) shall be provided on each side of each component section when housing size permits. A permanent platform shall be installed internal to the housing to provide access to filters for filter banks greater than or equal to six ft. in height. Platform shall not interfere with filter access or air flow distribution. Space shall be provided both internal and external to the *housing for equipment removal and maintenance. See* Nonmandatory Appendix HA-B for additional guidance.	HA-4433	This requirement is not applicable to these systems.	NA	NA	NA	NA
55 (D)	Lighting: Walk-in housings shall be fitted with vapor-tight lights between each bank of components. For walk-in air cleaning unit housings, fixtures shall be flush mounted and serviceable from outside of the housing. *Lighting levels shall be determined based on personnel safety visual* requirements as given in the Design Specification and guidance provided by IES Lighting Handbook as published by the Illuminating Engineering Society of North America.	HA-4434	This requirement is not applicable to these systems.	NA	NA	NA	NA
56 (D)	Miscellaneous: Drains: Consideration shall be given to drains depending on requirements, services, or components within each compartment. For example, drains shall be required for: (a) fire protection systems (b) removal of decontamination liquids (c) moisture separators (d) condensing cooling coils Drains form an integral part of the housing pressure boundary and are subject to air leakage requirements established in HA 4500. The size selected for each drain furnished in the housing as well as the collection point for each drain shall be documented by calculation or test as determined by the Owner or designee. For the additional *guidance in the design of drains, see Nonmandatory Appendix HA-B.*	HA-4440 HA-4441	This requirement is acceptable base on a review of the associated CVI data and applicable drawings for each system.	CC	CC	CC	CC

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57 (D,F)	Insulation: (a) Insulation shall be provided as specified by the Owner or designee to ensure air conditioning function, limit condensation, or provide acoustic noise reduction as required. (b) Acoustic linings and thermal insulation shall not be applied to the inside of housings that may become contaminated. (c) Insulation applied to the outside of housings shall not prevent access to doors, access panels, or other components requiring adjustment or maintenance. (d) The fire hazard classification of applied insulation, adhesive, and sealer shall not exceed a flame spread of 25 and smoke developed of 50 in accordance with NFPA-90A.	HA-4442	This requirement is acceptable base on a review of the associated CVI data and applicable drawings for each system.	CC	CC	CC	CC
58 (D)	Clamping Mechanism: Side access housings shall have a clamping mechanism, filter retrieval features, and filter indexing mechanisms. The clamping *mechanism shall be individually adjustable for each HEPA filter or* adsorber. For side access housings with fluid seals, the filter clamping mechanism shall be capable of moving the filter on and off through adequate travel to ensure the knife edge is embedded into the pliable sealant and provides seal for the complete perimeter of each filter or adsorber. The clamping mechanism shall provide for uniform gasket compression. The clamping mechanism for walk-in housings shall be designed per Section FG.	HA-4443	This requirement is acceptable base on a review of the associated CVI data and applicable drawings for each system.	CC	CC	CC	CC
59 (D)	Pressure Boundary Leakage (General): Pressure boundary leakage shall be controlled to ensure satisfactory environmental conditions, either within or outside of the nuclear facility. Allowable leakage for a housing, or portion of a housing, shall be determined considering the following factors: (a) control of airborne contamination (b) control of space pressure (c) control of space temperature (d) control of space humidity	HA-4500 HA-4510	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
60 (D)	Applicability: Housing pressure boundary leakage shall apply to air cleaning, air conditioning, and air handling systems. Each housing's pressure boundary shall include the following items: (a) housing enclosure (b) access panels and doors (c) penetrations for instrumentation piping, electrical, and other utilities.	HA-4520	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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61 (D)	Evaluation (Responsibility): The Owner or designee shall establish the allowable leakage to assure ventilation, temperature, and contamination control functions are achieved.	HA-4530 HA-4531	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
62 (D)	Allowable Leakage Determination: The following criteria shall be utilized in the determination of allowable leakage. (a) application of governing codes, regulations, and plant-specific requirements (b) consideration of each housing's operating mode, including anticipated system upset condition, such as rapid closure of dampers (c) normal and maximum operating pressures throughout the pressure boundary (d) system internal and external environmental conditions Guidance for determination of allowable leakage is given in Section SA, Nonmandatory Appendix SA-B.	HA-4532	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
63 (D)	Exceptions to Leakage Requirements: Air cleaning, air conditioning, and air handling housings exhibiting one of the following conditions need not be subjected to quantitative measurement of leakage unless otherwise required by the Design Specification. (a) Housings in systems serving only the protected space and located only within the same protected space. (b) Housings under negative pressure which are located entirely in a clean interspace, and only provide air cooling or heating function. However, the housing shall be pressurized to locate and seal all audible leaks. Reference Section SA, Nonmandatory Appendix SA-B, Figs. B-1410-1 through B-1410-3 for typical system configurations.	HA-4533	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
64 (D)	Documentation: Derivation of allowable leakage for each housing, or portion thereof, shall be documented by the Owner or designee. This documentation shall include the following: (a) identification of housing or portion of housing (b) governing codes, regulations, and plant-specific requirements (c) purpose of leakage control; see HA-4510 (d) system mode of operation (e) normal and maximum operating pressure (f) method of derivation of allowable leakage (g) test pressures and associated allowable leakage	HA-4534	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
65 (D)	Design Specification: The Owner Design Specification shall contain the following information which is relevant to the housing and housing supports covered by this Section. (a) Loads as defined by HA-4211. (b) Environmental conditions. (1) Housing external-design environmental conditions including, but not limited to pressure, temperature, relative humidity, radiation exposure, and hostile environmental factors for all plant conditions. (2) Housing internal-design environmental conditions for all system operating conditions. (c) Service conditions as defined by AA-4213. (d) Design and service limits as defined by AA-4214. (e) Allowable housing leakage as defined HA-4500. (f) *System safety-related function: Identify the function of the* housing for each plant condition. The function shall consist of purpose and operational parameters (i.e., flow, leakage, pressure, temperature). Plant conditions and service limits are defined by AA-4213 and AA-4214. (g) Fire protection requirements. (h) Material certification requirements. (i) Tolerance requirements. (j) Inlet and outlet configurations. (k) Housing components: adsorbers, fans, filters, moisture separators, dampers, heaters, coils, insulation, access requirements (i.e., doors, access panels), instrumentation and controls, spray-type conditioners.	HA-4600	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
	INSPECTION AND TESTING	HA-5000					
	General (Scope and Applicability): This Section contains general requirements for the inspection and testing of housings and housing supports.	HA-5100 HA-5110					
66 (I,T)	Responsibility for Procedures: When an inspection or test is required herein, written inspection or testing procedures shall be developed, by the parties performing the test or inspection, to the specific requirements of this Section. The inspection or testing shall be performed by personnel qualified in accordance with ASNT SNT-TC-1A as amended by ASME NQA-1 and AA-6433.	HA-5120	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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67 (I,T)	Inspection (General Requirements): Visual inspections shall be performed in accordance with AA-5200 and TA-3410. Inspection and testing of welds shall be performed in accordance with AA-5300 and AA-6000.	HA-5200 HA-5210	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
68 (I)	Housings: Housings shall be inspected for proper dimensions including tolerances, as specified by HA-6400 and governing construction documents.	HA-5220	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
69 (I)	Joints and Seams: Joints and seams shall be visually inspected. Acceptance criteria shall be as follows. (a) Joints and seams shall comply with the requirements of HA-6400 and HA-6500. (b) Gasketed joints shall provide uniform gasket compression. Gaskets shall be installed per construction documents. (c) Longitudinal or transverse welded joints shall comply with AA-6000 requirements. (d) Threaded fasteners shall be provided with locking devices in accordance with AA-6258.	HA-5221	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
70 (I)	Stiffeners: Stiffeners shall be visually inspected to ensure compliance with the following acceptance criteria. (a) Stiffeners shall comply with the fabrication and installation requirements of HA-6000. (b) Welds shall comply with AA-6000 requirements. (c) Threaded fasteners shall be provided with locking devices in accordance with AA-6258. (d) Removal of temporary attachments shall be verified.	HA-5222	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
71 (I)	Housing Supports: Supports shall be visually inspected during installation, after installation, or both in accordance with the following acceptance criteria. (a) Supports shall comply with the fabrication and installation requirements of HA-6400. (b) Welded joints shall comply with AA-6000 requirements. (c) Threaded fasteners shall be provided with locking devices in accordance with AA-6258. (d) Removal of temporary attachments shall be verified.	HA-5230	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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72 (I,T)	Filter Mounting Frame to Housing Weld Inspection: The housing filter mounting frame for HEPA filter and adsorbers shall be inspected using visual and nondestructive test methods per AA-6330.	HA-5240	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
73 (T)	Pressure Boundary Leakage Testing (General): Temporary isolation at a transverse joint shall be allowed subject to the following requirements. (a) Transverse joints not subjected to a quantitative leak test shall be companion angle type or other types which enable visual inspection of the sealing mechanism between mating housing sections. (b) Assembled joints utilizing gasketing shall be visually inspected to ensure uniformity of gasket compression. (c) *The reduced allowable leakage (L_r) of housing sections shall be* as follows: $L_r = L_s - R$ $R = (C_i / C_T)L_s$ Where…	HA-5300 HA-5310	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
74 (T)	Allowances for Housing Leakage Rates by Sections: *Temporary isolation at a transverse joint shall be allowed subject to* the following requirements.	HA-5320	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
75 (T)	Testing Procedures: Prior to pressure boundary leakage testing, test procedures shall be developed in accordance with TA-3330. All test equipment shall be specified with the proper range and required accuracy. Test procedures shall include acceptance criteria determined by HA – 4500, HA-5320, and HA-5350.	HA-5330	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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76 (T)	Documentation: A test report shall be prepared to document the Pressure Boundary Leakage Test. This report shall include the following information. (a) housing or portion of housing tested (b) specified allowable leakage and test pressure (c) calculations for housing section square footage for housings tested by sections (d) adjustments to allowable leakage per HA-5310(c) (e) measured leakage test (f) list of pressure boundary components which were not installed during the pressure boundary leakage test (g) test equipment used; including model number, serial number, and evidence of calibration (h) names of test personnel (i) date of test	HA-5340	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
77 (T)	Acceptance Criteria (Quantitative Leakage Tests): Acceptance criteria for quantitative leakage tests shall comply with HA-4500 and HA-5310(c)	HA-5350 HA-5351	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
78 (T)	Non-quantitative Leakage Tests: For non-quantitative leakage tests allowed by HA-4533, the acceptance criteria shall be that audible leaks have been sealed.	HA-5352	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
79 (T)	Mounting Frame to Housing Leakage Test: A mounting frame pressure leak test may be used to detect leaks in the HEPA filter and adsorber mounting frames that could affect the results of the in-place leak test I TA-4300. The test, if used, shall be conducted in accordance with Nonmandatory Appendix TA-A.	HA-5400	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
80 (T)	Structural Capability Tests (Housing Pressure Test): A pressure test shall be performed at the structural capability pressure per TA-3422. This test shall be maintained for the duration of the inspection. Upon completion of this pressure test, housings exhibiting permanent distortion or breach of integrity shall be repeated after repair or replacement until no permanent distortion or breach of integrity is observed.	HA-5500 HA-5510	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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81 (T)	Air Flow Distribution Tests: When required by the Owner, air flow distribution qualification test for housings containing more than ine HEPA filter or adsorber bank shall be made in the shop in accordance with Section TA-4600. This requirement shall be specified in the Owner's Specification. Acceptance criteria shall be in accordance with TA-4600. Housings containing HEPA filter(s), adsorbers, or both shall be field tested to demonstrate adequate air flow distribution in accordance with TA-4600. Tests shall be performed with components in the housing and the housing complete (i.e., assembled). Minor items such as temperature elements, pressure taps, etc., do not need to be installed as these components do not significantly influence air flow distribution.	HA-5600	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
82 (T)	Air-Aerosol Mixing Uniformity Tests: When required by the Owner or designee, air-aerosol qualification test for housings containing more than one HEPA/adsorber shall be made in the shop in accordance with TA-4600 for each manifold design. This requirement shall be specified in the Owner's Specification. Acceptance criteria shall be in accordance with TA-4600. Tests shall be performed with components in the housing and the housing complete (i.e., assembled). Minor items such as temperature elements, pressure taps, etc., do not need to be installed as these components do not significantly influence mixing. This design qualification test may be performed once and submitted to the Owner or designee for approval. This design qualification test may be performed once and submitted to the Owner or designee for approval. The design of the manifold and its location in the housing must be the same as qualified or a new aerosol mixing test is required.	HA-5700	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
83 (T)	Sample Manifold Testing: Sampling manifolds shall be qualified to demonstrate that they collect a representable sample equivalent to a single point sample taken at a point at least ten duct diameters downstream of the filters. Refer to Nonmandatory Appendix D for performance test guidance. To ensure required leakage detection, acceptance criteria for sampling manifold shall be equal to or greater than the concentration detected with the single point sample.	HA-5800	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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84 (T)	Air Conditioning and Air Handling Unit Testing: When required by the Owner or designee, integrated component functional acceptance testing shall be performed in the shop per TA-4000. This requirement shall be included in the Owner's Specification.	HA-5900	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
	FABRICATION	HA-6000					
85 (F)	General: Air cleaning, air conditioning, and air handling unit housings and *supports shall be fabricated in accordance with this Section and AA-6000.*	HA-6100	The requirements for fabrication of the housings is deemed acceptable based on *the fact that the vendor is a qualified* supplier on the evaluated suppliers list.	CC	CC	CC	CC
86 (D,P,F)	Materials (Material Selection): Materials used in fabrication performed under this Section shall conform to HA-3000 requirements.	HA-6120 HA-6121	The requirements for fabrication of the housings is deemed acceptable based on the fact that the vendor is a qualified supplier on the evaluated suppliers list.	CC	CC	CC	CC
87 (D,F)	Material Identification: Materials to be utilized in the fabrication and installation of components, parts, and appurtenances shall be identified on fabrication drawings and in the specification, as required in AA-6000.	HA-6122	The requirements for fabrication of the housings is deemed acceptable based on the fact that the vendor is a qualified supplier on the evaluated suppliers list.	CC	CC	CC	CC
88 (F)	Repair of Material with Defects: Material with defects that are discovered or produced during the fabrication process may be used, provided the defects are repaired in accordance with the requirements of AA-8000, and for weld repairs, in accordance with AA-6300.	HA-6123	The requirements for fabrication of the housings is deemed acceptable based on the fact that the vendor is a qualified supplier on the evaluated suppliers list.	CC	CC	CC	CC
89 (F)	Control of Installation and Fabrication Process: Quality control procedures shall be prepared and maintained current for all fabrication processes in accordance with AA-8000 requirements.	HA-6130	The requirements for fabrication of the housings is deemed acceptable based on the fact that the vendor is a qualified supplier on the evaluated suppliers list.	CC	CC	CC	CC
90 (F)	Welding: The welding of filter housings and supports shall comply with the requirements of AWS D1.1, AWS D1.3, AWS D9.1, or ASME Boiler and Pressure Vessel Code, Section IX. Welding and brazing performed in accordance with this Section shall meet the requirements of AA-6300 andAA-6400.	HA-6140	The requirements for fabrication of the housings is deemed acceptable based on the fact that the vendor is a qualified supplier on the evaluated suppliers list.	CC	CC	CC	CC
	Fabrication Process	HA-6200					
91 (F)	Cutting, Forming, Bending, Aligning, and Fitting Uncoated Metal: Uncoated metal may be cut, formed, or bent by any means that does not degrade the mechanical or chemical properties of the material.	HA-6210 HA-6211	The requirements for fabrication of the housings is deemed acceptable based on the fact that the vendor is a qualified supplier on the evaluated suppliers list.	CC	CC	CC	CC

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92 (F)	Coated Metal: Coated metal may be cut, formed, or bent as described in HA-6211. Coating damaged by scratches, gouge marks, or the removal of coating shall be repaired in accordance with AA-6540.	HA-6212	The requirements for fabrication of the housings is deemed acceptable based on the fact that the vendor is a qualified supplier on the evaluated suppliers list.	CC	CC	CC	CC
93 (F)	Inside Bend Radii: Inside bend radii shall not be less than the values of the material grade given in the AISC Manual of Steel Construction, Allowable Stress Design.	HA-6213	The requirements for fabrication of the housings is deemed acceptable based on the fact that the vendor is a qualified supplier on the evaluated suppliers list.	CC	CC	CC	CC
94 (F)	Joining Parts: *Parts that are to be joined may be fitted, aligned, and retained in* position during the joining operation by the use of bars, jacks, clamps, drift pins, tack welds, or other temporary attachment. The fitting and aligning process shall not damage the joined parts, or their surfaces, or enlarge bolted holes greater than the values shown in AISI, Specification for Design, Fabrication, Erection of Structural Steel for Buildings, Table 1.23.4.	HA-6214	The requirements for fabrication of the *housings is deemed acceptable* based on the fact that the vendor is a qualified supplier on the evaluated suppliers list.	CC	CC	CC	CC
95 (F)	Temporary Attachments: Temporary welded attachments may be used in the fabrication process but shall be completely removed after use. Where such temporary attachments are used, they shall be subject to the following requirements. (a) Material shall be suitable for welding with no deduction in the structural integrity of the member to which the attachment is secured. (b) Attachment material shall be identified as required by HA-3000. (c) The welder and welding procedures shall be qualified in accordance with HA-6140.	HA-6215	The requirements for fabrication of the housings is deemed acceptable based on the fact that the vendor is a qualified supplier on the evaluated suppliers list.	CC	CC	CC	CC
	Mechanical Fastening	HA-6300					
96 (F)	General: Nuts: Nuts for all bolts and studs shall be engaged for the full length of the nut thread. Margin shall be allotted to prevent the nut from engaging the unthreaded portion of the bolt or stud.	HA-6310 HA-3211	The requirements for fabrication of the housings is deemed acceptable based on the fact that the vendor is a qualified supplier on the evaluated suppliers list.	CC	CC	CC	CC
97 (F)	High Strength Bolts: High strength bolts, used in making bolted structural joints, shall be installed in accordance with the requirements of the "Specification for Structural Joints Using A325 or A490 Bolts," AISC Code.	HA-6312	*The requirements for fabrication of the* housings is deemed acceptable based on the fact that the vendor is a qualified supplier on the evaluated suppliers list.	CC	CC	CC	CC

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				AN	AP	AW	SY
98 (F)	Pins: Pins for securing insulation should be secured to the metal surface by welding. Other attachment methods are acceptable, if allowed by the Design Specification. Justification of the attachment method used shall be supported by evaluation or calculation as determined by the Owner or designee, considering the requirements of the Design Specification.	HA-6313	The requirements for fabrication of the housings is deemed acceptable based on the fact that the vendor is a qualified supplier on the evaluated suppliers list.	CC	CC	CC	CC
99 (F)	Connecting: Connecting flange faces shall be free of joint crevices at corners. These defects shall be eliminated by welding or grinding.	HA-6314	The requirements for fabrication of the housings is deemed acceptable based on the fact that the vendor is a qualified supplier on the evaluated suppliers list.	CC	CC	CC	CC
	Fabrication Tolerances	HA-6400					
100 (F)	General: Housing fabrication shall be accomplished within the tolerances detailed in the manufacturer's design drawings. These fabrication tolerances provide a method of quality control. For separately installed frames in walk-in housings, see Section FG.	HA-6410	The requirements for fabrication of the housings is deemed acceptable based on the fact that the vendor is a qualified supplier on the evaluated suppliers list.	CC	CC	CC	CC
101 (F)	Side Access Housing and Gasket Seal Surfaces: Flatness: Each HEPA filter/adsorber housing seating surface shall be plane within 1/16 in.	HA-6420 HA-6421	The requirements for fabrication of the housings is deemed acceptable based on the fact that the vendor is a qualified supplier on the evaluated suppliers list.	CC	CC	CC	CC
102 (F)	Surface Finish: Pits, roll scratches, weld spatter, and other surface defects within the sealing areas shall be ground smooth. After welding, ground areas shall merge smoothly with the surrounding base metal.	HA-6422	The requirements for fabrication of the housings is deemed acceptable based on the fact that the vendor is a qualified supplier on the evaluated suppliers list.	CC	CC	CC	CC
103 (F)	Side Access Housing Filter Fluid Seal Surfaces: Flatness: The tolerance on each knife edge shall be plane within 1/8 in.	HA-6430 HA-6431	The requirements for fabrication of the housings is deemed acceptable based on the fact that the vendor is a qualified supplier on the evaluated suppliers list.	CC	CC	CC	CC
104 (F)	Cleaning: All surfaces shall be cleaned per AA-6500 prior to acceptance. No halogen-bearing materials or carbon steel tools shall be used to clean housings or components constructed of stainless steel. Cleaning shall be performed in accordance with the Manufacturer's written procedures.	HA-6500	The requirements for fabrication of the housings is deemed acceptable based on the fact that the vendor is a qualified supplier on the evaluated suppliers list.	CC	CC	CC	CC
	PACKAGING, SHIPPING, RECEIVING, STORAGE, AND HANDLING	HA-7000					
105 (O)	General: Packaging, shipping, receiving, storage, and handling requirements shall be in accordance with AA-7000 and this Section.	HA-7100	The requirements for packaging, shipping, receiving, storage, and handling are deemed to be acceptable based on the fact that the vendor is a qualified supplier on the evaluated suppliers list.	CC	CC	CC	CC

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106 (O)	Packaging (General): Air cleaning, air conditioning, and air handling unit housing packaging requirements are dependent upon the protection level as described in AA-7230. Additional clarification or exceptions are provided below.	HA-7210	The requirements for packaging, shipping, receiving, storage, and handling are deemed to be acceptable based on the fact that the vendor is a qualified supplier on the evaluated suppliers list.	CC	CC	CC	CC
107 (O)	Packaging (Protection): Air cleaning, air conditioning, and air handling unit housings shall be protected to prevent physical damage. All openings shall be covered with wood, metal, or plastic. Waterproofing is required to exclude moisture from interior spaces and external devices. Mating surfaces shall be identified and specifically protected from damage. Protection equal to Level "D" is required for the basic unit. Protection for housing components must be equal to that required by the level of protection specified in the applicable Code section.	HA-7211	The requirements for packaging, shipping, receiving, storage, and handling are deemed to be acceptable based on the fact that the vendor is a qualified supplier on the evaluated suppliers list.	CC	CC	CC	CC
108 (O)	Shipping: *This Sub-article relates to transportation methods from the* manufacturer or supplier, to the job site. Shipping shall comply with the provisions of AA-7100, AA-7200, and AA-7300.	HA-7300	The requirements for packaging, shipping, *receiving, storage, and handling are* deemed to be acceptable based on the fact that the vendor is a qualified supplier on the evaluated suppliers list.	CC	CC	CC	CC
109 (O)	Receiving: Receiving at the job site or intermediate location, where additional work is to be performed or for long term storage, shall be *accomplished in accordance with the provisions of AA-7000.* It shall be the requirement, at any receiving point, to have adequate descriptions of items to permit suitable inspection for conformance, damage acknowledgment, and proper documentation.	HA-7400	This requirement is not applicable. These components have already been installed in the field.	NA	NA	NA	NA
110 (O)	Storage (General): Housing storage requirements are dependent upon the protection level described by AA-7230. Protection equal to Level "D" is required for the basic unit. Protection for housing components must be equal to that required by the level of protection specified in the applicable Code section. These levels shall be the required storage requirements along with the requirements of HA-7511 and HA-7512.	HA-7510	This requirement is not applicable. These components have already been installed in the field.	NA	NA	NA	NA
111 (O)	Storage (Drains and Vents): All housing drains or vents shall be sealed or closed as specified by the Owner or designee. Provisions may be made to use certain drains or vents for assurance that water or other objectionable material does not accumulate within the housing.	HA-7511	This requirement is not applicable. These components have already been installed in the field.	NA	NA	NA	NA
112 (O)	Storage (Other Components): Components covered by other Sections of this Code, that are installed into and integral assembly which is covered by this Section, shall be stored in accordance with AA-7230.	HA-7512	This requirement is not applicable. These components have already been installed in the field.	NA	NA	NA	NA

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	QUALITY ASSURANCE	HA-8000					
113 (QA)	General: Equipment and material covered under this Section shall be manufactured, fabricated, installed, inspected, and tested in accordance with the provisions of a Quality Assurance Program meeting AA-8000 requirements.	HA-8100	The requirements for Quality Assurance of the housings are deemed acceptable based on the fact that the vendor is a qualified supplier on the evaluated suppliers list.	CC	CC	CC	CC
114 (QA)	Material Identification: Measures shall be established for controlling and identifying material throughout the manufacturing process and during shipment in accordance with AA-8000.	HA-8200	The requirements for Quality Assurance of the housings are deemed acceptable based on the fact that the vendor is a qualified supplier on the evaluated suppliers list.	CC	CC	CC	CC
115 (QA)	Drawings and Documentation: The Design Specification shall list the documentation requirements for the housing and list when this documentation is to be provided by the manufacturer, supplied to the Owner or designee. Housing-related items shall include, but not be limited to the following: (a) material certification and test reports; (b) housing drawings including: (1) outline drawings (2) piping and instrumentation diagrams (3) wiring diagrams (c) material list (d) welding procedures and procedure qualification records as *required by applicable welding codes listed in* HA-6140 (e) reports for tests an inspections required by HA-5000 (f) seismic and environmental qualification reports (g) operating, installation, and maintenance manuals.	HA-8300	The requirements for Quality Assurance of the housings are deemed acceptable based on the fact that the vendor is a qualified supplier on the evaluated suppliers list.	CC	CC	CC	CC
	NAMEPLATES AND STAMPING	HA-9000					
116 (O)	General: All items manufactured under the requirements of this Section shall be identified to assure compliance with AA-9000 requirements. Records, as necessary to assure compliance with AA-8200, shall be maintained by the responsible organization in accordance with the approved quality assurance program.	HA-9100	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
117 (O)	Stamping/Marking: Stamping/marking, as used herein, provides a means of maintaining identification of finished products for the purpose of retaining traceability of material.	HA-9110	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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118 (O)	Housings: Housings shall be provided with nameplates, in accordance with AA-9120, which relate the housings to the applicable design and fabrication documents. Housings fabricated in multiple sections need only one nameplate. Each section shall have identification markings, observable after completed installation, which relate all sections. *Nameplates shall be visible after completed installation.*	HA-9111	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
119 (O)	Housing Accessories: Housing accessories shall be marked, stamped, or provided with a nameplate which shall relate to the design and fabrication drawings. Identification shall be observable after completed installation.	HA-9112	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Attachment 7

ASME AG-1 Section RA

Compliance Matrix

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
	SECTION RA: Refrigeration Equipment	RA					
	Applicability: This Section covers requirements for the performance, design, materials, construction, acceptance testing, and quality assurance for nuclear safety-related refrigeration equipment used in nuclear power plants. Refrigeration equipment covered by this Section constitutes equipment used to refrigerate fluids that ultimately maintain operating personnel habitability and process cooling for nuclear power plant systems.	RA-1000	There are no Refrigeration components in the design of these systems.	NA	NA	NA	NA
	MATERIALS	RA-3000					
1 (D,P)	General Material Requirements: (a) All materials used shall have properties and composition suitable for the application as defined by the Design Specification and the operating environmental conditions, as defined in RA-4200(b). When the equipment application requires the use of specific materials, these materials shall be explicitly defined in the Design Specification. All materials expressly prohibited or limited shall be explicitly defined in the Design Specification. (b) ...Water side materials suitable for the conditions must be stated must be stated in the Design Specification, with special attention being given to the effects of service conditions upon the properties of the materials. Materials for the refrigeration side shall be selected to conform with paragraph 9.1 of ANSI/ASHRAE 15. (c) The rules of this Section do not apply to any instruments or the permanently sealed, fluid filled tubing systems furnished with any instruments that function as temperature or pressure responsive devices.	RA-3100		NA	NA	NA	NA

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2 (D,P)	Pressure Retaining Materials: (a) All materials that form the pressure boundary of systems subject to ASME Code, Section III, requirements shall meet the material requirements for Class 3 components of that Code (ND-2000). (b) All material that represents a pressure boundary of systems not subject to ASME Code, Section III, requirements shall meet the applicable requirements for materials as specified in the ASME Code, Section VIII, Division 1. (c) All pressure boundary materials that are exempted by the codes listed in RA-3110(a) and (b) shall meet the material requirements ASME/ANSI B31.5, Chapter III, or shall meet the material requirements of paragraph 8.1 of ANSI/ASHRAE 15. Components constructed from the manufacturer's qualified material (AA-1130) shall have their suitability demonstrated by test per RA-5213 in lieu of the requirements stated in AA-3000.	RA-3110		NA	NA	NA	NA
3 (D,P)	Component Support Materials: (a) All materials that form the support structure for ASME Code, Section III, components, within the definitions provided in RA-4510, shall meet the material requirements specified in NF-2000 of Section III of the ASME Code. (b) All materials that form the support structure of non-ASME Code, Section III, components shall be selected from ANSI/ASME B31.1, Chapter IV, or Section II of the ASME Code.	RA-3120		NA	NA	NA	NA
4 (D)	Electrical Materials: Electrical component materials are not within the scope of this Section, except as covered by the referenced IEEE documents.	RA-3130		NA	NA	NA	NA
5 (D,P)	Pump and Compressor Materials: It is recognized that there are materials used in the design and fabrication of lubrication pumps and compressors that are unique to particular manufacturers (see AA-1130). Proof of suitability of materials used in the design and fabrication of lubrication pumps and compressors, as related to the pressure boundary, will be demonstrated by test and documented by using Data Report Forms RA-2, RA-2a, RA-2b, RA-3, and RA-3a.	RA-3140		NA	NA	NA	NA
	Valve, Piping, and Fitting Materials	RA-3150					
6 (D,P)	Refrigerant: Valve, piping, and fitting materials for refrigeration systems shall meet the material requirements of Chapter III of ANSI/ASME B31.5, and paragraph 9.1 of ANSI/ASHRAE 15.	RA-3151		NA	NA	NA	NA

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7 (D,P)	Water: (a) Water valves, fittings, and piping that form the pressure boundary of systems subject to the ASME Code, Section III, requirements shall meet the material requirements for Class 3 of that Code (ND-2000). (b) Valves, piping, and fittings for water systems (refrigerant transfer systems) that are not subject to the ASME Code, Section III, requirements shall meet the material requirements of Chapter III of ANSI/ASME B31.1.	RA-3152		NA	NA	NA	NA
8 (D,P)	*Lubrication*: Valves, piping, and fittings for oil circuits of lubrication subsystems shall meet the material requirements of Chapter III of ASME/ANSI B31.5, or be as specified in RA-3110(c).	RA-3153		NA	NA	NA	NA
9 (D,P)	Control: Valve and piping materials for control systems shall be compatible with the interfacing system materials and shall meet the requirements of Chapter III of ASME/ANSI B31.1 or ASME/ANSI B31.5.	RA-3154		NA	NA	NA	NA
10 (D,P)	Welding and Brazing Materials: (a) Materials for welding and brazing of components that form the pressure boundary of a system subject to the requirements of the ASME Code, Section III, shall meet the requirements specified in ND-2400 of that Code. (b) Welding materials for structures and supports of the ASME Code, Section III, Subsection ND, pressure vessels shall meet the requirements of Subsection NF of that Code. (c) Welding and brazing materials for components that form the pressure boundary of a system subject to the requirements of ASME/ANSI B31.5 shall be as specified in Chapter V of ASME/ANSI B31.5. (d) Materials for welding and brazing of components not covered by the ASME Code, Section III, Subsections ND and NF, ASME/ANSI B31.1, or ASME/ANSI B31.5, shall be in accordance with AA-6310(e) and AA-6410(e).	RA-3160		NA	NA	NA	NA
	DESIGN REQUIREMENTS	RA-4000					

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11 (D)	Design Specification: The Design Specification shall clearly establish the purpose (design function) of the refrigeration equipment, its safety classifications, and any external interface safety classification. Typical external interface diagrams are shown in Nonmandatory Appendix RA-B. (a) The Design Specification shall include performance requirements for all nuclear power plant operating modes wherein the equipment is expected to perform an intended function as defined in applicable ANSI documents. The event categories, design requirements, and safety functions for each safety class are defined in ANSI/ABNS 51.1 for pressurized water reactors and in ANSI/ANS 52.1 for boiling water reactors. (b) For each of the applicable operating conditions described in RA-4200(a), the following environmental and associated service conditions shall be specified in the Design Specification for the equipment (machine). (1) Minimum and maximum external operating temperatures shall be specified. (2) Minimum and maximum external operating pressures shall be specified. (3) Minimum and maximum external operating humidities (percent) shall be specified. (4) Maximum and cumulative dosage levels (alpha, beta, and gamma) shall be specified. (5) Corrosion allowances shall be specified for equipment subject to thinning by corrosion. Concentration of each chemical shall be specified. (6) Structural loads shall be specified. These loads shall include, but are not limited to, the loads listed in AA-4211. If a loas is not applicable, it shall be so stated. The structural interface between open refrigeration equipment and its drive and drivers shall be included in these loads. (7) Any electrical power transients shall be given and are stated in IEEE 323. The minimum, maximum, and average values for all variables, as well as their duration, shall be specified. (8) The maximum cooling load for which the machine is to be designed shall be specified (see RA-1400).	RA-4200		NA	NA	NA	NA

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11 continued	(9) A cooling load profile that identifies the range of load that the machine must be designed to accommodate shall be specified. For example, if the machine will be operated at full load at the equipment performance requirements (see RA-4300) of 18 hr a day and then at reduced load for the balance of the time, then this load profile shall be specified. The expected number of start-stop cycles during the life of the machine shall be specified. (10) Conditions of restart, other than those identified in RA-4300, must be specified. For example, if the machine must be restared 10 min after the first start.], or if it must be restarted at 75% of voltage, these conditions shall be specified. (11) The maximum and normal water side pressures to which pressure vessels will be subjected shall be given. (12) Temperature, pressure, relative humidity, and radiation time *histories shall be provided for use in qualifying all* refrigeration equipment Class 1E electrical equipment, cabling, controls, and accessories in accordance with IEEE 323. (c) Structural loads to be considered in the design of refrigeration equipment covered by this Code are defined in AA-4211. The magnitude and direction of all external loads shall be given in the Design Specification. Superimposed loads of a cyclical nature shall be clearly defined, including the occurrence of evaporator and condenser water flow variation or reversal, or both, where applicable. Load selected shall be show, and clearly identified, in the structural analysis report for the equipment.	RA-4200		NA	NA	NA	NA

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12 (D)	Equipment Performance Requirements: The required performance of the refrigeration equipment, under applicable conditions of RA-4200(a), shall be clearly specified in the Design Specification. The minimum performance requirements to be specified shall be: (a) design refrigeration load; (b) entering and leaving evaporator fluid temperature; (c) minimum and maximum entering condenser fluid temperature; (d) evaporator and condenser maximum and minimum flowrates; (e) evaporator and condenser fouling factors; (f) evaporator and condenser tube material and nominal wall thickness (corrosion and erosion effects should be considered); (g) liquid to be cooled and condenser cooling medium, including type, properties, and level of impurities in coolant; (h) power supply voltage, phases, and frequency at the terminals of *motors, starters, and controls for primary drives and auxiliaries*; (i) maximum allowable pressure drop for liquid to be cooled and condenser cooling medium; (j) maximum evaporator and condenser tube fluid velocity;	RA-4300		NA	NA	NA	NA
	Mechanical Design Requirements	RA-4400					
13 (D)	Code Class: Water side pressure vessel components of the refrigeration equipment shall be, as a minimum requirement, the same ASME Code class as the fluid system in which they are to be installed. The Design Specification shall clearly identify this Code class.	RA-4411		NA	NA	NA	NA
14 (D)	Boundaries: The Design Specification shall define the boundaries of the water side pressure vessels as required by Section III, NCA-3254, of the ASME Code.	RA-4412		NA	NA	NA	NA
15 (D)	Heat Exchanger Design: The refrigerant side of all heat exchangers shall, as a minimum, meet the design requirements of Section VIII of the ASME Code.	RA-4421		NA	NA	NA	NA
16 (D)	Compressor: This paragraph identifies the boundaries of refrigeration compressors. Refrigerant compressors include both the hermetic and open type used on either centrifugal, reciprocating, scroll, or screw refrigeration machines…Supporting structures, including integral casting, shall be analyzed per the requirements of RA-4510…The design of the refrigerant containing portions of the compressor shall be in accordance with ANSI/ASHRAE 15.	RA-4422 RA-4422.1 RA-4422.2 RA-4422.3		NA	NA	NA	NA

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17 (D)	Refrigerant System Interconnecting Piping, Valves, and Fittings: The refrigerant system interconnecting piping, valves, and fittings shall meet the requirements of ASME/ANSI B31.5 and ANSI/ASHRAE 15.	RA-4423		NA	NA	NA	NA
18 (D)	Transfer System: The refrigerant transfer system shall either meet the same requirements as the system to which is connected, or shall be isolated mechanically and electrically from the system whenever the refrigeration equipment is performing a design function.	RA-4424		NA	NA	NA	NA
19 (D)	Lubrication System—Piping, Valves, and Fittings: The lubrication system piping valves and fittings shall be in accordance with ASME/ANSI B31.5.	RA-4431		NA	NA	NA	NA
20 (D)	Pump: The design of the lubrication pump (if required) shall be in accordance with the requirements of ANSI/ASHRAE 15. Pressure *boundary portions of the pump shall be designed, constructed, and* assembled to meet the requirements of paragraph 9.11.1 of ANSI/ASHRAE 15.	RA-4432		NA	NA	NA	NA
21 (D)	Structural Design Requirements—General: All ASME Code, Section III, equipment and supporting structures shall be designed according to the rules established in the applicable subsections of that Code. Equipment classified as non-ASME Code, and the equipment as a whole, shall be designed analyzed, or tested in accordance with the structural requirements of AA-4000. Any components, assemblies, piping, tubing, and supports not required for a design basis event (as defined in the Design Specification) shall be so noted and a justification shall be given for their exclusion. Applicable structural requirements and load definitions are given in RA-4200(c).	RA-4500 RA-4510		NA	NA	NA	NA
22 (D)	Equipment Attachment Boundary: The attachment of the equipment to the foundation shall be designed according to AA-4360.	RA-4520		NA	NA	NA	NA

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23 (D)	Electrical Design Requirements: All electrical and electromechanical equipment including, but not limited to, motors, wiring, and control components that is required for the refrigeration equipment to perform its design function during all nuclear power plant operating modes [see RA-4200(a)], and hereafter referred to as class 1E components as defined in ANSI/IEEE 323, shall be environmentally qualified in accordance with ANSI/IEEE 323. Qualification of these components to ANSI/IEEE 323 can be accomplished by qualification in accordance with the applicable subtier documents of ANSI/IEEE 323. If the power supply system for the refrigeration equipment includes fast bus transfer capability, the Design Specification shall provide pertinent voltage drop and transfer time data.	RA-4600		NA	NA	NA	NA
24 (D)	Electric Motors: All Class 1E electric motors shall be designed and tested in accordance with ANSI/IEEE 334, IEEE 112A, and NEMA MG-1. Non-Class 1E shall be designed and tested in accordance with IEEE 112A and NEMA MG-1 to ensure operability.	RA-4610		NA	NA	NA	NA
25 (D)	Electric Valve and Vane Actuators: All Class 1E electric valve and vane actuators shall meet the requirements of IEEE 382. All non-Class 1E valve operators shall be suitable for the design condition as specified in the Design Specification.	RA-4620		NA	NA	NA	NA

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26 (D)	Control Systems: All Class 1E control components and control panels shall meet the requirements of ANSI/IEEE 323. The Design Specification shall identify the required NEMA enclosure designation. The instrumentation and control functions shown in Mandatory Appendix RA-II are the minimum that shall be provided by the Manufacturer. Other functions, or provisions for functions, shall be specified in the Design Specification. All non-Class 1E control components shall be suitable for the design conditions specified in the Design Specification (a) Controls shall provide for the proper and safe operation of the equipment under all operating conditions, including the postulated design basis event and loss of coolant accident (LOCA) event. (b) The Design Specification shall describe any equipment monitoring required and note whether provisions are to be made *for remote annunciation. If the external electrical system is a* Class 1E system, an interface between the machine electrical systems and external electrical systems must be identified in the Design Specification as being a Class 1E interface. (c) Control system devices that could prevent or limit the machine from performing its design function during all of the nuclear power plant operating modes as defined in RA-4200(a) are not permitted. Equipment safety devices are excluded from this requirement.	RA-4630		NA	NA	NA	NA
27 (D)	Electrical Wiring, Splices, and Connections: All wiring connections for system internal wiring and for connecting points for field wiring shall be made at terminal blocks. Splices between terminal points shall not be used. Wiring from components located inside the control panel(s) shall be connected to terminal blocks within the panels before being routed outside the panels. All terminal connectors for control wiring shall be the ring type.	RA-4640		NA	NA	NA	NA
28 (D)	Maintenance Criteria: (a) The equipment manufacturer's design shall ensure that all components that require maintenance are accessible for *servicing. All components shall be designed and installed to* facilitate servicing or replacement. (b) The equipment manufacturer shall provide maintenance and access design information for use by the Owner or his designee.	RA-4700		NA	NA	NA	NA
	INSPECTION AND TESTING	RA-5000					
29 (I,T)	General: The requirements of AA-5000 shall apply, except where expanded upon, modified, or otherwise exempted by the following.	RA-5000		NA	NA	NA	NA

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30 (T)	Rating: Performance ratings shall be based upon the actual design conditions supplied by the Design Specification, rated in accordance with ARI 550 or ARI-590, and tested in accordance with Mandatory Appendix RA-I.	RA-5100		NA	NA	NA	NA
31 (T)	ASME Section III Pressure Vessel Testing: ASME Boiler and Pressure Vessel Code, Section III, pressure vessels shall be hydrostatically or pneumatically tested in accordance with the requirements of Section III of the Boiler and Pressure Vessel Code, *ND-6100 through ND-6400.*	RA-5211		NA	NA	NA	NA
32 (T)	ASME Section VIII Pressure Vessel Testing: ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, pressure vessels shall be hydrostatically or pneumatically tested in accordance with the requirements of UG-99, UG-100, or UG-101 and UG-102. Section VIII, Division 2, pressure vessels shall be *hydrostatically or pneumatically tested in accordance with the* requirements of Part AT.	RA-5212		NA	NA	NA	NA
33 (T)	Non-ASME Pressure Vessels: Non-ASME pressure vessels shall be tested in accordance with the requirements of the code or standard specified in the Design Specification. Where not specified in the Design Specification, non-ASME pressure vessels shall: (a) be tested at a hydrostatic pressure of two times the design working pressure or pneumatically tested at a pressure of one and one-half times the design working pressure, provided that the design working pressure is less than or equal to 15 psig, or (b) be tested in accordance with the requirements of Section VIII, provided that the design working pressure is greater than 15 psig.	RA-5213.1		NA	NA	NA	NA
34 (T)	If the requirements of RA-5213.1(a) and (b) are invoked by not specifying a code or standard, the equipment manufacturer shall document the tests using Data Report Forms RA-1, RA-2, or RA-3, as *applicable.*	RA-5213.2		NA	NA	NA	NA

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35 (T)	Hermetic Centrifugal Compressor Testing: The following factory tests shall be performed on the compressors and hermetic motor housings. (a) Pressure Test. The compressor and hermetic motor housings shall be strength tested at the higher of either 45 psig, or 1½ times the design working pressure (hydrostatic), or 1¼ times the design working pressure (pneumatic). The pressure tests may be performed individually, as a discrete assembly, or as an assembly with other refrigeration machine components. Tests shall be documented using Data Report Form RA-2b. (b) Leak Test. A leak test shall be performed at the design working pressure of the compressor and hermetic motor housing assembly either as a discrete assembly, or as a subassembly or a complete assembly with other refrigeration machine components. No individual leak rates shall be greater than 0.1 oz per year. *Tests shall be documented using Data Report Form* RA-2b. (c) Machine Run Test. The compressor and motor assembly shall be run using the Manufacturer's approved test fluid to check for excessive vibration and proper operation of the lubrication system. Tests shall be documented using Data Report Form RA-2.	RA-5214.1		NA	NA	NA	NA

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36 (T)	Open Centrifugal Compressor Testing: The following factory tests shall be performed on the compressors. (a) Pressure Test. The compressor shall be strength tested at the greater of either 45 psig, or 1½ times the design working pressure (hydrostatic), or 1¼ times the design working pressure (pneumatic). The pressure tests may be performed individually, as a discrete assembly, or as an assembly with other refrigeration machine components. Tests shall be documented using Data Report Form RA-2b. (b) Leak Test. A leak test shall be performed at the design working pressure of the compressor and hermetic motor housing assembly either as a discrete assembly, or as a subassembly or a complete assembly with other refrigeration machine components. No individual leak rates shall be greater than 0.1 oz per year. Tests shall be documented using Data Report Form RA-2b. (c) Machine Run Test. The compressor and motor assembly shall be run using the Manufacturer's approved test fluid to check for excessive vibration and proper operation of the lubrication system. Tests shall be documented using Data Report Form RA-2.	RA-5214.2		NA	NA	NA	NA
37 (T)	Hermetic Reciprocating Scroll and Screw Compressor Testing: (a) Proof Test. The high and low side of the compressor and motor housing assembly shall be either hydrostatically tested at a minimum of 1½ times or pneumatically tested at 1¼ times the design pressures as established by ANSI/ASHRAE 15, paragraph 9.2. (b) Leak Test. The compressor and motor housing assembly shall be leak tested and proved tight at the design pressure(s) for which it is rated. No individual leak rates shall be greater than 0.1 oz per year.	RA-5214.3		NA	NA	NA	NA
38 (T)	Open Reciprocating Scroll and Screw Compressor Testing: (a) Proof Test. The high and low side of the compressor shall be either hydrostatically tested at a minimum of 1½ times or *pneumatically tested at 1¼ times the design pressures as* established by ANSI/ASHRAE 15, paragraph 9.2. (b) Leak Test. The compressor shall be leak tested and proved tight at the design pressure(s) for which it is rated. No individual leak rates shall be greater than 0.1 oz per year. (c) Documentation. Proof and leak tests shall be documented using Data Report Forms RA-3 and RA-3a. The Manufacturer's test log shall be submitted for record purposes.	RA-5214.4		NA	NA	NA	NA

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39 (T)	Lubricating Oil Pump Testing: Each pump and the associated lubrication system piping, valves, and fittings that form a pressure boundary shall be hydrostatically or pneumatically pressure tested. The system shall be leak tight at 1½ times (hydrostatic) or 1¼ times (pneumatic) the maximum design pressure. The test shall be documented using Data Report Form RA-2a.	RA-5214.5		NA	NA	NA	NA
	Functional Testing	RA-5220					
40 (T)	Electric Motors--Commercial Routine Test: This test shall include the following: (a) no-load speed, current, and power test per IEEE 112A; (b) locked rotor current test per IEEE 112A (all motors); (c) routine tests per NEMA MG-1-12.51 (small motors) and NEMA MG-1-20.46 (large motors), temperature rise per Form A-1 of IEEE 112A with exclusion for hermetic motors; Note: The starting torque in W/K^2 requirements of NEMA MG-1-12.50 are excluded for hermetic motors. (d) high potential test per NEMA MG-1-12.02 and MG-1-12.03 (small motors) and NEMA MG-1-20.47 (large motors); (e) winding resistance test performed in accordance with IEEE 118; (f) vibration test performed in accordance with NEMA MG-1-12.06 (small motors except for hermetic) and NEMA MG-1-20.53 (large motors). Hermetic motors may be tested at reduced voltage because of winding heating considerations. Test results for hermetic motors shall be in accordance with the requirements of NEMA MG-1-12.06. (g) insulation resistance test performed in accordance with ANSI/IEEE 43; (h) inspection of each motor for direction of rotation and, as applicable, the airflow of unidirectional cooling fans; and (i) inspection of each motor for measurement of air gap with motor stator and rotor at a measured ambient temperature.	RA-5221.1		NA	NA	NA	NA

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41 (T)	Other Tests: The following tests shall be performed on the prototype motor or the first of a series of identical motors supplied under a single order: (a) a complete test as necessary in accordance with IEEE 112A to determine efficiency, power factor, locked rotor torque and current, breakdown torque, rated load current and slip, rated load temperature rise (except hermetic motors), and rated voltage (reduced voltage for hermetic motors) speed torque and speed current curves; (b) a noise test per NEMA MG-1-12.49B (small motors) and NEMA MG-1-20.49B (large motors), except that hermetic motors are exempt; and (c) a shaft current test per IEEE 112A for motors covered by NEMA MG-1-20 only, except that hermetic motors are exempt.	RA-5221.2		NA	NA	NA	NA
42 (T)	Equipment Functional Testing: *The active refrigeration machine components shall be factory tested* for proper and safe operation by the Manufacturer, using the Manufacturer's written procedures. Each complete refrigeration machine shall be given a factory performance test in accordance with Mandatory Appendix, RA-I. Test results shall be documented using Data Report Form RA-5.	RA-5222		NA	NA	NA	NA
43 (T)	Control Functional Testing: All control components and assembled control panels shall be functionally tested by the Manufacturer. All wiring circuits shall have continuity and megger tests conducted by the Manufacturer. Test results shall be documented using Data Report Form RA-4.	RA-5223		NA	NA	NA	NA
44 (T)	Valve and Vane Electric Operator Functional Testing: All of the following tests shall be conducted by the original equipment manufacturer or the refrigeration equipment manufacturer. A Certificate of Conformance shall be made available to the Engineer.	RA-5224		NA	NA	NA	NA
45 (T)	All valve and vane operators shall be given a commercial routine test including: (a) no-load speed and current per IEEE 112A; (b) locked rotor current list per IEEE 112A and NEMA MG-1-12.51; (c) *high potential test per NEMA MG-1-12.02 and 12.03;* (d) insulation resistance test per ANSI/IEEE 43.	RA-5224.1		NA	NA	NA	NA

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46 (T)	All valve and vane operators shall be given a type test on each device except when more than one is supplied, in which case only the first need be tested. This type test shall determine efficiency, power factor, locked rotor torque and current, breakdown torque, rated load current and slip, rated load temperature ruse, and rated voltage speed torque and speed current. This test shall be performed in accordance with IEEE 112A.	RA-5224.2		NA	NA	NA	NA
47 (I)	An inspection of direction of rotation and, if applicable, the airflow of unidirection cooling fans shall be performed on each valve operator.	RA-5224.3		NA	NA	NA	NA
	Examination	RA-5300					
48 (I,T)	(NDE) ASME Code, Section III, Components: Nondestructive examination of ASME Code, Section III, pressure retaining components and Section III, Subsection NF, component supports shall be in accordance with Section III, NCA-5000, ND-5000, and NF-5000, and Code Section V.	RA-5311		NA	NA	NA	NA
49 (I,T)	(NDE) ASME Code, Section VIII, Components: Nondestructive examination of ASME Code, Section VIII, pressure retaining shall be in accordance with Section VIII, Division 1, UG-103.	RA-5312		NA	NA	NA	NA
50 (I,T)	(NDE) Non-ASME Pressure Vessels: Nondestructive examination of non-ASME Code pressure retaining components and component supports shall be in accordance with the Design Specification and AA-6334. As a minimum, nondestructive examination shall consist of visual examination of weldments of pressure retaining components and component supports in accordance with ANSI/AWS D1.1, and shall be documented with ANSI/AWS D1.1, and shall be documented by a Certificate of Conformance.	RA-5313		NA	NA	NA	NA
	FABRICATION AND INSTALLATION	RA-6000					
51 (F)	General: The requirements of AA-6000 shall apply except where expanded upon, modified, or otherwise exempted by the following.	RA-6000		NA	NA	NA	NA
	Welding and Brazing	RA-6100					
52 (F)	Welding and Brazing Performed on ASME Code, Section III, Pressure Retaining Components and Supports: Welding and brazing performed on ASME Code, Section III, pressure retaining components and Section III, Subsection NF, component supports shall be in accordance with Code Sections III and IX.	RA-6110		NA	NA	NA	NA

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53 (F)	Welding and Brazing Performed on ASME Code, Section VIII, Pressure Retaining Components: Welding and brazing performed on ASME Code, Section VIII, pressure retaining shall be in accordance with Code Sections VIII and IX.	RA-6120		NA	NA	NA	NA
	Welding and Brazing of Non-ASME Boiler and Pressure Vessel Code Pressure Retaining Components and Supports—General:	RA-6131					
54 (F)	Responsibility: Each Manufacturer is responsible for the welding and brazing done by his organization and shall conduct the tests required by this subparagraph to qualify the procedures used in the construction of the weldments and brazed joints built under this Code, the performance of brazers, welders, and welding operators who apply these procedures, and the inspections required for workmanship and quality verification.	RA-6131.2		NA	NA	NA	NA
55 (F)	Base Metal: Base metals to be joined by welding or brazing shall be one of those listed in RA-3000 or a combination of the base metals listed in RA-3000, provided the requirements of RA-6131.2 are met.	RA-6131.3		NA	NA	NA	NA
56 (F)	Welding Procedures: Qualification of the Manufacturer's welding procedure specifications shall be in accordance with the requirements of this Section and either the ASME Code, Section IX, or ANSI/AWS D1.1. Once a choice is made between Section IX or ANSI/AWS D1.1, all qualifications shall be consistent with that particular document.	RA-6132		NA	NA	NA	NA
57 (T,QA)	Welder and Welding Operator Qualifications: Welder or welding operator qualification testing, or both, shall be performed in accordance with the ASME Code, Section IX, or ANSI/AWS D1.1. Welding of the qualification test specimens shall be performed in accordance with the Manufacturer's welding procedure specification qualified in accordance with RA-6132.	RA-6133.1		NA	NA	NA	NA
58 (F)	Once a choice is made between Section IX or ANSI/AWS D1.1, all qualification shall be consistent with that particular document.	RA-6133.2		NA	NA	NA	NA
	Cleaning, Finishing, and Coating	RA-6200					

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59 (F)	Cleanliness: Equipment internals shall, as a minimum, be shop cleaned and be prepared for shipment per the requirements of ANSI/ASME NQA-2. Cleanliness levels shall be the same as for the fluid systems of which the equipment is a part. The Design Specification shall identify the internal cleanliness levels of the associated fluid system. As a minimum, ASME NQA-2, Part 2.1, Class D cleanliness level shall apply.	RA-6210		NA	NA	NA	NA
60 (F)	Surface Preparation, Finishing, and Coating: Surface preparation, finishing, and coating of all equipment and components shall be in accordance with the Design Specification. In lieu of specified standards, cleaning, finishing, and coating shall be in accordance with the Manufacturer's written procedures. Surface preparation, finish, and coatings that are compatible with the environmental conditions stated in RA-4200(b) shall be provided in accordance with the Design Specification.	RA-6220		NA	NA	NA	NA
61 (F)	Installation: Installation and startup of the equipment shall be performed under the Manufacturer's supervision and the requirements of AA-6000.	RA-6300		NA	NA	NA	NA
	PACKAGING, SHIPPING, STORAGE, AND HANDLING:	RA-7000					
62 (O)	General Requirements: (a) Packaging, shipping, receiving, storage, and handling requirements shall be in accordance with AA-7000, ASME NQA-1 Basic Requirement 13, and Supplement 13S-1, ASME NQA-2, Part 2.2, and the specific requirements of this article. (b) When different levels of classification are required for different parts of the machine, the Manufacturer's procedures shall state how this will be addressed. If the Owner has specific requirements, the Design Specification shall so state.	RA-7100		NA	NA	NA	NA
63 (O)	Packaging: All relative equipment listed in ASME NQA-2, Part 2.2, paragraph 2.2.2 and 2.2.3 shall meet the requirements of Packaging Levels B or C, as applicable, of NQA-2, Part 2.2, paragraph 3. The balance of the machine shall, as a minimum, meet the requirements of Packaging Level D of NQA-2, Part 2.2, paragraph 3.	RA-7200		NA	NA	NA	NA
64 (O)	Shipping: All relative equipment listed in ASME NQA-2, Part 2.2, paragraphs 2.2.2 and 2.2.3 shall meet the requirements of Shipping Levels B or C, as applicable, of NQA-2, Part 2.2, paragraph 4. The balance of the machine shall, as a minimum, meet the requirements of Shipping Level D of NQA-2, Part 2.2, paragraph 4.	RA-7300		NA	NA	NA	NA

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65 (O)	Storage: All relevant equipment listed in ASME NQA-2, Part 2.2, paragraphs 2.2.2 and 2.2.3 shall meet the requirements of Storage Levels B and C, as applicable, of ASME NQA-2, Part 2.2, paragraph 6. The balance of the machine shall, as a minimum, meet the requirements of Storage Level D of ASME NQA-2, Part 2.2, paragraph 6.	RA-7400		NA	NA	NA	NA
66 (O)	Handling and Rigging: Handling and rigging requirements shall be in accordance with AA-6610 and the following. All relevant equipment listed in ASME NQA-2, Part 2.2, paragraphs 2.2.2 and 2.2.3 shall meet the requirements of Handling Levels B and C, as applicable, of ASME NQA-2, Part 2.2, paragraph 7. The balance of the machine shall, as a minimum, meet the requirements of Handling Level D of ASME NQA-2, Part 2.2, paragraph 7.	RA-7500		NA	NA	NA	NA
67 (O)	Field Assembled or Field Erected Equipment: Where equipment requires component assembly during final installation, the equipment manufacturer shall provide detailed written procedures for making the proper final assembly in accordance with AA-6620.	RA-7610		NA	NA	NA	NA
68 (O)	External Connections and Services: (a) All external connections and services essential to the proper and safe operation of the refrigeration equipment supplied by the Owner or his designee shall be, as a minimum, governed by the same criteria as those specified as applicable to the refrigeration equipment itself. (b) The equipment manufacturer shall be responsible for advising the Owner of his designee of connections or services required for the proper and safe operation of the equipment as specified in the Design Specification.	RA-7620		NA	NA	NA	NA
69 (O,T)	Startup and Periodic Testing: The equipment Manufacturer shall provide detailed startup, inspection, and test procedures with his equipment. Post-startup and periodic testing shall be the responsibility of the Owner. The information required by RA-9200 shall be applied to a separate, corrosion-resistant nameplate permanently attached to the machine by suitable means. The method of attachment shall not affect the structural or operational integrity of the machine.	RA-7630		NA	NA	NA	NA
	QUALITY ASSURANCE:	RA-8000					

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70 (QA)	General: Equipment and materials fabricated under this Section shall be manufactured in accordance with the provisions of the Manufacturer's Quality Assurance Program. The Manufacturer's program shall be in accordance with the requirements of AA-8000 and ANSI/ASME NQA-1, except for those materials covered by RA-3120(b), RA-3140, RA-3151, RA-3152(b), RA-3153, RA-3154, RA-3160(c), and RA-3160(d). For RA-3120(b), RA-3140, RA-3151, RA-3152(b), RA-3153, RA-3154, RA-3160(c), and RA-3160(d), the requirements of RA-8110 shall apply. Where component material traceability is not obtainable per RA-3110(c), the refrigeration equipment Manufacturer shall take the following actions: (a) Designate and document which parts of the refrigeration equipment are nuclear safety related and which parts are non-nuclear safety related. This designated and documented listing *shall be furnished at the initial (proposal) stage of procurement* for the Engineer's review. (b) For non-nuclear safety related parts, no further action on the part of the Manufacturer is required, and the provisions of AA-8000 are not applicable. (c) For nuclear safety related parts, the Manufacturer shall prepare a procurement specification, drawing(s), or purchased material or part specification; maintain and inspection program to assure that the parts agree with the requirements of the procurement specification, drawing(s), or purchased part specification; segregate these parts; and test these parts in accordance with the applicable articles of this Section.	RA-8100		NA	NA	NA	NA
	NAMEPLATES, STAMPING, AND RECORDS:	RA-9000					
71 (O)	General Requirements: (a) Portions of refrigeration equipment manufactured under the rules of ASME Boiler and Pressure Vessel Code, Section III or Section VIII, shall be stamped in accordance with the applicable rules of those Sections. (b) Authorization to use the symbol stamp for those portions of the equipment covered by the rules of Section III and Section VIII must be obtained from the Society. The method for obtaining such authorization is covered in those sections.	RA-9100		NA	NA	NA	NA

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72 (O)	Nameplates and Stamping: The requirement given in AA-9100 shall apply for nameplates, in addition to the following requirements: (a) components of the refrigeration machine built in accordance with Sections of the ASME Boiler and Pressure Vessel Code shall be marked in accordance with the rules of those Sections (b) a nameplate shall be applied to each refrigeration machine and shall be marked as required by AA-9120 and as follows: (1) the Owner's name and the name of the Owner's facility (2) the year of manufacture (c) the information required by RA-9200 shall be applied to a separate, corrosion-resistant nameplate permanently attached to the machine by suitable means. The method of attachment shall not affect the structural or operational integrity of the machine.	RA-9200		NA	NA	NA	NA
73 (O)	Data Reports: (a) For ASME Boiler and Pressure Vessel Code stamped components, the applicable Code Data Reports (N-1, U-1, etc.) shall be completed, signed, and dated by the manufacturer's representative and the Authorized Inspector. (b) For non-ASME Code components, the Data Report Form RA-1 shall be completed and signed by the manufacturer's representative and his inspector. (c) The completed Data Report Form shall be the inspector's authority to ship the machine.	RA-9300		NA	NA	NA	NA
	Performance Testing of Chilled Water Refrigeration Unit	Mandatory Appendix RA-I					
	The performance of the chilled water refrigeration equipment shall be certified by conducting a factory performance test as required by RA-5222. The performance test shall be conducted in accordance with ARI 550, Appendix A (for reciprocating water chilling package, see ARI 590), with modifications to its paragraphs as outlined in I-1100 through I-1700 below.	I-1000		NA	NA	NA	NA
	Paragraph A4.1.1. The conditions to be used in this test shall be as shown in Table I-1000-1.	I-1100		NA	NA	NA	NA

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	Effects of Fouling Factors: The fouling factors to be used for the evaporator and condenser shall be as given in the Design Specification. The Method used for determining the adjusted suction and condensing temperatures at these fouling factors shall be the analytical method as described in ARI 450 and 480, using the Manufacturer's certified data. The adjusted condensing temperature increase and suction temperature decrease shall be calculated at the time of the test based on the actual cleaned tube condensing and suction temperatures (determined from averaging the three tests in accordance with paragraph 5.4.1 of ARI 450 and 480) and tabulated on Form RA-5 as shown in Table I-1200-1.	I-1200		NA	NA	NA	NA
	Paragraph A7.3.1. The general heat balance equation shall be as follows: $Q(e_v) + q(\text{kW input}) = q(c)$ and shall be tabulated on Form RA-5.	I-1300		NA	NA	NA	NA
	Paragraph A7.3.3. The measured heat balance for the tests shall be within 5% of that specified for the full load condition and within 7½% of the other test points.	I-1400		NA	NA	NA	NA
	Paragraph A8.1.1. The capacity in tons shall be obtained by the following: $\text{Tons} = (W)(t_e - t_d)/12{,}000$ Where… and shall be tabulated on Form RA-5 according to Table I-1500-1.	I-1500		NA	NA	NA	NA
	Power Input: The power input expressed in kW/ton of refrigeration shall be within 5% of the Manufacturer's proposed power input for the full load test.	I-1600		NA	NA	NA	NA
	Refrigeration Machines Equipped with Subcoolers: Subcooler performance will be adversely affected when the condensing water temperature is increased to simulate fouling. To compensate, it is acceptable to add 0.1% to the kW/ton of refrigeration tolerance of 5% for each Fahrenheit degree of adjustment made to the entering condenser water temperature.	I-1700		NA	NA	NA	NA

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Attachment 8

ASME AG-1 Section CA

Compliance Matrix

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	SECTION CA: Conditioning Equipment:	CA					
	Applicability: This Section establishes requirements for the design, manufacture, testing, and documentation for forced circulation air cooling and heating coils, air washers, evaporative coolers, and electric heating coils used in nuclear safety-related air conditioning and air and gas treatment systems in nuclear facilities.	CA-1000					
	MATERIALS	CA-3000					
1 (D,P)	Material Specifications: The ASME and ASTM specification listed in Tables CA-3200, CA-3300, and CA-3400 contain requirements for the chemical composition, material thickness limits, minimum yield strength, and tensile strength for each grade designation covered. Where a grade designation is not assigned a minimum yield strength and tensile strength, tests in accordance with ASTM A 370 shall be conducted in order to obtain these values. Maximum allowable design stress values shall be calculated by the procedures in AA-4000.	CA-3110	CMTR's were located in the Project Files, however, they were not specifically traceable back to the exact materials used for systems AN, AP, and AW. Based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
2 (D,P)	Pressure Retaining Materials for Water and Steam Coils: (a) Allowable stresses and yield strengths of materials for all pressure retaining items shall conform to the requirements given in the ASME Code for the appropriate class of service. For Codes of Record prior to the 1992 Edition, use Section III Appendices, Tables I-7.0, I-8.0, or I-13.3, as applicable. . For Codes of Record beginning with the 1992 Edition, use Section II Part D, Subpart 1, Tables 1A, 1B, and Y-1, as applicable. (b) Refer to SFA-5.8 for alloys that produce occupational hazardous fumes. Strict safety and ventilation rules shall be observed if these alloys are used.	CA-3210	There were no water or steam coils associated with the design of these systems. Only electric heating coils.	NA	NA	NA	NA
3 (D,P)	Pressure Retaining Materials for Volatile Refrigerant Coils: (a) Material for all pressure retaining items shall conform to the material requirements of ANSI/ASME B31.5, Table 502.3.1 In addition to this Table, the materials shall meet the requirements of this Code. All materials selected shall be suitable for the intended service. (b) Refer to SFA-5.6 for alloys that produce occupational hazardous fumes. Strict safety and ventilation rules shall be observed if these alloys are used.	CA-3220	There were no volatile refrigerant coils associated with the design of these systems. Only electric heating coils.	NA	NA	NA	NA
4 (D,P)	Nonpressure-Retaining Materials: Materials for safety-related extended fin coils shall be selected from Table CA-3200.	CA-3230	Safety-related extended fin coils were not associated with the design of these systems.	NA	NA	NA	NA

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5 (D,P)	Load Bearing Members: Materials that are part of the water coil casing and are used for component support and transmission of loads from the pressure retaining boundary to the intervening element structure shall conform to the requirements of the ASME Code, Section III, Table NF-2122(a)-1. Applicable ASME Code Classes in effect on the date of the Code Edition and Addenda listed in the Certified Design Specification may be used by mutual consent of the Owner or his designee and the Certificate Holder. Boundary definitions and limits shall be per NF-1130. Bolts and nuts transmitting loads shall be supplied in accordance with Subsection NF.	CA-3240	There were no water or steam coils associated with the design of these systems. Only electric heating coils.	NA	NA	NA	NA
6 (D,P)	Nonload-Carrying Members: Materials that are part of the coil casing or tube support and for which no structural credit is taken do not have to comply with the ASME Code, Section III, Subsection NF; however, thy shall be selected from Table CA-3200.	CA-3250	This requirement is acceptable based on the review of the CVI data and the associated drawings for each systems.	CC	CC	CC	CC
	Air Washer and Evaporative Cooler Materials	CA-3300					
7 (D,P)	General Requirements: Materials for air washers, evaporative coolers, and accessories shall be capable of meeting all requirements of CA-4320. Materials shall be in conformance with the ASME or ASTM specifications listed in Table CA-3300, as a minimum. Materials that exceed the requirements in Table CA-3300 may be used when required by the Design Specification or AA-4000.	CA-3310	There are no air washer or evaporative coolers associated with the design of these systems.	NA	NA	NA	NA
	Electric Heating Coil Materials	CA-3400					
8 (D,P)	General Requirements: Materials for electric heating coils and accessories shall meet all requirements of CA-4400. Materials shall be in conformance with the ASME or ASTM specifications listed in Table CA-3400, as a minimum. Materials that exceed the requirements in Table CA-3400 may be used subject to the approval of the Owner or his designee.	CA-3410	This requirement is acceptable based on a review of the CVI data and associated drawings for each system.	CC	CC	CC	CC

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9 (D,P,QA)	Certification of Materials: Certification of materials shall be in accordance with AA-3000, AA-8000, and the specific requirements of the following subparagraphs. (a) The materials supplied shall be in full compliance with the appropriate ASME, AWS, or ASTM specification. The thickness shall be as specified in the Design Specification or as required in CA-4000. (b) The coil Manufacturer shall supply to the Purchaser, as a minimum, Certified Material Test Reports (CMTR) of chemical and physical properties of all materials that form pressure boundaries. The pressure boundary includes the coil tubing, headers, return bends, nozzles, and flanges. A Material Manufacturer's Certificate of Compliance with the material specification, grade, class, and heat treated condition, as applicable, may be provided in lieu of a CMTR for the coil *material defined below:* (1) pipe, fittings, flanges, material for valved and tubes (except heat exchanger tubes) NPS ¾ and less; (2) bolting of 1 in. nominal diameter and less. (c) ASME Code, Section III, Subsection NF, materials shall e supplied with CMTRs except as designated in NF-2600. (d) For nonpressure boundary coil material, electric heaters, air washers, and evaporative coolers, a Material Manufacturer's Certificate of Compliance with the material specification, grade, class, and heat treated condition, as applicable, is acceptable in lieu of a CMTR.	CA-3510	CMTR's were located in the Project Files, however, they were not specifically traceable back to the components for systems AN, AP, and AW. Based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	DESIGN	CA-4000					

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10 (D)	Design Specification for Water and Steam Coils: A Design Specification shall be prepared and certified by the Owner or his designee in accordance with NCA-3255 of the ASME Code, in sufficient detail to provide a complete basis for coil design in accordance with this Code. The Design Specification shall include, as a minimum, the following data: (a) ASME Code Edition, Addenda, Class, and applicable Code Cases (b) Coil type (c) Corrosion allowance per ASME Code, Section III, NX-3121. (d) Fouling factor – fluid side (e) Safety classification per ASME Code, Section III, NCA-2110(d) (f) Boundaries of jurisdiction per NCA-3254 (g) Tube, fin, minimum material thickness (h) Maximum allowable fin spacing (i) *Materials of construction* (j) Conditions of operation – normal, accident, containment pressurization (leak) test (1) entering air temperature, dry bulb/wet bulb (2) leaving air temperature, dry bulb/wet bulb (3) entering fluid temperature (4) air density (5) fluid side flow rate (6) entering air flow rate, SCFM (7) maximum fluid side pressure drop (8) maximum air side pressure drop (9) minimum total heat transfer (10) maximum face velocity (11) maximum environmental design pressure (k) design and service loading per ASME Code, Section III, NCA-2140 (l) radiation, total integrated dosage, rads (m) coating system requirements	CA-4110	Water and steam coils are not associated with the design of these systems.	NA	NA	NA	NA
11 (D)	Additional Requirements: The Design Specification shall contain a complete cooling water analysis, including tests for ammonium compounds.	CA-4111	Water and steam coils are not associated with the design of these systems.	NA	NA	NA	NA

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12 (D)	Technical Requirements – General: (a) The fluid side of the coil shall be designed, constructed, tested, and stamped in accordance with the ASME Code, Section III. (b) All fluid side coil requirements shall be, as a minimum, the same ASME code class as the fluid system in which they are to be installed. The Design Specification shall identify this code class. (c) Coils shall be capable of meeting the design requirements of CA-4122 through CA-4134. (d) Inspection and testing shall be in accordance with CA-5100.	CA-4121	Water and steam coils are not associated with the design of these systems.	NA	NA	NA	NA
13 (D)	Technical Requirements – Tubes: (a) All water coils shall be designed for a minimum tube velocity of 2 ft/sec and maximum velocities as listed in TablebCA-4122. (b) Steam Coils shall be capable of withstanding twice the maximum fluid side pressure.	CA-4122	Water and steam coils are not associated with the design of these systems.	NA	NA	NA	NA
14 (D)	Return Bends: (a) Separate noncleanable return bends are allowed. (b) Where a minimum wall thickness is specified, separate return bends shall be formed from a tube with an increased wall thickness sufficient to maintain the required wall thickness in the bends. As a minimum, such increased wall thickness shall be the equivalent of 1 gage heavier than the wall thickness required for straight tube. (c) Hairpin (or U-bend) return bends are permitted only when wall thinning is allowed be the Design Specification. The amount of thinning in the outside fibers of a hairpin shall be in accordance with ASME Code, Section II, Part B, SB-395, 14.3. (d) Cleanable return bends shall be cast or machined fittings with plugs and gaskets.	CA-4124	Water and steam coils are not associated with the design of these systems.	NA	NA	NA	NA
15 (D)	Nozzles and Header Assembly: (a) Carbon steel nozzles, tubular headers, and water box headers shall have a minimum corrosion allowance of 1/16 in. (b) The water and steam header assembly shall be provided with a vent and drain connection. (c) Cleanable tube coils shall be of the removable header type or the plug type with O-ring gaskets. (d) Loading considerations shall be in accordance with CA-4130. (e) Joints shall be brazed or welded in accordance with CA-6000. (f) Nozzles shall be furnished with weld end preparation or flanges, as specified.	CA-4212	Water and steam coils are not associated with the design of these systems.	NA	NA	NA	NA

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16 (D)	Fins: (a) Fins shall have a minimum thickness of 0.009 in. (b) Fins shall be permanently bonded to the tubes by a mechanical expansion or tensioning process or by brazing. (c) Fin spacing shall be specified in the Design Specification.	CA-4125	Water and steam coils are not associated with the design of these systems.	NA	NA	NA	NA
17 (D)	Casing and Tube Support: The casing and tube supports shall be designed to withstand, without causing permanent distortion or breach of integrity, stresses and external overpressure as defined in AA-4000. Structural requirements for coils are given in CA-4130.	CA-4126	Water and steam coils are not associated with the design of these systems.	NA	NA	NA	NA
	Structural Requirements for Water, Steam, and Volatile Refrigerant Coils	CA-4130					
18 (D)	General: Coils shall be designed in accordance with the structural requirements given in AA-4000. Structural requirements and load definitions specific to water and steam coils are given in CA-4132 through CA-4134.	CA-4131	Water, steam and volatile refrigerant coils are not associated with the design of these systems.	NA	NA	NA	NA
19 (D)	Support Boundaries for Coils: Coils may be supported as a unit (as part of an air handling system) or line supported (as in an assembly inserted into a run of ductwork). (a) In a unit supported coil assembly, the support boundary for the coil shall consist of the attachment and interface points between the air handling equipment housing and the coil. (b) In a line supported coil assembly, the support boundary for the coil shall consist of the interface flanges or other mechanical connections between the coil and ductwork that are designed to transfer all components of load across the joints. (c) The coil supplier shall be responsible for specifying all information necessary to define the support boundary interfaces. This information shall include, but not necessarily be limited to : (1) configuration, size, and type of support attachments required; (2) magnitudes and directions of all loads imposed on the anchorage points, including all static, dynamic, and operating loads resulting from the installed coil assembly. Loads shall be provided in a form that shall allow combinations to be considered as required in AA-4212. (3) Any limitations, such as allowable nozzle loads, or other interface load requirements necessary to ensure that the coil can perform its required safety function under all design conditions.	CA-4132	Water, steam and volatile refrigerant coils are not associated with the design of these systems.	NA	NA	NA	NA

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20 (D)	Load Definition: Loads to be considered in the structural design if equipment are given in AA-4211 and AA-4212 with the following additions. (a) Normal loads *N* shall include: (1) deadweight load – including any added weight due to water or the heat transfer medium; (2) operating pressure load – the load resulting from the maximum pressure differential that may occur during normal operation. Included are loads imposed by normal design air flows and impact pressures resulting from rapid change of other air flow control devices in a system. (3) Nozzle loads – the shear and bending moments associated with the attached piping system; (4) Normal equipment interface load – the normal externally applied load or loads from adjacent equipment or ductwork attached to the coils. (b) Thermal loads *T* shall include temperature induced loads resulting from constraint of force and displacements. (c) Design and service limits shall be as follows. (1) Pressure boundary limits shall conform to the ASME Code, Section III, NCA-2142.2, and Tables NC/ND-3321-1. (2) For subsection NF casings, limits shall be in accordance with NCA-2142.2, NF-3321, NF-3350, NF-3360, and Table NF-3523.2-1.	CA-4133	Water, steam and volatile refrigerant coils are not associated with the design of these systems.	NA	NA	NA	NA
2 (D)	Structural Verification by Analysis: When verification of design by analysis is appropriate (see AA-4310 through AA-4340), the results of the analysis shall be compiled by the Manufacturer and submitted to the Owner or his designee in the form of a Design Verification Stress Report (DVSR). The DVSR shall identify the objectives, assumptions, analysis results, and the conclusions. Equipment shall be considered structurally verified if the stress conditions identified in AA-4000 are not exceeded under the applicable load combination.	CA-4134.1	Water, steam and volatile refrigerant coils are not associated with the design of these systems.	NA	NA	NA	NA

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22 (D,T)	Structural Verification by Testing: When verification by testing is appropriate (see AA-4350), a design verification test procedure shall be compiled and submitted to the Owner or his designee. Upon completion of the tests, a Design Verification Report (DVTR) shall be prepared by the Manufacturer and submitted to the Owner or his designee. The DVTR, as a minimum, shall identify the objectives, design criteria, assumptions, test result data, and conclusions of the design verification test (DVT). Equipment shall be considered structurally verified if before, and after the qualification test the equipment performs its safety-related function.	CA-4134.2	Water, steam and volatile refrigerant coils are not associated with the design of these systems.	NA	NA	NA	NA
23 (D)	Structural Verification by Comparison: When equipment to be structurally verified is of similar design to other equipment that has been verified in accordance with CA-4134.1 or CA-4134.2, and when all elements of the unverified equipment are shown to be equal to or more rigid than the similar, verified equipment, and when it can be shown that the previously verified equipment has greater loading conditions, the equipment may be verified by comparison in lieu of analysis or tests. When verification by this method is selected, a Design Verification by Comparative Evaluation Report DVCER) shall be submitted to the Owner or his designee. The DVCER shall identify the specific equipment to be verified, and include a copy of the appropriate DVSR or DVTR and a detailed comparative evaluation between the two pieces of equipment.	CA-4134.3	Water, steam and volatile refrigerant coils are not associated with the design of these systems.	NA	NA	NA	NA
24 (D)	Design Reports: (a) For coils designed and fabricated in accordance with the ASME Code, Section III, the Design Report requirements of NCA-3550 shall be met. (b) For casings designed to ASME Code Section III, Subsection NF, the requirements of NF-3132 and CA-4134.4(a) shall be met.	CA-4134.4	Water, steam and volatile refrigerant coils are not associated with the design of these systems.	NA	NA	NA	NA

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25 (D)	Design Verification Acceptance Criteria: (a) Coils designed and fabricated in accordance with the ASME Code shall be considered structurally verified if the stress limits identified in Tables NC/ND-3321-1 are not exceeded under the applicable load combinations. (b) Coil casings designed to ASME Code, Section III, Subsection NF, shall be considered structurally verified if the stress limits given in NF-3321, NF-3350, NF-3360, and Table NF-3523.2-1 are not exceeded under the applicable load combinations. (c) Equipment not designed and fabricated in accordance with the ASME Code shall be considered structurally verified if the stress limits of Table AA-4332 are not exceeded under the load combinations of Table AA-4212.	CA-4134.5	Water, steam and volatile refrigerant coils are not associated with the design of these systems.	NA	NA	NA	NA
26 (D)	Design Specification for Volatile Refrigerant Coils: A Design Specification shall be prepared by the Owner or his designee and certified by a registered professional engineer in sufficient detail to provide a complete basis for coil design. The specification shall include, but not be limited, to, the following items as required for proper design and construction of the coil in accordance with this and other applicable codes and the Owner's requirements: (a) design and testing standards (b) materials of construction (c) refrigerant type (d) safety classifications per ANSI/ASHRAE 15 (e) maximum allowable fin spacing (f) conditions of operation – normal, accident (1) total heat transfer (2) sensible heat transfer (3) entering air temperature, dry bulb/wet bulb (4) leaving air temperature, dry bulb/wet bulb (5) minimum refrigerant suction temperature (6) entering air flow rate, Standard (7) maximum air side pressure drop (8) maximum face velocity (9) design loadings (10) radiation, total integrated dosage, rads (11) coating system requirements	CA-4210	Water, steam and volatile refrigerant coils are not associated with the design of these systems.	NA	NA	NA	NA
27 (D)	Tubes: Volatile refrigerant tubes shall be capable of withstanding 1.5 times the maximum fluid side pressure defined in the Design Specification.	CA-4222	Water, steam and volatile refrigerant coils are not associated with the design of these systems.	NA	NA	NA	NA

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28 (D)	Return Bends: Hairpin (or U-bend) return bends are permitted only when wall thinning is allowed by the Design Specification. The amount of thinning in the outside fibers of a hairpin shall be in accordance with the ASME Code, Section II, Part B, SB-395, 14.3.	CA-4223	Water, steam and volatile refrigerant coils are not associated with the design of these systems.	NA	NA	NA	NA
29 (D)	Distributors: (a) Distributors shall be utilized when required to disperse the refrigerant evenly through the coil. (b) Distributor feed tubes shall be oriented in a nonuniform configuration and shall be exactly the same length for each circuit. (c) Each distributor and distributor feed tube shall be constructed of materials compatible with other adjoining materials and with CA-3100.	CA-4224	Water, steam and volatile refrigerant coils are not associated with the design of these systems.	NA	NA	NA	NA
30 (D)	Suction Header Assembly: Vertical headers shall have a bottom outlet to allow gravity drainage of refrigerant oil in the suction line. The suction header shall be nearest the entering air face of the foil.	CA-4225	Water, steam and volatile refrigerant coils are not associated with the design of these systems.	NA	NA	NA	NA
31 (D)	Fins: Fins shall be designed in accordance with CA-4125. Fin spacing shall be as specified in the Design Specification.	CA-4226	Water, steam and volatile refrigerant coils are not associated with the design of these systems.	NA	NA	NA	NA
32 (D)	Casing and Tube Support: The casing and tube support shall be designed in accordance with CA-4126.	CA-4227	Water, steam and volatile refrigerant coils are not associated with the design of these systems.	NA	NA	NA	NA
33 (D)	Structural Requirements for Volatile Refrigerant Coils: Structural requirements for volatile refrigerant coils shall be in accordance with CA-4130 through CA-4134.	CA-4229	Water, steam and volatile refrigerant coils are not associated with the design of these systems.	NA	NA	NA	NA

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34 (D)	Design Specification for Air Washers and Evaporative Coolers: A Design Specification shall be prepared by the Owner or his designee in sufficient detail to provide a complete basis for equipment design in accordance with this Code. The Design Specification shall include, as a minimum, the following data: (a) equipment type – air washer or evaporative cooler (b) materials of construction (c) conditions of operation, normal and accident (1) entering temperature, dry bulb/wet bulb (2) leaving temperature, dry bulb/wet bulb (3) total heat transfer (4) operating air density (5) minimum and maximum air flow rate, standard (6) minimum and maximum air velocity (7) air pressure loss (8) *humidifying effectiveness, percent* (d) pump flow rate (e) pump head (f) makeup water flow (g) space limitations (h) drain connections, types and sizes (i) insulation requirements (j) design loadings (k) radiation, total integrated dosage, rads (l) electrical characteristics (m) maximum specified design temperature	CA-4310	Water, steam and volatile refrigerant coils are not associated with the design of these systems.	NA	NA	NA	NA

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
35 (D)	Technical Requirements for Air Washers and Evaporative Coolers: (a) Air washers and evaporative coolers shall be capable of meeting the design requirements of CA-4322 through CA-4328 and the structural requirements of CA-4330. (b) Spray-type air washers shall consist of a chamber or casing (including spray system), a water tank, a recirculating water pump, and, when required, a moisture eliminator section. (c) Cell-type air washers shall consist of an array of cells packed with glass, metal, or fiber media held in place with wire mesh screens. Cells shall be arranged in tiers. Each tier shall be equipped with a spray header and drain pan, and with the exception of the bottom tier, a drain pipe. This type of washer also consists of a water tank, pump, and downstream moisture eliminator section if required. (d) Wetted media evaporative air coolers shall consist of a casing *housing, evaporative pack, water tank, recirculating pump, and* water distribution system. (e) Rigid media evaporative air coolers shall use a rigid corrugated material as the wetted surface. (f) Other types of air washers shall and evaporative coolers shall be acceptable, provided the design and performance criteria meet the requirements of the Design Specification. (g) When required by the Design Specification, units shall be insulated or contain air distribution baffles, or both.	CA-4320 CA-4321	Water, steam and volatile refrigerant coils are not associated with the design of these systems.	NA	NA	NA	NA
36 (D)	Chamber: (a) The panels and tank shall be sealed and fastened to provide a leak-tight joint. (b) Side and top blanks attached to the panels and extending to the eliminator bank shall minimize the bypass of air and spray around the eliminator section. (c) Intermediate spacers shall provide the spacing and support functions for the eliminators and baffles. (d) When required, access doors located on spray chamber panels shall be watertight or provided with an outside drain that can be directed back into the chamber. (e) Internal bracing in the spray pattern shall not be located closer than 6 in. from the orifice of a nozzle. (f) The spray chamber shall be accessible for maintenance.	CA-4322	Water, steam and volatile refrigerant coils are not associated with the design of these systems.	NA	NA	NA	NA

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37 (D)	Eliminators: (a) Spray removal from the air stream shall be accomplished by a bank of eliminators designed to capture and drain spray water into the washer tank. (b) Eliminators shall be formed and properly spaced to provide effective spray removal at the velocity and pressure drop stated i the Design Specification. (c) The material shall be a minimum of 24 gauge steel in accordance with ASTM A 525 Coating Designation G90, or 26 gage stainless steel. (d) The material shall be capable of maintaining its shape at the maximum specified temperature and velocity. (e) The eliminator bank shall be designed to provide easy access for cleaning each blade. (f) The eliminator bank shall be provided with a plate extending below the water level at the intake to prevent the bypass of air and spray underneath the bank. (g) Scum plates located at the bottom of the eliminator bank on the discharge side shall be provided to prevent foam from escaping into the air stream.	CA-4323	Water, steam and volatile refrigerant coils are not associated with the design of these systems.	NA	NA	NA	NA
38 (D)	Fill: (a) Rigid and semi-rigid fill media shall be designed to provide wetted surfaces from which water evaporates and excess water drains into the tank. (b) Fill media shall be of resilient fibrous glass or cellulose material, or of rigid, corrugated material of cellulose or glass fiber sheet that has been impregnated with suitable material to provide rigidity and shape-holding characteristics without destroying its hygroscopic properties. The media may be chemically treated to increase wettability. The fill shall be treated to resist bacteria, fungi, and other microorganisms. Fill media shall be selected to perform in accordance with the design conditions.	CA-4324	Water, steam and volatile refrigerant coils are not associated with the design of these systems.	NA	NA	NA	NA

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39 (D)	Baffles: (a) Baffles shall provide uniform airflow to the spray chamber. (b) Broken plate baffles shall be a minimum of 24gage steel in accordance with ASTM A 525 Coating Designation G90, or 26 gage stainless steel. (c) The material shall be capable of maintaining its shape at the maximum specified temperature and velocities. (d) The baffle bank shall be designed for easy access for cleaning each blade. (e) Perforated metal baffles with greater than 65% net free area shall be not less than 18 gage steel in accordance with ASTM A 525 Coating Designation G90, or 20 gage stainless steel.	CA-4325	Water, steam and volatile refrigerant coils are not associated with the design of these systems.	NA	NA	NA	NA
40 (D)	Spray Bank: (a) Uniform spray distribution shall be provided in the spray chamber of the air washers and evaporative coolers to produce *90% saturation efficiency at 500 FPM face velocity. Distribution* headers for soaking the media shall extend the full length of and be above the media, be equally spaced, and have uniform distribution of water at each orifice to produce the stated efficiency. (b) Water flow shall not exceed 10 ft/sec in the piping. (c) Piping shall be not less than Schedule 40 galvanized or stainless steel. (d) Welding of piping shall be in accordance with CA-6120(c). (e) Nozzles shall be made from materials compatible with piping materials. (f) The header shall be attached by bolting or welding to the tank, supports, or panels. Welding shall be in accordance with CA-6000. (g) Cleanout provisions, such as pipe caps or blind flanges, shall be provided to flush the header and standpipes if required by the Design Specification. (h) Headers shall not be less than NPS 4 and standpipes NPS 1½. Nipples shall not be less than NPS 3/8. Headers for fill-type evaporative coolers shall not be less than NPS 1½, Schedule 80. (i) Bolted flanges for the header section shall be as follows: (1) stainless steel type 304 (UNS S30400), ANSI/ASME B16.5 Class 150 flange; (2) forged steel ANSI/ASME B16.5 Class 150 flange; (3) forged steel flanges shall be galvanized in accordance with ASTM A 123.	CA-4326	Water, steam and volatile refrigerant coils are not associated with the design of these systems.	NA	NA	NA	NA

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				AN	AP	AW	SY
41 (D)	Tanks: (a) The tank shall provide a sump for the spray system, a mount for accessories such as makeup, quick fill, and level control. (b) The tank plate material shall not be less than 10 gage steel in accordance with ASTM A 525 Coating Designation G90, or 12 gage stainless steel. (c) Supports for eliminators, fill, and baffles shall be spaced to allow no greater deflection than 1/16 in. of the span between supports during anticipated construction, normal or accident conditions. (d) The pump suction shall be threaded, flanged, flanged, and bolted or welded through the wall. If the pump is mounted with a vertical shaft, it shall be bolted to a submerged suction plate. (e) All welding on the tank shall be in accordance with CA-6120(c).	CA-4327	Water, steam and volatile refrigerant coils are not associated with the design of these systems.	NA	NA	NA	NA
42 (D)	Miscellaneous Requirements: (a) Welds on galvanized steel shall be cleaned and coated with a *zinc-rich inorganic paint in accordance with AA-6535.* (b) Electrical installation for lighting, power, and control wiring shall be in accordance with ANSI/NFPA 70, UL 1096, and the Design Specification. (c) Air washers and evaporative coolers shall be designed in modules and field erected where size precludes shipment by common carriers.	CA-4328	Water, steam and volatile refrigerant coils are not associated with the design of these systems.	NA	NA	NA	NA
43 (D)	Structural Requirements: Air washers and evaporative coolers shall be designed in accordance with the structural requirements given in AA-4000. Structural requirements and load definitions specific to air washers and evaporative coolers are given in CA-4332 through CA-4334.	CA-4331	Water, steam and volatile refrigerant coils are not associated with the design of these systems.	NA	NA	NA	NA

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44 (D)	Support Boundary for Air Washers and Evaporative Coolers: (a) The support boundary for air washers and evaporative coolers shall consist of the interface flanges, pipe nozzles, mounting bolts, or other mechanical connections between the air washer or evaporative cooler and adjacent ductwork or equipment that are designed to transfer all components of load. (b) The air washer or evaporative cooler Manufacturer shall be responsible for specifying all information necessary to define the support boundary interfaces. This information shall include, but not necessarily be limited to: (1) configuration, size, and type of support attachments required; (2) magnitudes and directions of all loads imposed on the anchorage points, including all static, dynamic, and operational loads. Loads shall be provided in a form that *shall allow combinations to be considered*, as required in AA-4212. (3) Any limitations, such as allowable nozzle loads, deflection limits, or other interface load requirements necessary to ensure that the assembly can perform its required safety function under all design conditions.	CA-4332	Water, steam and volatile refrigerant coils are not associated with the design of these systems.	NA	NA	NA	NA

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45 (D)	Load Definition: Loads to be considered in the structural design of air washers and evaporative coolers are given in AA-4211 and AA-4212, with the following additions. (a) Normal loads *N* which shall include: (1) deadweight load – including any added weight due to water or other medium; (2) operating pressure load – the load resulting from the maximum pressure differential that may occur during normal operation. Included are loads imposed by normal design air flows and impact pressures resulting from rapid change of other devices in a system; (3) Nozzle loads – the shear and bending moments associated with the attached piping systems; (4) Normal equipment interface load – the normal external applied loads from interfacing equipment or ductwork attached to the equipment; (5) Attachment loads – the dead weight load associated with any unit attachments such as actuators or gages. (b) Sloshing effects of liquids used in air washer or evaporative cooler spray systems. (c) Thermal loads *T* which shall include temperature induced loads resulting from constraint of force and displacements.	CA-4333	Water, steam and volatile refrigerant coils are not associated with the design of these systems.	NA	NA	NA	NA
46 (D)	Structural Verification: (a) Air washers and evaporative coolers and all of their components shall be capable of remaining functional under the structural loadings given in CA-4333. (b) Structural verification shall be in accordance with CA-4134.	CA-4334	Water, steam and volatile refrigerant coils are not associated with the design of these systems.	NA	NA	NA	NA

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47 (D)	Design Specification for Electric Heating Coils: A Design Specification shall be prepared by the Owner or his designee in sufficient detail to provide a complete basis for electric heating coil design in accordance with this Code. Design Specifications shall include, as a minimum, the following data: (a) entering temperature, dry bulb (b) relative humidity, percent (c) leaving temperature, dry bulb (d) entering air flow, standard (e) air entering velocity (f) *line voltage, phase, Hz* (g) control voltage, phase, Hz (h) coil type – flange, slip in (i) element type – open coil, fin tubular (j) heater capacity (k) *number of stages* (l) materials of construction (m) location of controls – integral, remote (n) type of controls – electric, pneumatic (o) design loadings (p) radiation, total integrated dosage, rads	CA-4400 CA-4410	Design Specifications were not available for review for systems AN, AP, and AW, however, a review of the associated CVI data identified some of these requirements. Also, based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
48 (D)	Technical Requirements for Electric Heating Coils: (a) Electric heating coils shall be designed following the guidelines of ANSI/NFPA 70 and UL 1096, but need not bear the UL label. (b) Electric heating coils shall be capable of meeting the design requirements of CA-4422 through CA-4429 and the structural requirements of CA-4430.	CA-4420 CA-4421	Design Specifications were not available for review for systems AN, AP, and AW, however, a review of the associated CVI data identified some of these requirements. Also, based on past operating performance, *these systems are considered acceptable* as-is. SY system complied with this requirement completely	DR	DR	DR	CC

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49 (D)	Elements: (a) Elements shall be of open coil or finned tubular design. The resistance wire shall be in accordance with ASTM B 344. (b) Open coil heating elements shall be 80% nickel and 20% chromium resistance wire centered in a high temperature ceramic or phenolic sleeve. (c) Finned tubular elements shall have 80% nickel and 20% chromium resistance wire centered in a metal sheath and insulated from the sheath by magnesium-oxide refractory. (d) Sheath and fins shall be stainless steel, monel, or copper clad carbon steel. Carbon steel elements shall be coated with high temperature aluminum paint or ceramic frit finish. (e) Element hardware shall be stainless steel or monel. Insulators and bracket bushings shall be nonporous ceramic and securely positioned. Terminals shall be machine crimped to elements. (f) Element support brackets shall be positioned not more than 4 in. apart for open coil elements and 18 in. apart for finned tubular elements. Stiffening ribs and gussets shall be provided for rigidity. (g) Open and finned heating stages shall be arranged to prevent stratification when operating at less than full capacity. A minimum of the first one-third of heating elements shall be spread evenly across the heater face.	CA-4422	Most of these technical requirements are documented in the CVI data or on the associated drawings for systems AN, AP, and AW however, not all could be accounted for. Based on past operating performance of the heaters, they are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
50 (D)	Frames: (a) Frames shall be flanged or slip-in. (b) Stacking flanges shall be furnished when multiple sections are required. (c) Frames, supports, and flanges shall be of approved materials from Table CA-3400.	CA-4423	These requirements are either not applicable or are acceptable based on a review of the CVI data and associated drawings for each system.	CC	CC	CC	CC
51 (D)	Thermal Cutouts: (a) Primary and secondary temperature thermal cutouts shall be provided in accordance with UL 1096 and ANSI NFPA 70 requirements. The primary thermal protection shall be the automatic reset type. The secondary thermal protection shall be manually reset type, or replaceable. (b) Heaters in multi-zone or dual duct air handling units and heaters with frame widths over 36 in. shall be furnished with linear thermal cutouts that extend the full length of the frame.	CA-4424	This requirement is acceptable based on a review of the CVI data and applicable drawings for each system.	CC	CC	CC	CC

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52 (D)	Fan Interlock: Each heater shall be provided with a fan interlock, which can be either a fan relay or a built-in pressure differential-type air flow switch. Switches shall be provided in accordance with the requirements of UL 1096 and wired in series with the primary thermal protector.	CA-4425	This requirement is acceptable based on a review of the associated drawings and CVI data for each system.	CC	CC	CC	CC
53 (D)	Terminal Boxes: The terminal boxes shall meet NEMA standards. The enclosures shall be NEMA 1, 4, or 12, as required by the Design Specification. The terminal boxes shall be fabricated from stainless steel or carbon steel not less than 16 guage.	CA-4426	This requirement is acceptable based on a review of the associated drawings and the applicable CVI data. Design specifications were not available for review. Also, these systems are acceptable as-is based on past operating performance.	CC	CC	CC	CC

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54 (D)	Electrical Requirements: (a) Electrical heating coils shall be constructed in accordance with applicable requirements on ANSI/NFPA 70 and UL 1996. All internal wiring shall be factory installed and terminated at conveniently located factory installed and terminated at conveniently located terminal blocks to facilitate field wiring. No more than two wires shall be terminated on any one terminal block. Power and control terminals shall be clearly marked. Power and control wiring shall be terminated on different terminal blocks and shall not be intermixed. Grounding lugs for incoming ground wire shall be provided. (b) The electric heating unit and components shall be qualified to ANSI/IEEE 323 and ANSI/IEEE 344. The units shall be qualified to operate at the specified environmental conditions such as relative humidity, radiation dose, temperature, etc. Based on the heater qualification test results, the heater Manufacturer shall provide a recommended replacement schedule for any components that do not achieve the specified life conditions. (c) Control and power wiring located in electric heating coil enclosures and terminal boxes shall be UL listed, certified to meet the vertical flame test per VW-1 per section 1080 of UL 1581 and marked with VW-1 on the wire insulation. Control and power wiring located in open trays shall be UL listed and certified to the ANSI/IEEE 383 flame test. Wiring shall be *continuous between the terminal, with no splicing permitted.* All wiring terminals for wire smaller than AWG No. 6 shall be made with crimp-type, preinsulated ring tongue, solderless terminal lugs. For AWG No. 6 and heavier wiring, pressure or clamp-type terminals shall be used. Insulation shall be the radiation resistant type. Spade-type quick-connect terminals may be used where required for component wiring. (d) Terminal blocks shall be the molded phenolic type with screw-type terminals with barriers between the terminals. Pressure or clamp-type terminals are not acceptable except for AWG No. 6 and heavier wires. (e) Fuse blocks shall be the molded phenolic type with reinforcement clips. (f) A built-in, full capacity, safety, unfused disconnect switch or molded case switch shall be provided. The switch shall be designed so that the terminal box door cannot be opened unless the switch is in the off position.	CA-4427	Some of these requirements are determined to be acceptable based on the review of the drawings and CVI data for systems AN, AP, and AW. Not all the requirements stated in this paragraph could be verified for these systems, however. Deviations might need to be requested. Based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

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54 Continued	(g) Contactors shall be of the full line break magnetic disconnect type and shall be capable of holding without overheating within +/- 10% of the specified supply voltage. (h) Elements shall have a maximum watt density of 45 W/sq in. (i) Heating coils that are rated at more than 48 A shall be divided into circuits of not more than 48A each.	CA-4427 Continued	(Continued)	DR	DR	DR	CC
55 (D)	Built-in Control Sequencers: (a) Silicon control rectifier (SCR) power controllers, when required, shall be solid state, utilizing zero voltage firing. They shall be able to vary the output from 0% to 100% with respect to the input signal. (b) The SCR power controller shall be designed such that, when the thermostat or other external control leads are shorted or opened, the SCR is de-energized. All units operating at 480 V and above shall be equipped with transient/surge absorbers. (c) Step controllers, when required, shall recycle to zero on loss of power. Each step shall have both on and off actuation points that are field adjustable at any point. (d) When a pneumatic control signal is used, the range shall be specified in the Design Specification. On loss of pneumatic signal, the heater shall be de-energized.	CA-4428	This requirement is applicable only if the SCR power controllers are required. There is no evidence they are required for this application.	NA	NA	NA	NA
56 (D)	Remote Control Panels: (a) The enclosure for remote controls shall be suitable for free standing or wall mounting, as required by the Design Specification. The enclosures shall be fabricated from stainless steel, galvanized steel, or painted carbon steel not less than 16 gauge. The enclosures shall be NEMA type 1, 4, 4X, 12, or 13. The device mounting panel for the remote control enclosure shall be stainless steel or painted carbon steel not less than 14 gauge. The carbon steel mounting panels shall be painted. (b) Remote control enclosures shall meet the applicable requirements of CA-4427 and CA-4428. Additionally, control panels shall be equipped with a disconnect switch mechanically interlocked to the enclosure door in accordance with ANSI/NFPA 70 requirements. When the terminal box is separate from the remote control enclosure, it shall be provided with an integral switch set to disconnect the heater when the terminal box door is opened.	CA-4429	Based on a review of the documentation that was available for systems AN, AP, and AW, it could not be determined whether Remote Control Panels were required for these systems or not. Deviations could be required if this requirement is applicable. Based on past operating performance, these systems are considered acceptable as-is.	DR	DR	DR	CC

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
57 (D)	Structural Requirements for Electric Heating Coils: Electric heating coils shall be designed in accordance with the structural requirements given in AA-4000. Structural requirements and load definitions specific to electric heating coils are given in CA-4133 through CA-4134.	CA-4430 CA-4431	Structural requirements for Electric Heating Coils could not be verified through the review process of documentation that was available however, based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
58 (D)	Support Boundary for Electric Heating Coils: Electric heating coils may be supported as a unit (as part of an air handling housing) or line supported (as in an assembly inserted into a run of ductwork). (a) Unit Supported Coils. The support boundary for the heater shall consist of the attachment and interface points between the air handling equipment housing and the heater. (b) Line Supported (In-Duct) Heater Assembly. The support boundary for the heater shall consist of the interface flanges, control box attachment to ductwork, or other mechanical connections between the heater and ductwork that are designed to transfer all components of load across the joints. (c) Documentation. The heater Manufacturer shall be responsible for specifying all information necessary to define the support boundary interfaces. This information shall include, but not necessarily be limited to: (1) configuration, size, and type of support attachment required; (2) magnitude and directions of all loads imposed on the anchorage points, including all static, dynamic, and operational loads resulting from the installed heater assembly. Loads shall be provided in a form that shall allow combination to be considered as required in AA-4000. (3) Any information such as deflection limits or interface load requirements necessary to ensure that the heater can perform its required safety function under all design conditions.	CA-4432	This requirement could not be verified based on a review of the documentation that was available. Some of these requirements were identified in the applicable CVI data for systems AN, AP, and AW. Based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	INSPECTION AND TESTING	CA-5000					
59 (T,I)	Introduction: Examination, testing, and inspection shall be in accordance with AA-5000 and the requirements of this Section.	CA-5110	See the following sub-sections for compliance to the requirements.				
	Testing of Water, Steam, and Volatile Refrigerant Coils	CA-5200					
60 (D,T)	Performance Verification: The performance of air coils shall be verified by one of the following methods as determined from the Design Specification.	CA-5211	Water, steam, and volatile refrigerant coils were not components associated with the design of these systems.	NA	NA	NA	NA

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
61 (T)	Method 1: The air coil rating shall have been derived from tests conducted in accordance with ASHRAE 33. The coil Manufacturer shall issue a Coil Certification or an ARI Certification. In either case, the certificate shall state: (a) the coil capacity based on design parameters; (b) the fouling factor used in the computation; and (c) the coil data identified in ASHRAE 33, Section 8.2. A certification report shall be issued for each coil. For each model number coil, serial numbers shall be listed in the certification.	CA-5211.1	Water, steam, and volatile refrigerant coils were not components associated with the design of these systems.	NA	NA	NA	NA
62 (T)	Method 2: A laboratory test on a prototype coil in accordance with ASHRAE 33 shall be conducted by the coil Manufacturer to determine performance ratings. The results of the test shall be documented in a test report. The report shall include: (a) design conditions (b) description of test method (c) test procedure (d) computation (e) a statement of coil capacity	CA-5211.2	Water, steam, and volatile refrigerant coils were not components associated with the design of these systems.	NA	NA	NA	NA
63 (T)	Pressure Testing for Water and Steam Coils: Components that comply with the ASME Code, Section III, shall be hydrostatically or pneumatically tested in accordance with the requirements of Section III, NC/ND-6000.	CA-5220	Water, steam, and volatile refrigerant coils were not components associated with the design of these systems.	NA	NA	NA	NA
64 (T)	Pressure Testing for Volatile Refrigerant Coils: All refrigerant coils shall be pneumatically tested for a minimum of 10 min at 1.5 times the maximum allowable pressure. The test shall be conducted under water. Any loss of pressure or visible air bubbles shall not be acceptable.	CA-5230	Water, steam, and volatile refrigerant coils were not components associated with the design of these systems.	NA	NA	NA	NA
65 (T)	Material Examination: Coil tubing material shall be eddy current tested when required by the Design Specification. For water and steam coils designed and fabricated in accordance with the ASME Code, Section III, NC/ND-2510 and NC/ND-2552, and with Section V, Article 8 and Article 26, SE-243. For volatile refrigerant coils, ASTM E 243 shall be used.	CA-5341	Water, steam, and volatile refrigerant coils were not components associated with the design of these systems.	NA	NA	NA	NA

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
66 (I)	Visual Examination of Brazed Joints: (a) For coils designed and fabricated in accordance with the ASME Code, brazed joints shall be visually inspected in accordance with AA-5200. Visual Examination shall also comply with Section III, NC/ND-4540, NC/ND-5275, and NC/ND-5360, and with Section V, Article 9. Acceptance criteria shall be as given in NC/ND-5360. (b) For non-ASME coils, brazed joints shall be inspected in accordance with AA-5200. To be acceptable, brazing metal shall give evidence of having flowed uniformly through a joint by the appearance of an uninterrupted, narrow, visible line of brazing alloy at the joint.	CA-5242	Water, steam, and volatile refrigerant coils were not components associated with the design of these systems.	NA	NA	NA	NA
67 (T)	Testing of Air Washers and Evaporative Coolers: Performance testing of air washers or evaporative coolers shall be conducted at the factory in accordance with AA-5700 and Mandatory Appendix CA-II.	CA-5300 CA-5310	Water, steam, and volatile refrigerant coils were not components associated with the design of these systems.	NA	NA	NA	NA
6 (I)	Nondestructive Examination: Nondestructive examination and inspection of air washers and evaporative coolers shall be conducted at the factory in accordance with AA-5000. Minimum acceptance criteria shall be in accordance with AA-6000.	CA-5320	Water, steam, and volatile refrigerant coils were not components associated with the design of these systems.	NA	NA	NA	NA
69 (T)	Testing of Electric Heating Coils: Electric heating coils shall be inspected and tested to verify there are no defects in design or manufacture. Tests and inspections shall include, as a minimum, those indicated in this Subarticle. Test reports shall be furnished in accordance with CA-5500.	CA-5400 CA-5410	The requirements for inspection and testing of electrical heating coils could not be verified by a review of the documentation that was available.	DR	DR	DR	NA
70 (T)	Functional Test: Heaters with step controllers or SCRs, or both, shall be functionally tested by simulating a call for heat and verifying that these components function correctly.	CA-5420	The requirements for inspection and testing of electrical heating coils could not be verified for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
71 (T)	Dielectric Withstand Test: A 60 Hz potential in compliance with UL 1996 as indicated below shall be applied between high voltage live parts and dead metal parts for a period of 1 min, except that the time of application of the potential may be reduced to 1 sec if the value of the test potential is 120% of the value shown below: (a) 1000 V for heaters rated 250 V or less; (b) 1000 V plus twice the rated voltage, or 2000 V, whichever is greater.	CA-5430	The requirements for inspection and testing of electrical heating coils could not be verified for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
72 (T)	Resistance Test: (a) The resistance test shall be done with an ohmmeter calibrated by an approved vendor with standards traceable to the National Institute of Standards and Technology. (b) The readings shall be taken from the load side of the device that energizes each stage of heater elements. On three phase heaters, all legs shall be checked by reading from L1 to L2, L2 to L3, and L3 to L1. (c) Resistance measured must be within 5% of the Manufacturer's design resistance for the specified application.	CA-5440	The requirements for inspection and testing of electrical heating coils could not be verified for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
73 (T,I)	Nondestructive Examination: (a) The configuration and dimensions of the electric heating coils shall be in accordance with approved design drawings. (b) Wiring shall be in accordance with approved wiring diagrams. Wire gages shall be suitable for heater amperage. (c) Welds shall be visually inspected for pits, cracks, or other surface defects. (d) The nameplate for compliance with heater ratings shall include kilowatts, voltage, phase, control voltage, and number of stages. (e) Electrical connections shall be tight. (f) Built-in components shall be verified as having proper ratings (voltage, amperage, etc.) for the intended purpose. (g) Metal gages shall be checked with a calibrated micrometer for conformance to design drawings. (h) Paint shall be checked for meeting the minimum thickness requirements, if applicable.	CA-5450	The requirements for inspection and testing of electrical heating coils could not be verified for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
74 (T,QA)	Test Reports: Sufficient records shall be provided to show documentary evidence of all testing. Records shall include inspections and test reports, and shall show the date of inspection or test, the inspector or data recorder, the type of observation, and the results and their acceptability. Requirements and responsibilities for record transmittal, retention, and maintenance shall conform to those established by the Design Specification and CA-8120.	CA-5500	Test report documentation was not available for review and verification to meet this requirement for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	FABRICATION AND INSTALLATION	CA-6000					

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
75 (F)	Introduction: (a) Fabrication and installation shall be in accordance with AA-6000 and the specific requirements of this section. (b) Welding and welding qualification shall be in accordance with AA-6300 and CA-6120. Brazing and brazing qualification shall be in accordance with AA-6400 and CA-6130. Mechanical joints shall be in accordance with AA-6250 and CA-6140.	CA-6110	Fabrication and installation requirements could not be verified by a review of the documents that were available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
76 (F)	Welding: (a) Welding for pressure retaining components designed and fabricated in accordance with the ASME Code shall meet the requirements of Section III and of Section IX, Part QW. (b) Welds and welded joints in coil frames designed and fabricated in accordance with the ASME Code, Section III, Subsection NF, shall meet the requirements of NF-3324.5, NF-4240, and NF-3000, and of Section IX, Part QW. (c) Welding for air washers and evaporative coolers, and electric heating coils shall be in accordance with AA-6300.	CA-6120	Fabrication and installation requirements could not be verified by a review of the documents that were available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
77 (F)	Brazing: Brazing for pressure retaining components designed and fabricated in accordance with the ASME Code shall meet the requirements of Section III and of Section IX, Part QB. (a) Base metals shall be listed in Tables I-7.0 and I-8.0 of the Section III Appendices (for ASME Codes of Record prior to 1992) or Section II, Part D, Subpart 1, Tables 1A and1B (for Codes of Record beginning with the 1992 edition). They shall also be listed under P-No. 101 and P-No. 107 in Section IX, QB-422. (for Codes of Record prior to the 1994 Addenda of the 1992 Edition) or QW/QB-422 (for Codes of Record beginning with the 1994 Addenda of the 1992 Edition). (b) Filler metals shall be in accordance with the ASME Code, Section II, Part C, SFA-5.8, Classification Bag (?). Fluxes shall be AWS Type FB 3A or FB 3C, SAE Specifications AMS 3410 or 3411, or both. (c) Fitting and joining of parts to be brazed shall be in accordance with the ASME Code, Section III, NC/ND-4530. (d) Brazing procedure specifications shall conform to the rules for brazing listed in the ASME Code, Section III, NC/ND-4510, and in Section IX, Articles XI and XIV. (e) Brazing qualifications shall conform to the ASME Code, Section III, NC/ND-4520, and Section IX, Articles XII and XIII. (f) For examination of coils, see CA-5240.	CA-6130	Fabrication and installation requirements could not be verified by a review of the documents that were available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key)			
				AN	AP	AW	SY
78 (F)	Mechanical Joining: (a) Bolts and bolted joints in coil frames designed and fabricated to the requirements of the ASME Code, Section III, Subsection NF, shall be in accordance with NF-3324.6 and NF-4700. (b) Other coils shall comply with AA-4360. (c) Mechanical joints for all equipment shall conform to the provisions of AA-6250.	CA-6140	Fabrication and installation requirements could not be verified by a review of the documents that were available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
79 (F)	Cleaning and finishing: This Sub-article covers the cleaning prior to surface preparation, coating, or painting. Surfaces shall meet the following requirements. (a) Surfaces shall be free of particle contaminants such as sand, metal chips, weld slag, or weld spatter. (b) All surfaces to be coated shall be clean and free from oil, grease, soil, dust, or foreign matter before further mechanical or chemical surface preparation. Solvent cleaning shall be in accordance with the requirements of SSPC-SP1. Halogen based materials or chlorinated degreasers shall not be used for surface preparation.	CA-6210	Fabrication and installation requirements could not be verified by a review of the documents that were available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
80 (F)	Finishing and Surface Preparation: Surface preparation of metal surfaces located inside the containment building shall conform to the following requirements. (a) All welds shall be continuous where feasible, free from sharp projections and spatters, and blended smoothly into the base metal. The surface shall be cleaned in accordance with SSPC-SP10, as appropriate. The abrasive shall be selected to produce an anchor pattern that is compatible with the substrate and the coating system used and acceptable to the coating Manufacturer. (b) All loose foreign material shall be removed. Crevices, gouges, deep pitting, and joints shall be filled, where required, with a suitable material compatible with the substrate and the coating system used. (c) The primer shall be applied only to dry surfaces and shall be applied before the prepared surface rusts. (d) Where special circumstances make it impractical to employ blasting, alternative methods of surface preparation may be used, provided the surface preparation is adequate for the coating system and the intended service.	CA-6220	Fabrication and installation requirements could not be verified by a review of the documents that were available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

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81 (F)	Coating and Application: Coating and application shall be in accordance with the following requirements. (a) Coating material mixing and thinning procedures shall conform to those outlined in SSPC-PA1 and to the recommendations of the coating manufacturer. (b) Application equipment, its use, and its maintenance shall conform to the requirements of SSPC-PA1 and to the recommendations of the coating manufacturer. (c) Coating materials and application equipment shall be suitable for the intended purpose and shall be maintained in satisfactory operating condition for the proper coating application. (d) Application of coating shall conform to the requirements of SSPC-PA1 and to the recommendations of the coating manufacturer. (e) The dry film thickness of each coat and of the entire coating system shall conform to the requirements of the project specification. (f) No coating materials shall be applied to the coil heat transfer surfaces unless specifically required by the Design Specification. (g) Quality assurance and quality control for coating materials, surface preparation, and coating application, including procedures and personnel qualifications necessary to provide specified documentation and adequate confidence that the coating work will satisfy service conditions, shall conform to the requirements of ASTM D 3843.	CA-6230	Fabrication and installation requirements could not be verified by a review of the documents that were available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	PACKAGING, SHIPPING, AND STORAGE	CA-7000					
82 (O)	Introduction: (a) Packaging, shipping, and storage requirements shall be in accordance with AA-7000, ANSI/ASME NQA-1 Basic Requirement 13 and Supplement 13S-1, and the specific requirements of this Article. (b) When different levels of classification are required for different parts of the equipment, the Manufacture's procedures shall state how this will be addressed. If the Owner has specific requirements, the Design Specification shall so state.	CA-7110	Packaging, shipping, and storage requirements could not be verified for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. SY system complied with these requirements completely.	DR	DR	DR	CC

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
83 (O)	Equipment Requirements (Packaging): (a) Water, steam, volatile refrigerant coils, air washers, and evaporative coolers shall meet the requirements of Packaging Level C of NQA-2, Part 2.2, paragraph 3. (b) Electric heating coils, control panels, and terminal boxes shall meet the requirements of Packaging Level B of NQA-2, Part 2.2, paragraph 3.	CA-7210	Packaging, shipping, and storage requirements could not be verified for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. SY system complied with these requirements completely.	DR	DR	DR	CC
84 (O)	Equipment Requirements (Shipping): (a) Water, steam and volatile refrigerant coils, air washers, and evaporative coolers shall meet the requirements of Shipping Level C of NQA-2, Part 2.2, paragraph 4. (b) Electrical heating coils, control panels, and terminal boxes shall meet the requirements of Shipping Level B of NQA-2, Part 2.2, paragraph 4.	CA-7310	Packaging, shipping, and storage requirements could not be verified for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. SY system complied with these requirements completely.	DR	DR	DR	CC
85 (O)	Equipment Requirements (Storage): (a) Water, steam and volatile refrigerant coils, air washers, and evaporative coolers shall meet the requirements of Storage Level C of NQA-2, Part 2.2, paragraph 6. (b) Electric heating coils, control panels, and terminal boxes shall meet the requirements of Storage Level B of NQA-2, Part 2.2, paragraph 6.	CA-7410	Packaging, shipping, and storage requirements could not be verified for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. SY system complied with these requirements completely.	DR	DR	DR	CC
86 (O)	Equipment Requirements (Handling): Handling and rigging requirements shall be in accordance with AA-6610 and the following: (a) Water, steam and volatile refrigerant coils, air washers, and evaporative coolers shall meet the requirements of Handling Level C of NQA-2, Part 2.2, paragraph 7. (b) Electric heating coils, control panels, and terminal boxes shall meet the requirements of Handling Level B of NQA-2, Part 2.2, paragraph 7.	CA-7510	Packaging, shipping, and storage requirements could not be verified for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. SY system complied with these requirements completely.	DR	DR	DR	CC
	QUALITY ASSURANCE	CA-8000					

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
87 (QA)	Introduction: (a) Quality assurance comprises all those planned and systematic actions required to provide confidence that equipment will perform its required function. This applies to control both materials and fabricated assemblies, and is applicable to both factory and field fabricated work. Quality control is part of quality assurance by providing controls on the physical characteristics of components or materials to meet specified requirements. (b) The organization responsible for a project shall establish documented quality assurance programs in accordance with the requirements of AA-8000. A project includes design, fabrication, assembly, shipping, packaging, and storage; and the various organizations that will be involved in the steps of the project. The quality assurance program shall define the organizational structure within which the program is to be implemented. The program shall delineate the authority and responsibility of the persons and organizations involved in various activities affecting quality. Provisions shall be made in the program for review and evaluation of it effectiveness. Correction of deficiencies shall be an integral part of the program.	CA-8110	Quality assurance requirements could not be verified as acceptable based on a review of the documents that were available for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
88 (QA)	Documentation and Retention: The lifetime and nonpermanent quality assurance records shall be in accordance with Tables CA-8120-1 and CA-8120-2. (a) *Water coils:* For coils designed and fabricated in accordance with the ASME Code, Section III, permanent and nonpermanent records shall be in conformance with ANSI/ASME NQA-1 as amended by NCA-4134.17, and Tables NCA-4134.17-1 and NCA-4134.17-2. Documentation package requirements shall be as listed in the certified Design Specification. (b) *Steam and Volatile Refrigerant Coils, Evaporative Coolers, Air Washers, and Electric Heating Coils:* For other equipment designed and fabricated in accordance with this Code, the provisions of the Design Specification shall identify the requirements for classification, retention of records, and facility storage. Such records, as identified in Table CA-8120-1, shall be maintained as a minimum.	CA-8120	Quality assurance requirements could not be verified as acceptable based on a review of the documents that were available for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	NAMEPLATES AND RECORDS	CA-9000					

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
89 (O)	Introduction: Nameplates and stamping requirements shall meet the requirements of AA-9000, except as provide in this Article.	CA-9110	Nameplate and stamping requirements could not be verified as acceptable based on a review of the documentation available for systems AN, AP, and AW however, *based on past operating performance*, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
90 (O)	General Requirements (Coils): Coils that are designed and fabricated in accordance with the ASME Code, Section III, shall meet the requirements of NCA-8000 for nameplates, stamping, certification, and data reports.	CA-9210	Nameplate and stamping requirements could not be verified as acceptable based on a review of the documentation available for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
91 (O)	Water, Steam, and Volatile Refrigerant Coils: In place of AA-9120, a permanent nameplate of non-corrosive metal shall be affixed to water, steam, and volatile refrigerant coils. The nameplate shall bear the following information: (a) Manufacturer, model number, year manufactured. (b) Total capacity, Btu/hr (kW). (c) Type of fluid. (d) Fluid flow rate for water and steam coils. (e) Item tag number, if furnished by the purchaser. (f) Serial number. (g) Type of refrigerant for volatile refrigerant coils.	CA-9310	Water, steam, and volatile refrigerant coils were not used as components in these systems.	NA	NA	NA	NA
92 (O)	Electric Heating Coils: (a) In place of AA-9120, electric heating coils shall be affixed with a permanent nameplate of non-corrosive material bearing, as a minimum, the following information: (1) Manufacturer, model number, year manufactured. (2) Capacity, (kW). (3) Item tag number, if furnished by the purchaser. (4) Electrical characteristics, V/Phase/Hz. (5) Serial number. (b) Contactor panels that are mounted remote from the heating coils shall be provided with the same nameplate data as the heating coils.	CA-9320	Nameplate and stamping requirements could not be verified as acceptable based on a review of the documentation available for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
93 (O)	Air Washers and Evaporative Coolers: In place of AA-9120, air washers and evaporative coolers shall be affixed with a permanent nameplate of non-corrosive material bearing, as a minimum, the following information: (a) Manufacturer, model number, year manufactured. (b) Serial number. (c) Total capacity, Btu/hr (kW). (d) Airflow rate, standard cu ft/min (m^3/min). (e) Pump flowrate, gal/min (L/sec). (f) Electrical characteristics, V/Phase/Hz.	CA-9330	Air washers and evaporative coolers were not used as components in these systems.	NA	NA	NA	NA
94 (O)	Visibility (Nameplate Location): In some cases, water, steam, and volatile refrigerant coils are installed inside of housings or ductwork. The nameplate will, therefore, not be visible without removal of a panel, or in some cases, removal of the coil from the housing. In those cases, the *visibility requirement of AA-9140 does not apply.*	CA-9410	Water, steam, and volatile refrigerant coils were not used as components in these systems.	NA	NA	NA	NA
95 (O,QA)	Data Reports (Water and Steam Coils): (a) Coils designed, fabricated, and stamped in accordance with the ASME Code, Section III shall have an N-1 Code Data Report completed for each coil. (b) For coils not stamped in accordance with the ASME Code, Section III, a Manufacturer's Data Report shall be provided in accordance with Mandatory Appendix CA-I, form CA-IA.	CA-9510	Water, steam, and volatile refrigerant coils were not used as components in these systems.	NA	NA	NA	NA
96 (O,QA)	Data Reports (Volatile Refrigerant Coils): For volatile refrigerant coils, a Manufacturer's Data Report shall be provided in accordance with Mandatory Appendix CA-I, form CA-IB.	CA-9520	Volatile refrigerant coils were not used as components in these systems.	NA	NA	NA	NA
	Manufacturer's Data Reports:	Mandatory Appendix CA-I					
	Factory Testing of Evaporative Coolers and Air Washers	Mandatory Appendix CA-II	Air washers and evaporative coolers were not used as components in these systems.	NA	NA	NA	NA
97	Accuracy of Instruments: The accuracy of instruments shall be in accordance with ASHRAE 33, Section 4.	II-2500		NA	NA	NA	NA
98	Test Setup – General Requirements: The apparatus for the discharge measuring duct shall be assembled in accordance with AMCA 210. In order to follow this procedure, reasonably constant entering conditions, an electric power supply, and airflow measuring duct, a water supply, a means of water temperature measurement, electrical measuring instruments, and pressure measuring instruments shall be provided.	II-3000 II-3100		NA	NA	NA	NA

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
99	Instrument Requirements: (a) A recorder shall be placed in the intake to measure the stability and to record the condition of the incoming air. (b) Psychrometers shall be provided to measure the entering and leaving conditions of the air washer or evaporative cooler as shown in Fig. II-3300. (c) A thermometer shall be provided in the discharge of the pump to measure the nozzle supply water temperature. (d) A thermometer shall be provided in the tank water at the eliminators to determine the temperature differential between the supply and return water. (e) A pressure gage top shall be provided at the pump discharge to be used in determining pump discharge header. (f) A pressure gage shall be located on each nozzle bank, as specified by the vendor, to represent the average nozzle head. (g) A *voltmeter shall be employed to measure the pump and fan* voltages. (h) An ammeter shall be employed to measure the pump and fan amperages. (i) A means for measuring angular velocity for the pump and fan (strobe light, tachometer, stopwatch, and revolution counters) shall be provided. (j) Average nozzle pressure shall be used to determine the flow from the pump. The vendor shall provide certified pressure and flow curves, by type, to establish the flow. (k) A manometer and pitot tube shall be provided to measure static and velocity pressure. A draft gage shall be provided to measure pressure drops across the air washer and fan.	II-3200		NA	NA	NA	NA

Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key)			
				AN	AP	AW	SY
100	Preparation: (a) A layout of the measuring pattern on entering and leaving faces of the humidifying or spray chamber shall be provided. (1) The width and height of the faces shall be divided into equal divisions. (2) A grid of equal areas shall be constructed by connecting opposing division points. (3) Measurement points shall be in the center of each area. The aspect ratio of the area shall not exceed 1:3. (4) Measuring points shall be at a minimum of 9 locations (see Fig. II-3300). (b) The pump and fan shall be connected to the electrical supply and jogged to observe that rotation is proper. (c) Arrangements shall be completed for measuring intake and discharge conditions. Intake and discharge connections shall reasonably stimulate the site configuration, if known.	II-3300		NA	NA	NA	NA

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
101	Test Procedure: (a) The flow of air through the apparatus shall be established with all equipment running: fan, pump, supply air equipment, and supply water equipment. (b) The velocity and static pressures shall be measured at the traverse point. (c) The pressure drop across the air washer and other air path components shall be measured. (d) Psychrometric data at grid points shall be measured as follows. (1) Dry bulb and wet bulb readings in the intake and discharge shall be read as quickly as possible at the same corresponding grid point (see Fig. II-3300). (2) The saturation efficiency shall be calculated from the average of the wet and dry bulb temperatures taken at the grid points. (e) The velocity at each grid point shall be measured during the air test phase. (f) The water temperatures at the beginning and at the completion of the grid point readings shall be measured at the locations shown in (1) and (2) below. To establish agreement with the record and to establish stability during readings: (1) supply at pump discharge (2) tank at eliminators (g) The following readings shall be recorded before and after the psychrometric traverse: (1) pump discharge pressure; (2) *standpipe pressure; (3) flow at pump discharge or nozzle* pressure. (h) The electrical measurements on the pump shall be recorded as follows: (1) voltage; (2) amperage; (3) rpm, if accessible.	II-4100		NA	NA	NA	NA
102	Acceptance: (a) There shall not be any water drops coming from the top and side blanks on the discharge side of the eliminators. (b) A light beam shall not indicate heavy fog in the air stream at the design wet bulb depression. Fog can be present with high humidity in the intake. (c) Surfaces and leading edges of equipment in the leaving air stream shall not be wet. (d) The velocity distribution of the air shall be within +/-10% of nominal design air velocity. (e) Using the apparatus vendor's documented test data, test performance must extrapolate to the design parameters in order to be accepted.	II-4200		NA	NA	NA	NA

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SECTION 3

Document Information			
Document #	**RPP-9782**	**Revision**	**0**
Title	**ALARACT DEMONSTRATION FOR THE PRIMARY VENTILATION SYS AT THE DST TANK FARMS FOR THE INTERIM STABILIZATION PROJECT (SALTWELL PUMPING)**		
Date	**01/08/02**		
Originator	**EC STAM**	**Originator Co.**	**VISTA**
Recipient		**Recipient Co.**	
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Other Information	ATT 9 – ASME AG-1 Sec FA Compliance Matrix " 10 – " " " FB " " " 11 – " " " FC " " " 12 – " " " FD " " " 13 – " " " FE " " " 14 – " " " FF " " " 15 – " " " FG " " ~~" 16 – " " " IA " "~~ " 17 – " " TA " " " 18 – " N509 Compliance Matrix " 19 – " AG-1 " " Legend		

Attachment 9

ASME AG-1 Section FA

Compliance Matrix

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
	SECTION FA: Moisture Separators	FA					
	MATERIALS	FA-3000					
1 (D,P)	Allowable Materials: *Pads:* the pad is usually constructed of glass fiber and/or corrosion resistant (stainless steel) wire. Other materials that have demonstrated equal or better corrosion resistance are allowable if they meet the requirements of UL 900, Class 1 filters and the design conditions. *Frames, cross-grids, and supports:* material shall meet the requirements of ASTM-A 240, Type 304, stainless steel or as required to meet design conditions. *Rivets:* when rivets are used for fabrication or attachment they shall be 300 series austenitic steel meeting the minimum requirements of ASTM-A 581, Type 303. *Gaskets:* the material for these parts shall be closed cell silicone rubber sponge, Grade SCE-43-1 or SCE-44-1, in accordance with ASTM-D 1056. *Adhesive:* adhesive used to splice gaskets or to fasten gasket to cell shall be compatible wit gasket material and appropriate to intended application.	FA-3100	This requirement is acceptable based on a review of the CVI data and the associated drawings for systems AN, AP, and AW. System SY complied with this requirement completely.	CC	CC	CC	CC
2 (D,P)	Limits: Materials of construction specified here for the moisture separator are typical. Alternative materials are acceptable as long as they meet the design conditions, UL 900, Class 1 filter requirements and pass the qualification test of FA-5000.	FA-3200	Alternative materials for these components were not used.	NA	NA	NA	NA
3 (D,QA)	Material Certification: The Manufacturer shall supply certification to the purchaser that all materials used in fabrication of the moisture separator conform to the requirements of FA-3200	FA-3300	Material Certifications for materials used in fabrication were located in the Project Files for systems AN, AP, and A, however, they were not specifically traceable back to the materials used for moisture separators for these systems. Based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	DESIGN CONDITIONS	FA-4000					
4 (D)	General: Design conditions for moisture separators are a maximum relative humidity of 100%, operating temperature of up to 285 degrees F, and a total integrated radiation environment of 8 x 10^7 Rads unless otherwise specified in the design specifications.	FA-4000	This requirement could not be verified based on a review of the CVI data and associated drawings for systems AN, AP, SY and AW however, based on past operating performance, these systems are considered acceptable as-is.	DR	DR	DR	DR

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
5 (D)	General Design: Moisture separators shall consist of frames designed to retain the deep bed fibrous pads. The pad shall be held in place in the frame by a retaining grid(s) or mechanism. Frames shall be designed to include drain holes to prevent re-entrainment of trapped liquids. Seals shall be provided as necessary to prevent bypass of entrained liquid droplets. (Refer to Non-mandatory Appendix FA-A for a typical configuration).	FA-4100	This requirement is acceptable based on a review of the CVI data and the associated drawings for systems AN, AP, and AW. System SY complied with this requirement completely.	CC	CC	CC	CC
6 (D)	Design Requirements: The moisture separator shall meet the requirements given in Table FA-4200-1.	FA-4210	This requirement is acceptable based on a review of the CVI data and the associated drawings for systems AN, AP, and AW. System SY complied with this requirement completely.	CC	CC	CC	CC
7 (D,F)	Pad: The pad shall be fabricated of approved material (FA-3100). *Fabrication of the pad shall be controlled as to provide the required* pad density.	FA-4220	This requirement is acceptable based on a review of the CVI data and the associated drawings for systems AN, AP, and AW. System SY complied with this requirement completely.	CC	CC	CC	CC
8 (D,F)	Moisture Separator Assembly: The frame shall be fabricated from corrosion resistant non-perforated steel sheet and shall be formed and assembled in a manner that no bypassing of the separator pad is possible. Drain holes shall be provided in the bottom of the frame. Design shall include provisions to assure that the pad is maintained in its operating position and that the pad does not settle, pack down, or pull away from the top or sides of the frame when installed.	FA-4230	This requirement could not be verified by a review of the CVI data or the associated drawings for systems AN, AP, SY and AW. Fabrication records were not available for review on these systems, however based on past operating performance, these systems are considered acceptable as-is.	DR	DR	DR	DR
9 (D)	Structural Requirements: The moisture separators shall be designed in accordance with the structural requirements given in AA-4000 or qualified by test in accordance with AA-4350 or FA-5210.	FA-4300 FA-4310	Documentation to verify structural requirements or test records to verify testing acceptance were not available for review for systems AN, AP, SY and AW however, based on past operating performance, these systems are considered acceptable as-is.	DR	DR	DR	DR

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
10 (D)	Load Definition: Loads to be considered in the structural design of the moisture separator defined in AA-4211 are as follows. (a) Deadweight (DW) consists of the metal frame that contains the pad, and bolting integral to the moisture separator. Instrumentation and ancillary equipment attached to the moisture separator are treated as external loads (EL). (b) The pressure (NOPD) differential which must be considered is from the upstream to downstream side of the pad. (c) The seismic acceleration and response spectra (OBE and SSE) shall be as provided in the Design Specification. Additional dynamic loads (ADL) will also be provided by the Design Specification as applicable.	FA-4320	Documentation to verify load definitions was not available for review and verification for systems AN, AP, SY and AW however, based on past operating performance, these systems are considered to be acceptable as-is.	DR	DR	DR	DR
11 (D)	Load Combinations: Unless stated otherwise in the Design Specification, the applicable loading conditions noted in Table AA-4212 for moisture separators are as follows: (a) Service Level A – DW + EL + NOPD (b) Service Level B – DW + EL + NOPD + OBE (c) Service Level C – DW + EL + NOPD + SSE + ADL (d) Service Level D – not applicable	FA-4330	Documentation to verify load definitions was not available for review and verification for systems AN, AP, SY and AW however, based on past operating performance, these systems are considered to be acceptable as-is.	DR	DR	DR	DR
12 (D)	Acceptance Criteria: The acceptance criteria are listed in Table AA-4321. The design stress values S shall be 0.6 S_y.	FA-4340	Documentation to verify load definitions was not available for review and verification for systems AN, AP, SY and AW however, based on past operating performance, these systems are considered to be acceptable as-is.	DR	DR	DR	DR
	INSPECTION AND TESTING	FA-5000					
13 (I,T)	Inspection and Testing: Inspection and testing of the moisture separator shall conform to requirements of this Section and to specific requirements set forth in Article AA-5000.	FA-5000	Inspection and Testing documentation and records were not available for review and verification for systems AN, AP, SY and AW however, based on past operating performance, these systems are considered acceptable as-is.	DR	DR	DR	DR
14 (T)	Qualification Tests: A design qualification test shall be performed on each specific moisture separator design. Four units of each design shall be tested to all requirements of FA-5200. New or revised designs shall require requalification.	FA-5100	Inspection and Testing documentation and records were not available for review and verification for systems AN, AP, SY and AW however, based on past operating performance, these systems are considered acceptable as-is.	DR	DR	DR	DR

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
15 (I,T)	Production Inspection and Testing: Each moisture separator to be delivered to the purchaser shall be inspected and tested in accordance with this Section.	FA-5200	Inspection and Testing documentation and records were not available for review and verification for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
16 (I)	Dimensional Inspection: Overall dimensions shall be inspected to determine conformity to drawing requirements. Each moisture separator shall be inspected to ensure that it conforms to all dimensional requirements of its design. Any components which will be "hidden" in the final assembly shall be inspected prior to assembly. Measurements of the pad depth and density shall be made to determine that it conforms to design requirements. Location and placement stiffeners and supports shall be inspected to determine conformance to drawing requirements.	FA-5210	Inspection and Testing documentation and records were not available for review and verification for systems AN, AP, SY and AW however, based on past operating performance, these systems are considered acceptable as-is.	DR	DR	DR	DR
	Welding Inspection	FA-5220					
17 (I)	Spot welds shall be inspected visually in accordance with Subarticle AA-6332.	FA-5221	Weld records were not available for review and verification for systems AN, AP, SY and AW however, based on past operating performance, these systems are considered to be acceptable as-is.	DR	DR	DR	DR
18 (I)	Seal welds shall be inspected visually in accordance with Subarticle AA-6331.	FA-5222	Inspection and Testing documentation and records were not available for review and verification for systems AN, AP, SY and AW however, based on past operating performance, these systems are considered acceptable as-is.	DR	DR	DR	DR
19 (I)	Fillet welds shall be inspected visually in accordance with Subarticle AA-6331.	FA-5223	Inspection and Testing documentation and records were not available for review and verification for systems AN, AP, SY and AW however, based on past operating performance, these systems are considered acceptable as-is.	DR	DR	DR	DR
20 (T)	Moisture Separator Air Flow Resistance Test: With the moisture separator oriented in a test tunnel in its service orientation and operating at its rated airflow, the pressure differential across the separator shall not exceed the maximum pressure drop rating in Table FA-4200-1 for the clean, dry condition.	FA-5230	Test records were not available for review and verification for systems AN, AP, SY, and AW however, based on past operating performance, these systems are considered acceptable as-is	DR	DR	DR	DR

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key)			
				AN	AP	AW	SY
21 (T)	Moisture Separator Rough Handling Qualifications: Four moisture separators shall be selected at random, hard-mounted to a rough-handling machine with sharp cutoff cams in the service orientation (Section FA-4100), and vibrated for 10 min at a frequency of 200 cycles per minute at an amplitude of 0.75 in. (19 mm). There shall be no settling of the mesh pad and no broken welds or other physical damage as a result of the rough handling.	FA-5240	Qualification records were not available for review and verification for systems AN, AP, SY, and AW however, based on past operating performance, these systems are considered acceptable as-is.	DR	DR	DR	DR
22 (T)	Moisture Separator Air Flow Resistance Test: Each of the four separators subjected to the rough handling test shall be individually mounted in a test tunnel in its service orientation and operated at its rated airflow. The pressure differential across the separator shall not exceed the ratings in Table FA-4200-1 for the clean dry condition and clean wet condition. The separator shall also demonstrate that it can withstand the minimum burst pressure differential given in Table FA-4200-1 without any visible physical damage or change in pressure drop (clean) at rated flow.	FA-5250	Test records were not available for review and verification for systems AN, AP, SY, and AW however, based on past operating performance, these systems are considered acceptable as-is.	DR	DR	DR	DR
23 (T)	Moisture Separator Performance Test: The four separators subjected to the rough handling test after successfully meeting the requirements of FA-5220 shall be tested to demonstrate compliance with the moisture removal and efficiency requirements of Table FA-4200-1.	FA-5260	Test records were not available for review and verification for systems AN, AP, SY, and AW however, based on past operating performance, these systems are considered acceptable as-is.	DR	DR	DR	DR
	FABRICTION	FA-6000					
24 (F,P)	General: The moisture separators shall be fabricated using only those materials designated in FA-3000 and in accordance with the design outlined in FA-4000. All welding shall be in accordance with AA-6300. After manufacture, the units shall be tested and inspected in accordance with FA-5000.	FA-6000	Fabrication records were not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
25 (F)	Repairs: All welds shall be repaired in accordance with AA-6000. Damaged materials shall be replaced.	FA-6100	Fabrication records were not available for review for systems AN, AP, SY and AW however, based on past operating performance, these systems are considered acceptable as-is.	DR	DR	DR	DR
26 (F)	Cleaning: Metal parts of the moisture separator shall be cleaned and degreased in accordance with ASTM A-380 before any welding.	FA-6200	Fabrication records were not available for review for systems AN, AP, SY and AW however, based on past operating performance, these systems are considered acceptable as-is.	DR	DR	DR	DR
	PACKAGING, SHIPPING, AND STORAGE	FA-7000					

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key)			
				AN	AP	AW	SY
27 (O)	Packaging: Each moisture separator shall be individually wrapped and enclosed in a wood or heavy corrugated paperboard carton with internal cushioning to decouple shock and vibration under accelerations up to 50 g. Separators shall be oriented in the carton or crate with the top of the frame up. The cartons or crates shall be clearly marked with the legend "THIS SIDE UP" or a similar imprint to ensure proper orientation of cartons and crates during handling, shipping, and storage.	FA-7100	Records to verify compliance to these requirements for packaging, shipping, and storage were not available for review for systems AN, AP, SY and AW however, based on past operating performance, these systems are acceptable as-is.	DR	DR	DR	DR
28 (O)	Loading for Shipment: Cartons shall be banded to skids or pallets in the orientation specified in FA-7100. Wood separators and strapping protectors shall be provided between tiers of cartons and above the topmost cartons in the load. Sufficient steel strapping shall be used to prevent shifting of the load on the skid or pallet. Separators shall not be stacked higher than three cartons on a skid or pallet. Skids shall not be stacked more than two high unless bracing is provided to support the upper tiers to prevent damage to the bottom separators.	FA-7200	Records to verify compliance to these requirements for packaging, shipping, and storage were not available for review for systems AN, AP, SY and AW however, based on past operating performance, these systems are acceptable as-is.	DR	DR	DR	DR
29 (O)	Storage: Storage shall be in accordance with ANSI/ASME NQA-2, Part 2.2, Level C.	FA-7300	Records to verify compliance to these requirements for packaging, shipping, and storage were not available for review for systems AN, AP, SY and AW however, based on past operating performance, these systems are acceptable as-is.	DR	DR	DR	DR
	QUALITY ASSURANCE	FA-8000					
30 (QA)	General: The moisture separator manufacturer shall establish and comply with a comprehensive quality assurance program and plan in accordance with Article AA-8000.	FA-8000	Records to verify compliance to these requirements for Quality Assurance were not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
31 (QA)	Documentation: The following documentation shall be provided to the Purchaser: (a) Drawing giving outline and interface dimensions of the separator; (b) List of materials of construction; (c) Qualification Reports; (Seismic) (d) Certification of Performance (resistance and performance tests); (e) Installation and maintenance instructions; and (f) Storage and handling instructions.	FA-8100	Records to verify compliance to these requirements for Quality Assurance were not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
	NAMEPLATES, STAMPINGS, AND MANUALS	FA-9000					

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key)			
				AN	AP	AW	SY
32 (O)	General: Each separator shall have a nameplate permanently attached to the top or side of the frame with the following information: (a) Moisture separator; (b) Manufacturer's name or symbol; (c) Weight of separator; (d) Pressure drop across separator (clean) airflow velocity specified; (e) Serial number (each separator shall be identified by a nonrecurring alpha-numeric symbol which shall also identify all documentation for the separator); (f) Direction of flow; and (g) Mounting orientation.	FA-9000	Records to verify compliance to these requirements for Nameplates, Stamping, and Manuals were not available for review *for systems AN, AP, and AW however*, based on past operating performance, these systems are acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Attachment 10

ASME AG-1 Section FB

Compliance Matrix

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
	SECTION FB: Filters--Medium Efficiency	FB					
	APPLICABILITY: This section shall be applied to the use of medium efficiency filters installed in nuclear facilities. The normal function of these filters is to reduce the particulate loading to the HEPA filters in the air and gas cleaning systems. This section applies to extended media, dry-type filters with an average atmospheric dust spot efficiency (ASHRAE 52) greater than 40%.	FB-1120					
	MATERIALS	FB-3000					
1 (D,P)	Media: The media shall be made of glass fiber.	FB-3110	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, SY and AW however, based on past operating performance, these systems are considered acceptable as-is.	DR	DR	DR	DR
2 (D,P)	Filter Frame: The filter frame shall be any corrosion resistant material suitable for the environment as specified in accordance with FB-4000.	FB-3120	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, SY and AW however, based on past operating performance, these systems are considered acceptable as-is.	DR	DR	DR	DR
3 (D,P)	Separators: The separators shall be any corrosion resistant material suitable for the environment as specified in accordance with FB-4000.	FB-3130	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, SY and AW however, based on past operating performance, these systems are considered acceptable as-is.	DR	DR	DR	DR
4 (D,P)	Sealants and Adhesives: Sealants and adhesives shall be self-extinguishing as evidenced by testing the filter in accordance with UL 900, Class 1.	FB-3140	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, SY and AW however, based on past operating performance, these systems are considered acceptable as-is.	DR	DR	DR	DR
5 (D,P)	Gaskets: Gasket material shall be oil resistant, expanded cellular elastomer, in accordance with ASTM D1056, Grade SCE-43E1 or SCE-44E1.	FB-3150	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, SY and AW however, based on past operating performance, these systems are considered acceptable as-is.	DR	DR	DR	DR

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
6 (D,P)	Special Limitations of Materials: The consideration of material deterioration caused by service is generally outside the scope of this Code. It is the responsibility of the Owner, or Engineer, to identify the environment in which the filter must operate.	FB-3200	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, SY and AW however, based on past operating performance, these systems are considered acceptable as-is.	DR	DR	DR	DR
	DESIGN	FB-4000					
7 (D)	General Design: Medium efficiency filters shall be replaceable, extended media, dry-type, and certified to UL 900, Class 1.	FB-4100	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, SY and AW however, based on past operating performance, these systems are considered acceptable as-is.	DR	DR	DR	DR
8 (D)	Design Criteria shall be specified for the following parameters: (a) type of gas to be treated (b) rated flow, nominal (CFM) per ASHRAE 52 (c) design pressure (d) pressure-time transients (e) temperature operating range (Degrees F) (f) relative humidity operating range (%RH) (g) contaminants to be removed (lb/SCFM) (h) medium efficiency filter class required (see Table FB-4200-1) (i) integrated radiation dose (j) initial resistance at rated flow per ASHRAE 52 (k) final operating resistance at rated flow per ASHRAE 52 (l) seismic requirements (m) minimum dust holding capacity (lbs) per ASHRAE 52 (n) Medium efficiency filter dimensions (h x w x d)	FB-4200	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, SY and AW however, based on past operating performance, these systems are considered acceptable as-is.	DR	DR	DR	DR
9 (D)	Structural Requirements: Medium efficiency filters shall be in accordance with AA-4350.	FB-4310	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, SY and AW however, based on past operating performance, these systems are considered acceptable as-is.	DR	DR	DR	DR
10 (D)	Acceptance Criteria: The medium efficiency filters shall maintain structural integrity. No structural damage by visual inspection shall be present after test.	FB-4320	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, SY and AW however, based on past operating performance, these systems are considered acceptable as-is.	DR	DR	DR	DR
	INSPECTION AND TESTING	FB-5000					

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key)			
				AN	AP	AW	SY
11 (I,T)	General: The inspection and testing of medium efficiency filters shall conform to the requirements of AA-5000 and the specific requirements of this Article.	FB-5000	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, SY and AW however, based on past operating performance, these systems are considered acceptable as-is.	DR	DR	DR	DR
12 (I,QA)	Inspection Plan: The Manufacturer shall establish a recognized sampling and inspection plan acceptable to the purchaser.	FB-5110	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, SY and AW however, based on past operating performance, these systems are considered acceptable as-is.	DR	DR	DR	DR
13 (I)	Inspection Plan: Inspection samples shall be filters that have been packaged for shipment.	FB-5120	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, SY and AW however, based on past operating performance, these systems are considered acceptable as-is.	DR	DR	DR	DR
14 (I)	Inspection Plan: For the purpose of the inspection plan, a lot is the quantity of filters from which the inspection sample is selected.	FB-5130	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, SY and AW however, based on past operating performance, these systems are considered acceptable as-is.	DR	DR	DR	DR
15 (I)	Inspection Plan: Inspection shall be visual. The Manufacturer shall develop a checklist plan the visual inspection and to verify that observations were performed. This checklist shall establish minimum inspection requirements to be followed and shall include provision for the following. (a) inspection of the media for splits, tears, or holes (b) inspection of the connection between the media and filter frame for splits, tears, or holes (c) inspection for missing or incorrect parts or components (d) inspection for incorrect fit of parts or components (e) inspection for workmanship (f) inspection for cleanliness and appearance (g) inspection for correct identification on the filter nameplate and carton.	FB-5140	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, SY and AW however, based on past operating performance, these systems are considered acceptable as-is.	DR	DR	DR	DR

Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
16 (I)	Inspection Plan: If a lot (as defined in ANSI Z1.4) is rejected it may be resubmitted for inspection. Following 100% inspection of the lot and repair or removal of all defective units the lot will then be inspected in the same manner as any other lot using the sampling and inspection plan.	FB-5150	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, SY and AW however, based on past operating performance, these systems are considered acceptable as-is.	DR	DR	DR	DR
17 (T)	Qualification Testing: Three medium efficiency filters of the design to qualified shall be tested in accordance with ASHRAE 52 to obtain standard ratings. These ratings may be obtained by averaging the results of the tests on the three filters. Standard ratings shall be established at airflow rate(s) selected by the Manufacturer for initial resistance, initial atmospheric dust spot efficiency, average synthetic dust weight arrestance and dust holding capacity.	FB-5200 FB-5210	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, SY and AW however, based on past operating performance, these systems are considered acceptable as-is.	DR	DR	DR	DR
18 (I,T)	Medium efficiency filters shall be certified to UL-900, Class 1.	FB-5220	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, SY and AW however, based on past operating performance, these systems are considered acceptable as-is.	DR	DR	DR	DR
19 (I,T)	The filter design must be re-qualified whenever there is a change in design, material, or manufacturing methods.	FB-5230	This requirement is not applicable to these systems.	NA	NA	NA	NA
	FABRICATION	FB-6000					
20 (F)	General: The medium efficiency filter shall be assembled from materials that conform to Article FB-3000 and meet the design requirements of Article FB-4000. Following assembly, the filter shall be inspected and tested in accordance with the requirements of Article FB-5000.	FB-6100	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, SY and AW however, based on past operating performance, these systems are considered acceptable as-is.	DR	DR	DR	DR
	PACKAGING, SHIPPING, RECEIVING, STORAGE, and HANDLING	FB-7000					
21 (O)	General: Filters with separators shall be placed in protective cartons with pleats arranged vertically. All packaging, shipping, receiving, storage, and handling shall meet the requirements of Article AA-7000 and ASME NQA-2, Part 2.2, Level C.	FB-7100	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, SY and AW however, based on past operating performance, these systems are considered acceptable as-is.	DR	DR	DR	DR
	QUALITY ASSURANCE	FB-8000					

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22 (QA)	Documentation: The following documentation shall be made available to the Purchaser, if requested: (a) A table or drawing giving outline dimensions of the filter. (b) A list of the materials of construction with appropriate specifications. (c) A list of the medium efficiency filter performance ratings that shall include, as a minimum, the rated airflow, the initial resistance, the final resistance, the average atmospheric dust spot efficiency, the average synthetic dust weight arrestance, and the dust holding capacity. (d) Certification that the performance rating provided to meet the requirements of Article FB-8100(c) were obtained in conformance with ASHRAE 52. (e) Certification that the filter conforms to UL 900, Class 1 requirements.	FB-8100	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, SY and AW however, based on past operating performance, these systems are considered acceptable as-is.	DR	DR	DR	DR
	LABELS AND MARKING	*FB-9000*					
23 (O)	Filter Markings: Each filter shall be equipped with a permanent label. The marking on the label shall be legible, and shall provide the following minimum information: (a) Manufacturer's name and location; (b) Manufacturer's designation and part number; (c) Date of manufacture (month and year); (d) Rated flow capacity; (e) Average initial pressure drop in inches of water; (f) Recommended final operating resistance; (g) Average atmospheric dust spot efficiency; (h) Airflow direction arrow (showing both directions if allowable without impacting published ratings); (i) Installation orientation (e.g., "Install this way up" or Install with this side vertical"); (j) UL label.	FB-9100	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, SY and AW however, based on past operating performance, these systems are considered acceptable as-is.	DR	DR	DR	DR

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24 (O)	Package Marking: Marking or labeling of each shipping container (carton containing one filter) shall be of a size and type that can be read at a distance of 3 ft. As a minimum, the following information shall be provided: (a) Manufacturer's name; (b) Manufacture's designation and part number; (c) Arrows and "This Side Up" indication orientation for shipping and storage, and "Fragile" in letters no less than ¾ in. high; (d) Purchase order number or other identifying markings requested by the Purchaser.	FB-9200	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, SY and AW however, based on past operating performance, these systems are considered acceptable as-is.	DR	DR	DR	DR

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Attachment 11

ASME AG-1 Section FC

Compliance Matrix

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
	SECTION FC: HEPA Filters	FC					
1 (D)	Applicability: This Section applies to extended-media, dry type filters for use in air and gas streams with a 250 degree F maximum continuous temperature. Three types of HEPA filters are addressed: Type A – folded filter media with corrugated separator/supports Type B – mini-pleat medium with glass fiber or noncombustible thread separators Type C – continuous corrugated filter media folded without separators.	FC-1121	This requirement is acceptable based on a review of the associated CVI data and applicable drawings. These filters were supplied by Flanders Filters Inc. Flanders is recognized on the evaluated suppliers list as a qualified supplier for Nuclear Grade HEPA filters systems, therefore, we are confident that they manufactured, tested and installed these filters in accordance with most of the requirements of AG-1.	CC	CC	CC	CC
2 (D)	Limitations: This section does not cover: (a) integration of HEPA filters into air cleaning systems; (b) HEPA filters larger than 24 x 24 x 11½ in. case dimensions; and (c) Filter mounting frames.	FC-1122	These requirements are addressed in other sections of AG-1.	CC	CC	CC	CC
	MATERIALS	FC-3000					
3 (D,P)	Case materials: The case shall be made from the following materials. Type I – Steel sheet, 0.0720 in. (14 gage USS) (1.83 mm) minimum thickness conforming to ASTM A 366, A 570, or A 611. Prior to case construction but after cutting, the metal sections shall be cadmium plated in accordance with ASTM B 766-86, type OS, minimum. Type II – Stainless steel sheet, 0.0720 in. minimum thickness, conforming to ASTM A 176, Type 409, or ASTM A 240, Type 304. Type III – ¾ in. (19 mm) plywood conforming to marine exterior type, minimum grade A-C, APA H850. The grade shall be fire retardant treated. The plywood shall have a flame spread classification of 25 or less when tested as specified in ASTM E84. Type IV - ¾ in. (19 mm) plywood conforming to exterior type, minimum grade A-C, APA H850. The grade shall be fire retardant treated. The plywood shall have a flame spread classification of 25 or less when tested as specified in ASTM E84.	FC-3110	This requirement is acceptable based on a review of the associated CVI data and applicable drawings. Acceptance is also based on the fact that Flanders was an evaluated supplier.	CC	CC	CC	CC
	Gasket Material	FC-3120					
4 (D,P)	Elastomer: Oil resistant, expanded cellular elastomer in accordance with grade 2C3 2C4 of ASTM D 1056.	FC-3121	This requirement is acceptable based on a review of the associated CVI data and applicable drawings. Acceptance is also based on the fact that Flanders was an evaluated supplier.	CC	CC	CC	CC

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5 (D,P)	Gelatinous Seal: A self-adhesive and self-healing cured gel seal made of Polidimethylsiloxane. The filter shall be qualified per Subarticle FC-5100 using the gel as the seal.	FC-3122	This requirement is acceptable based on a review of the associated CVI data and applicable drawings. Acceptance is also based on the fact that Flanders was an evaluated supplier.	CC	CC	CC	CC
6 (D,P)	Filter Media: The filter media shall conform to the requirements of Appendix FC-I.	FC-3130	This requirement is acceptable based on a review of the associated CVI data and applicable drawings. Acceptance is also based on the fact that Flanders was an evaluated supplier.	CC	CC	CC	CC
7 (D,P)	Faceguards: Metallic faceguards shall be fabricated from galvanized 4 x 4 mesh, wire fabric (hardware cloth) made from 23 gage steel wire (0.56 mm) conforming to ASTM A 740.	FC-3140	This requirement is acceptable based on a review of the associated CVI data and applicable drawings. Acceptance is also based on the fact that Flanders was an evaluated supplier.	CC	CC	CC	CC
8 (D,P)	Adhesives: Adhesives used to splice the media, fasten gaskets to filter frame, and seal the filter pack or faceguards to the frame shall be self-extinguishing as evidenced by testing in accordance with the spot-flame test of FC 5160 or UL-586.	FC-3150	This requirement is acceptable based on a review of the associated CVI data and applicable drawings. Acceptance is also based on the fact that Flanders was an evaluated supplier.	CC	CC	CC	CC
9 (D,P,C)	Separators: (a) The separators for filters constructed according to Fig. FC-4100-2, Type A shall be made from corrugated aluminum, 0.0015 in. (0.038 mm) thick, min. conforming to ASTM B 209, Alloy 5052-H39, 3003-H19 or 1145-H19. (b) Acid resistant separators for filters constructed according to Fig. FC-4100-2, Type A shall be made from corrugated aluminum, 0.0015 in. thick, min., conforming to ASTM B 209, Alloy 5052-H39 or 3003-H19, or 1145-H19 coated on both surfaces with a vinyl-epoxy coating 0.8 to 1.2 mils thick. The applied coating shall meet the adhesion requirements, off-gas test, and flexibility test per FC-4151. The coating shall be tinted to verify coverage of the separator. (c) The separators for filters constructed according to Fig. FC-4100-3, Type B shall be ribbons of noncombustible adhesive threads or glass fiber bonded to the filter media. (d) Separatorless filters constructed according to Fig. FC-4100-4, Type C shall have the filter media folded in such a manner that the filter pack is self supported by the convolutions of the adjacent folds.	FC-3160	This requirement is acceptable based on a review of the associated CVI data and applicable drawings. Acceptance is also based on the fact that Flanders was an evaluated supplier.	CC	CC	CC	CC

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10 (D)	Special Limitations of Materials: The consideration of deterioration of materials caused by service is generally outside the scope of this Code. It is the responsibility of the Owner or Engineer to identify the environment in which the filter must operate.	FC-3200	This requirement is acceptable based on a review of the associated CVI data and applicable drawings. Acceptance is also based on the fact that Flanders was an evaluated supplier.	CC	CC	CC	CC
11 (D,P,T)	Alternate Materials: Notwithstanding the materials referenced in this Code, other materials found acceptable by the qualification tests will be acceptable for fabrication of HEPA filters.	FC-3210	This requirement is not applicable to these systems.	NA	NA	NA	NA
	DESIGN	FC-4000					
12 (D,C)	HEPA Filters: (a) Filters shall be constructed as depicted in Figs. FC-4100-1, FC-4100-2, FC-4100-3, and FC-4100-4. The size and ratings shall be as specified in Table FC-4000-1. The filter shall be assembled with filter pack Type A, Type B, or Type C. The entire inside surface of the case shall be coated with adhesive to secure and seal the filter pack to the case. The gasket shall be fixed to the case with an adhesive per FC-3150. (b) The total media area provided within the filter pack shall be such that maximum media velocity is 5 ft/min (1.52 m/min) at the rated flow. (c) Filter designs for flows other than those listed in Table FC-4000-1 are acceptable provided that the minimum ratings of Table FC-4000-1 and requirements of FC-4102 are met.	FC-4110	This requirement is acceptable based on a review of the associated CVI data and applicable drawings. Acceptance is also based on the fact that Flanders was an evaluated supplier.	CC	CC	CC	CC
13 (D)	Splices and Patches: Filters smaller than 500 cfm and all Type B filters shall not have splices. Filters 500 cfm and larger shall not have more than one splice in the filter pack. The filter media shall have no patches.	FC-4111	This requirement is acceptable based on a review of the associated CVI data and applicable drawings. Acceptance is also based on the fact that Flanders was an evaluated supplier.	CC	CC	CC	CC
14 (D,P,C)	Filter Case: Filter cases are used to house the filter pack. All case joints shall be sealed. Case materials shall be in accordance with Section FC-3110. Construction shall meet the requirements of Article FC-6000.	FC-4120	This requirement is acceptable based on a review of the associated CVI data and applicable drawings. Acceptance is also based on the fact that Flanders was an evaluated supplier.	CC	CC	CC	CC

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15 (D,C)	Filter Pack: (a) Type A filter packs shall be made by folding the media to the required depth. The folded filter media shall be supported with corrugated separators. The filter media pack shall not extend beyond the exposed ends of the separators. The separators shall not extend beyond the ends of the frame when the media pack is bonded to the frame. The filter pack shall be rigid within the frame and the separators shall be perpendicular to two opposite parallel sides of the frame. Separators and media shall not vary more than ¼ in. (6 mm) from a straight line connecting the fixed ends. Abrupt deviations are not acceptable. (b) Type B filter packs shall be made from a series of flat panels of pleated filter media which are assembled in a V-panel fashion. Each media pack with a panel shall use a shallow pleated fold with a maximum height of ¾ in. (19 mm). Adjacent pleats shall be separated and supported by ribbons of glass fiber media or noncombustible threads glued to the filter media. When the panels are installed in the filter case, the top and bottom panels shall be sealed in a reservoir of adhesive at least 1/16 in. (1.6 mm) deep. The mating panels shall have no common glued metal joint. No panel shall vary more than ¼ in. (6mm) from a straight line connecting the fixed ends to the frame. Filter media and supports shall not extend beyond individual panel frames. No ribbons and/or media supports shall vary from a straight line by more than ¼ in. (6 mm). Side panels shall be securely bonded to the side of the filter case with adhesive. No media splicing is permitted within the individual filter panels. (c) Type C filter packs shall be made by corrugating or embossing a continuous sheet of filter media and folding media to the required depth to make the filter pack. When installed in the frame, the self supporting media convolute or embossed centers shall not vary more than in. (9 mm) top to bottom from a straight line drawn perpendicular to the top and bottom frame. Crest to crest contacts on adjacent folds shall not vary by more than 1/16 in. (1.6 mm). Abrupt deviations in media folds are not acceptable. Filter media and/or filter media supports, if used, shall not extend beyond the filter frame. The filter pack shall be rigid within the frame and there shall be no kinked media.	FC-4130	This requirement is acceptable based on a review of the associated CVI data and applicable drawings. Acceptance is also based on the fact that Flanders was an evaluated supplier.	CC	CC	CC	CC

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16 (D,F)	Elastomer Gasket: The gasket shall be sealed to the filter frame with an adhesive per FC-3150. The edge of the gasket shall not be projected beyond the outside of the frame. If gasket material joints are required, they shall be notched or dovetailed and the edges glued in a manner that assures no leakage. There shall be no more than four gasket joints per HEPA filter.	FC-4141	This requirement is acceptable based on a review of the associated CVI data and applicable drawings. Acceptance is also based on the fact that Flanders was an evaluated supplier.	CC	CC	CC	CC
17 (D,F)	Gelatinous Seal Gasket: The seal shall be effected by means of a continuous knife edge on sealing surface of the holding frame which mates into a continuous channel on the case of the HEPA filter. The channel shall be filled with a gelatinous compound per FC-3122 that conforms to the seal knife edge. See Fig. FC-4100-5.	FC-4142	This requirement is acceptable based on a review of the associated CVI data and applicable drawings. Acceptance is also based on the fact that Flanders was an evaluated supplier.	CC	CC	CC	CC
18 (D)	Separators: Separator material shall be capable of withstanding continuous service under all specified operating conditions without swelling, sagging, or melting.	FC-4150	This requirement is acceptable based on a review of the associated CVI data and applicable drawings. Acceptance is also based on the fact that Flanders was an evaluated supplier.	CC	CC	CC	CC
19 (D,T)	Separator Coating: Separators coated in accordance with Section FC-3160(b), shall meet the following tests after application of the coating to the separator: (a) The coating shall meet or exceed a rating of 3A when tested using Method A of ASTM D3359. (b) Off-gas volatiles, as determined by thermo-gravimetric analysis, shall not exceed 5% by weight when a 2 in. (50.8 mm) x 2 in. (50.8 mm) sample if the coated separator is subjected to temperatures from 20 degrees C to 1000 degrees C. (c) The coated separator shall pass a flexibility test in accordance with FED-STD-141C, Method 6221.	FC-4151	This requirement is acceptable based on a review of the associated CVI data and applicable drawings. Acceptance is also based on the fact that Flanders was an evaluated supplier.	CC	CC	CC	CC
20 (D)	Faceguard: A faceguard shall be installed in each face of the filter, inside the filter case but not under the gasket.	FC-4160	This requirement is acceptable based on a review of the associated CVI data and applicable drawings. Acceptance is also based on the fact that Flanders was an evaluated supplier.	CC	CC	CC	CC
21 (D)	Performance Requirements: Designs shall be qualified in accordance with Section FC-5000.	FC-4200	Documentation to verify this requirement for systems AN, AP, and AW was not available for review however, based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

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22 (D,T)	Test Aerosol Penetration: The total test aerosol penetration through the filter media, frame, and gasket shall be not greater than 0.03% of upstream concentration when tested at rated airflow and at 20% of rated flow when tested in accordance with FC-5120.	FC-4210	Testing Reports and other related documentation was not available for review to verify that all the testing requirements for systems AN, AP, and AW had been satisfied, however, based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
23 (D,T)	Resistance to Airflow: The resistance to airflow at the rated airflow of the clean filter shall meet the requirements of Table 4000-1, when tested in accordance with FC-5110.	FC-4220	Testing Reports and other related documentation was not available for review to verify that all the testing requirements for systems AN, AP, and AW had been satisfied, however, based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
24 (D,T)	Structural Requirements: The HEPA filters shall be seismically qualified by test in accordance with AA-4350.	FC-4300 FC-4310	Testing Reports and other related documentation was not available for review to verify that all the testing requirements for systems AN, AP, and AW had been satisfied, however, based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
25 (D,QA)	Acceptance Criteria: The acceptance criteria are : (1) no structural damage shall be evident by visual examination: and (2) airflow resistance and aerosol penetration requirements of sub-subarticles FC-5110 and FC-5120 shall be met.	FC-4320	Testing Reports and other related documentation was not available for review to verify that all the testing requirements for systems AN, AP, and AW had been satisfied, however, based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	INSPECTION	FC-5000					

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26 (T)	Qualification Testing: New or revised filter designs shall require qualification testing prior to acceptance and production. Filter designs shall be requalified at least every 5 years. Tests must be performed and certified by an independent test facility. A qualification sample of 11 of each size HEPA filter shall be manufactured using the same methods, materials, equipment, and processes as will be used during production. The test sequence is detailed in TableFC-5100-1. The 11 filters used in the qualification sample shall then be divided into four test groups by the random selection shown in Table FC-5100-1 and assigning them to the required test groups. (a) If the Manufacturer intends to deliver filters with a splice in the filter media, three of the qualification samples shall contain a spice. (b) Each filter in the qualification sample shall be visually *examined for defects.* (c) The qualification samples shall be tested for all the requirements for this section. Failure of any filter to comply with the requirements of this section shall be cause for the rejection of the qualification sample.	FC-5100	Testing Reports and other related documentation was not available for review to verify that all the testing requirements for systems AN, AP, and AW had been satisfied, however, based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
27 (T)	Resistance to Airflow: The clean filter resistance to airflow shall meet the requirements of Table FC-4100-1 when tested in accordance with para. FC-5120.	FC-5110	Testing Reports and other related documentation was not available for review to verify that all the testing requirements for systems AN, AP, and AW had been satisfied, however, based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
28 (T)	Test Aerosol Penetration: The resistance to airflow and test aerosol penetration shall be determined in accordance with Table FC-5100-1. The test conditions need to be corrected at standard temperature and pressure. The total aerosol penetration through the filter media, frame, and gasket shall be no greater than 0.03% of upstream concentration at rated *airflow and at 20% of rated airflow. Suitable test aerosol* penetrometers are included in Tables FC-5100-2 for filter sizes 1, 2, and 3 and filter sizes 4, 5, 6, 7, 8, and 9. The use of laser particle counters in accordance with the methods and procedures of IES-RP-CC-007.1 are also acceptable.	FC-5120	Testing Reports and other related documentation was not available for review to verify that all the testing requirements for systems AN, AP, and AW had been satisfied, however, based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

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29 (T)	Resistance to Rough Handling: The type A and C filters shall be tested on a rough handling machine for 15 min. at ¾ in. (19 mm) total amplitude at 200 cycles per min. in accordance with Test Method 105.10 of MIL-STD-282. The filter shall be placed on the machine with the faces and pleats in a vertical position. Type B filter rough handling machine test position shall be with the face vertical and pleats horizontal. At the conclusion of the shaking period, the filter shall be visually examined for damage. Cracked or warped frames, loose corners or joints, cracked adhesive, loose or deformed media, separators, or faceguards shall be cause for rejection. After the rough handling test, the same filter shall meet the requirements in paras. FC-5110 and FC-5120.	FC-5130	Testing Reports and other related documentation was not available for review to verify that all the testing requirements for systems AN, AP, and AW had been satisfied, however, based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
30 (T)	Resistance to Pressure: The filter shall be tested for resistance to pressure on a machine capable of testing in accordance with Table FC-5140-3. Prior to *being tested for resistance to pressure, the filter shall be conditioned* at atmospheric pressure for 24 hrs min. in a chamber at 95° ± 5° F (35°C ± 3°C) and a relative humidity (RH) of 95° ± 5%. After being conditioned, the filters shall withstand the airflow and water spray environment listed in Table FC-5100-3 without rupture of the filter media. Within 15 min after completion of the pressure test and while *still wet, the filter shall meet the requirement of para. FC-5120 at 20%* airflow.	FC-5140	Testing Reports and other related documentation was not available for review to verify that all the testing requirements for systems AN, AP, and AW had been satisfied, however, based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
31 (T)	Resistance to Heated Air: For resistance to heated air, the filter shall be installed in the test chamber and subjected to the rated flow of air heated to 700°F ± 50°F for no less than 5 min. Following exposure to heated air, the filter shall be tested at rated flow for test aerosol penetrations through the filter media, case, and gasket or gelatinous seal. The penetration shall not exceed 3%. An Underwriters' Laboratories label (UL-586) shall be acceptable objective evidence of compliance with FC-5150.	FC-5150	Testing Reports and other related documentation was not available for review to verify that all the testing requirements for systems AN, AP, and AW had been satisfied, however, based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC

Best Available Image

Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
32 (T)	Spot Flame Resistance: The filter is to be mounted in the test duct and the airflow adjusted to rated airflow. A gas flame from a Bunsen burner is to be directed against the upstream face of the unit. The Bunsen burner is to be adjusted to produce a flame with a blue cone 2½ in. (63 mm) long with a tip temperature of 1750°F ± 50°F (955°C ± 25°C), as measured by a thermocouple inserted in the flame. The tip of he cone is to be so applied that it touches the surface of the filter media at a distance of not less than 2 in. (51 mm) from the filter frame. The flame is to be applied for 5 min. at each of three separate locations on the filter face. The Bunsen burner flame then is to be directed into a top corner of the filter unit in such a manner that the tip of the blue cone contacts the frame, filter pack, and sealing materials. The flame is to be applied for a period of 5 min. The test is to be repeated upon the opposite top corner of the sample filter unit. After removal of the test flame at each point of application, there shall be no sustained flaming on the downstream face of the unit. An Underwriters' Laboratories label (UL-586) shall be acceptable objective evidence of compliance with FC-5160.	FC-5160	Testing Reports and other related documentation was not available for review to verify that all the testing requirements for systems AN, AP, and AW had been satisfied, however, based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
33 (T)	Production Testing: Each filter manufactured for delivery shall be tested for test aerosol penetration and resistance to airflow in accordance with FC-5110 and FC-5120. The results of these tests shall be marked on the label of each filter.	FC-5200	Testing Reports and other related documentation was not available for review to verify that all the testing requirements for systems AN, AP, and AW had been satisfied, however, based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	DR	DR	DR	CC
	FABRICATION	FC-6000					
34 (F)	General: The HEPA filter shall be assembled from the materials designated in Sub-article FC-3100 in accordance with the design requirements established in Article FC-4000. Following assembly, the filter shall be inspected and qualified in accordance with Sub-article FC-5100. Production testing of qualified filters shall conform to Sub-article FC-5200.	FC-6000	This requirement is acceptable based on a review of the associated CVI data and applicable drawings for systems AN, AP, and AW. Acceptance is also based on the fact that Flanders was an evaluated supplier. SY systems complied with this requirement completely.	CC	CC	CC	CC
35 (F)	Manufacturer and Assembly: The general requirements for fabrication and installation are contained in Sub-articles AA-6200 and AA-6300.	FC-6200	This requirement is acceptable based on a review of the associated CVI data and applicable drawings for systems AN, AP, and AW. Acceptance is also based on the fact that Flanders was an evaluated supplier. SY systems complied with this requirement completely.	CC	CC	CC	CC

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36 (F)	Flatness and Squareness: The faces of the case shall be flat and parallel to within a total allowance of 1/16 in. (1.6 mm). The case shall be square to within a total allowance of 1/8 in. (3 mm) when measured diagonally across the corners of both faces.	FC-6211	This requirement is acceptable based on a review of the associated CVI data and applicable drawings for systems AN, AP, and AW. Acceptance is also based on the fact that Flanders was an evaluated supplier. SY systems complied with this requirement completely.	CC	CC	CC	CC
37 (F)	Overall Dimensions: Filters of size 24 x 24 x 5 in. and larger shall be +0, - in. outside dimensions, except depth, which shall be +1/16, -0 in. All filters smaller than the above shall be +0, -1/16 in. outside dimensions, except depth, which shall be +1/16, -0 in. The above dimensions exclude gaskets.	FC-6212	This requirement is acceptable based on a review of the associated CVI data and applicable drawings for systems AN, AP, and AW. Acceptance is also based on the fact that Flanders was an evaluated supplier. SY systems complied with this requirement completely.	CC	CC	CC	CC
38 (F)	Media Installation: *The filter media shall be fastened to the sides and ends of the filter* case with adhesive to completely seal the edges of the media to the filter case. Patching of holes or tears in the media shall not be permitted.	FC-6220	This requirement is acceptable based on a *review of the associated CVI data and* applicable drawings for systems AN, AP, and AW. Acceptance is also based on the fact that Flanders was an evaluated supplier. SY systems complied with this requirement completely.	CC	CC	CC	CC
39 (F)	Workmanship: The filter shall be free from foreign matter (dirt, oil, or viscous material) and damage, such as distorted or cracked frame, deformation or sagging of media, separators and faceguards, cracks in adhesive, and cracks or holes in exposed portions of the media. All the dimensional and performance requirements of this Code Section are directed toward achieving the highest quality and workmanship possible.	FC-6300	This requirement is acceptable based on a review of the associated CVI data and applicable drawings for systems AN, AP, and AW. Acceptance is also based on the fact that Flanders was an evaluated supplier. SY systems complied with this requirement completely.	CC	CC	CC	CC
	PACKAGING, SHIPPING, AND STORAGE	FC-7000					
40 (O)	General: Packaging, shipping, and storage shall be in accordance with Article AA-7000 and ANSI/ASME NQA-2, Level B. Filters shall be individually packaged. Cartons shall have extra shock absorbing *material at the corners of the filter. Types A and C filters shall be* placed in the carton with the pleats vertical. Type B filters shall be placed in the carton with the pleats horizontal. The carton shall be clearly marked for proper orientation per FC-9200. Stacking of filters during storage and handling shall not be more than three filters high.	FC-7000	Because Flanders was an evaluated supplier for these filter assemblies, we are confident that the packaging, shipping, and storage requirements were accomplished in *accordance with AG-1 for all systems.*	CC	CC	CC	CC
	QUALITY ASSURANCE	FC-8000					

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air *Conditioning* Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
41 (QA)	General: Quality Assurance shall conform to the requirements of Article AA-8000 and the following:	FC-8000	This requirement is acceptable based on a review of the associated CVI data and applicable drawings for systems AN, AP, and AW. Acceptance is also based on the fact that Flanders was an evaluated supplier. SY systems complied with this requirement completely.	CC	CC	CC	CC
42 (QA)	Responsibility: The Manufacturer has the responsibility of providing all specified information and of assuring that the quality control, and detailed examination and tests required by this Code, are performed at the stages of construction necessary to permit them to be meaningful.	FC-8100	This requirement is acceptable based on a review of the associated CVI data and applicable drawings for systems AN, AP, and AW. Acceptance is also based on the fact that Flanders was an evaluated supplier. SY systems complied with this requirement completely.	CC	CC	CC	CC
43 (QA)	Certificate of Conformance: *The Certificate of Conformance shall include, but is not limited to, the following:* (a) That the filter assembly has been designed in accordance with Article FC-4000; (b) That the materials of construction comply with Article FC-3000 and Appendix I; (c) That the filters have been qualified in accordance with Sub-article FC-5100; (d) That the filters have been tested in accordance with Sub-article FC-5200; (e) Copies of all filter case material certifications, if required by the purchasing documents; (f) Copies of the production test results required in Sub-article FC-5200; (g) That the filters have been packaged in accordance with Article FC-7000; (h) Copy of certification in accordance with Sub-article FC-5100.	FC-8200	This requirement could not be verified. A *certificate of conformance was not available* for review for these systems AN, AP, and AW however, Flanders was an evaluated supplier for these filters, therefore, we are confident that the filter assemblies were built and designed to these requirements. *These* systems are also considered to be acceptable as-is based on past operating performance. SY system complied with this requirement completely.	CC	CC	CC	CC
	NAMEPLATES	FC-9000					

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
44 (O)	Filter Marking: Marking or labeling of each filter shall be on the top of the filter when the pleats are vertical, of such size and legibility that it can be read at a distance of 3 ft. (0.9 m). As a minimum, the following information shall be provided: (a) Manufacturer's name or symbol; (b) Model number; (c) Serial number; (d) Rated flow capacity; (e) Direction of airflow for penetration and pressure drop tests; (f) Pressure drop, in inches of water, at 100% rated flow; (g) Overall penetration at rated flow; (h) Overall penetration at 20% of rated flow; (i) UL label indicating successful testing per UL 586, if applicable.	FC-9100	Because Flanders was an evaluated supplier for these filter assemblies, we are confident that the marking and labeling requirements were accomplished in accordance with AG-1 for all systems.	CC	CC	CC	CC
45 (O)	Package Marking: Marking or labeling of each shipping container (carton containing one filter) shall be of such size and type that it can be read at a distance of 3 ft. (0.9 m). As a minimum, the following information shall be provided: (a) Manufacturer's name or symbol; (b) Arrows and "THIS SIDE UP" indicating orientation for shipping and storage, and "FRAGILE" in letters no less than in. (19mm) high; (c) Filter model number; (d) Purchase order number or other identifying marking requested by Purchaser.	FC-9200	Because Flanders was an evaluated supplier for these filter assemblies, we are confident that the package marking and labeling requirements were accomplished in accordance with AG-1 for all systems.	CC	CC	CC	CC
	FILTER MEDIA–FIRE RESISTANT, HIGH EFFICIENCY	Mandatory Appendix FC-I					
46	Scope: This Code Appendix establishes requirements for the manufacture of high efficiency, fire-resistant, filter media for use in the construction of HEPA filters as described in Section FC. This Appendix supercedes and has been derived from the Military Specification MIL-F-51079D for Fire Resistant, High Efficiency Filter Media.	I-1000					
	REQUIREMENTS	I-3000					
47	Form: The filter media shall be furnished in rolls. The medium shall be tightly and evenly wound on non-returnable fiber or paperboard cores with a minimum inside diameter of 3 1/16 +/- 1/8 in. and a minimum wall thickness of 3/8 in. Unless otherwise specified in the contract or purchase order, the roll diameter shall not exceed 25 in. in diameter.	I-3110	Because Flanders was an evaluated supplier for these filter assemblies, we are confident that these mandatory requirements were accomplished in accordance with AG-1 for all systems.	CC	CC	CC	CC

Best Available Image

Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key)			
				AN	AP	AW	SY
48	Size: The width of the roll shall be specified at the time of procurement. The tolerance on the specified width shall be +1/4 in. and –0. The length of media on the roll shall be clearly marked on the outside of the roll. The length shall not include the first wrap around the core or the outermost wrap of the roll.	I-3120	Because Flanders was an evaluated supplier for these filter assemblies, we are confident that these mandatory requirements were accomplished in accordance with AG-1 for all systems.	CC	CC	CC	CC
49	Splices: The location of splices within the rolls shall be marked with paper tabs of contrasting color extending from each end of the roll. The number of splices permitted per roll shall mot exceed the whole number obtained by dividing the length of the roll in feet by 1000.	I-3130	Because Flanders was an evaluated supplier for these filter assemblies, we are confident that these mandatory requirements were accomplished in accordance with AG-1 for all systems.	CC	CC	CC	CC
50	Airflow Resistance: The pressure drop across the media shall not exceed 1.6 in. WG with ambient temperature airflow through the media at a minimum velocity of 10 ft/min when tested as specified in I-4221.	I-3210	Because Flanders was an evaluated supplier for these filter assemblies, we are confident that these mandatory requirements were accomplished in accordance with AG-1 for all systems.	CC	CC	CC	CC
51	Test Aerosol Penetration: The penetration of the media by test aerosol of 0.3 micrometer average particle size shall not exceed 0.03%, as determined by comparing upstream with downstream aerosol concentration with the air and aerosol mixture having the flow rate specified in I-3210 when tested in accordance with I-4221.	I-3220	Because Flanders was an evaluated supplier for these filter assemblies, we are confident that these mandatory requirements were accomplished in accordance with AG-1 for all systems.	CC	CC	CC	CC
52	Tensile Strength and Elongation: The average tensile breaking strength of the media shall be not less than 2.5 lb/in. width in the machine direction, no less than 2.0 lb/in. width in the cross direction, and the average elongation in both directions shall be no less than 0.5% at rupture when tested as specified in I-4222(a).	I-3231	Because Flanders was an evaluated supplier for these filter assemblies, we are confident that these mandatory requirements were accomplished in accordance with AG-1 for all systems.	CC	CC	CC	CC
53	Tensile Strength After Heated Air: The average tensile strength of the media shall be not less than 0.6 lb/in. width in the cross direction after exposure to heated air at 700 +/- 50 degrees F in a forced draft oven for 5 min when tested as specified in I-4221(b).	I-3232	Because Flanders was an evaluated supplier for these filter assemblies, we are confident that these mandatory requirements were accomplished in accordance with AG-1 for all systems.	CC	CC	CC	CC
54	Wet Tensile Strength: The average wet tensile breaking strength of the media after being soaked for 15 min. in water at room ambient temperature shall be not less than 1.0 lb/in. of width in the cross direction when tested as specified in I-4221(c).	I-3233	Because Flanders was an evaluated supplier for these filter assemblies, we are confident that these mandatory requirements were accomplished in accordance with AG-1 for all systems.	CC	CC	CC	CC

Best Available Image

Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
55	Tensile Strength After Gamma Irradiation: The average tensile strength of the filter media shall not be less than 1.0 lb/in. of width in either the machine or cross direction after the media is exposed to gamma irradiation for an integrated dose rate not to exceed 2.5 megarads per hour when tested as specified in I-4222(d).	I-3234	Because Flanders was an evaluated supplier for these filter assemblies, we are confident that these mandatory requirements were accomplished in accordance with AG-1 for all systems.	CC	CC	CC	CC
56	Water Repellency Prior to Irradiation: The average water repellency of the filter media shall not be less than 20 in. WG with no single value being less than 18 when tested as specified in I-4223(a).	I-3240 I-3241	Because Flanders was an evaluated supplier for these filter assemblies, we are confident that these mandatory requirements were accomplished in accordance with AG-1 for all systems.	CC	CC	CC	CC
57	Water Repellency After Gamma Irradiation: The average water repellency of the filter media shall not be less than 6 in. WG with no single value being less than 5 after the media is exposed to an integrated dose of 6.0×10^7 to 6.5×10^7 rads at a dose rate not to exceed 2.5 megarads per hour when tested in accordance with I-4223(b).	I-3242	Because Flanders was an evaluated supplier for these filter assemblies, we are confident that these mandatory requirements were accomplished in accordance with AG-1 for all systems.	CC	CC	CC	CC
58	Acidity: The pH of the media shall be between 6.0 and 8.0 when tested as specified in I-4244.	I-3250	Because Flanders was an evaluated supplier for these filter assemblies, we are confident that these mandatory requirements were accomplished in accordance with AG-1 for all systems.	CC	CC	CC	CC
59	Thickness: Media thickness shall be a minimum of 0.015 in. and a maximum of 0.040 in. when measured as specified in I-4225.	I-3260	Because Flanders was an evaluated supplier for these filter assemblies, we are confident that these mandatory requirements were accomplished in accordance with AG-1 for all systems.	CC	CC	CC	CC
60	Combustible Material: The combustible material in the filter media shall not exceed 7% by weight when tested as specified in I-4226.	I-3270	Because Flanders was an evaluated supplier for these filter assemblies, we are confident that these mandatory requirements were accomplished in accordance with AG-1 for all systems.	CC	CC	CC	CC
61	Flexing: The media shall show no tears, breaks, cracks, or fiber separation after it is drawn back and forth, five times, around a 3/16 in. dia. Mandrel and moving through an arc of at least 180 deg. When tested as specified in I-4227.	I-3281	Because Flanders was an evaluated supplier for these filter assemblies, we are confident that these mandatory requirements were accomplished in accordance with AG-1 for all systems.	CC	CC	CC	CC
62	Test Aerosol Penetration: The penetration of the media by test aerosol of essentially 0.3 micron particle size when determined as stated in I-3220 and specified in I-4221 shall not exceed 0.03% after the media is drawn back and forth as required in I-3281, when tested as specified in I-4221.	I-3282	Because Flanders was an evaluated supplier for these filter assemblies, we are confident that these mandatory requirements were accomplished in accordance with AG-1 for all systems.	CC	CC	CC	CC

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63	Workmanship: The medium shall be free from contamination (foreign matter), thick or thin spots, wrinkles, and damage, such as tears, cracks, holes, abrasions, and punctures.	I-3300	Because Flanders was an evaluated supplier for these filter assemblies, we are confident that these mandatory requirements were accomplished in accordance with AG-1 for all systems.	CC	CC	CC	CC
64	Supplier's Responsibility: Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein.	I-4110	Because Flanders was an evaluated supplier for these filter assemblies, we are confident that these mandatory requirements were accomplished in accordance with AG-1 for all systems.	CC	CC	CC	CC
65	Objective Evidence: The supplier shall provide objective evidence acceptable to purchaser that the requirements of Articles I-3000 and I-5000 have been satisfied.	I-4120	Because Flanders was an evaluated supplier for these filter assemblies, we are confident that these mandatory requirements were accomplished in accordance with AG-1 for all systems.	CC	CC	CC	CC
66	Qualification Sample: A qualification sample of 10 linear ft., full width, shall be manufactured using the same methods, materials, equipment and processes as will be used during regular production.	I-4200 I-4210	Because Flanders was an evaluated supplier for these filter assemblies, we are confident that these mandatory requirements were accomplished in accordance with AG-1 for all systems.	CC	CC	CC	CC
67	Material Change: Any change in materials or source of materials after qualification shall require a new qualification sample.	I-4211	Because Flanders was an evaluated supplier for these filter assemblies, we are confident that these mandatory requirements were accomplished in accordance with AG-1 for all systems.	CC	CC	CC	CC
69	Reverification of Qualification: Media shall be requalified at least every five years. Tests shall be performed and certified by an independent test facility.	I-4212	Because Flanders was an evaluated supplier for these filter assemblies, we are confident that these mandatory requirements were accomplished in accordance with AG-1 for all systems.	CC	CC	CC	CC
	Test Procedures	I-4220					
70	Airflow Resistance and DOP Smoke Penetration: Three test specimens shall be tested for airflow resistance and DOP smoke penetration at a flow rate of 1.1 cfm using the Q127 DOP Filter Testing Penetrometer (Drawing 136-42-102-5B). The exposed test area of the specimens is 16 in^2.	I-4221	Because Flanders was an evaluated supplier for these filter assemblies, we are confident that these mandatory requirements for testing were accomplished in accordance with AG-1 for all systems.	CC	CC	CC	CC

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71	Tensile strength and Elongation: Ten test specimens, five taken in each direction, shall be tested for tensile strength and elongation in accordance with TAPPI Standard T494 except that the test specimens shall be 1 by 6 in. (shear cut) and the jaw separation shall be 4 in. Use a motorized tensile testing machine which has a constant rate of elongation (see 6.7) and uses a flat jaw clamping device at a loading rate of 0.5 in. per min or at a loading rate which will complete the test in 10 +/-2 sec, which ever is greater.	I-4222(a)	Because Flanders was an evaluated supplier for these filter assemblies, we are confident that these mandatory requirements for testing were accomplished in accordance with AG-1 for all systems.	CC	CC	CC	CC
72	*Tensile Strength After Heated Air:* Four test specimens (6 by 6 in.) shall be subjected to heated air using a suitable commercial forced draft oven, capable of allowing full circulation of air to each test specimen. The test specimen shall be placed in the oven for five min after the temperature has reached 700 degrees F. After the exposure, the specimen shall be remove from the oven and conditioned in accordance with TAPPI Standard T402. One test strip, 6 in. in cross direction and 1 in. wide, shall be shear cut from each test specimen and tested for tensile strength in accordance with I-4222(a).	I-4222(b)	Because Flanders was an evaluated supplier for these filter assemblies, we are confident that these mandatory requirements for testing were accomplished in accordance with AG-1 for all systems.	CC	CC	CC	CC
73	Wet Tensile Test: Three test specimens 1 by 6 in. taken in the cross direction shall be submerged in water at a depth of 10 in. for 15 min. and then tested for tensile strength as specified, I-4222(a).	I-4222(c)	Because Flanders was an evaluated supplier for these filter assemblies, we are confident that these mandatory requirements for testing were accomplished in accordance with AG-1 for all systems.	CC	CC	CC	CC
74	Tensile Strength After Gamma Irradiation: Six test specimens, 7 by 3 in. three with the 7 in. side in the machine direction and three with the 7 in. side in the cross direction shall be exposed to irradiation in a ventilated chamber as specified in I-3234. After exposure and conditioning, eight test strips 7 by 1 in. shall be shear cut; four with the 7 in. side in each direction. The tensile strength of each strip shall be determined in accordance with I-4222(a).	I-4222(d)	Because Flanders was an evaluated supplier for these filter assemblies, we are confident that these mandatory requirements for testing were accomplished in accordance with AG-1 for all systems.	CC	CC	CC	CC
75	*Water Repellency Prior to Gamma Irradiation:* Three test specimens 2¾ by 5½ in. rectangles shall be conditioned (4.2.3) and tested for water repellency using the Q101 Water Repellency Indicator (125-8-1). The two surfaces of each test specimen shall be identified as top and bottom. The specimen shall then be cut into two equal squares. The top surface of one square and the bottom surface of the other square shall be tested. The lesser of the two results shall be considered the water repellency of the specimen.	I-4223 I-4223(a)	Because Flanders was an evaluated supplier for these filter assemblies, we are confident that these mandatory requirements for testing were accomplished in accordance with AG-1 for all systems.	CC	CC	CC	CC

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76	Water Repellency After Gamma Irradiation: Three test specimens 7 by 3 in. shall be exposed to irradiated in a ventilated chamber as specified in 3.2.4.2. After exposure each test specimen shall be cut to form three test specimens 2¾ by 5½ in. rectangles and tested in accordance with I-4223(a).	I-4223(b)	Because Flanders was an evaluated supplier for these filter assemblies, we are confident that these mandatory requirements for testing were accomplished in accordance with AG-1 for all systems.	CC	CC	CC	CC
77	Acidity: The pH of two specimens from each sample shall be determined in accordance with TAPPI uniform method UM-440.	I-4224	Because Flanders was an evaluated supplier for these filter assemblies, we are confident that these mandatory requirements for testing were accomplished in accordance with AG-1 for all systems.	CC	CC	CC	CC
78	Thickness: The thickness of the medium shall be determined in accordance with TAPPI Standard T411.	I-4225	Because Flanders was an evaluated supplier for these filter assemblies, we are confident that these mandatory requirements for testing were accomplished in accordance with AG-1 for all systems.	CC	CC	CC	CC
79	Combustible Material: The dried weight of the sample shall be recorded. The ash weight of the sample shall be determined as specified in TAPPI Standard T413…	I-4226	Because Flanders was an evaluated supplier for these filter assemblies, we are confident that these mandatory requirements for testing were accomplished in accordance with AG-1 for all systems.	CC	CC	CC	CC
80	Flexing Characteristics – Examination: Eight test specimens, cut 12 in. long in the machine direction and 6 in. wide shall be bent perpendicular to the machine direction over 3/16 in. Wide mandrel and drawn back and forth so that 10 in. of medium are drawn five times through an arc of 180 deg. Four specimens with the screen/wire side against the mandrel and four specimens with the felt side against the mandrel shall be flexed. Examine the flexed 10 in. section for compliance with I-3281.	I-4227(a)	Because Flanders was an evaluated supplier for these filter assemblies, we are confident that these mandatory requirements for testing were accomplished in accordance with AG-1 for all systems.	CC	CC	CC	CC
81	Flexing Characteristics – Test: After examination as specified in I-4227(a), the center of each test specimen shall be tested for DOP penetration in accordance with the procedure of I-4221 for compliance with I-3282.	I-4227(b)	Because Flanders was an evaluated supplier for these filter assemblies, we are confident that these mandatory requirements for testing were accomplished in accordance with AG-1 for all systems.	CC	CC	CC	CC
82	Acceptance/Rejection Criteria: If a sample fails when tested as specified in I-4220, the lot represented shall be rejected.	I-4230	Because Flanders was an evaluated supplier for these filter assemblies, we are confident that these mandatory requirements for testing were accomplished in accordance with AG-1 for all systems.	CC	CC	CC	CC

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83	Quality Conformance Inspection: Each roll of media shall be examined for defects. Defects such as abrasions greater than ¼ in. diameter; cuts; holes; tears; punctures exceeding 1/16 in.; thick or thin spots greater than ¼ in. in diameter; burn holes, charring or scorching from the drying operation; and deviations outside the width tolerance +1/4 in. –0 are reasons for rejection.	I-4300	Because Flanders was an evaluated supplier for these filter assemblies, we are confident that these mandatory requirements for testing were accomplished in accordance with AG-1 for all systems.	CC	CC	CC	CC
	Packaging and Shipping	I-5000					
84	Packaging: Packaging shall conform to Level B of ASME NQA-2 suitable for storage under Level B of ASME NQA-2.	I-5100	Because Flanders was an evaluated supplier for these filter assemblies, we are confident that these mandatory requirements for packaging and shipping were accomplished in accordance with AG-1 for all systems.	CC	CC	CC	CC
85	Shipping: Shipping of the media shall be undertaken to assure the quality of the product upon arrival at the purchaser. Shipping containers shall comply with the rules and regulations applicable to the mode of transport being utilized.	I-5200	Because Flanders was an evaluated supplier for these filter assemblies, we are confident that these mandatory requirements for packaging and shipping were accomplished in accordance with AG-1 for all systems.	CC	CC	CC	CC

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Attachment 12

ASME AG-1 Section FD

Compliance Matrix

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
	SECTION FD: Type II Adsorber Cells	FD					
	Applicability. The Type II Adsorber unit is a single cell composed of 2 in. Adsorber beds, access panel(s) for recharging, and a gasketed flange…	FD-1120	There are no Type II Adsorber Cell components associated with the design of these systems.	NA	NA	NA	NA
	MATERIALS	FD-3000					
1 (D,P)	Allowable Materials – Adsorbent: The adsorbent material used in these cells shall be in full compliance with Section FF.	FD-3100 FD-3110		NA	NA	NA	NA
2 (D,P)	Screens: Screen material shall meet the requirements of ASTM A 240, Type 304. Perforation shall be round and arranged in standard IPA (International Perforators Association) Pattern No. 105; hole size diameter shall be 0.045 in. maximum; open area of the perforated portion of the screen shall be 35% +/- 5%. Margins and blank areas shall be as specified in Article FD-4000.	FD-3120		NA	NA	NA	NA
3 (D,P)	Casing: Casing material shall meet the requirements of ASTM A 240 (Type 304). The material thickness shall be as stated in FD-4000. Handles, spacers, and baffles shall meet the requirements of ASTM A 240 or 479 as appropriate.	FD-3130		NA	NA	NA	NA
4 (D,P)	Gaskets and Seal Pads: The material for these parts shall be a closed cell neoprene or silicone rubber sponge, Grade SCE-43E1 or SCE-44E1, in accordance with ASTM D 1056.	FD-3140		NA	NA	NA	NA
5 (D,P)	Adhesive: Adhesive used to splice gaskets or to fasten gasket to fell shall be compatible with gasket material and appropriate to intended application.	FD-3150		NA	NA	NA	NA
6 (D,P)	Threaded Fasteners: Bolting material shall be in accordance with ASTM a 320, grade B8; or A193, Grade B8. Nuts for use with this bolting material shall be in accordance with ASTM A 194, Grade 8.	FD-3160		NA	NA	NA	NA
7 (D,P)	Rivets: When rivets are used for fabrication or attachment of fill ports, they shall be austenitic steel meeting the minimum requirements of Type 303. If there is a potential "mechanical leak" path, the rivets shall be closed-end type of construction.	FD-3170		NA	NA	NA	NA
8 (D,P)	Limits: Materials of construction for the Type II cell are limited to those materials herein specified. No caulking or sealing materials are allowed in the fabrication of these cells.	FD-3200		NA	NA	NA	NA

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
9 (D,P,QA)	Certification of Materials: Documentation for adsorbent media shall conform as specified in Section FF. Certification for parts, material, and components shall be supplied to the purchaser as required below.	FD-3300		NA	NA	NA	NA
10 (D,P,QA)	Metal Parts: The cell manufacturers shall obtain certified test reports that the material, except for the handlers, conforms to the appropriate standards of FD-310. Handles serve an auxiliary function not critical to the performance of the cell.	FD-3110		NA	NA	NA	NA
11 (D,P,QA)	Gaskets and Seal Pads: Certificate of Conformance to ASTM D 1056 is required for gaskets and/or seal pads.	FD-3320		NA	NA	NA	NA
12 (D,P,QA)	Threaded Fasteners: Certification of Conformance is required.	FD-3340		NA	NA	NA	NA
13 (D,P,QA)	Hardware Items (Washers and Rivets): Certification of Conformance is required.	FD-3350		NA	NA	NA	NA
	DESIGN	FD-4000					
14 (D)	General Design: The cell shall consist of 2 in. thick minimum adsorbent beds in a modular unit as shown in Fig. FD-1. Alternatively, the cell may be of a "wraparound" type, wherein all beds are perpendicular to direction of airflow. The beds shall be enclosed by a nonperforated case on *three sides (except for alternate design) and a faceplate on the fourth* side. The cell shall be installed horizontally in a cabinetlike mounting frame to which the faceplate is clamped and sealed. Handles are provided on the front of the cell to facilitate handling and installation.	FD-4100		NA	NA	NA	NA
15 (D)	Design Requirements: The cell shall meet the following specifications. When filled with sorbent , the cell shall have a minimum residence time of 0.25 sec at rated capacity of 333 cfm. The residence time shall be determined by the procedure in Mandatory Appendix I. The filled cell shall have a maximum airflow resistance of 1.5 in. w.g. when testes at rated flow.	FD-4210		NA	NA	NA	NA

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16 (D)	Adsorber Bed: (a) The adsorber bed shall consist of a volume bounded by perforated sheets and solid metal. Nowhere shall the adsorber bed be less than 2 in. thick. Adsorber frames shall be solid metal and perforated sheets shall be fastened to the solid metal by welding. A minimum of ½ in. solid margin shall be provided at perforated sheet-to-solid side interface. (b) Frame corers shall be welded to provide a seal. The beds shall have internal spacers extending the full width and depth of the bed, or other such means of maintaining bed thickness and minimizing distortion when the cell is filled. If spacers are used, they shall have 1/2 in. +/- 1/16 in. baffles to prevent channeling. If through bolts are used, a ½ in. baffle, minimum shall be provided.	FD-4220		NA	NA	NA	NA
17 (D)	Case and Assembly: (a) *The case form shall be made from non-perforated sheet and* shall be formed and assembled in such a manner that no bypassing of the absorbent beds is possible. (b) The faceplate shall be interlocked with or welded to the bed assemblies in such a manner that no bypassing, wall effect, or channeling is possible under service conditions. It is not intended that the cell faceplate support the weight of the installed cell. Handles shall be formed, attached by welding, and finished so they present no hazard to personnel and do not interfere with clamping of the cell into its mounting frame. The faceplate may be either welded or bolted to the body assembly. If welded, a filling hatch shall be provided in the body of the cell. If bolted, a seal pad shall be provided between the faceplate and cell body to seal this interface and impose a pressure on the adsorbent bed. The seal pad may be attached to the faceplate with adhesive or may be held mechanically, and the outer edge of the seal pad may be extended to form the gasket for sealing the cell into its mounting frame. If seal pads are not used, a one-piece gasket or a gasket formed from four strips with interlocking keyhole or dovetail corners shall be used. Gaskets shall be ¾ in. wide and ¼ in. thick; all excess adhesive shall be removed from visible surfaces of the gasket before it dries. No caulking compounds or sealants shall be used in the manufacture and assembly of cells. (c) The faceplate design shall provide a 1 in. wide clear edge for clamping as depicted in Fig. FD-1 to interface with standard mounting frame design.	FD-4230		NA	NA	NA	NA

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18 (D)	Structural Requirements: The Type II cells shall be designed in accordance with the structural requirements given in AA-4000 or qualified by test in accordance with AA-4350.	FD-4300 FD-4310		NA	NA	NA	NA
19 (D)	Load Definition: Loads to be considered in the structural design of the Type II adsorber cells defined in AA-4211 are as follows. (a) Deadweight (DW) consists of the metal enclosure that contains the adsorbent, bolting integral to the cell, and the adsorbent media. Instrumentation and ancillary equipment attached to the cell are treated as external loads (EL). (b) The pressure (NOPD) differential which must be considered is from the upstream to downstream side of the media bed. This differential is a maximum of 1.25 in. w.g. at rated airflows. (c) The seismic acceleration and response spectra (OBE and SSE) *shall be as provided in the Design Specification.* Additional dynamic loads (ADL) will also be provided by the Design Specification as applicable.	FD-4320		NA	NA	NA	NA
20 (D)	Load Combinations: Unless stated otherwise in the Design Specification, the applicable loading conditions noted in Table AA-4212 for Type II cells are as follows: (a) Service Level A – DW + EL + NOPD (b) Service Level B – DW + EL + NOPD + OBE (c) Service Level C – DW + EL + NOPD + SSE + ADL (d) Service Level D – not applicable	FD-4330		NA	NA	NA	NA
21 (D)	Acceptance Criteria – Design By Analysis: If designed by analysis, the acceptance criteria are as listed in Table AA-4321. The design stress values S shall be 0.6 S_y.	FD-4340 FD-4341		NA	NA	NA	NA
22 (D,T)	Acceptance Criteria – Qualification By Test: If qualified by test, the acceptance criteria are: (a) no structural damage shall be evident by visual examination; and (b) airflow resistance and refrigerant leak requirements of subarticle FD-5330 shall be meet.	FD-4342		NA	NA	NA	NA
	INSPECTION AND TESTING	*FD-5000*					
23 (I,T)	General: Inspection and testing of the Type II cell shall conform to the requirements of this Section and to specific requirements set forth in AA-5000.	FD-5000		NA	NA	NA	NA

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				AN	AP	AW	SY
24 (I)	Dimensional Inspection: Overall dimensions shall be inspected to determine conformance to drawing requirements. Each cell shall be inspected to assure it conforms to all dimensional requirements. Location and placement of stiffeners, supports, baffles, and handles shall be inspected to determine conformance to design requirements.	FD-5100		NA	NA	NA	NA
25 (I)	Spot Weld Inspection: Spot welds shall be visually inspected in accordance with AA-6332.	FD-5210		NA	NA	NA	NA
26 (I)	Other Weld Inspection: Fillet welds, butt welds, and seal welds shall be visually inspected in accordance with AA-6331.	FD-5220		NA	NA	NA	NA
27 (T)	Qualification Tests: The cell design and filling method shall be qualified as outlined below. Equipment Manufacturer's requalification shall be required every 5 years and if there is any change in design, filling procedure, or the adsorbent's physical properties.	FD-5300		NA	NA	NA	NA
28 (T)	Design Qualification: Four cells shall be selected at random, filled with sorbent of the specified mesh size by the proposed filling method (FD-6300), and hard-mounted in the cells service orientation to a rough handling machine. This machine shall have sharp cutoff cams and be capable of vibrating the mounted cell at a frequency of 200 cycles per min. at *an amplitude of ¾ in. +/- 1/32 in. for a minimum of 10 minutes.* After vibration testing the test cell shall be inspected and there shall be no broken welds or other physical damage as a result of this test.	FD-5310		NA	NA	NA	NA

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29 (T)	Filling Method Qualification: Four cells shall be selected at random, filled with an adsorbent of the specified mesh size and hardness using the proposed filling method. The test cells shall be hard-mounted to a rough handling machine orientated with the fill at the top, and vibrated for 10 min at an amplitude of ¾ in. After rough handling, the level of adsorbent shall not have dropped more than one-half of the baffler or margin width perpendicular to the adsorbent surface. Three cells with fill parts reinstalled shall be moved in the same orientation as rough handled to a test tunnel. Care must be taken to avoid disturbing the adsorbent granules. Each cell shall be leak-tested in accordance with FD-5332, except that the cell is oriented with filling port up. If any one of the cells leaks, it may be replaced with the remaining cell. If any one of the final three cells leak, or if loss of adsorbent or excessive settling of adsorbent occurs in any of the four cells, the filling procedure shall *be judged not qualified and must be adjusted as mecessary, the tests* sha be repeated. Airflow resistance shall not increase by more than 20% as a result of rough handling when tested in accordance with FD-5331.	FD-5320		NA	NA	NA	NA
30 (T)	Acceptance Tests: Each cell to be delivered to the purchaser shall be tested for airflow resistance and refrigerant leak test.	FD-5330		NA	NA	NA	NA
31 (T)	*Airflow Resistance Test:* Install cell in test tunnel in its service orientation, and adjust airflow to 333 scfm +/- 17 scfm. Airflow resistance shall not exceed 1.25 in. w.g. Cells that do not meet this criteria shall be rejected.	FD-5331		NA	NA	NA	NA

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32 (T)	Refrigerant Leak Test: Install cell in test tunnel in its service orientation, and adjust airflow to 333 scfm +/- 17 scfm. The cell shall be tested with one of the refrigerants shown in Table FD-1 with an inlet concentration of not less than 10,000 times the minimum sensitivity of the value specified in Table FD-1 and it shall be essentially insensitive to hydrocarbons. The refrigerant injection port shall be located in such a manner as to ensure proper mixing of the refrigerant. The downstream test port shall be located in such a manner as to ensure that a representative sample is obtained. Qualification data verifying location of injection and test port shall be on file and available for inspection. Performance consists of operating the test tunnel at rated flow rate and injecting the chosen refrigerant continuously in a concentration conforming to the above requirements. When a single detector is used, at least three upstream and three downstream determinations shall be made at intervals of approximately 1 min. However, the first determination shall not be made prior to ½ min after start of injection of refrigerant gas. During the test the downstream concentration of the refrigerant gas shall not exceed 0.001 times the upstream concentration. Cells that do not meet this requirement shall be rejected.	FD-5332		NA	NA	NA	NA
	FABRICATION	FD-6000					
33 (D,F,P,T)	General: The cells shall be fabricated using only those materials designated in FD-3000 and in accordance with the design outlined in FD-4000. All welding shall be in accordance with FD-6200. After manufacture, the cell shall be tested and inspected in accordance with FD-5000.	FD-6000		NA	NA	NA	NA
34 (F)	Dimensions and Tolerances: The cell shall conform to the requirements in Table FD-2.	FD-6100		NA	NA	NA	NA
35 (F)	Welding and Brazing: Procedure qualification, personnel qualification, and performance of welding and brazing during fabrication and installation shall be in accordance with AA-6300.	FD-6200		NA	NA	NA	NA
36 (F,I,T)	Testing and Inspection: Testing and inspection of welding and brazing utilized in fabrication and installation shall be performed in accordance with AA-6000.	FD-6210		NA	NA	NA	NA
37 (F)	Repairs: Weldments, brazements, or portions thereof that do not meet the acceptance criteria defined in AA-6000 shall be removed and rewelded or rebrazed in accordance with the original requirements. Damaged gaskets shall be replaced. Damaged screens or material shall be replaced.	FD-6220		NA	NA	NA	NA

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38 (F)	Filling: Cells shall be filled with adsorbent specified by the purchaser using a filling method qualified in accordance with FD-5320. After filling, adsorbent fines shall be removed from the beds by blowing with clean, dry, oil-free compressed air or by vacuuming. After filling, each cell shall be tested in accordance with FD-5330.	FD-6300		NA	NA	NA	NA
39 (F)	Cleaning: Metal surfaces shall be cleaned and degreased in accordance with ASTM A 680 before any welding, installation of gaskets or seal pads, *and filling with adsorbent.*	FD-6400		NA	NA	NA	NA
	PACKAGING AND SHIPPING	FD-7000					
40 (O)	Packaging: Each cell shall be individually wrapped and enclosed in a sealed plastic bag that is moisture and water-vapor resistant from –30° F to + 140° F (-34.4° C to +60° C). The wrapped cell shall, in turn, be enclosed in a wood or heavy fiberboard carton with internal cushioning to dampen shock and vibration under accelerations up to 50 g. Cells shall be oriented in the carton or crate with screens horizontal. The cartons or crates shall be clearly marked with the legend "THIS SIDE UP" or similar imprint to ensure proper orientation of cartons and crates during handling, shipping, and storage.	FD-7100		NA	NA	NA	NA
41 (O)	Loading for Shipment: Cartons shall be banded to skids or pallets in the orientation specified in FD-7100. Wood separators and strapping protectors shall be provided between tiers of cartons and above the topmost cartons in the load. Sufficient strapping shall be used to prevent shifting of stacked cartons on the skid or pallet. Cells shall be stacked no higher than five tiers on a skid or pallet. Skids shall not be stacked more than two high unless bracing is provided to support the upper tier to prevent damage to the bottom cells.	FD-7200		NA	NA	NA	NA

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42 (O)	Storage: Storage at all times (except during transit) shall be indoors in an area with: (a) Ventilation; (b) Minimum temperature of 40° F (4.4° C); (c) Maximum temperature of 120° F (48.9° C); (d) Minimum exposure to fume-producing materials or volatile organic solvents; Additionally: (a) Store filters in correct orientation (check marking arrows on cartons); (b) Store filters in factory packed cartons and do not remove until just prior to installation; (c) Store filters such that tagging information is easily accessible.	FD-7300		NA	NA	NA	NA
43 (O)	Containers: *The integrity of the packing container in general and the vapor* container in particular should be maintained. Therefore, storage should not be near frequently traveled aisleways or corridors, near vibrating equipment, or among short-term storage items which require frequent personnel access. Care should be taken to avoid dropping of tipping of the storage containers.	FD-7400		NA	NA	NA	NA
	QUALITY ASSURANCE	FD-8000					
44 (QA)	General: The Type II cell Manufacturer shall establish and comply with a quality assurance program and plan in accordance with AA-8000.	FD-8000		NA	NA	NA	NA
45 (QA)	Documentation: The following documentation shall be provided: (a) Table or drawing giving outline dimensions of the filter; (b) Certified list of materials of construction; (c) Adsorbent type with applicable test reports; (d) Welder qualification; (e) All qualification reports (seismic and filling method); (f) Certification of performance (resistance and leak test).	FD-8100		NA	NA	NA	NA
	NAMEPLATES AND CERTIFICATION	FD-9000					

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				AN	AP	AW	SY
46 (O)	General: Each cell shall be legible and permanently marked on the front of the faceplate or on a metal label affixed to the faceplate with the following information: (a) Type II cell; (b) Manufacturer's name or symbol; (c) Serial number; (d) Month/year (of manufacture); (e) Empty weight. Each cell shall bear a replaceable label with the following information: (a) Adsorbent Manufacturer's name or symbol; (b) Adsorbent type and grade designation, lot, and batch; (c) Filled weight; (d) Adsorbent weight; (e) Airflow resistance at specified airflow rating; (f) Refrigerant leak test results; (g) Date of filling.	FD-9000		NA	NA	NA	NA
	Calculation of Residence Time of Adsorber Cells	Mandatory Appendix FD-I		NA	NA	NA	NA

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Attachment 13

ASME AG-1 Section FE

Compliance Matrix

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	SECTION FE: Type III Adsorber Cells	FE					
	Applicability: The Type III Adsorber is a gas phase adsorber characterized as being a single assembly, fixed and rechargeable in place, with an adsorbent.	FE-1120	There are no Type III Adsorber Cell components in the design of these systems.	NA	NA	NA	NA
	MATERIALS	FE-3000					
1 (D,P)	Allowable Materials – Adsorbent: Adsorbent materials used in Type III adsorbers shall be in compliance with Section FF of this Code.	FE-3100 FE-3110		NA	NA	NA	NA
2 (D)	Screens And Casing: Screen material in contact with the adsorbent shall be stainless steel Type 304 or 304L.	FE-3120		NA	NA	NA	NA
3 (D)	Gaskets and Seal Pads: The material for these parts shall be closed-cell ozone resistant, neoprene or silicone rubber sponge, Grade SCE-43E1 (or SCE-44E1) in accordance with ASTM D 1056.	FE-3130		NA	NA	NA	NA
4 (D,P)	Other Components: Materials used in the fabrication of other components shall be selected in compliance with the following: (a) Plate, Sheet, Strip, Stainless Steel – ASTM A 240 or A 167 (b) Bar and Structurals, Stainless Steel – ASTM A 276 or A 479 (c) Tubing, Stainless Steel – ASTM A 511, A 554, A 213, A 269 (d) Pipe, Stainless Steel – ASTM A 312, A 376 (e) Fitting, Stainless Steel – ASTM A 182, A 403, A 351 (f) Bolting, Stainless Steel – ASTM A 193, A 320, A 194 (g) Adhesives – ASTM D 903	FE-3140		NA	NA	NA	NA
	DESIGN	FE-4000					
5 (D)	General Design – Adsorber Service Equipment: The type III adsorber is loaded with adsorbent by means of the adsorbent service equipment that interfaces with the service openings or ports on the adsorber bed. It provides the means of loading bulk granular adsorbent into the adsorber bed. The method of loading shall ensure that the bed is uniformly filled.	FE-4120		NA	NA	NA	NA
6 (D)	General Design – Adsorbent Removal Equipment: The adsorbent service equipment also provides the means for removing spent adsorbent from the Type III adsorber. The service equipment shall include the necessary separating/filter capacity to control safety and health hazards arising from handling of the adsorbent. The spent adsorbent shall be containerized as specified for disposal.	FE-4121		NA	NA	NA	NA

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7 (D)	Design Criteria: Design criteria for the following parameters shall be specified: (a) type of gas to be treated; (b) volumetric flow rate, (SCFM); (c) design pressure (internal and external); (d) pressure-time transients; (e) temperature (operating range); (f) relative humidity (operating range); (g) contaminants to be removed; (h) adsorbent type; (i) required adsorber performance efficiency; (j) face velocity and bed thickness of the adsorbent or; (k) face velocity and residence time (see Appendix FE-I); (l) component integrated radiation dose; (m) minimum and maximum pressure differential across the adsorber unit; (n) corrosion effects of contaminant, process gases or other potential sources (i.e., impregnants or other chemicals); (o) seicmic requirements; (p) adsorbent sampling requirements (quantity and frequency); (q) spent adsorbent handling requirements; (r) fire protection requirements.	FE-4210		NA	NA	NA	NA
8 (D)	Sizing: Each adsorber unit shall be sized to provide the specified total volumetric flow and meet the performance requirements as specified in FE-4210(l) and (j) or (k).	FE-4220		NA	NA	NA	NA

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9 (D)	Adsorbent Bed Details: (a) Each bed section shall consist of perforated sheets, spaced uniformly to form the bed. The sheets shall be assembled to a formed, nonperforated frame by welding. The frame, or a nonperforated margin on the sheet, shall be of such width as to prevent bypass. Each bed shall have 1 in. (25.4 mm) minimum margins in order to prevent wall effect in the gas flow. Location and placement of spacers, stiffeners, and supports shall be designed to assure conformance to design requirements. (b) The smooth side of the perforated sheet shall be in contact with the adsorbent. (c) Caulking compounds or sealants shall not be used in the assembly of the beds or in the installation if the beds into the adsorber assembly. (d) A reservoir of makeup adsorbent (to allow for settling) shall cover the entire top section of each bed. The reservoir shall have a minimum volume of adsorbent equivalent to 5% of the bed volume. The reservoir volume begins one design bed depth above the top perforation of any bed. Only that adsorbent above a bed that will flow freely into the bed shall be considered as part of the makeup reserve. (e) The reservoir cover shall be designed to provide full access for filling and inspection. The reservoir cover shall have suitable handles and be secured to prevent gas leakage during normal operation. Gaskets shall conform to section FE-3130 and be compatible with the design criteria of FE-4210. Bolting patterns shall provide for uniform gasket compression in accordance with AA-4212. (f) The adsorber unit shall be designed so that spent adsorbent can be removed and replaced. If vibration is required for fill/empty operations or to assure uniform packing density, the vibrator shall be an integral part of the design and shall not affect the structural integrity of the adsorber unit. (g) Provision shall be made to allow drainage of accumulated liquids from the adsorber. Such drains shall be designed to retain the adsorbent within the adsorber. Drains shall have a positive shut off design which will preclude bypass or leakage of contaminated gases. Liquid drains shall be sized to accommodate the full flow rate of a fire deluge system if one is specified. (h) Inspection and service openings shall be provided as necessary to allow access to the top of each adsorber section for visual examination and/or sample extraction.	FE-4300		NA	NA	NA	NA

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10 (D)	Structural Requirements: The Type III adsorber shall be designed as a plate and shell type component using maximum stress theory in accordance with AA-4320 or by testing in accordance with AA-4350.	FE-4400 FE-4410		NA	NA	NA	NA
11 (D)	Load Definition: Loads to be considered in the structural design of the Type III adsorber as defined in AA-4211 are as follows. (a) Deadweight (DW) consists of the weight of the metal enclosure that contains the adsorbent, structural support members, *all* permanent hardware to service the bank, and twice the expected adsorbent media. Instrumentation, test canisters, manifolds, and other like items shall be considered as external loads (EL). (b) Normal Operating Pressure Differential (NOPD) consists of he operating pressure across the bank from upstream to downstream of the adsorbant bed. This differential is a *maximum of 0.62 in. w.g. per inch of bed depth at rated flow.* (c) The seismic loads that are the result of either operating basis earthquake (OBE) or safe shutdown earthquake (SSE) shall be defined in the Design Specification. Additional dynamic loads (ADL), as required, will also be provided in the Design Specifications.	FE-4420		NA	NA	NA	NA
12 (D)	Load Combinations: The loading conditions (noted in Table AA-4212) for the Type III adsorber shall be designed as follows: (a) Service Level A – DW + EL + NOPD (b) Service Level B – DW + EL + NOPD + OBE (c) Service Level C – DW + EL + NOPD + SSE + ADL (d) Service Level D – not applicable	FE-4430		NA	NA	NA	NA
13 (D)	Acceptance Criteria: The allowable stress limits shall be calculated in accordance with Table AA-4321. Calculated design stress shall not exceed the allowable design stress of $S = 0.6\ S_y$.	FE-4440		NA	NA	NA	NA
14 (D)	Adsorbant Handling Subsystems: Adsorbant filling and emptying systems shall be designed as a compatible part of the Type III design.	FE-4500		NA	NA	NA	NA

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15 (D)	Adsorbant Loading System – Design: The adsorbent loading system shall be designed, tested, and qualified to meet the requirements of FE-4200. The design shall include provisions to receive, transport, and place bulk quantities of granular material with adequate containment of adsorbent fines. The design shall not adversely affect the particle size distribution of the adsorbent as discussed on Appendix FE-III. Design of this service equipment must take into consideration all operating conditions and requirements defined by the Owner. These should include access, toxicity of contaminants, and time required for change-out. Typical designs include pneumatic transfer systems and gravity feed hopper designs. Other methods, which can be shown to meet the design, are also acceptable.	FE-4510 FE-4511		NA	NA	NA	NA
16 (D)	Loading: Loading systems shall provide for the uniform distribution and packing of adsorbent into the bed assembly. Packing characteristics of the loading system shall be demonstrated during qualification testing per FE-5620. Any design or process changes will require requalification.	FE-4512		NA	NA	NA	NA
17 (D)	Hoppers: Fill hopper designs shall match the adsorber service openings. Service opening to hopper connections shall include adequate seals or a containment system to control release of adsorbent fines.	FE-4513		NA	NA	NA	NA
18 (D)	Adsorbent Removal System: Adsorbant removal connections from the adsorber beds shall be piped external to the filter housing and provided with a mechanically sealed, leak-tight closure system. The removal system or systems shall have a demonstrated capability for handling adsorbent that may be liquid saturated.	FE-4520		NA	NA	NA	NA
19 (D)	Adsorbent Sampling Systems: The Type III adsorber design shall include a means to obtain samples of the adsorbent. The preferred method is one which incorporates a set of sample canisters. Other methods or designs are acceptable if it can be shown (through Manufacturer's qualification testing) that they will provide representative sampling of the total bed thickness without introducing voids or bypass conditions.	FE-4600 FE-4610 FE-4611		NA	NA	NA	NA
20 (D,P)	Materials: Test canisters installed in adsorber units shall conform to the same material requirements as apply to the Type III adsorber.	FE-4612		NA	NA	NA	NA
21 (D,T)	Quantity: When test canisters are provided, there shall be a minimum of six canisters for each adsorber unit to support specified in-service testing.	FE-4613		NA	NA	NA	NA

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
22 (D,T)	Design Criteria: Test canister design shall be qualified in accordance with FE-5600. Test canisters shall be mounted such that the airflow is in a vertical direction and the effective flow rate is the same as the main bed. Canister bed depth, residence time, pressure droop, and the packing density of the canister adsorbent shall be defined by the Manufacturer to assure compliance with these requirements for initial and repeat filling operations. Documentation of Qualification testing verifying compliance with these design criteria shall be provided.	FE-4614		NA	NA	NA	NA
23 (D)	Gaskets: The requirements for canister gaskets, seal pads, and adhesives shall be the same as those applying to other adsorber service openings.	FE-4615		NA	NA	NA	NA
24 (D)	Fire Protection: Fire protection is required and this function may be accomplished by any number of means, the simplest of which is to isolate the bed (stop the airflow, close all isolation dampers) and allow it to cool. Regardless of the type of fire protection system incorporated into the Type III adsorber, the Manufacturer shall provide a complete and comprehensive documentation package covering the proper care and response to fire conditions.	FE-4620		NA	NA	NA	NA
25 (D)	Temperature Sensors: Temperature sensors shall be installed in the gas stream, upstream and downstream of the Type III adsorber units. Detailed requirements are contained in Section IA.	FE-4621		NA	NA	NA	NA
26 (D)	Alternative Methods of fire Detection: Other means of fire detection (CO, CO_2, smoke, or other types of detectors), which meet the reliability and sensitivity requirements of the system specification, may be used. The active element(s) of any such system shall be properly located with respect to each bed to ensure coverage of the total bed as well as localized hot spots which may occur within the bed. This requirement can normally be satisfied by locating the detector in the gas stream, downstream of the adsorbent bed. Locating the sensor within the adsorbent bed is not permitted.	FE-4622		NA	NA	NA	NA
27 (D)	Fire Control Systems: Fire control systems for adsorbers are intended to limit the hazards associated with accidental ignition of the bed. Although infrequent, this may occur by internal heating or external causes (welding, etc.). In the event of ignition, control (and eventual cooling of the bed to less than 250° C) must be accomplished without release of significant contamination.	FE-4623 FE-4623.1		NA	NA	NA	NA

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28 (D)	Fire control systems shall be designed and tested to demonstrate satisfactory performance under all anticipated accident situations. The design of the system shall consider mot only the risk of fire, but shall also address such items as normal maintenance, accidental initiation, isolation, containment, cleanup, repair, reconditioning, and recertification of the bed. The preferred design incorporates automatic sensing and alarm of incipient ignition coupled with a manual activation of the fire control system after verification of the fire.	FE-4623.2		NA	NA	NA	NA
29 (D)	Gaseous blanketing/purge systems (N_2, CO_2, Halogen, etc.) designed to smother a fire are preferred. They shall be designed to have sufficient capacity to fill all connected housings and ductwork (up to any isolation dampers) without overpressurizing the filter system. They shall also provide for monitoring the system leakage and supplying makeup gas as needed.	FE-4623.3		NA	NA	NA	NA
30 (D)	*Water deluge piping systems, which may be required by other codes* or specifications, shall be designed to saturate the adsorber media throughout the adsorber assembly, including the reservoir. Piping material shall be Typed 304 or 304L series stainless steel in accordance with FE-3100. The deluge pipe system shall terminate on the exterior of the adsorber assembly or other remote location where it can be manually connected to the water supply system. Manual safety shutoff valves shall provide for isolation of the system until such time as it is temporarily connected to the water supply system. Connection to the water system shall be through a standard hose or jumper fitting. The deluge design shall provide a minimum water flow rate of 3.2 gal per minute per cubic foot of adsorbent. Adsorber catch basins and drain popes inside the adsorber assembly shall be designed to accommodate the full flow rate of the deluge system and be routed to an adequate drain.	FE-4623.4		NA	NA	NA	NA
	INSPECTION AND TESTING	FE-5000					
31 (I,T)	General: This Section establishes the minimum requirements for inspection and testing of Type III adsorbers. Certain individual inspection items may require completion prior to final assembly and should be identified in the Manufacturer's plan. Documentation of all results shall be provided as required by FE-8200.	FE-5100		NA	NA	NA	NA
32 (I)	Visual Inspection: Type III adsorbers shall be visually inspected to ensure conformance with the requirements of FE-4000. Inspection shall be documented in accordance with AA-8000. A suggested checklist for visual inspection is contained in Appendix FE-A	FE-5200		NA	NA	NA	NA

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key)			
				AN	AP	AW	SY
33 (I)	Dimensional Inspection: The Type III adsorber shall be inspected to determine conformance to design drawings.	FE-5300		NA	NA	NA	NA
34 (I)	Bed Depth: Measurements of the adsorbent bed depth, including the contributing effects of screen waviness, shall be made to determine that it conforms to design requirements.	FE-5310		NA	NA	NA	NA
35 (I)	Screens: All perforated or screen areas shall be inspected for screen waviness in accordance with Appendix FE-II. This inspection is to be performed at the subassembly level of the bed to ensure access to all screens and to determine that the "smooth" side contacts the adsorbent.	FE-5320		NA	NA	NA	NA
36 (I)	Adsorbent Reservoir: The adsorbent reservoir shall be inspected to determine conformance to design requirements. Necessary measurements and volume calculations shall be included in the inspection report to demonstrate compliance with the design criteria.	FE-5330		NA	NA	NA	NA
37 (I)	Spot Weld Inspection: Spot welds shall be inspected per AA-6332.	FE-5410		NA	NA	NA	NA
38 (I)	Seal Weld Inspection: Seal welds and structural welds shall be inspected per AA-6331.	FE-5420		NA	NA	NA	NA
39 (D,I)	*Fabrication Tolerances:* Tolerances for the fabrication of the adsorber beds shall be in compliance with the requirements in Appendix FE-II.	FE-5500		NA	NA	NA	NA
40 (D,T)	Design Qualification: The adsorber unit performance and filling method shall be qualified as outlined in the Mandatory Appendices. All qualification testing shall include the test canisters (if applicable) as an integral part of the adsorber unit design. Modular units, representative in all functional and dimensional aspects (i.e., full size), shall be used for testing. Requalification shall be required if there are any changes in design, filling procedure (i.e., feed rate, vertical fall, vibration), or adsorbent physical properties.	FE-5600		NA	NA	NA	NA
41 (D,T)	Functional Design Qualification: The adsorber design shall be tested and qualified in accordance with Appendix FE-IV. Deviation from specified acceptance criteria shall be cause for rejection of design.	FE-5610		NA	NA	NA	NA

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42 (T)	Filling Method Qualification: The adsorber unit filling method shall be tested and qualified in accordance with Appendix FE-III. Failure to meet specified acceptance criteria shall cause the filling method to be adjusted as necessary; both the performance and filling test shall be repeated.	FE-5620		NA	NA	NA	NA
43 (D,T)	Seismic Qualification: Each design shall meet the Owner's specified seismic requirements. Seismic analysis/testing shall be performed to the requirements of AA-4000.	FE-5630		NA	NA	NA	NA
44 (T)	Acceptance Tests: The complete adsorber unit shall be tested for acceptance in accordance with AA-5700 and this Section of the Code.	FE-5700		NA	NA	NA	NA
	FABRICATION AND INSTALLATION	FE-6000					
45 (F)	General: The fabrication and assembly of Type III adsorbers shall be performed in accordance with Owner approved design drawings and industry standards.	FE-6100		NA	NA	NA	NA
46 (F)	Welding: All welding and welder qualifications shall be in accordance with the requirements of AA-6300.	FE-6200		NA	NA	NA	NA
47 (F)	Cleaning: All surfaces shall be cleaned prior to acceptance. No halogen bearing materials nor carbon steel tools shall be used to clean the stainless steel surfaces. Cleaning shall be performed in accordance with the procedures contained in AA-6000 and the Manufacturer's written procedure.	FE-6300		NA	NA	NA	NA
48 (F)	Construction and Installation: The Type III adsorber shall be seal welded into the air cleaning component housing. All seal welds shall be accessible for inspection and repairs once the beds are in place.	FE-6400		NA	NA	NA	NA
49 (F)	Repairs: Should the screen of a Type III adsorber be damaged or defective, repair procedures shall be developed by the Manufacturer. The repair of small tears or burn-through holes can be patched by welding a piece of perforated material (at least ½ in. larger than the defect) over the defect. The perforations in the patch should be aligned with those in the base material. Precautions against damaging the base screen during welding (such as the use of a copper back-up plate) shall be taken.	FE-6500		NA	NA	NA	NA
	PACKAGING AND SHIPPING	FE-7000					

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50 (O)	Type III Adsorbers: Packaging, shipping, and storage of Type III adsorbers shall be in accordance with ANSI/ASME NQA-2 Level C criteria. Type III adsorbers shall not be shipped with adsorbent in place.	FE-7100		NA	NA	NA	NA
51 (O)	Adsorbent Materials: The requirements are detailed in Section FF and as specified by the Owner.	FE-7200		NA	NA	NA	NA
	QUALITY ASSURANCE	FE-8000					
52 (QA)	General: Quality assurance shall be in accordance with AA-8000 of this Code. The Manufacturer of this equipment shall develop and maintain a QA program acceptable to the Owner and provide required documentation as requested.	FE-8100		NA	NA	NA	NA
53 (QA)	Inspection Reports and Documentation: The inspection reports and other documents to be provided in the documentation package include: (a) Net bed area certification; (b) Residence time calculations; (c) Certificates of compliance are required on all materials; (d) Certificates of conformance to this Code and purchase specifications; (e) Nonconformance Reports and resolutions; (f) Qualification reports (including type of adsorbent used); (g) Operational, maintenance, and repair manuals/procedures; (h) Drawing package sufficient to support field testing, inspection, and repairs; (i) Welder qualification documentation.	FE-8200		NA	NA	NA	NA
	NAMEPLATES	FE-9000					
54 (O)	Permanent Nameplates: Each Type III adsorber shall be legibly and permanently marked with either a nameplate affixed to a wall or by metal stamping on the wall of the adsorber assembly. Such marking shall be done in a manner that is accessible and will not damage the structural integrity of the adsorber unit. The preferred location is on the downstream side of the adsorber. An additional nameplate shall be prepared and furnished for attachment to the exterior of the filter housing after final assembly. The nameplate shall include the information included in this Sub-article, as a minimum. (see this section for information)	FE-9100		NA	NA	NA	NA

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55 (O)	Filling Label: Each Type III adsorber shall be provided with a replaceable label to record the following information at the time of filling. Test canisters shall be similarly labeled at the time of filling. (a) Adsorbent Manufacturer's name (and symbol if applicable); (b) Adsorbent type and grade designation, lot, and batch; (c) Adsorbent density and weight of fill; (d) Airflow resistance at specified airflow rating after filling; (e) Refrigerant penetration test results of bed and canisters; (f) Date of filling; (g) Filled by.	FE-9200		NA	NA	NA	NA
	Residence Time Calculation	Mandatory Appendix FE-I		NA	NA	NA	NA
	Screen Waviness Inspection Test	Mandatory Appendix FE-II		NA	NA	NA	NA
56	*Procedure:* Each section should be checked: (a) Lay a flat edge across the screen to identify any depressions of more than 5% of bed depth. (b) Carefully note the associated low points and high points. (c) Check both the low points and high points for bed depth using a bed depth probe. The bed depth probe is a small diameter rod which is sufficiently rigid yet will pass through the holes of the screen. The length of the rod passing perpendicularly through the plane of one screen and touching the face of the opposite screen provides a measure of bed depth. The thickness of the screen may be neglected.	II-2000		NA	NA	NA	NA
57	Acceptance Criteria: If the bed depth varies by more than ± of the design bed depth the assembly is unacceptable and corrective action is required.	II-3000		NA	NA	NA	NA
	Adsorber Filling Qualification Test Procedure	Mandatory Appendix FE-III		NA	NA	NA	NA
58	The filling method shall be qualified by the following procedures: The objective of qualifying the filling method is to ensure that the *resulting as filled density of the adsorbent meets the specifications of* Section FF. To ensure this, the same adsorber unit tested under Appendix FE-IV shall be tested to show compatibility of design with fill method.	III-3000		NA	NA	NA	NA
	Procedure	III-4000					

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59	Before filling the Type III adsorber with the specified adsorbent, the apparent density and adsorbent size distribution of the adsorbent shall be determined by ASTM D 2854 and ASTM D 2862. AT least one sample shall be taken from each drum for testing.	FE-III-4010		NA	NA	NA	NA
60	Calculate total bed volume, including bottom hopper and top reservoir. These calculations are to be based on approved production drawing dimensions, which have been verified by inspection measurements.	FE-III-4020		NA	NA	NA	NA
61	Charge the Type III adsorber with adsorbent, recording the weight of adsorbent used to fill the bed to its design level.	FE-III-4030		NA	NA	NA	NA
62	After the adsorber is filled, samples shall be taken from at least three different locations within each bed section (bottom, middle, and top). A determination of particle size distribution of each sample shall be made according to ASTM D 2862. The numbering of samples shall be large enough to provide a statistically significant distribution. The *method of sample extraction shall be specified by the Manufacturer*, and should provide repeatability sample results within ± 5%.	FE-III-4050		NA	NA	NA	NA
63	Packing Density: The packing density of the bed shall be calculated as follows:…	FE-III-4050		NA	NA	NA	NA
64	Adsorbent Losses: The filling process is a major contributor to the generation of dust or "adsorbent fines."…Therefore. as part of the adsorber qualification, after filling, any visible fines shall be collected by vacuum cleaning the beds and other areas of collecting with a cleaning system incorporating a high efficiency filter (HEPA). In those systems using pneumatic transfer for filling, the transfer/dust separator filter may be used. The net change in weight of the HEPA filter shall be used as the weight of fines generated for use in Eq. (1).	FE-III-4060		NA	NA	NA	NA
65	Qualification Reports: (a) The results of all calculations and tests. (b) A detailed filling procedure used. (c) Report the feed rate of adsorbent. (d) Report the adsorbent size distribution of the samples and their associated bed location.	III-5000		NA	NA	NA	NA
66	Acceptance Criteria: (a) The packing density shall be within ±10% of the average density per ASTM D 2854. (b) Adsorbent size distribution shall be within ±5% of the adsorbent particle size distribution of the original samples (see FE-III-4010).	III-6000		NA	NA	NA	NA
	Type III Adsorber Qualification Test Procedure	Mandatory Appendix FE-IV		NA	NA	NA	NA

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				AN	AP	AW	SY
67	Scope: This procedure describes a method for determining the effectiveness of Type III adsorbers in removing contaminants by ensuring that the entire bed contributes to the removal. Alternate methods which can be shown to accomplish the purpose of this procedure with acceptable results may be used by agreement of all parties.	IV-1000		NA	NA	NA	NA
68	Example: The following example and calculations illustrate the methods involved in arriving at the qualification of a 4 in. bed…	IV-4000		NA	NA	NA	NA
69	Acceptance Criteria: Results of laboratory sample analysis shall be within ±20% of each other or the flow pattern in this bed is unacceptable.	IV-5000		NA	NA	NA	NA

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Attachment 14

ASME AG-1 Section FF

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	SECTION FF: Adsorbent Media	FF					
	Applicability: This section shall be applied to the use of adsorbent media installed in nuclear safety-related atmospheric cleanup systems for the removal of radioiodine compounds during and after an accident…	FF-1120	There is no Adsorbent Media in the design of these systems.	NA	NA	NA	NA
	MATERIALS	FF-3000					
1 (D,P)	Materials: …Activated carbon manufactured from coconut shell raw material has been traditionally used. However, carbons manufactured from raw material such as wood, coal, or petroleum coke may be used provided they satisfy the requirements of this Section. Only virgin material may be acceptable. Reactivation of activated carbon for use in nuclear safety-related systems is not allowed… Reimpregnation of carbon that has been in service or outdated impregnated carbon is permitted, but must be qualified in accordance with this Section.	FF-3000		NA	NA	NA	NA
	DESIGN	FF-4000					
2 (D)	General Design: The adsorbent media shall be a free-flowing granular substance capable of being used in Type II, Type III, or other approved mechanical structures constituting adsorber units. In some instances, an impregnant may be adsorbed onto the medium to increase the radioiodine removal capability, particularly at high humidity conditions. If activated carbon is specified as the adsorbent medium, the activation and impregnation processes are left to the discretion of the Manufacturer; the requirements contained in Article FF-5000 shall be applicable. If another adsorbent medium is proposed, it shall meet the minimum performance requirements outlined in Article FF-5000 to conform with this Article.	FF-4100		NA	NA	NA	NA
3 (D)	Adsorbent Degradation: The adsorbent is qualified to perform under the temperature and relative humidity conditions of Sub-article FF-5210, Qualification Tests. Furthermore, system design criteria and parameters in other sections of ASME AG-1 provide the conditions under which the adsorbent operates.	FF-4200		NA	NA	NA	NA

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4 (D)	Desorption: (a) Desorption is the reverse of the process of adsorption and is primarily a function of temperature. Temperature conditions which are outside the limits under which the adsorbent was qualified can cause desorption, or conversely, adsorption efficiency may be less than qualified values. (b) If normal or abnormal operation of the system outside the qualification temperatures is desired, the Owner shall requalify the adsorbent media to the other operating conditions.	FF-4210		NA	NA	NA	NA
5 (D)	*Degradation:* In addition to experiencing the process of desorption, adsorbent can degrade as a result of other adverse conditions. These conditions include but are not limited to the following: (a) Operation at relative humidity conditions above the limits under which the adsorbent was qualified results in adsorbent *efficiencies less than qualified values.* (b) Spurious activation of the water deluge system may saturate the adsorbent with water and leach any adsorbed material, either impregnant or adsorbed gases, from the adsorption surfaces.	FF-4220		NA	NA	NA	NA
	INSPECTION AND TESTING	FF-5000					
6 (I,T)	General: This Article specifies the inspection and testing criteria applicable to activated carbon adsorbent media for use in engineered safety feature atmosphere cleanup systems. Article AA-5000 shall apply, with the additional guidance given below.	FF-5000		NA	NA	NA	NA
7 (T)	Physical Testing – Before Impregnation: Each batch of activated carbon to be impregnated shall undergo a physical test for carbon tetrachloride activity in accordance with ASTM D 3467 to a minimum level of 60% prior to impregnation.	FF-5110		NA	NA	NA	NA

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8 (T)	Physical Testing – After Impregnation: Each batch of activated carbon that has been impregnated shall undergo the following physical tests after impregnation: (a) a test of apparent density in accordance with ASTM D 2854 to a minimum level of 0.38 g/ml; (b) a test of particle size distribution in accordance with ASTM D 2862 to satisfy the following ASTM E 11 series of screens: (1) retained on No. 6 – 0.1% maximum (2) retained on No. 8 – 5.0% maximum (3) through No. 8, retained on No. 12 – 60% maximum (4) through No. 12, retained on No. 16 – 40% minimum (5) retained on No. 16 – 5.0% maximum (6) retained on No. 18 – 1.0% maximum (c) ignition temperature shall be measured in accordance with ASTM D 3466 and shall be a minimum level of 330° C; *(d) ball-pan hardness shall be measured in accordance with* ASTM D 3802 and shall be a minimum level of 92%.	FF-5120		NA	NA	NA	NA
9 (T)	Radioactive Testing: In addition to specifications for the physical properties of activated carbon, this Article also requires testing of the adsorbent with radioactive material to verify removal capabilities. Qualification tests are to be repeated at least once every 5 years, in accordance with ASTM D 4069. Batch tests are to be performed on each batch of material supplied, and as indicated in ASTM D 4069.	FF-5200		NA	NA	NA	NA
10 (T)	Qualification Tests: Each grade or type of impregnated activated carbon shall be qualified at least once every 5 years by satisfying the following radioactive qualification tests.	FF-5210		NA	NA	NA	NA
11 (T)	Methyl Iodide Removal (Low Temperature): Verify methyl iodide removal efficiency to be not less than 99.0% at 80° C and 95% relative humidity when tested in accordance with ASTM D 3803.	FF-5211		NA	NA	NA	NA
12 (T)	Elemental Iodine Removal: Verify elemental iodine removal efficiency to be not less than 99.9% *at 30° C and 95% relative humidity when tested in accordance with* ASTM D 3803.	FF-5212		NA	NA	NA	NA
13 (T)	Methyl Iodide Removal (High Temperature): Verify methyl iodide removal efficiency to be not less than 98% at 130° C and 95% relative humidity when tested in accordance with *ASTM D 3803 for carbon to be installed in primary containment* cleanup systems.	FF-5213		NA	NA	NA	NA

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14 (T)	Radioactive Batch Tests: In addition to the radioactive qualification tests, each batch of impregnated activated carbon shall undergo radioactive batch tests at the time of manufacture to verify that the batch has the same characteristics as the carbon sample which has been qualified.	FF-5220		NA	NA	NA	NA
15 (T)	Methyl Iodide Removal: Each batch of impregnated activated carbon shall be tested for methyl iodide removal efficiency at 30° C and 95% relative humidity in accordance with ASTM D 3803. The minimum acceptable efficiency level shall be 97%.	FF-5221		NA	NA	NA	NA
16 (T)	Elemental Iodine Retention: Each batch of impregnated activated carbon shall be tested for elemental iodine retention efficiency at 180° C in accordance with ASTM D 3803. The minimum acceptable efficiency level shall be 99.5%.	FF-5222		NA	NA	NA	NA
17 (I,T)	Acceptable ASTM Standards: The inspection and testing requirements of FF-5100 and FF-5200 are not intended to supersede or replace the requirements of ASTM D 4069 for impregnated activated carbon, but the requirements are included in this Article for completeness. Any impregnated activated carbon that satisfies the requirements of ASTM D 4069 shall be considered to be in conformity with this Code.	FF-5300		NA	NA	NA	NA
	FABRICATION	FF-6000					
18 (F)	General: There are no established industry standards, procedures, or guidelines for the activation of carbon or the impregnation of activated carbon. Rather, these procedures are left to the Manufacturer. The acceptability of the Manufacturer's product shall be determined by satisfactory conformity of the product with the inspection and testing requirements of FF-5000.	FF-6000		NA	NA	NA	NA
	PACKAGING AND SHIPPING	FF-7000					
19 (O)	Protection of Adsorbent Media: After the adsorbent has satisfied the requirements of FF-5200 and is ready for shipment, all packaging, shipping, and storage procedures shall ensure that the media do not degrade by any means (aging, abrasion) before use. Accordingly, the media shall be packaged, shipped, and stored in containers designed to minimize influx of vapors and protect the contents from the environment. Media shall be packaged, shipped, and received in accordance with the requirements of Level B items specified in ANSI/ASME NQA-2. Media shall be stored in the original shipping containers with the seals intact.	FF-7100		NA	NA	NA	NA

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20 (O)	Storage: Storage at all times (except during transit) shall be indoors in an area with: (a) Ventilation; (b) Minimum temperature of 40° F; (c) Maximum temperature of 120° F; (d) Relative humidity less than 70%; (e) Minimum exposure to fume-producing materials or volatile organic solvents; (f) Protection from mechanical shock and vibration.	FF-7200		NA	NA	NA	NA
21 (O)	Containers: The integrity of the packing container in general and the vapor container in particular should be maintained; therefore, storage should not be near frequently traveled aisleways or corridors, near vibrating equipment, or among short term storage items which require *frequent personnel access. Care shall be taken to avoid dropping or* tipping the storage container.	FF-7300		NA	NA	NA	NA
	QUALITY ASSURANCE	FF-8000					
22 (QA)	General: The quality assurance requirements of AA-8000 shall apply to the Manufacturer of adsorbent media and to all contractors performing any of the medium testing or inspection functions for the Manufacturer, the Supplier, or the user.	FF-8000		NA	NA	NA	NA
23 (QA)	Documentation: The following documentation shall be provided: (a) Type of tests; (b) Date performed; (c) Procedure followed (by reference is acceptable); (d) All test conditions (per ASTM D 3803); (e) Laboratory performing the tests; (f) Test results; and (g) Identity and signature of person performing laboratory work.	FF-8100		NA	NA	NA	NA
	NAMEPLATE AND CERTIFICATION	FF-9000					

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24 (O)	General: Article AA-9000 nameplate and certification requirements shall apply, with the additional guidance given below. In addition to a shipping label, the following information shall be affixed to each shipping container: (a) Manufacturer; (b) Date of manufacture; (c) Grade or type of adsorbent; (d) Batch identification; and (e) Purchaser's identification number. This information shall be attached to the packing container in such a manner that it becomes an integral part of the container and shall not be removed until the adsorbent is used. All labels shall be of a material that allows the required information to remain visible and legible at all times during shipping and storage and until the media are completely used.	FF-9000		NA	NA	NA	NA

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Attachment 15

ASME AG-1 Section FG

Compliance Matrix

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	SECTION FG: Mounting Frames Conagt-Air Cleaning Equipment Nuclear Safety-Related Equipment	FG					
	MATERIALS	FG-3000					
1 (D,P)	Allowable Materials: *Materials used in the construction of mounting frames shall conform* to requirements of specifications for materials given in Table FG-3100.	FG-3100	Acceptability of this requirement was determined from a review of the associated CVI data, and also from the fact that these mounting frames were provided by a supplier that was on the evaluated supplier's list.	CC	CC	CC	CC
2 (D,P)	*Material limitations:* Tape, mastics, caulk, lubricants, and sealant materials are not allowed in the fabrication of mounting frames.	FG-3200	Acceptability of this requirement was determined from a review of the associated CVI data, and also from the fact that these mounting frames were provided by a supplier that was on the evaluated supplier's list.	CC	CC	CC	CC
	DESIGN	FG-4000					
3 (D,C)	General Design: The design and construction of mounting frames shall incorporate requirements for structural strength and rigidity, and sealing surface requirements to provide leak-tight individual positive clamping of HEPA filters and Type II adsorber cells to the mounting frames. Mounting frames shall be designed from structural welding to the housing wall, and for seal welding of adjoining members.	FG-4100	Acceptability of this requirement was determined from a review of the associated CVI data, and also from the fact that these mounting frames were provided by a supplier that was on the evaluated supplier's list.	CC	CC	CC	CC
4 (D)	Structural Requirements: Mounting Frames shall be designed in accordance with the structural requirements given in Article AA-4000. Additional structural requirements and load definitions specific to Type II adsorber mounting frames appear in FD-4300.	FG-4200	Acceptability of this requirement was determined from a review of the associated CVI data, and also from the fact that these mounting frames were provided by a supplier that was on the evaluated supplier's list.	CC	CC	CC	CC

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
5 (D)	Load Definition: Loads to be considered in the structural design of mounting frames are listed in paragraph AA-4211, with the following definitions: (a) *Dead weight* (DW); The weight of the mounting frame members. (b) *External load* (EL); 100 pounds (45 kg) for HEPA filters and 200 pounds (91 kg) for Type II adsorber cells. These loads are based on net weight of the HEPA filter and Type II adsorber cells. (c) *Normal operating pressure differential* (NOPD); for type II adsorber cells as defined in Table FC-5100-II, unless specified otherwise by the Owner in the Design Specification. The dirty filter pressure drop value shall be stated in the Design Specification, with input from the Manufacturer.	FG-4220.1	Acceptability of this requirement was determined from a review of the associated CVI data, and also from the fact that these mounting frames were provided by a supplier that was on the evaluated supplier's list.	CC	CC	CC	CC
6 (D)	Load Definition: System Operation Pressure Transient (SOPT) shall be provided in the Design Specification.	FG-4220.2	Acceptability of this requirement was determined from a review of the associated CVI data, and also from the fact that these mounting frames were provided by a supplier that was on the evaluated supplier's list.	CC	CC	CC	CC
7 (D)	Load Definition: The seismic acceleration and response spectra (OBE and SEE) shall be provided in the Design Specification. Additional Dynamic Loads (ADL) and Design Pressure Differential (DPD) may also be provided in the Design Specification.	FG-4220.3	Acceptability of this requirement was determined from a review of the associated CVI data, and also from the fact that these mounting frames were provided by a supplier that was on the evaluated supplier's list.	CC	CC	CC	CC
8 (D)	Load Combinations: Unless stated otherwise in the Design Specification, the applicable loading conditions noted in Table AA-4212 for mounting frames are as follows: (a) Service Level A – DW + EL + NOPD + SOPT (b) Service Level B – DW + EL + NOPD + SOPT OBE + ADL (c) Service Level C – DW + EL + NOPD + SOPT + SSE + ADL (d) Service Level D – not applicable	FG-4240	Acceptability of this requirement was determined from a review of the associated CVI data, and also from the fact that these mounting frames were provided by a supplier that was on the evaluated supplier's list.	CC	CC	CC	CC
9 (D)	Acceptance Criteria: The acceptance criteria are listed in Table AA-4321. The stress design value, S, shall be calculated as 0.6 S_y, where S_y is yield stress, as defined in Article AA-4000.	FG-4240	Acceptability of this requirement was determined from a review of the associated CVI data, and also from the fact that these mounting frames were provided by a supplier that was on the evaluated supplier's list.	CC	CC	CC	CC

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				AN	AP	AW	SY
10 (D)	Structural Design Analysis: The mounting frame shall be analyzed as a statically indeterminate lattice.	FG-4300	Acceptability of this requirement was determined from a review of the associated CVI data, and also from the fact that these mounting frames were provided by a supplier that was on the evaluated supplier's list.	CC	CC	CC	CC
11 (D)	HEPA Mounting Frame Deflection Limits: The mounting frame should deflect no more than 0.0007 in. (0.18 mm) per inch (25.4 mm) span under a load equivalent for the EL plus NOPD for HEPA filters. The uniform frame loading due to NOPD is determined from equation: $W = 0.036(1.5)\Delta pC$ Where *W = uniform frame loading, lb/in.* 0.036 = conversion factor, in. wg to psi p = dirty filter pressure drop across bank, in. wg *C* = center-to-center spacing of filter bank, in. The value determined from equation (1) and EF is used in standard beam equations to determine the minimum moment of inertia required. Based on the minimum moment of inertia required for the member, the size and shape is determined by analysis or can be selected directly from the tables of structural shape properties given in the AISC Manual of steel Construction.	FG-4310	Acceptability of this requirement was determined from a review of the associated CVI data, and also from the fact that these mounting frames were provided by a supplier that was on the evaluated supplier's list.	CC	CC	CC	CC
12 (D)	Type II Adsorber Cell Mounting Frame Deflection Limits: The mounting frame shall deflect no more than 00.007 (or should it be 0.0007) in. per inch span under a load equivalent to the mounting weight when in a water flooded condition (empty cell weight plus double the dry carbon weight) plus 1.17 lb/in. (0.02 kg/mm) to account for NOPD. The load value is to be used in standard beam equations to determine the minimum moment of inertia required. Based on the minimum moment of inertia, the size and shape of the material can be determined by analysis or can be selected directly from the tables of structural shape properties given in the AISC Manual of steel Construction.	FG-4320	Acceptability of this requirement was determined from a review of the associated CVI data, and also from the fact that these mounting frames were provided by a supplier that was on the evaluated supplier's list.	CC	CC	CC	CC

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13 (D)	Impact Loading: In addition to flexural strength, the mounting frame shall also be capable of withstanding a shock loading of at least 3 psi across the bank without exceeding the elastic limit of the frame material. The section moduli given in Part 1 of the AISC Manual of Steel Construction shall be compared with the minimum values obtained from equation (2)… The value obtained in Eq. (2) shall be less than that determined in the AISC Manual.	FG-4330	Acceptability of this requirement was determined from a review of the associated CVI data, and also from the fact that these mounting frames were provided by a supplier that was on the evaluated supplier's list.	CC	CC	CC	CC
	INSPECTION AND TESTING	FG-5000					
14 (I,T)	General: Inspection and testing of the HEPA filter5 and Type II adsorber mounting frames shall conform to the requirements in Article AA–5000.	FG-5000	Acceptability of this requirement was determined from a review of the associated CVI data, and also from the fact that these mounting frames were provided by a supplier that was on the evaluated supplier's list.	CC	CC	CC	CC
15 (I)	*Dimensional Inspection:* Overall dimensions shall be inspected to determine conformance to Manufacturer's drawing requirements. Length and spacing of members shall be inspected such that the openings are within tolerance. See Appendices FG-I and FG-II for details.	FG-5100	Acceptability of this requirement was determined from a review of the associated CVI data, and also from the fact that these mounting frames were provided by a supplier that was on the evaluated supplier's list.	CC	CC	CC	CC
16 (I)	Alignment and Surface Finish: The alignment of adjoining members shall be inspected, as will as the filter seating surface. Adherence to the following tolerances for HEPA filter and Type II adsorber cell mounting frames is required.	FG-5200	Acceptability of this requirement was determined from a review of the associated CVI data, and also from the fact that these mounting frames were provided by a supplier that was on the evaluated supplier's list.	CC	CC	CC	CC
17 (I)	Alignment: (a) *perpendicularity*; mounting frame adjoining members are to be perpendicular, with a maximum offset of : 1/64 in. (0.4 mm) per foot of frame member, or 1/16 in. (1.6 mm) deviation over entire frame member length, whichever is greater. (b) *Planarity of adjoining members*; adjoining members are to be aligned not to exceed 1/64 in. (0.4 mm) at any point on the joint between the members.	FG-5210	Acceptability of this requirement was determined from a review of the associated CVI data, and also from the fact that these mounting frames were provided by a supplier that was on the evaluated supplier's list.	CC	CC	CC	CC

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18 (I)	Flatness: Each HEPA filter or adsorber cell seating surface shall be plane within 1/16 in. (1.6 mm). The HEPA filter or adsorber cell seating surface is defined as a 1 ¼ in. (31.8 mm) perimeter around the HEPA filter or adsorber cell opening only. The entire mounting frame shall be plane with ½ in. (12.7 mm) total allowance in any 8 x 8 ft (203 x 203 mm) area. Waviness nit exceeding ± 1/32 in. (0.8 mm) per 6 in. (152 mm) is permissible as long as the overall flatness is not compromised.	FG-5220	Acceptability of this requirement was determined from a review of the associated CVI data, and also from the fact that these mounting frames were provided by a supplier that was on the evaluated supplier's list.	CC	CC	CC	CC
19 (I)	Surface Finish: Filter seating surfaces – 125 micro in. (0.003) AA, maximum, in accordance with ANSI Standard B46.1. Pits, roll scratches, weld splatter, and other surface defects within the sealing areas shall be ground smooth. After welding, ground areas shall merge smoothly with the surrounding base metal.	FG-5240	Acceptability of this requirement was determined from a review of the associated CVI data, and also from the fact that these mounting frames were provided by a supplier that was on the evaluated supplier's list.	CC	CC	CC	CC
20 (I)	Weld Inspection: Seal and structural weld shall be inspected in accordance with Article AA-6300.	FG-5300	Acceptability of this requirement was determined from a review of the associated CVI data, and also from the fact that these mounting frames were provided by a supplier that was on the evaluated supplier's list.	CC	CC	CC	CC
21 (I)	Coating Inspection: Coating, when required, shall be inspected per Subarticle AA-6500.	FG-5400	Acceptability of this requirement was determined from a review of the associated CVI data, and also from the fact that these mounting frames were provided by a supplier that was on the evaluated supplier's list.	CC	CC	CC	CC
	FABRICATION	FG-6000					
22 (F)	General: The fabrication and assembly of the mounting frames shall be performed in accordance with approved design drawings.	FG-6100	Acceptability of this requirement was determined from a review of the associated CVI data, and also from the fact that these mounting frames were provided by a supplier that was on the evaluated supplier's list.	CC	CC	CC	CC
23 (F)	Welding: All welding procedures and welder qualifications shall be in accordance with the requirements of Sub-article AA-6300.	FG-6200	Acceptability of this requirement was determined from a review of the associated CVI data, and also from the fact that these mounting frames were provided by a supplier that was on the evaluated supplier's list.	CC	CC	CC	CC

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				AN	AP	AW	SY
24 (F)	Clamping Devices: Required bolt or stud size ½ - 13–UNC or - 11-UNC.	FG-6300	Acceptability of this requirement was determined from a review of the associated CVI data, and also from the fact that these mounting frames were provided by a supplier that was on the evaluated supplier's list.	CC	CC	CC	CC
25 (F)	Cleaning: All surfaces shall be cleaned per Article AA-6000 prior to acceptance. No halogen bearing materials or carbon steel tools shall be used to clean frames constructed of stainless steel. Cleaning shall be performed in accordance with Manufacturer's written procedure.	FG-6400	Acceptability of this requirement was determined from a review of the associated CVI data, and also from the fact that these mounting frames were provided by a supplier that was on the evaluated supplier's list.	CC	CC	CC	CC
26 (F)	Coating: Coating of the frames, if applicable, shall be in accordance with Sub-article AA-6500.	FG-6500	Acceptability of this requirement was determined from a review of the associated CVI data, and also from the fact that these mounting frames were provided by a supplier that was on the evaluated supplier's list.	CC	CC	CC	CC
	PACKAGING AND SHIPPING	FG-7000					
27 (O)	General: Packaging and shipping of mounting frames shall be in accordance with ANSI/ASME NQA-2 Level D criteria if shipped by themselves. Mounting frames installed by the unit manufacturer in an air filtration unit shall be packaged and shipped in accordance with the Level assigned to the unit. See Article AA-7000 for general requirements.	FG-7000	Acceptability of this requirement was determined from a review of the associated CVI data, and also from the fact that these mounting frames were provided by a supplier that was on the evaluated supplier's list.	CC	CC	CC	CC
	QUALITY ASSURANCE	FG-8000					
28 (QA)	General: The mounting frame manufacturer shall establish and comply with a quality assurance program which complies with Article AA-8000.	FG-8000	Acceptability of this requirement was determined from a review of the associated CVI data, and also from the fact that these mounting frames were provided by a supplier that was on the evaluated supplier's list.	CC	CC	CC	CC
	NAMEPLATES	FG-9000					

Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air *Conditioning* Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: *(See Legend for Key)* AN	AP	AW	SY
29 (O)	General: The following information, as a minimum, shall be permanently marked on an accessible on-sealing surface of the mounting frame; (a) TYPE OF FRAME BY: (Manufacturer's name or symbol); (b) FRAME SERIAL NUMBER (or other identification); (c) PURCHASE ORDER NUMBER; (d) YEAR OF MANUFACTURE. This does not apply to frames installed as integral parts of air handling units or ducts. Any other stampings necessary shall be specified in the design specifications.	FG-9000	Acceptability of this requirement was determined from a review of the associated CVI data, and also from the fact that these mounting frames were provided by a supplier that was on the evaluated supplier's list.	CC	CC	CC	CC
	HEPA Filter Mounting Frames	Mandatory Appendix FG-I					
30	HEPA Filter Mounting Frame Dimensions: A minimum frame width of 4 in. is required for major and cross *members of face sealed HEPA filter frames. This allows a 1 in. wide* filter seating surface to compensate for any misalignment of the filter during installation, and allows a 2 in. space between filters horizontally and vertically, to give adequate room for clamping, handling, for use of power tools, or torque wrenches during filter change, and for manipulating a test probe between the units. The openings for HEPA filters shall be square within 1/16 in. and shall be 2 in. smaller than the filter size. See Table FC-4000-1 for filter sizes.	FG-I-1010	Acceptability of this requirement was determined from a review of the associated CVI data, and also from the fact that these mounting frames were provided by a supplier that was on the evaluated supplier's list.	CC	CC	CC	CC
31	HEPA Filter Clamping: HEPA filters are to be clamped with at least four pressure points. Each cell is to be independently clamped. The clamping device shall be designed with a factor of safety of four (4) at the required gasket compression load. If the filters are gasketed, the clamping shall produce a uniformity of gasket compression of 65% + 15%.	FG-I-1020	Acceptability of this requirement was determined from a review of the associated CVI data, and also from the fact that these mounting frames were provided by a supplier that was on the evaluated supplier's list.	CC	CC	CC	CC
32	Galling Prevention: Threaded surfaces in the region of clamping device movement shall be lubricated with a chemically compatible lubricant to prevent galling, as specified in the Design Specification, or the clamping device nuts shall be of a dissimilar metal that is environmentally and structurally *compatible with the threaded surface.*	FG-I-1021	Acceptability of this requirement was determined from a review of the associated CVI data, and also from the fact that these mounting frames were provided by a supplier that was on the evaluated supplier's list.	CC	CC	CC	CC
33	Filter Support: Supports or cradles are required for HEPA filters to facilitate installations. The supports shall permit inspection of the filter-to-frame interface when the filter is installed.	FG-I-1030	Acceptability of this requirement was determined from a review of the associated CVI data, and also from the fact that these mounting frames were provided by a supplier that was on the evaluated supplier's list.	CC	CC	CC	CC

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34	Penetrations: No penetration of HEPA filter mounting frames is allowed.	FG-I-1040	Acceptability of this requirement was determined from a review of the associated CVI data, and also from the fact that these mounting frames were provided by a supplier that was on the evaluated supplier's list.	CC	CC	CC	CC
	Type II Adsorber Cell Mounting Frames	Mandatory Appendix FG-II					
35	Mounting Frame Dimensions: Mounting frame dimensions for installing Type II adsorber cells shall be: openings – 6-3/8 x 24-1/8 in. (+1/8, -0) Space between openings – vertical 4 in. min.	FG-II-1000	Acceptability of this requirement was determined from a review of the associated CVI data, and also from the fact that these mounting frames were provided by a supplier that was on the evaluated supplier's list.	CC	CC	CC	CC
36	Clamping: *Type II adsorbers are to be clamped with at least four pressure* points. Major requirements for filter clamping systems are magnitude and uniformity of clamping. Each cell is to be independently clamped. The clamping device shall be designed with a factor of safety of four (4) at the required gasket compression of 65% +15% of the original gasket thickness. Clamping shall be accomplished in the first 3 ½ in. of the right and left sides of the adsorber face plate and within 1 in. of the top and bottom edge of the face plate (to avoid interference with handles).	FG-II-1100	Acceptability of this requirement was *determined from a review of the associated* CVI data, and also from the fact that these mounting frames were provided by a supplier that was on the evaluated supplier's list.	CC	CC	CC	CC
37	Galling Prevention: Threaded surfaces in the region of clamping device movement shall be lubricated with a chemically compatible lubricant to prevent galling, as specified in the Design Specification, or the clamping device nuts shall be of a dissimilar metal that is environmentally and structurally compatible with the threaded surface.	FG-II-1110	Acceptability of this requirement was determined from a review of the associated CVI data, and also from the fact that these mounting frames were provided by a supplier that was on the evaluated supplier's list.	CC	CC	CC	CC
38	Sealing: Type II adsorber cells employing gaskets for sealing to the frame shall be by a method which will produce a gasket compression-deflection of at least 65% + 15% without exceeding a stress in the *clamping device of 67% of its yield strength.*	FG-II-1200	Acceptability of this requirement was determined from a review of the associated CVI data, and also from the fact that these mounting frames were provided by a *supplier that was on the evaluated* supplier's list.	CC	CC	CC	CC
39	Adsorber Support: A structure is required behind the Type II adsorber frame openings to support the weight of the cells. Structure minimum length is 30 in., and shall be built without backstops.	FG-II-1300	Acceptability of this requirement was determined from a review of the associated CVI data, and also from the fact that these mounting frames were provided by a supplier that was on the evaluated supplier's list.	CC	CC	CC	CC

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40	Penetrations: Any penetration in the mounting frames shall be seal welded and isolatable.	FG-II-1400	Acceptability of this requirement was determined from a review of the associated CVI data, and also from the fact that these mounting frames were provided by a supplier that was on the evaluated supplier's list.	CC	CC	CC	CC

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Attachment 16

ASME AG-1 Section IA

Compliance Matrix

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				AN	AP	AW	SY
	SECTION IA: Instrumentation and Controls	IA					
	MATERIALS	IA-3000					
1 (D,P)	Materials of Construction: All materials used shall have properties and composition suitable for the application as defined by the Design Specification and the operating environmental conditions as defined in Subarticle IA-4120. Materials shall be in conformance with the latest revision of the ASME and ASTM materials listed in Table IA-3100. Substitute materials shall be equivalent to or exceed the requirements in Table IA-3100. Materials that are part of the pressure boundary or support equipment shall meet the structural requirements of Article AA-4000.	IA-3100	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
2 (D,P)	Nonpermissable Materials: Use of the following materials is prohibited in the manufacture and installation of instrumentation and controls in nuclear air and gas treatment systems: (a) mercury (b) radiologically unstable fluorinated polymers (c) asbestos	IA-3200	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
3 (D,P)	Restricted Materials: All material shall be compatible with the operating environment. The following material shall not be used unless approved by the Owner or his designee: (a) Aluminum and zinc in the presence of corrosive vapors (b) Adjoining materials which may cause galvanic corrosion. (c) Chlorine producing materials, e.g. Polyvinylchloride (PVC).	IA-3300	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
4 (D,P)	Certification of Material: The Manufacturer shall make available a Certificate of Conformance for panel structural material and tubing to the ASTM numbers listed in Table IA-3100. For those materials which do not have ASTM ratings, testing should be performed per ASTM A370. All other components used in the construction of the panel assembly shall be provided with a Manufacturer's Certificate of Compliance to the requirements in the Design Specification.	IA-3400	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
	DESIGN REQUIREMENTS	IA-4000					

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				AN	AP	AW	SY
5 (D)	Design Specification: The Design Specification shall establish the purpose (design function) of the instrumentation and control components. The Design Specification shall also identify the instrumentation and control component safety classifications. For guidance in determining instrumentation and controls for nuclear air and gas treatment systems refer to Nonmandatory Appendix IA-C. The Design Specification shall provide requirements for the design, fabrication, and selection of instrumentation and control systems in accordance with this Code and shall include, as applicable: (a) Performance requirements for all plant operating modes (accident and normal) wherein the equipment is expected to perform an intended function. (b) Ambient and process operating conditions including the measured variable for each of the applicable operating modes *described in Subarticle* IA-4120(a). (1) Temperature: the minimum and maximum temperatures to which the instrumentation and control system devices will be subjected. (2) Pressure: the minimum and maximum pressures to which the instrumentation and control system devices will be subjected. (3) Relative Humidity: the minimum and maximum relative humidities to which the instrumentation and control system devices will be subjected. (4) Radiation – alpha, beta, and gamma: the cumulative dosage levels and maximum dose rates to which the equipment will be subjected. (5) Chemicals: concentration and duration of chemical exposure to which the equipment will be subjected. (6) Electrical: all electrical power transients to which the instrumentation and control system devices may be subjected. Variations in parameters such as voltage, frequency, and current shall include minimum and maximum values and their duration. (7) Structural: structural loads to which the instrumentation and control system components will be subjected. The loads shall include as a minimum the applicable loads listed in para. AA-4211.	IA-4120	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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6 (D)	Manufacturer's Documentation Requirements: When required by the Design Specification, documentation provided by the Manufacturer to the Owner or his designee shall include the following, as applicable: (a) mounting connection details (b) weight and center of gravity (c) service connections, size, type, and locations (d) materials of construction (e) design life (f) environmental and seismic qualifications (g) mounting restrictions and instructions (h) loop and logic diagrams (i) electric schematic and wiring drawings (j) panel general arrangement and construction drawings (k) instrument piping and tubing drawings (l) Certificate of Conformance (m) Calibration procedures and data (n) Panel mounted instrument list including nameplate engraving (o) Maintenance and surveillance requirements	IA-4130	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
7 (D)	Clarification of Code Applicability: Pressure retaining part whose design, materials, manufacture, test, and documentation are covered by ASME Section III shall be in accordance with the applicable requirements of that Code. When conflict exists between this Section and ASME Section III, the latter shall take precedence.	IA-4140	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
8 (D)	Single Failure Criteria: Where redundant safety channels are required by the Design Specification, they shall meet the single failure requirements of ANSI/IEEE 379.	IA-4200	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
	Separation Criteria	IA-4300					
9 (D)	Physical separation of nuclear safety-related circuits and devices shall be in accordance with IEEE Standards 384.	IA-4311	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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10 (D,C)	Instrument Cables, including but not limited to computer, transducer, thermocouple, resistance temperature detector, or other low level signal cables shall be installed in separate raceways from power-carrying cables.	IA-4312	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
11 (D,C)	Instrument sensing lines and interconnecting tubing for redundant safety channels shall be routed a minimum of 18 in. apart from each other, in areas free of or protected from missiles, high-energy jet streams, and pipe whips.	IA-4321	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
12 (D,C)	Where 18 in. of separation cannot be maintained each line shall be separated by a barrier extending at least 1 in. beyond the line of sight between redundant sensing lines. The design and installation of separation barrier shall be in accordance with the requirements of Article AA-4000.	IA-4322	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
13 (D,C)	Tubing shall not rest against surfaces that can cause wear or mechanical damage.	IA-4323	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
14 (D,C)	Sensing lines shall be routed to ensure that the intended function is not jeopardized due to high vibration, abnormal temperature or stresses due to thermal expansion.	IA-4324	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
15 (D)	Divisional separation of permanently filled capillaries, sensing lines and interconnecting tubing for nuclear safety-related devices shall be identified by color coding and tagging, as a minimum, at both ends.	IA-4325	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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				AN	AP	AW	SY
16 (D,C)	Redundant tubing inside panels shall be separated by a minimum of 1 in.	IA-4326	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
17 (D,C)	Qualification of Equipment: All components shall be operable when exposed to the range of operating conditions specified during normal and accident conditions. Manufacturer installation and maintenance requirements that are needed to maintain qualification of the equipment shall be identified by the Manufacturer and followed in the qualification program.	IA-4400	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
18 (D)	Normal Operating Conditions: All components shall be specified, manufactured, and qualified to ensure operation within performance limits (e.g., accuracy) when exposed to their normal operating conditions. Normal operating conditions include but are not limited to exposure to the following: temperature, pressure, humidity, vibration, chemicals, power levels and fluctuations, radiation.	IA-4410	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
19 (D)	Environmental Qualification: Safety related components operating in a harsh environment (as defined in 10CFR50.49) shall be qualified in accordance with IEEE Standard 323.	IA-4420	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
20 (D)	Seismic Qualification: Safety related components and mounting shall be seismically qualified using the guidelines of IEEE Standard 344 to the Owner's required response spectra, plus applicable amplification factors, for the components location and mounting. Components that do not perform a safety-related function but must retain their structural integrity so as not to damage, degrade or interfere with the performance of safety functions by any safety related equipment or components shall maintain their structural integrity when subjected to applicable seismic loads.	IA-4430	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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				AN	AP	AW	SY
21 (D,QA)	Qualification Documentation: The Owner shall have documentation demonstrating the qualification of components and showing the Owner's acceptance of the qualification testing and results.	IA-4440	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
	Panels	IA-4500					
22 (D)	Control panels shall be designed to support and protect the nuclear safety-related instrumentation and controls and to facilitate the monitoring and control of the mechanical equipment operation and performance.	IA-4511	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
23 (D)	Instrumentation and control devices on the front and the inside of control panels shall be arranged in accordance with the requirements of ISA-RP60.3.	IA-4512	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
24 (D)	Temperature limits inside a control panel shall be maintained within the allowable specified design temperature range for all components mounted inside the panel.	IA-4513	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
25 (D)	Material for enclosures, stiffeners, braces, supports and frames shall be selected to meet the structural design requirements of Article AA-4000.	IA-4521	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
26 (D,C)	Support shall be provided for incoming cables, wiring, piping, and other appurtenances.	IA-4522	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
27 (D)	Subpanels and brackets for mounting instruments shall meet the structural loads and load combinations set forth by the Design Specification.	IA-4523	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
28 (D)	Panels weighing over 200lbs shall be provided with removable lifting eyes or other means as required for loading, unloading, and moving the panels to their final installation location.	IA-4524	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
29 (D)	All tubing, wire troughs or raceways used in the panel shall be of the metallic type or shall be manufactured from fire retardant or self-extinguishing material. Nonmetallic components and devices shall be manufactured from self-extinguishing materials, as classified by ASTM Standard D635, Standard Method of Test for Flammability of Self-Supportive Plastics.	IA-4525	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
30 (D)	Panels shall be provided with an integral mounting plate or a separate structural channel member, as required by the Design Specification, to facilitate the mounting of panels on imbedment plates or anchor bolts provided in walls or floors.	IA-4526	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
31 (D,C)	Wiring bundles shall be supported by such devices as clamps, straps, wire ties, wirewrap, etc. Uninsulated metallic/wire ties shall not be used.	IA-4531	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
32 (D,C)	Insulating grommets shall be installed through all openings provided in partitions for the passage of wires or cables.	IA-4532	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
33 (D,C)	Where a cable crosses a panel hinge, multi-stranded flexible wire shall be used. The cable shall also be secured on each side of the hinge, protected from damage.	IA-4533	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
34 (D,C)	Both ends of each wire shall be marked with color-coded wire markers as required by the Design Specification.	IA-4534	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
35 (D)	All wiring shall have current capacity, mechanical strength, thermal rating, and insulation characteristics to meet the circuit and installation requirements required by the Design Specification and NFPA 70, para. 384-9. The wire insulation and Class 1E cables shall meet the requirements of ANSI/IEEE 383.	IA-4535	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
36 (D,C)	Terminal blocks shall be installed on subpanels for terminating cables entering and leaving the panels, except that wire leads from thermocouples and certain other temperature-detecting devices may be brought directly to the terminal blocks in the instrument cases.	IA-4536	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
37 (D,C)	Terminal blocks shall be provided with a marking strip, and terminals shall be clearly identified.	IA-4537	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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				AN	AP	AW	SY
38 (D,C)	The terminal blocks used for the termination of power voltage circuits, the control voltage circuits, and signal circuits (low voltage or current) shall be physically separate from each other.	IA-4538	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
39 (D,C)	The control panel and its appurtenant equipment shall be connected to a ground bus inside the panel for personal safety. The method of grounding shall not compromise the independence of the redundant safety-related instruments and shall be in accordance with IEEE 1050. A method of terminating to the Owner's station ground bus shall be provided.	IA-4539	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
40 (D,C)	Power supplies within control panels shall be provided with branch circuit overload protection and a means to disconnect incoming power.	IA-4541	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
41 (D,C)	Fuses shall be installed in locations free from obstructions.	IA-4542	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
42 (D)	Fuses shall be sized to limit fault currents within the requirements of the cable insulation.	IA-4543	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
43 (D)	Process sensing lines, fittings and valves installed within panels shall meet the requirements of Subarticle IA-4600.	IA-4551	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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				AN	AP	AW	SY
44 (D)	All non-process piping, tubing, or valves installed inside panels shall be in accordance with ANSI B31.1 unless otherwise required by the Design Specification.	IA-4552	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
45 (D,C)	Tubing bends shall be smooth and formed to avoid flattened, kinked, or wrinkled bends.	IA-4553	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
46 (D,C)	Panel piping or tubing installation shall not interfere with panel mounted instrument removal or access to the instrument for maintenance purposes.	IA-4554	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
47 (D,C)	Isolation valves and test connections shall be installed in an easily accessible location to allow in-place calibration of all instrumentation.	IA-4555	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
48 (D,C)	Isolation valves shall not be solely supported by the instrument tubing. Isolation valve supports shall be secured to the panel structure or substructure to prevent torque being applied to the tubing.	IA-4556	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
49 (D,C)	Bulkhead fittings shall be used for termination of the control tubing from inside and outside of the panel.	IA-4557	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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50 (D)	Instrument lines shall have permanent tags on both ends where required to assure proper identification. The type of material, color coding, and method of tagging shall be as required by the Design Specification.	IA-4558	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
51 (D)	Where required, pressure reducing valves, complete with isolation valves, relief valves, and gauges, shall be installed inside the panel to provide a regulated instrument air supply to an instrument air header.	IA-4561	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
52 (D)	The instrument air header shall be provided with isolation valves for each branch line.	IA-4562	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
53 (D)	Permanent nameplates shall be installed on control panels to designate instrument function and tag number. Nameplates shall be in accordance with ISA-RP60.6 or the Owner's requirements.	IA-4570	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
54 (D,C)	Mounted Instruments and Sensors: Instruments shall not be mounted in locations where their performance will be adversely affected by equipment vibration. Instrument chassis and attached capillary tubing shall be supported to meet the seismic requirements for their particular location.	IA-4600	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
55 (D)	Interconnecting Wiring for Skid Mounted Components: Interconnecting circuits between components mounted on a skid shall meet the requirements of the National Electric Code, Sections 250-59 and 250-95, and paras. IA-4534 and IA-4535.	IA-4700	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
	Instrument Sensing Lines and Field-Installed Tubing	IA-4800					
56 (D,C)	Instrument piping , tubing, isolation valves, and permanently filled capillaries in systems designed to ASME Section III shall be designed and constructed to the requirements of ISA Standard S67.02 as supplemented below: (a) Instrument sensing lines that are connected to Class 2 process piping or vessels shall not be less than Class 2 Seismic Category I from their connections to the process piping or vessel to and including the accessible isolation valve. (b) Instrument sensing lines that are connected to Class 2 processing piping or vessels and that are used to actuate or monitor safety related systems shall not be less than Class 2 Seismic Category I from their connections to the process piping or vessel to the sensing instrumentation. (c) Instrument sensing lines that are connected to Class 3 *processing piping or vessels and that are used to actuate or* monitor safety related systems shall not be less than Class 3 Seismic Category I from their connections to the process piping or vessel to the sensing instrumentation.	IA-4811	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
57 (D)	Instrument sensing lines not connected to ASME Section III Class 2 or 3 piping, vessels or ductwork shall meet the requirements of ANSI B31.1.	IA-4812	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
58 (D)	Fitting material shall be compatible with the tube or pipe material to avoid galvanic corrosion and provide acceptable soldering or brazing joints.	IA-4813	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
59 (D)	Tube Pitch and Condensate Trap: Where the potential for condensation or oil migration exists, condensate or oil traps with valved drain legs shall be provided at the low points of the tubing.	IA-4820	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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60 (D,C)	Sensing lines and tubing shall be installed in a continuous support system such as metal trays wherever practical. Sensing lines and tubing shall be run along walls, columns and ceilings to avoid damage by pipe whip, missiles. Jet forces or falling objects.	IA-4831	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
61 (D)	The support system for instrument sensing or interconnecting lines shall be taken into account in the tray or duct hanger loading requirements.	IA-4832	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
62 (D)	Supports for nuclear safety-related sensing lines shall be designed using the requirements of Article AA-4000.	IA-4833	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
63 (D)	Loads such as thermal expansion and weight of insulation shall be evaluated in accordance with para. AA-4212 for instrument tubing.	IA-4834	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
64 (D,C)	Root valves shall be located in the vicinity of the point of connection to the process pipe or duct.	IA-4841	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
65 (D,C)	Isolation valves and test connections shall be installed in a location to allow in-place calibration of instrumentation.	IA-4842	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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				AN	AP	AW	SY
	Instrument Setpoints	IA-4900					
66 (D)	The Owner shall establish setpoints for nuclear safety-related air and gas treatment systems with allowance for loop inaccuracy and have provision for margin to assure that systems perform within their design limits.	IA-4910	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
67 (D)	Safety-related setpoints and loop error determinations shall be determined using the methodology of ISA Standard S67.04.	IA-4920	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
	INSPECTION AND TESTING	IA-5000					
68 (I,T)	Inspection and testing of instrumentation and control components shall be in accordance with IEEE 336. In addition, the requirements of Article AA-5000 supplemented by the following shall apply.	IA-5100	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
69 (I,T)	Written procedures with acceptance criteria for visual examination, inspection and functional testing shall be developed in accordance with Subarticle AA-5120 and Article TA-3000 for instrumentation and control components.	IA-5111	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
70 (I,T)	The procedures shall be reviewed and approved by the Owner or designee.	IA-5112	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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71 (I,T)	Test Reports: After inspection and testing is completed a written test report shall be prepared by personnel performing the test in accordance with Subarticle AA-5250.	IA-5120	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
72 (I)	Visual Inspection: Visual inspection shall be performed in accordance with a written checklist per Subarticle AA-5240. For example of a checklist see Nonmandatory Appendix IA-B.	IA-5200	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
73 (I)	Methods of Visual Examination: *Visual examination shall be performed by either method of direct* visual or remote visual examination in accordance with Subarticle AA-5220.	IA-5220	Documentation to verify this requirement *was not available for review for systems* AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
7 (I)	Written Procedures: Visual examination shall be performed in accordance with approved written procedures.	IA-5230	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
75 (T)	Calibration and Testing: Manufacturer's calibration and test instrumentation shall be in accordance with Article TA-3000 and traceable to NIST.	IA-5300	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
76 (T)	All instruments and devices shall be calibrated and tested in accordance with the procedures developed for para. IA-5111.	IA-5311	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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77 (T)	Wiring for control power shall be subjected to a Megger test at the panel assembly facility. Megger or other high voltage test shall not be applied to instrumentation or shielded cables.	IA-5312	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
78 (T)	An electrical continuity test shall be performed to demonstrate the correctness of the wiring termination of all panel mounted instruments. Functional tests shall be performed in accordance with written test procedures approved by the Owner or designee.	IA-5313	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
79 (T)	All local mounted instruments and devices shall be calibrated and tested in accordance with the Manufacturer's calibration and test procedures and the procedures developed for para. IA-5111.	IA-5321	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
80 (T)	Pressure testing of pneumatic control circuits shall be performed in accordance with ISA Standard RP7.1.	IA-5331	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
81 (T)	Pressure testing of sensing lines shall be performed in accordance with ANSI/ASME B31.1 or ASME Section III as applicable	IA-5332	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
	PANEL FABRICATION AND ASSEMBLY	IA-6000					

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				AN	AP	AW	SY
82 (F)	General Requirements: In addition to the requirements of Article A-6000, the following requirements shall apply.	IA-6100	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
83 (D,P,F)	Materials: Materials to be used in the fabrication of control panels, instruments, devices, components, parts, sensing lines; and support systems, anchors and bolts shall conform to the requirements of Article IA-3000.	IA-6111.1	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
84 (D,P,F)	Materials: Thickness of plate material for the enclosure skin, stiffeners braces, and frame shall be selected to meet the structural loadings and applicable seismic requirements of Article IA-4000 and the Design Specification.	IA-6111.2	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
85 (F)	Repair of materials and surfaces with defects shall be performed in accordance with para. AA-6123.	IA-6112	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
	Fabrication Process	IA-6200					
86 (F)	Cutting, forming, and bending shall be in accordance with Sub-article AA-6210.	IA-6210	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key)			
				AN	AP	AW	SY
87 (F)	Thermal cutting shall be in accordance with para. AA-6212	IA-6211	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
88 (F)	Panel Fabrication by Welding: When the control panel enclosure is fabricated by welding more than one piece of sheet steel, the welding joint shall be made in accordance with the requirements of Sub-article AA-6300. Warping or distortion from cutting, punching or welding operations shall not extend beyond the outer edge of the panel mounted device.	IA-6212.1	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
89 (F)	Panel Fabrication by Welding: The control panel shall be all welded sheet steel or plate construction. Reinforcing shall be provided so that the deflection due to the added weight of the instruments will not exceed 0.125 in. for any 4 ft of panel surface.	IA-6212.2	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
90 (F)	Fittings and Aligning: Fitting and aligning shall be in accordance with Sub-article AA-6230.	IA-6220	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
9 (F)	Mechanical Joints: Mechanical joints shall be in accordance with Sub-article AA-6230.	IA-6230	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
92 (F)	Welding: Welding shall be in accordance with Sub-article AA-6300.	IA-6300	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

Best Available Image

Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
93 (F)	Brazing: Brazing shall be in accordance with Sub-article AA-6400.	IA-6400	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
94 (F)	Cleaning and Coating: Cleaning and coating shall be in accordance with Sub-article AA-6500.	IA-6500	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
95 (F)	Installation Requirements – Handling and Rigging: Handling and rigging shall be in accordance with Sub-article AA-6610.	IA-6600	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
96 (F,P,QA)	Material Identification: Materials of construction of the control panel shall be as specified by the Owner or designee. A Certificate of Conformance shall be supplied as required by the Design Specification and Sub-article IA-3400.	IA-6700	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
	PACKAGING, SHIPPING, RECEIVING, STORAGE, AND HANDLING	IA-7000					
97 (O)	General Requirements: Packaging, shipping, receiving, storage, and handling of all control panels, instrumentation, and accessories shall be in accordance with Article AA-7000 and ANSI/ASME NQA-2, Part 2.2. Any control panel made of items requiring different levels of handling shall be classified to the highest level designated for any of the respective items.	IA-7100	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

Best Available Image

Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key)			
				AN	AP	AW	SY
98 (O)	Packaging: All control panels and sensitive instrumentation (if packaged separately) shall meet the requirements of packaging level B in accordance with ANSI/ASME NQA-2, Part 2.2 paras. 2.2.2 and 3.2.2. When bulk accessories are packaged separately (i.e., valves, sensing lines, instrument cables) the packaging shall meet the requirements of packaging level C in accordance with ANSI/ASME NQA-2, Part 2.2 paras. 2.2.3 and 3.2.3. Identification and marking on the outside of all packages shall be maintained and weather-proofed.	IA-7200	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
99 (O)	Shipping: The mode of transportation used shall be consistent with the protection classification of the item and with the packaging method employed.	IA-7300	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
100 (I,O)	Inspection (Receiving): Preliminary visual inspection shall be performed prior to or immediately after unloading to determine if any damage occurred during shipping. Unless the packaging marking prohibits unpacking, the contents of all shipments shall be visually inspected to verify that the specified packaging and shipping requirements have been maintained. The inspection shall be performed in an area equivalent to the level of storage requirement for the item (see Sub-article IA-7500).	IA-7410	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
101 (O)	Disposition: Packages shall be controlled in accordance with ASME NQA-1.	IA-7420	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No./Ops. Step	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
102 (O)	Storage: Control panels and sensitive instruments shall be stored indoors. This area shall have paved floor or equal and shall not be subject to flooding. The area shall be well ventilated and shall be provided with uniform temperature control to prevent condensation and corrosion. Original packaging is recommended if item is to be stored for a long period of time. Miscellaneous accessories such as valves, sensing lines, and instrument cables shall be stored as described above, except that temperature control is not required. All items shall be plainly marked so that they are easily identified, and shall be stored in a manner as to permit ready access for inspection, maintenance, or retrieval without excessive handling to minimize risk of damage.	IA-7500	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
	QUALITY ASSURANCE REQUIREMENTS	IA-8000					
103 (QA)	General: Quality assurance for instrumentation and controls shall be in accordance with the requirements of Article AA-8000 and the requirements below.	IA-8100	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
104 (QA)	Test Reports and Data: The following test reports and data supporting the design and installation of instrumentation and control devices used in nuclear facilities air and gas treatment systems shall be maintained in records: (1) All records and procedures that are required to be maintained by ANSI B31.1 for the portion of installation designed to ANSI B31.1 and ASME Section III for the portions of installation designed to ANSI B31.1 and ASME Section III. (2) Documentation as identified in Sub-articles IA-4130 and IA-4440.	IA-8210 IA-8211 IA-8212	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
	NAMEPLATES	IA-9000					
105 (O)	General: Permanent types of nameplates shall be designed, manufactured, and installed in accordance with the requirements of Article AA-9000 and the requirements below.	IA-9100	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No./Ops. Step	Division II -- Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key)			
				AN	AP	AW	SY
106 (O)	Requirements: Each instrument and control device shall be provided with a permanent type of Manufacturer's nameplate.	IA-9200	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
10 (O)	Nameplate (Material): Nameplates supplied and installed by the manufacturer shall be made from noncorrosive material.	IA-9310	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
108 (O)	Nameplate (Size): Nameplates shall be sized to accommodate all pertinent information.	IA-9320	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
109 (O)	Information: The following information shall be stamped or engraved on each nameplate in lieu of requirements of Sub-article AA-9120: (a) Manufacturer; (b) Model or catalog number; (c) Serial number; (d) Range.	IA-9330	Documentation to verify this requirement was not available for review for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Attachment 17

ASME AG-1 Section TA

Compliance Matrix

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Rqmt No.Ops. Step	Division IV – Testing Procedures Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
	SECTION TA: Field Testing of Air Treatment Systems	TA					
	GENERAL INSPECTION AND TEST REQUIREMENTS	TA-3000					
1 (T)	General: All inspections and tests shall be conducted in accordance with these requirements and the specific requirements of TA-4000.	TA-3010	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
2 (T,QA)	Test Instruments: A calibration program shall be established in accordance with the Owner's Quality Assurance Program. All permanent and temporary test instruments used in the conduct of tests required by TA-4000 shall be in calibration. Instrument accuracy shall meet or exceed the requirements of Table TA-3000-1.	TA-3100	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
3 (T)	Range Requirements: The full-scale range of instruments shall be limited as necessary to ensure that the readings are within the accuracy requirements of Table TA-3000-1.	TA-3110	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
4 (T)	Instrument Fluctuation: Symmetrical damping devices or averaging techniques may be used to reduce random signal fluctuations. Hydraulic instruments may be damped by using gauge snubbers or by throttling valves in instrument lines.	TA-3120	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

Rqmt No.Ops. Step	Division IV – Testing Procedures Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
5 (T)	Evaluation Following Test Instrument Loss, Damage, or Calibration Failure: When a test instrument is lost, damaged, or otherwise fails to meet the requirements of Table TA-3000-1 during calibration, all test results obtained using the instrument shall be evaluated, dating back to the time of the previous calibration. If the evaluation does not confirm that the instrument met the acceptance criteria for the test(s) in question, the test(s) shall be repeated with calibrated instruments.	TA-3130	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
	Specific Instrument Accuracy Requirements	TA-3140					
6 (T)	Vibration Instrument: Vibration instrument accuracy shall be at least +/-10%. The minimum frequency response range of the vibration measuring instrument shall be approximately one third of the minimum shaft speed. For rotating components, the maximum frequency response range shall be at least two times the rotational shaft speed of the component being measured. For reciprocating components, the maximum frequency response range shall be at least two times the sped of the crankshaft, times the number of unique planes occupied by a piston throw.	TA-3141	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
7 (T,QA)	Challenge Aerosol Measuring Instrument: The Challenge Aerosol Measuring Instrument shall be verified to have a linear range of at least 10^5 times the minimum detectable quantity of the instrument with an accuracy in accordance with the Facility Project Specifications and Owner's Quality Assurance Program.	TA-3142	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
8 (T,QA)	Challenge Gas Measuring Instrument: The Challenge gas Measuring Instrument shall be verified to be capable of distinguishing challenge gas from background and measuring challenge gas over a linear range of at least 10^5 times the minimum detectable quantity of the instrument with an accuracy in accordance with the Facility Project Specifications and Owner's Quality Assurance Program.	TA-3143	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No.Ops. Step	Division IV – Testing Procedures Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
9 (D,T)	Establishment of Reference Values: Reference values shall be determined from results achieved during acceptance testing (seeTA-4000), when a component or system is proven to be operating within the acceptable limits of the Owner's Design Specification. Operating tests and inspections specified in TA-4000 shall be observed, measured, or calculated under conditions readily reproducible during subsequent in-service tests to allow for direct comparison of test results. All test results and associated analyses shall be included in the test procedure documentation (see TA-6300).	TA-3210	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
10 (I,T)	Inspections and Test Requirements: Acceptance tests shall be conducted following initial component installation but prior to releasing the system for normal operations. Applicable acceptance tests shall also be used to obtain new reference values and verify design function following component replacement, repair, modification, or maintenance. Equipment shall be evaluated as separate components and as functioning parts of an integrated system. The Owner shall define system test boundaries and evaluate system performance with respect to system functional requirements in accordance with the Owner's Design Specifications. Field acceptance tests shall be implemented as applicable and in accordance with this Section. Test designations associated with tests required by TA-4000 are listed in Table TA-3000-2. Within the context of TA-4000, when a test is not associated with a designator it shall be considered a prudent action and not a test requirement.	TA-3300	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
11 (I,T)	Inspection and Test Parameters: Parameters which need to be observed, calculated, and recorded in order to meet the requirements of this Section shall be identified for each system based on the functional requirements of the Owner's Design Specification and shall be included in the test procedure documentation (see TA-6300).	TA-3310	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

Rqmt No.Ops. Step	Division IV – Testing Procedures Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
12 (T)	System Operating Conditions: Operating conditions required for acceptance testing shall be determined for each system. These conditions and acceptance criteria shall be based on the requirements of the Owner's Design Specification and shall be included in the test procedure documentation (see TA-6300).	TA-3320	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
13 (T)	Procedure Requirements: The Owner shall be responsible for the development and implementation of written test procedures that meet the requirements of this section. Each equipment test section consists of generic (see TA-3400) and specific (see TA-4000) test requirements and acceptance criteria which apply to each of the systems in the facility. *The Owner shall document which requirements are applicable in the* test procedure documentation (see TA-6300).	TA-3330	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review *however, based on past operating* performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
14 (T)	Test Reports: Test reports shall be prepared in accordance with TA-6300.	TA-3340	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
15 (T)	Generic Tests: Generic Tests as specified in TA-3410 through TA-3433 shall be used in Article TA-4000 where applicable.	TA-3400	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this *requirement was not available for review* however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No.Ops. Step	Division IV – Testing Procedures Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
16 (I)	Visual Inspections (VT): Visual inspections shall be conducted in accordance with AA-5000 and the applicable portions of Mandatory Appendix TA-I. Field acceptance visual inspections, required in TA-4000, shall include verification of component installation in accordance with the Owner's Design Specification and the applicable sections of this Code. Acceptance inspections shall be conducted prior to releasing the equipment for normal operation.	TA-3410	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
17 (T)	Pressure Boundary Tests: Pressure boundary tests consist of hydrostatic (or pneumatic) tests for hydraulic systems, leak tests for refrigerant systems, and structural capability and leak tests for ducts and housings, including fan and damper housings.	TA-3420	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
18 (T)	Hydrostatic Tests (HYD): Hydrostatic tests shall be conducted at the hydrostatic pressure defined by the Owner and shall verify that he component will not rupture, leak, or be permanently deformed under design pressure loads. Testing shall be conducted in accordance with the design codes used in the Owner's Design Specification (e.g., ASME B31.1). Pneumatic testing may be used in lieu of water where allowed by the applicable codes and in the Owner's Design Specification.	TA-3421	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
19 (T)	Structural Capability Test (PS): Structural capability test shall be conducted at the structural capability pressure defined by the Owner's Design Specification and shall verify that the component will not rupture or be permanently deformed under design pressure loads. Testing shall be conducted in accordance with Mandatory Appendix TA-II.	TA-3422	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No.Ops. Step	Division IV – Testing Procedures *Requirement Text*	Rqmt Source / Sec #	*Rqmt Compliance*	Status Indicators: (See Legend for Key) AN	AP	AW	SY
20 (T)	Leak Test, Duct, Housing, and Frames (PL): Leak tests for duct and housing sections shall be conducted using either the pressure decay method or the constant pressure method to verify that the leak rate for duct or housing does not exceed the allowable limit established for the system. Testing shall be conducted in accordance with Mandatory Appendix TA-III. Leak testing performed to satisfy Section SA of this Code may be used to meet these test requirements when the test method is compatible with Mandatory Appendix TA-III. An optional leak test for HEPA filter and adsorber mounting frames is authorized to be conducted in conjunction with the housing leak test by blanking off the frame openings and pressurizing the isolated test boundary. This procedure is useful for detecting small leaks in the mounting frame during acceptance testing. This test is used to verify that there are no defects in a frame that may cause failure of the in-place leak test. Testing should be conducted in accordance with Nonmandatory Appendix TA-A.	TA-3423	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
21 (T)	Leak Test, Refrigeration Piping and Coils (PL): Leak tests of refrigerant piping and coils shall be conducted in accordance with Mandatory Appendix TA-VIII.	TA-3424	This requirement is not applicable. There are no refrigerants associated with these HVAC systems.	NA	NA	NA	NA
22 (T)	Functional Tests (F): A functional test shall be used to verify mechanical and system performance parameters of equipment. Functional tests include component and system tests as required in Article TA-4000. Component functional tests are used to verify the operational readiness of individual components. Integrated system functional tests are used to verify that all of the system components will operate together under normal operating or simulated conditions and will meet all of the performance requirements of the Owner's Design Specification.	TA-3430	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
23 (D,T)	Test Conditions: Equipment shall be tested within the normal operating range specified in the Owner's Design Specification except as otherwise specified in TA-4000.	TA-3431	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No.Ops. Step	Division IV – Testing Procedures Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
24 (T)	Restoration of Function Following Testing: Mechanical and electrical equipment status shall be restored as required by plant conditions and according to approved procedures following completion of any test.	TA-3432	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
25 (T)	Vibration Test (Vb): Vibration measurements shall be taken on the accessible motor, fan, compressor, and pump bearing housings in at least two different orthogonal planes approximately perpendicular to the line of the rotation shaft. When the bearing housing is not accessible, the frame of the component may be used if it will be representative of bearing *housing vibration. When portable vibration instruments are used,* reference points shall be clearly identified on the component being measured to permit duplication in both location and plane.	TA-3433	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review *however, based on past operating* performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
26 (T)	Acceptance Criteria: Results of tests described on Article TA-4000 shall be subject to the acceptance criteria in TA-3510 through TA-3530 and to the applicable *operating and design criteria* specified by the Owner's Design Specification. Acceptance criteria are specified in TA-4000 only when they affect the quality of other tests. When test results do not met the applicable acceptance criteria, the corrective actions required by TA-5000 shall be initiated.	TA-3500	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
27 (I)	Visual Inspection: Visual inspections are acceptable when there are no visual indications of improper installation, physical damage, structural distress or degradation that would impair the ability of a component or system to perform its intended function.	TA-3510	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No.Ops. Step	Division IV – Testing Procedures Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
28 (T)	Pressure Boundary Tests: Pressure boundary tests are acceptable when there is no permanent structural deformation or leaks in excess of the limits specified in the applicable sections of this Code and the Owner's Design Specification.	TA-3520	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
29 (T)	Functional Tests: Functional tests are acceptable when they meet the requirements of the applicable sections of this Code and the Owner's Design Specification.	TA-3530	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review *however, based on past operating* performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
	FIELD ACCEPTANCE TESTS	TA-4000					
30 (T)	General: Field acceptance tests shall be conducted following initial system *installation but prior to releasing the equipment for normal operation.* Application inspections and tests shall be conducted to verify compliance with the Owner's Design Specifications following equipment replacement, modification, or abnormal incident. Repair or maintenance that has not affected acceptance test reference values does not require repeating acceptance tests. Within the context of Article TA-4000, a test not associated with a test designator is considered to be a prudent action and not a test requirement.	TA-4010	These HVAC systems have been installed in the applicable Tank Farms since the late *70's and early 80's, therefore, it is unsure* whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
31 (T)	Fan Acceptance Tests: Acceptance tests shall be conducted with the fan operating at a flow rate within the normal operating range for the system. The tests listed in Table TA-4000-1 shall be conducted and test results verified to be within the acceptance limits of the Owner's Design Specification, the applicable portions of Section BA of this Code, and as required in TA-3500 and TA-4160. These test results shall be documented in accordance with TA-6300 and shall be retained as reference values for comparison during periodic in-service tests.	TA-4110	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No.Ops. Step	Division IV – Testing Procedures *Requirement Text*	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
32 (I)	Visual Inspection (VT): A visual inspection of the fan and associated components shall be conducted in accordance with TA-3410 and Mandatory Appendix TA-I (I-1100).	TA-4120	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
33 (T)	*Structural Capability Test (PS):* When a fan housing is part of the system pressure boundary, a structural capability test shall be conducted to verify structural capability of the fan housing and connections in accordance with TA-3422 and Mandatory Appendix TA-II. The fan housing may be tested concurrent with the duct and housing structural capability test specified in TA-4331.	TA-4131	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
34 (T)	Leak Test, Fan Housing (PL): When a fan housing is part of the system pressure boundary, a pressure boundary leak test shall be conducted to verify leak tightness of the fan housing and attached interfaces in accordance with TA-3423 and Mandatory Appendix TA-III. The fan housing may be tested concurrent with the duct and housing leak test specified in TA-4332.	TA-4132	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
35 (T)	Leak Test, Fan Shaft Seal (PL): When a fan shaft seal is part of the system pressure boundary, a pressure boundary leak test shall be conducted to verify leak tightness of the shaft seal in accordance with TA-3423 and Mandatory Appendix TA-III. The shaft seal may be tested concurrent with the duct and housing leak test specified in TA-4332. However, the shaft seal leakage rate shall be evaluated (qualitatively) independent of the overall system leak rate. The qualitative evaluation of the leakage shall be included in the test report.	TA-4133	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No.Ops. Step	Division IV – Testing Procedures Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
36 (T)	Component Functional Tests: The following prerequisites shall be conducted on the fan and motor assemblies prior to the system functional tests specified TA-4150.	TA-41140	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
37 (T)	Electrical Prerequisites: Prior to the initial energizing of the fan, the electrical power circuits shall be checked for installation, circuit continuity, voltage capacity, and protective relay device settings.	TA-4141	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, *based on past operating* performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
38 (T)	Control System Prerequisites: Prior to the initial energizing of the fan, controls shall be calibrated and verified operational.	TA-4142	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
39 (SU)	Startup Prerequisites: Prior to the initial energizing of the fan, The fan and motor shaft shall be manually rotated to verify moving parts are free of interference. The motor shall be momentarily energized to verify correct rotational direction. The fan shall be restarted and stable operation (no surging) verified. Fan and motor vibration, bearing temperature, motor electrical amperage and phase balance, fan speed, differential pressure, and airflow shall be monitored. Following one hour of operation, or immediately after observation of unusual performance (i.e., unstable performance), the fan shall be secured and a detailed visual inspection for signs of damage or degradation shall be conducted.	TA-4143	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No.Ops. Step	Division IV – Testing Procedures Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
40 (T)	System Functional Tests: This section provides the system level field acceptance test requirements for fan systems.	TA-4150	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
41 (T)	System Flow Balance Test (F): A system flow balance shall be conducted. Recommended procedures include SMACNA, NEBB, ACGIH, or AABC (see TA-2000). System flow balancing may be conducted using artificial resistance in lieu of filters. However, final component reference values shall be obtained with clean system components installed. *TA-4152 through TA-4159 shall be conducted in the same time* frame.	TA-4151	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review *however, based on past operating* performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
42 (T)	Mechanical Run Test (F): Prior to conducting the tests specified in TA-4153 through TA-4159, the fan shall be operated at the design flow rate for at least 15 *minutes and stable system operation (no surging) verified.*	TA-4152	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
43 (T)	Flow Rate Test (Qf): The fan flow rate shall be measured. Recommended procedures include ACGIH "Industrial Ventilation" or equivalent.	TA-4153	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No.Ops. Step	Division IV – Testing Procedures Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
44 (T)	Static Pressure Test (DP): The fan inlet and outlet static pressure and velocity pressure shall be measured and the overall fan static pressure determined.	TA-4154	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
45 (T)	Electrical Tests (AMP): The fan motor supply voltage and amperage shall be measured for each phase.	TA-4155	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
46 (T)	Rotational Speed Test (N): The rotational speed f the fan shall be measured.	TA-4156	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
47 (T)	Vibration Test (Vb): The vibration of each fan and motor bearing shall be measured in accordance with TA-3433.	TA-4157	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No.Ops. Step	Division IV – Testing Procedures Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
48 (T)	Bearing Temperature Test (Tb): Following bearing temperature stabilization, the fan and motor bearing temperatures shall be measured. Stabilization occurs when temperature changes are less than or equal to +/- 3 degrees F in a 10 minute period.	TA-4158	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
49 (T)	Fan Performance/Airflow Capacity Test (F): For systems with filter or adsorber banks, the fan performance shall be measured under maximum design dirty filter conditions. This may be done by increasing the system resistance to the design dirty filter differential pressure, (design basis maximum dirty filter condition), using artificial resistance. The measurement procedures in TA-4152 through TA-4158 shall be used.	TA-4159	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
50 (I,T)	Acceptance Criteria: The following acceptance criteria are in addition to the requirements of TA-3500.	TA-4160	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
51 (T)	Airflow Capacity Test Acceptance Criteria: Airflow capacity shall be within +/- 10% of design when tested in the normal clean and maximum dirty filter conditions.	TA-4161	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No.Ops. Step	Division IV – Testing Procedures Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
52 (D,I,T)	Fan Performance Acceptance Criteria: Fan performance (flow, static pressure, horsepower) shall meet the specifications of the Manufacturer's fan performance curve and the Owner's Design Specification.	TA-4162	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
53 (T)	Damper Acceptance Tests: This section provides the field acceptance test requirements for dampers and related accessories. Integrated system testing shall be conducted in accordance with TA-4900.	TA-4200	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
54 (D,T)	Acceptance Test Requirements: Acceptance tests shall be conducted with the dampers installed in the system. The tests listed in Table TA-4000-2 shall be conducted and test results verified to be within the acceptance limits of the Owner's Design Specification, the applicable portions of Section DA of this Code, and as required in TA-3500. These test results shall be documented in accordance withTA-6300 and shall be retained as reference values for comparison to periodic in-service test results.	TA-4210	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
55 (I)	Visual Inspection (VT): A visual inspection of the damper and associated components shall be conducted in accordance with TA-3410 and Mandatory Appendix TA-I, Subarticle I-1200.	TA-4220	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No.Ops. Step	Division IV – Testing Procedures Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
56 (T)	Structural Capability Test, Damper Housing (PS): When the damper housing and actuator shaft seal are part of the system pressure boundary, a structural capability test shall be conducted to verify the structural capability of the damper housing, shaft seal, and interfaces in accordance with TA-3422 and Mandatory Appendix TA-II. The damper housing may be tested concurrent with the duct and housing structural capability test specified in TA-4331.	TA-4231	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
57 (T)	Structural Capability Test, Damper Blades (PS0): Isolation dampers shall be tested to verify the structural capability of the damper blade and seat in accordance with TA-3422 and Mandatory Appendix TA-II. The damper blades and seat may be tested concurrent with the duct and housing structural capability test specified in TA-4331.	TA-4232	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review *however, based on past operating* performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
58 (T)	Leak Test, Damper Housing (PL): When a damper housing is part of the system pressure boundary, a pressure boundary leak test shall be conducted to verify leak tightness of the damper housing and interfaces in accordance with TA-3423 and Mandatory Appendix TA-III. The damper housing may be tested concurrent with the duct and housing leak test specified in TA-4332.	TA-4233	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
59 (T)	Leak Test, Damper Shaft Seal (PL): When a damper shaft seal is part of the system pressure boundary, a pressure boundary leak test shall be conducted to verify leak tightness of the shaft seal in accordance with TA-3423 and Mandatory Appendix TA-III. The shaft seal may be tested concurrent *with the duct and housing leak test specified in TA-4332. However,* the shaft seal leak rate shall be evaluated (qualitative) independently of the overall system leak rate. The qualitative evaluation of the leakage shall be included in the test report.	TA-4234	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this *requirement was not available for review* however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No.Ops. Step	Division IV – Testing Procedures Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
60 (T)	Leak Test, Damper Seat (PL): When dampers have seat leakage limits, a leak test shall be conducted in the direction the damper is expected to function, in accordance with TA-3423 and Mandatory Appendix TA-III. The seat leak rate shall be tested by blanking off or otherwise isolating a duct section upstream of the damper. The leak test shall be performed with the damper cycled closed using its normal closing mechanism (without any additional manual assistance).	TA-4235	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
61 (T)	Component Functional Tests: Component functional tests shall verify that the damper is operational prior to conducting the system functional tests specified in TA-4250.	TA-4240	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
62 (D,T)	Electrical Prerequisites: Prior to the initial energizing of the damper operator, the electrical circuits shall be checked for proper installation, circuit continuity, voltage capacity and protective relay device settings.	TA-4241	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
63 (D,T)	Pneumatic Prerequisites: Prior to the initial pressurizing of the damper control system, pneumatic systems shall be checked for proper installation and leak tightness.	TA-4242	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No.Ops. Step	Division IV – Testing Procedures Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
64 (D,T)	Control System Prerequisites: Prior to the initial energizing of the damper operator, control instrumentation shall be calibrated and verified to be operational.	TA-4243	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
65 (T)	*Position Indication Test (F):* Dampers having remote position indicators shall be observed during operation to verify that the mechanical damper position corresponds to the remote indication.	TA-4244	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
66 (T)	Exercise Test (F): Power operated dampers shall be fully cycled using a control switch or other actuating device to verify operation. Manual dampers, including balancing dampers, shall be fully cycled to verify operation. Fire dampers shall be tested in accordance with TA-4252.	TA-4245	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
67 (T)	Static Timing Test (F): Power operated dampers (electrical or pneumatic), that are required to operate within a specified time limit, shall be tested by measuring time for the damper to fully open or fully close (as required by the Owner's Design Specification).	TA-4246	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No.Ops. Step	Division IV – Testing Procedures Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
68 (T)	Flow Control Damper Functional Test (F): Power operated dampers that control air flow shall be observed under throttled (throughout its anticipated operating range) flow conditions to verify free movement and stable operation.	TA-4251	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
69 (T)	Fire Damper Test (F): Fire dampers shall be tested, using a normal or simulated actuation signal, to verify activation under design airflow conditions.	TA-4252	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
70 (T)	Dynamic Timing Test (F): Isolation dampers having a required actuation response time shall be timed to the fully open or fully closed position (as required by the Owner's Design Specification) under design airflow conditions.	TA-4253	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
71 (T)	Interlock Test (F): Dampers that have an opening or closing function interlocked with other components (e.g., fans, other dampers) shall be tested to verify interlock action.	TA-4254	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
	Duct, Housing, and Mounting Frame Acceptance Tests	TA-4300					

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Rqmt No.Ops. Step	Division IV – Testing Procedures Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key)			
				AN	AP	AW	SY
72 (T)	Acceptance Test Requirements: Acceptance tests shall be conducted with the ducts, housings and mounting frames installed in the system. The tests listed in Table TA-4000-3 shall be conducted and test results verified to be within the acceptance limits of the Owner's Design Specification, the applicable portions of Section SA of this Code, and as required in TA-3500. These test results shall be documented in accordance with TA-6300 and shall be retained as reference values for comparison to periodic in-service test results.	TA-4310	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
73 (I)	Visual Inspection (VT): A visual inspection of ducts, housings, and mounting frames, shall be conducted in accordance with TA-3410 and Mandatory Appendix TA-I (I-1300).	TA-4320	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
74 (T)	Pressure Boundary Tests: Pressure boundary tests apply to all ducts housings, and interface connections that are parts of the system. Individual components may be tested at separate times provided that all system pressure boundaries are ultimately tested prior to the system being placed into service.	TA-4330	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
75 (T)	Structural Capability Test, Duct and Housing (PS): A structural capability test shall be conducted to verify structural capability of ducts and housings in accordance with TA-3422 and Mandatory Appendix TA-II.	TA-4331	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No.Ops. Step	Division IV – Testing Procedures Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
76 (T)	Leak Test, Duct and Housing (PL): A pressure boundary leak test shall be conducted to verify leak tightness of the ducts and housings in accordance with TA-3423 and Mandatory Appendix TA-III.	TA-4332	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
77 (T)	Leak Test, Mounting Frame (optional) (PL): A mounting frame pressure test may be used to detect leaks in the HEPA filter and adsorber mounting frames that could affect the results of the in-place leak tests in TA-4600 and TA-4700. This test is optional and may be conducted in accordance with Nonmandatory Appendix TA-A.	TA-4333	This requirement is not applicable to these systems. It is an optional test.	NA	NA	NA	NA
78 (T)	Refrigeration Equipment Acceptance Tests: This section provides the field acceptance test requirements for refrigeration equipment. Integrated system testing shall be conducted in accordance with TA-4900.	TA-4400	This requirement is not applicable. There are no refrigeration components associated with these HVAC Systems.	NA	NA	NA	NA
79 (T)	Acceptance Test Requirements: Acceptance tests shall be conducted with the refrigeration equipment in service under normal operating conditions. The tests listed in Table TA-4000-4 shall be conducted and test results verified to be within the acceptance omits of the Owner's Design Specification, applicable portions of Section RA of this Code, and as required in TA-3500. These test results shall be documented in accordance with TA-6300 and shall be retained as reference values for comparison to periodic in-service test results.	TA-4410	This requirement is not applicable. There are no refrigeration components associated with these HVAC Systems.	NA	NA	NA	NA
80 (I)	Visual Inspection (VT): A visual Inspection of the refrigeration equipment components shall be conducted in accordance with TA-3410 and Mandatory Appendix TA-I, Subarticle I-1400.	TA-4420	This requirement is not applicable. There are no refrigeration components associated with these HVAC Systems.	NA	NA	NA	NA
81 (T)	Leak Test, Refrigerant Piping and Coil (PL): Refrigeration systems, including piping, coils, and pressure vessels, shall have a pressure test conducted to verify structural integrity and leak tightness. Testing shall be conducted in accordance with TA-3424 and Mandatory Appendix TA-VIII.	TA-4431	This requirement is not applicable. There are no refrigeration components associated with these HVAC Systems.	NA	NA	NA	NA
82 (T)	Hydrostatic Test, Hydronic Piping and Coils (HYD): Hydronic piping, coils, and pressure vessels, shall have a hydrostatic test conducted to verify structural integrity and leak tightness. Testing shall be conducted in accordance with TA-3421.	TA-4432	This requirement is not applicable. There are no refrigeration components associated with these HVAC Systems.	NA	NA	NA	NA

Best Available Image

Rqmt No.Ops. Step	Division IV – Testing Procedures Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
83 (T)	Component Functional Tests: The following component functional tests and prerequisites shall be conducted to verify that the refrigeration system equipment is operating acceptably prior to conducting the system functional tests specified in TA-4450. Fans shall be tested in accordance with TA-4100.	TA-4440	This requirement is not applicable. There are no refrigeration components associated with these HVAC Systems.	NA	NA	NA	NA
84 (D,T)	Electrical Prerequisites: Prior to the initial energizing of the refrigeration system components, the electrical circuits shall be checked for installation, circuit continuity, voltage capacity, and protective relay device settings.	TA-4441	This requirement is not applicable. There are no refrigeration components associated with these HVAC Systems.	NA	NA	NA	NA
85 (D,T)	Control System Prerequisites: Prior to the initial energizing of the refrigeration system components, the system controls shall be calibrated and verified operational.	TA-4442	This requirement is not applicable. There are no refrigeration components associated with these HVAC Systems.	NA	NA	NA	NA
86 (T)	Valve Position Indication Test (F): Valves having remote position indicators shall be observed during valve full stroke operation to verify that the valve position corresponds to the remote indication.	TA-4443	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
87 (T)	Valve Exercise Test (F): Power operated valves shall be fully cycled using a control switch or other actuating device to verify operation. Manual valves shall be fully cycled to verify operation.	TA-4444	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No.Ops. Step	Division IV – Testing Procedures Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
88 (T)	Valve Timing Test (F): Power operated valves that are required to operate within a specified time shall be tested by measuring the time to fully cycle.	TA-4445	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
89 (D,SU)	Startup Prerequisites: Correct direction of rotation shall be verified for compressor motors. Start the compressor motor, verify stable operation and monitor the compressor motor electrical supply voltage, amperage and phase balance, vibration, bearing temperatures, rotational speed, as applicable. Following one hour of operation, or immediately after observation of unusual performance (i.e., unstable operation), the equipment shall be secured and a detailed visual inspection conducted for signs of damage or degradation.	TA-4446	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
90 (T)	System Functional Tests: The refrigeration equipment shall be tested to verify mechanical component integrity and design cooling function. TA-4451 through TA-4457 shall be conducted in the same time frame.	TA-4450	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
91 (T)	Flow Control Valve Test (F): Power operated valves, controlled by flow instrumentation, shall be observed under throttled (throughout its anticipated operating range) flow conditions to verify freedom of movement, stable operation, and ability to maintain required flow.	TA-4451	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No.Ops. Step	Division IV – Testing Procedures Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
92 (T)	Mechanical Run Test (F): The refrigeration compressor shall be operated with the system in the normal heat load range for at least 15 minutes and stable system operation verified.	TA-4452	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
93 (T)	Performance Test (F): The refrigeration compressor inlet and outlet pressure and temperature shall be measured with the equipment operating at achievable load points.	TA-4453	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
94 (T)	Electrical Test (AMP): The compressor motor electrical supply voltage and amperage shall be measured for each phase.	TA-4454	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
95 (T)	Rotational Speed Test (N): The rotational speed of the compressor shall be measured when accessible.	TA-4455	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No.Ops. Step	Division IV – Testing Procedures Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
96 (T)	Vibration Test (Vb): The vibration of each accessible bearing on the compressor and compressor motor shall be measured in accordance with TA-3433.	TA-4456	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
97 (T)	Bearing Temperature Test (Tb): Following compressor and compressor motor bearing temperature stabilization, the accessible bearing temperatures shall be measured. Stabilization occurs when temperature changes are less than or equal to +/-3 degrees F in a 10 minute period.	TA-4457	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
98 (T)	Conditioning Equipment Acceptance Tests: This section provides the field acceptance test requirements for forced circulation air cooling and heating coils, air washers, evaporative coolers, and electric heating coils. Integrated system testing shall be conducted in accordance with TA-4900.	TA-4500	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
99 (T)	Acceptance Test Requirements: Acceptance tests shall be conducted with the conditioning equipment in service under normal operating conditions for the system. The tests listed in Table-TA-4000-5 shall be conducted and test results verified to be within the acceptance limits of the Owner's Design Specification, the applicable portions of Section CA of this Code, and as required in TA-3500 and TA-4570. These test results shall be documented in accordance with TA-6300 and shall be retained as reference values for comparison to periodic in-service test results.	TA-4510	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No.Ops. Step	Division IV – Testing Procedures Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
100 (I)	Visual Inspection (VT): A visual Inspection of the conditioning equipment components shall be conducted in accordance with TA-3410 and Mandatory Appendix TA-I, Subarticle I-1500.	TA-4520	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
101 (T)	Hydrostatic Test, Hydronic Piping and Coils (HYD): Hydronic piping, coils, and pressure vessels, shall have a hydrostatic test conducted to verify structural integrity and leak tightness. Testing shall be conducted in accordance with TA-3421.	TA-4531	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review *however, based on past operating* performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
102 (T)	Component Functional Tests: The following component functional tests and prerequisites shall be conducted to verify that the conditioning system equipment is operating acceptably prior to conducting the system functional tests specified in TA-4550. Fans shall be tested in accordance with TA-4100. Refrigeration components shall be tested in accordance with TA-4400.	TA-4540	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
103 (D,T)	Electrical Prerequisites: Prior to the initial energizing of the conditioning system equipment, the electrical circuits shall be checked for installation, circuit continuity, voltage capacity, and protective relay device settings.	TA-4541	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No.Ops. Step	Division IV – Testing Procedures *Requirement Text*	Rqmt Source / Sec #	*Rqmt Compliance*	Status Indicators: (See Legend for Key) AN	AP	AW	SY
104 (D,T)	Control System Prerequisites: Prior to the initial energizing of the conditioning system components, the system controls shall be calibrated and verified operational.	TA-4542	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
105 (T)	*Electric Heater Step Controller Test (F):* Electric heater step controllers shall be tested by initiating a simulated demand signal to verify the heater circuit step controller is operational.	TA-4543	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
106 (T)	Electric Heater Coil Resistance Test (F): The electrical resistance shall be measured across each heater circuit in accordance with CA-5440.	TA-4544	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
107 (T)	Electric Heater Resistance to Ground Test (F): The electrical resistance to ground shall be measured on each heater circuit.	TA-4545	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No.Ops. Step	Division IV – Testing Procedures *Requirement Text*	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
108 (T)	Valve Performance Tests (F): Conditioning system valves shall be tested in accordance with TA-4443, TA-4444, and TA-4445.	TA-4546	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
109 (SU,T)	*Startup Prerequisites:* Prior to starting the conditioning system pumps, the pump shaft shall be manually rotated to verify freedom of movement. The motor shall be momentarily energized to verify correct rotational direction. Restart the pump motor and verify stable operation and monitor the pump motor electrical supply voltage, amperage and phase balance, bearing vibration, bearing temperatures, rotational speed, pump differential pressure, and fluid system flowrate, as applicable. Following one hour of operation, or immediately after observation of unusual performance (i.e., unstable operation), the pump shall be secured and a detailed visual inspection for signs of damage or degradation shall be conducted.	TA-4547	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
110 (T)	System Functional Tests: The conditioning equipment shall be tested in conjunction with the system to verify mechanical component integrity and design cooling or heating function. TA-4551 through TA-4556 shall be conducted in the same time frame.	TA-4550	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
111 (T)	Hydronic System Flow Balance Test (F): A hydronic system flow balance shall be conducted. Recommended procedures include AMCCNA, NEBB, or AABC (see TA-2000)	TA-4551	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No.Ops. Step	Division IV – Testing Procedures Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
112 (T)	Flow Control Valve Test (F): Power operated valves, controlled by flow instrumentation, shall be observed under throttled (throughout its anticipated operating range) flow conditions to verify freedom of movement, stable operation, and ability to maintain required flow.	TA-4552	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
113 (T)	Mechanical Run Test (F): The conditioning system pumps shall be operated with the system in the normal operating range for at least 15 minutes and stable system operation (no surging) verified.	TA-4553	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
114 (T)	Performance Test (F): The conditioning pump differential pressure and flow rate shall be measured with the pump operating at achievable flow rates.	TA-4554	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
115 (T)	Electrical Test (AMP): The conditioning system pump supply voltage and amperage shall be measured for each phase.	TA-4555	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No.Ops. Step	Division IV -- Testing Procedures *Requirement Text*	Rqmt Source / Sec #	*Rqmt Compliance*	Status Indicators: (See Legend for Key) AN	AP	AW	SY
116 (T)	Rotational Speed Test (N): The rotational speed of the pump shall be measured when.	TA-4556	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
117 (T)	*Vibration Test (Vb):* The vibration of each bearing on the pump and motor shall be measured in accordance with TA-3433.	TA-4557	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
118 (T)	Bearing Temperature Test (Tb): Following pump and motor bearing temperature stabilization, the bearing temperature shall be measured. Stabilization occurs when temperature changes are less than or equal to +/-3 degrees F in a 10 minute period.	TA-4558	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
119 (T)	Electric Heater Performance Test (F): With design airflow (+/-10%) through the heater bank, the electrical supply voltage, amperage, and phase balance of each heater circuit, and differential temperature and air flow across the heater bank shall be measured. Following one hour of continuous operation, the heater shall be secured and a detailed visual inspection for signs of damage or degradation shall be conducted.	TA-4559	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No.Ops. Step	Division IV – Testing Procedures Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
120 (T)	Hydronic System Heating and Cooling Performance Test (F): With the conditioning system operating at design airflow (+/-10%) and design hydronic flow (+/-10%) and at achievable heat load conditions, the air-side flow, differential temperature and differential pressure, and the hydronic side flow, differential temperature and differential pressure shall be measured.	TA-4560	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
121 (T)	Air Washer, Evaporative Cooler Performance Test (F): A performance test for the conditioning system air washers and evaporative coolers shall be conducted in accordance with CA-5000, Mandatory Appendix CA-II.	TA-4561	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review *however, based on past operating* performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
122 (T)	Acceptance Criteria: The following acceptance criteria are in addition to TA-3500.	TA-4570	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
123 (T)	Electrical Heater Ground Resistance Acceptance Criteria. Conditioning system electric heater resistance to ground shall be greater than 50,000 Ohms.	TA-4571	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
	Moisture Separator, Pre-Filter, HEPA Filter Bank Acceptance Tests	TA-4600					

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Rqmt No.Ops. Step	Division IV – Testing Procedures Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
124 (T)	Acceptance Test Requirements: Acceptance tests shall be conducted with clean moisture separator, pre-filter and HEPA filter banks installed in the system. The tests listed in Table-TA-4000-6 shall be conducted and test results verified to be within the acceptance limits of the Owner's Design Specification, the applicable portions of Sections FA, FB, and FC of this Code, and as required in TA-3500 and TA-4640. These test results shall be documented in accordance with TA-6300 and shall be retained as reference values for comparison to periodic in-service test results.	TA-4610	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
125 (I)	Visual Inspection (VT): A visual Inspection of the installed moisture separator, pre-filter, and HEPA filter banks shall be conducted in accordance with TA-3410 and Mandatory Appendix TA-I, Subarticle I-1600.	TA-4620	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review *however, based on past operating* performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
126 (T)	Differential Pressure Test (DP): With the system operating at design flow rate (+/-10%) the differential pressure across each moisture separator, pre-filter, and HEPA filter bank shall be measured.	TA-4631	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
127 (T)	Airflow distribution Test (AD): With the system operating at design flow rate (+/-10%) the airflow distribution shall be measured downstream of each moisture separator, pre-filter, and HEPA filter bank in accordance with Mandatory Appendix TA-IV.	TA-4632	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this *requirement was not available for review* however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

Rqmt No.Ops. Step	Division IV – Testing Procedures Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
128 (T)	Air-Aerosol Mixing Test (AA): With the system operating at design flow rate (+/-10%) the air-aerosol mixing upstream of each HEPA filter bank shall be measured in accordance with Mandatory Appendix TA-V.	TA-4633	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
129 (T)	In-Place Leak Test (IP): With the system operating at design flow rate (+/-10%) the challenge aerosol leak rate of each HEPA filter bank shall be measured in accordance with Mandatory Appendix TA-VI.	TA-4634	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
130 (T)	Acceptance Criteria: The following acceptance criteria are in addition to TA-3500.	TA-4640	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
131 (T)	Airflow Distribution Test Acceptance Criteria: With the system operating within +/-10% of design flow rate, the variation in velocity measurements across the HEPA filter banks shall be limited to +/-20% of the average, when measured in accordance with Mandatory Appendix TA-IV. Airflow distribution across the moisture separator and pre-filter banks shall be in accordance with the Owner's Design Specification.	TA-4641	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No.Ops. Step	Division IV – Testing Procedures Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
132 (T)	Air-Aerosol Mixing Test Acceptance Criteria: With the system operating within +/-10% of design flow rate, the variation in concentration of the air-aerosol mixture immediately upstream of the HEPA filter banks shall be limited to +/-20% of the average, when measured in accordance with Mandatory Appendix TA-V.	TA-4642	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
	Type II and Type III Adsorber Bank Acceptance Tests.	TA-4700					
133 (D,T)	Acceptance Test Requirements: Acceptance tests shall be conducted with the adsorbent media installed and in service under normal operating conditions for the system. The tests listed in Table-TA-4000-7 shall be conducted and test results verified to be within the acceptance limits of the Owner's *Design Specification, the applicable portions of Sections FD and FE* of this Code, and as required in TA-3500 and TA-4740. These test results shall be documented in accordance with TA-6300 and shall be retained as reference values for comparison to periodic in-service test results.	TA-4710	There are no Type II or Type III Adsorber Cell Banks in these systems.	NA	NA	NA	NA
134 (I)	Visual Inspection (VT): A visual Inspection of the type I and type II adsorber banks shall be conducted in accordance with TA-3410 and Mandatory Appendix TA-I, Subarticle I-1700.	TA-4720	There are no Type II or Type III Adsorber Cell Banks in these systems.	NA	NA	NA	NA
135 (T)	Electric Heater Step Controller Test (F): Electric heater step controllers shall be tested by initiating a simulated demand signal to verify the heater circuit step controller is operational.	TA-4731	There are no Type II or Type III Adsorber Cell Banks in these systems.	NA	NA	NA	NA
136 (T)	Electric Heater Coil Resistance Test (F): The electrical resistance shall be measured across each heater circuit in accordance with CA-5440.	TA-4732	There are no Type II or Type III Adsorber Cell Banks in these systems.	NA	NA	NA	NA
137 (T)	Electric Heater Resistance to Ground Test (F): The electrical resistance to ground shall be measured on each heater circuit.	TA-4733	There are no Type II or Type III Adsorber Cell Banks in these systems.	NA	NA	NA	NA
138 (T)	Differential Pressure Test (DP): With the system operating at design flow rate (+/-10%) the differential pressure across each adsorber bank shall be measured.	TA-4741	There are no Type II or Type III Adsorber Cell Banks in these systems.	NA	NA	NA	NA
139 (T)	Airflow distribution Test (AD): With the system operating at design flow rate (+/-10%) the airflow distribution across each adsorber bank shall be measured in accordance with Mandatory Appendix TA-IV.	TA-4742	There are no Type II or Type III Adsorber Cell Banks in these systems.	NA	NA	NA	NA

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Rqmt No.Ops. Step	Division IV – Testing Procedures Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
140 (T)	Air-Aerosol Mixing Test (AA): With the system operating at design flow rate (+/-10%) the air-aerosol mixing immediately upstream of each adsorber bank shall be measured in accordance with Mandatory Appendix TA-V. This test is not required when it con be determined that the air-aerosol test conducted on a HEPA bank immediately upstream of the adsorber bank also provides equivalent challenge to the adsorber bank.	TA-4743	There are no Type II or Type III Adsorber Cell Banks in these systems.	NA	NA	NA	NA
141 (T)	In-Place Leak Test (IP): With the system operating at design flow rate (+/-10%) the challenge gas leak rate of each adsorber bank shall be measured in accordance with Mandatory Appendix TA-VII.	TA-4744	There are no Type II or Type III Adsorber Cell Banks in these systems.	NA	NA	NA	NA
142 (T)	Test Canister Flow Rate Test (Qf): When the system is equipped with test canisters used for obtaining adsorbent samples for laboratory analysis, the velocity through each test canister shall be measured (or calculated from flow measurements) with the system operating at design airflow rate. Alternatively, when access is limited and measurements cannot be performed, the design documentation shall be verified to assure that the installed canisters meet the performance requirements, (differential pressure/flow rate), of canisters used during shop testing of the test canister sampling system.	TA-4745	There are no Type II or Type III Adsorber Cell Banks in these systems.	NA	NA	NA	NA
143 (T)	Electric Heater Performance Test (F): With design airflow (+/-10%) through the heater bank, the electrical supply voltage, amperage, and phase balance of each heater circuit, and differential temperature and air flow across the heater bank shall be measured. Leaving air temperature shall be monitored so that temperature limits are not challenged. Following one hour of continuous operation, the heater shall be secured and a detailed visual inspection for signs of damage or degradation shall be conducted.	TA-4746	There are no Type II or Type III Adsorber Cell Banks in these systems.	NA	NA	NA	NA
144 (T)	Acceptance Criteria: The following acceptance criteria are in addition to TA-3500.	TA-4750	There are no Type II or Type III Adsorber Cell Banks in these systems.	NA	NA	NA	NA
145 (T)	Airflow Distribution Test Acceptance Criteria: With the system operating within +/-10% of design flow rate, the variation in velocity measurements across the face of the adsorber banks shall be limited to +/-20% of the average, when measured in accordance with Mandatory Appendix TA-IV.	TA-4751	There are no Type II or Type III Adsorber Cell Banks in these systems.	NA	NA	NA	NA

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146 (T)	Air-Aerosol Mixing Test Acceptance Criteria: With the system operating within +/-10% of design flow rate, the variation in the challenge gas or aerosol concentration readings immediately upstream of each adsorber banks shall be limited to +/-20% of the average, when measured in accordance with Mandatory Appendix TA-V.	TA-4752	There are no Type II or Type III Adsorber Cell Banks in these systems.	NA	NA	NA	NA
147 (T)	Test Canister flow Rate Test Acceptance Criteria: The test canister velocity shall be within +/-10% of the average adsorber design velocity as specified by the Owner's Design Specification.	TA-4753	There are no Type II or Type III Adsorber Cell Banks in these systems.	NA	NA	NA	NA
148 (T)	Electric Heater Performance Test Acceptance Criteria: Operating currents, voltages and changes in temperature shall be within the limits of the Owner's Design Specification.	TA-4754	There are no Type II or Type III Adsorber Cell Banks in these systems.	NA	NA	NA	NA
	Adsorbent Acceptance Tests	TA-4800					
149 (T)	Acceptance Test Requirements: Verify that laboratory acceptance tests have been performed on a representative sample of adsorbent per FF-5000. Test results shall be documented in accordance with TA-6300 and shall be retained as reference values for comparison to periodic in-service test results.	TA-4810	There is no Adsorbent Media associated with these systems.	NA	NA	NA	NA
150 (T)	Laboratory Analysis of Adsorbent (LAB): New adsorbent installed in the adsorber banks shall be certified in accordance with the Manufacturer's test data for radioiodine penetration (see FF-5000). Adsorbent stored more than 50% of Manufacturer's assigned shelf life or 5 years per FF-5000 shall have a laboratory test conducted in accordance with ASTM D-3803-89 prior to installation.	TA-4820	There is no Adsorbent Media associated with these systems.	NA	NA	NA	NA

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Rqmt No.Ops. Step	Division IV – Testing Procedures Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
151 (T)	Integrated System Tests: Each system shall be tested to verify the functional performance at design operating conditions. Integrated system tests shall be conducted to challenge all integrated control functions including interlocks and manual or automatic actuation circuits, (damper position changes, fan starts and stops, compressor and pump stares or stops, valve position changes, heater energization or de-energization). Actuations can be from a number of different sources including radiation sensors, temperature sensors, chlorine sensors, pressure sensors, manual controls and emergency safeguard signals. Sensor operation shall be verified in addition to control circuitry. Integrated testing shall also include an overall system leak test to verify that there are no unacceptable bypasses of the HEPA filter or adsorber banks. Integrated system testing shall verify that the intended design function of the system is achieved in accordance with the Owner's Design Specification. Test results shall be documented *in accordance with TA-6300.*	TA-4900	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
152 (T)	Fan Integrated System Test Requirements (F): Fans designed to respond automatically to a process or emergency actuation signal shall be tested. Sequencing of starts, stops and speed changes shall be conducted utilizing an actual or simulated actuation signal.	TA-4910	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
153 (T)	Damper Integrated System Test Requirements (F): Dampers designed to respond automatically to a process or emergency actuation signal shall be tested. Sequencing of damper position changes shall be conducted utilizing an actual or simulated actuation signal.	TA-4920	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No.Ops. Step	Division IV – Testing Procedures Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
154 (T)	Refrigeration and Conditioning Integrated System Test Requirements (F): Refrigeration and conditioning equipment designed to respond automatically to a process or emergency actuation signal shall be tested. Sequencing of equipment operation (starts, stops, speed changes, valve operations or isolation, heater operation) shall be conducted utilizing an actual or simulated actuation signal.	TA-4930	This requirement is not applicable. There are no Refrigerants associated with these HVAC systems.	NA	NA	NA	NA
155 (T)	HEPA and Adsorber Bank Integrated System Test Requirements (F): All potential HEPA filter and adsorber bank bypass flow paths, including housing bypass ducts and associated dampers, shall be challenged to verify that leak rates are within the Owner's Design Specification. Bypass flow paths may be challenged during the in-place leak test specified in TA-4634 and TA-4744, by ensuring that the challenge aerosol or gas injection and sample ports encompass all potential bypass flow paths (see Mandatory Appendix TA-V, Subarticle V-1100). If a potential bypass flow path within the system *is not challenged during these in-place tests, a separate test shall be* performed using Mandatory Appendix TA-VI or TA-VII to verify that the HEPA or adsorber banks are not being bypassed in excess of the limits specified in the Owner's Design Specification.	TA-4940	This requirement in not applicable. There are no Adsorber Banks associated with these HVAC Systems.	NA	NA	NA	NA
	CORRECTIVE ACTION REQUIREMENTS	TA-5000					
156 (D,QA)	General: Corrective action is required when test results do not meet the *acceptance criteria specified in the applicable section or in the* Owner's Design Specifications. For equipment that is replaced, modified, repaired, or has undergone maintenance, such that reference values may change, a new set of reference values shall be obtained in accordance with the requirements of Subarticle TA-3200. Additional guidance for corrective actions is included in Nonmandatory Appendix TA-B.	TA-5000	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
	QUALITY ASSURANCE	TA-6000					
157 (QA,T)	General: Field testing of nuclear air treatment, heating, ventilating, and air conditioning systems shall be conducted in accordance with the quality assurance requirements of Article AA-8000 and ANSI/ASME NQA-1.	TA-6100	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

Rqmt No.Ops. Step	Division IV – Testing Procedures Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
158 (QA,T)	Personnel: Tests shall be conducted by personnel who have demonstrated competence to perform the specified tests, as evidenced by documented experience and training. Personnel shall be certified in accordance with ANSI/ASME NQA-1 or ANS 3.1, and in accordance with the Owner's requirements.	TA-6200	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
159 (QA,T)	Documentation (Procedures): Written acceptance test procedures shall document the field acceptance testing performed and test results obtained as specified in TA-4000. These records shall be maintained for the life of the facility.	TA-6310	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
160 (QA,T)	Documentation (Reports): A written report shall be provided to document the acceptance testing performed in accordance with TA-4000. The report shall contain the following as a minimum: (a) the system name, test/inspection procedure(s) used, date of test results, and the test performer's signature; (b) identification of instruments, equipment, tools, and documents to the extent that they or their equivalents can be identified for future examinations; (c) observations and dimensional checks specified by the respective test data and reports developed during inspection and testing; (d) conclusions and recommendations by visual examination and testing personnel; (e) reference to previous reports if this report is for reinspection and testing.	TA-6320	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
	Visual Inspection Items	Mandatory Appendix TA-I					

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Rqmt No.Ops. Step	Division IV – Testing Procedures Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
161 (I)	General: A specific inspection checklist for each component in the system shall be included in the acceptance test procedures. This Appendix lists typical items for each component that need to be inspected visually in Article TA-4000 (Acceptance tests). As a minimum, the lists of items indicated below shall be checked for compliance with the Owner's Specifications. The inspection shall be conducted in accordance with TA-3410j. The acceptance criteria for these inspections shall be in accordance with TA-3500 and TA-3510.	I-1000	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
162 (I)	Fan Inspection Items: (a) housing and duct interface (b) fan belt and shaft guards (c) interferences with moving parts (d) fan shaft seal (e) belt adjustment and condition (f) lubricant levels (g) supports and attachments (h) bolting and fasteners (i) instrumentation (j) electrical connections (k) control system components (l) pneumatic connections (m) as built configuration in accordance with design drawings (n) fan nameplate (o) provisions for assess for performing tests and maintenance	I-1100	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
163 (I)	Damper Inspection Items: (a) housing and duct interface (b) actuator linkage, motor, controller (c) interferences with moving parts (d) damper shaft seal (e) blade edge seals, damper seat (f) limit switches (g) supports and attachments (h) bolting and fasteners (i) instrumentation (j) electrical connections (k) pneumatic connections (l) as built configuration in accordance with design drawings (m) damper nameplate (n) provisions for assess for performing tests and maintenance	I-1200	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

Rqmt No.Ops. Step	Division IV – Testing Procedures Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
164 (I)	Duct, Housing and Mounting Frame Inspection Items: (a) housing and duct connections (no caulking) (b) provision for opening access doors from both inside and outside (c) access door seals, gaskets (d) access door latches (e) housing internal access ladders and platforms (f) sample and injection ports, location and caps (g) *supports and attachments* (h) bolting and fasteners (i) instrumentation, connections (j) electrical connections (k) housing/duct penetration seals (l) loop seals (water level), drain connections (m) lighting conduits, socket housing seals (flush mounted) (n) HEPA/adsorber mounting frame continuous seal welds (o) Mounting frame penetrations seal welded (p) *Mounting frame seating surface (weld splatter, flatness, scratches)* (q) Sample canister installation (r) Mounting frame clamping devices (s) as built configuration in accordance with design drawings (t) provisions for assess for performing tests and maintenance (u) lighting for test and maintenance available (?)	IA-1300	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
165 (I)	Refrigeration Equipment Inspection Items: (a) housing or duct interface with refrigeration equipment (b) fan, pump, compressor belt, and coupling guards (c) interferences with moving parts (d) belt adjustment and condition (e) fluid leaks (f) lubricant levels (g) supports and attachments (h) bolting and fasteners (i) instrumentation (j) electrical connections (k) control system and components (l) pneumatic connections and tubing (no crimping) (m) as built configuration in accordance with design drawings (n) fan, pump, and compressor nameplate (o) provisions for assess for performing tests and maintenance	I-1400	There are no Refrigeration equipment components associated with these HVAC Systems.	NA	NA	NA	NA

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Rqmt No.Ops. Step	Division IV – Testing Procedures Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
166 (I)	Conditioning Equipment Inspection Items: (a) housing or duct interface with conditioning equipment (b) belt and coupling guards (c) interferences with moving parts (d) belt tightness (e) fluid leaks (f) *lubricant levels* (g) supports and attachments (h) bolting and fasteners (i) instrumentation (j) electrical connections (k) *control system and components* (l) pneumatic connections and tubing (no crimping) (m) drains and spray nozzles not plugged (n) as built configuration in accordance with design drawings (o) fan, pump, and compressor nameplate (p) provisions for assess for performing tests and maintenance	I-1500	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
167 (I)	Moisture Separator Bank, Pre-filter Bank, HEPA Filter Bank Inspection Items: (a) moisture separator media, frame, clamps, and gaskets (b) moisture separator water collection system and drains (c) pre-filter media, frame, clamps, and gaskets (d) HEPA filter media, frame, clamps, and gaskets (e) *Sealant or caulking (none allowed)* (f) Moisture separator, pre-filter, HEPA orientation (vertical) (g) bolting and fasteners (h) as built configuration in accordance with design drawings (i) HEPA filter nameplate (j) provisions for assess for performing tests and maintenance	I-1600	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
168 (I)	Type II, Type III Adsorber Bank Inspection Items: (a) type II media, frame, screen, clamps, and gaskets (b) sealant or caulking (none allowed) (c) type III media, screens, frame (d) test canisters (e) bulk loading equipment (f) fire protection system piping, nozzles, *instrumentation* (g) bolting and fasteners (h) as built configuration in accordance with design drawings (i) adsorber nameplate (j) provisions for assess for performing tests and maintenance	I-1700	There are no Type II or Type III Adsorber Banks associated with these HVAC Systems.	NA	NA	NA	NA
	Structural Capability Test Procedural Guidelines	Mandatory Appendix TA-II					

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Rqmt No.Ops. Step	Division IV – Testing Procedures Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
169 (T)	Summary of Method: Ducts and housings which form the pressure boundary of the system shall be pressure tested, with air, to the structural capability pressure to verify that there is no breach of integrity or unacceptable distortion. Fans, dampers, and other components which form parts of the pressure boundary shall be installed and tested with the ducts and housings to verify the interface connection integrity.	II-1000	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
170 (D,T)	Prerequisites: Construction, modifications, or repairs affecting the test boundary shall be complete and inlet and discharge openings of the duct or housing sealed before the test is started. Electrical, piping, and instrument connections shall be complete and all permanent seals installed before the test is started.	II-2000	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
171 (T)	Test Equipment: (a) pressurization source (b) covers to seal test boundaries (c) pressure indicating device accurate to +/-0.1 in. w.g.	II-3000	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
172 (D,QA,T)	Procedural Guidelines: (a) Connect the pressurization source to the duct or housing. (b) Install instrumentation to indicate the pressure inside the duct or housing being tested. (c) Start the pressurization source and operate until the structural capability pressure is achieved. Maintain pressure for the duration of the inspection. (d) Inspect the test boundary for breach of integrity or distortion. (e) Release pressure and inspect for permanent distortion.	II-4000	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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173 (D,I,T)	Acceptance Criteria: All distortion shall be measured and compared to the acceptance limits of the Owner's Design Specification.	II-5000	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
	Duct and Housing Leak Test Procedural Guidelines	Mandatory Appendix TA-III					
174 (T)	Summary of Method: Ducts and housings that form the pressure boundary of the system shall be leak tested, with air, using one of the methods listed in this procedure. Either method may be used and will produce a similar result. The constant pressure method is useful in testing small vlumes whereas the pressure decay method is useful in testing large volumes. Fans, dampers, and other components that are part of the pressure boundary shall be installed and tested with the pressure boundary to verify interface connection leak tightness. If the measured leak rate is in excess of the acceptance criteria, the leaks shall be located by one of the methods listed in this procedure. After leaks are repaired, the duct and housing shall be re-tested to verify leak tightness.	III-1100	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
175 (D)	Prerequisites: Construction, modifications, and repairs affecting the test boundary shall be complete and the inlet and discharge openings of the duct or housing sealed before the test is started. All electrical, piping, and instrument connections shall be complete and all permanent seals shall be installed before the test is started. For pressure decay testing, the volume of the pressure test boundary must be calculated.	III-2000	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No.Ops. Step	Division IV – Testing Procedures Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
176 (T)	Test Equipment: (a) pressurization source (b) covers to seal test boundaries (c) clock or timer accurate to +/-1.0 second (d) pressure indicating device accurate to +/- 0.1 in. (e) flowmeter or totalizing gas volume meter accurate to +/-5% (constant pressure method) (f) temperature indicating device accurate to +/-0.5 degrees F (g) bubble solution for detecting air leaks (bubble method) (h) optional portable electronic sound detection equipment (audible leak method) (i) barometer	III-3000	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
177	Constant Pressure Method...(see this article in AG-1 for test procedure)	III-4100	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
178	Pressure Decay Test...(see this article in AG-1 for test procedure)	III-4200	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
179	Acceptance Criteria: If the calculated leak rate exceeds the Owner's acceptance criteria, locate leaks in accordance with one of the techniques outlined in III-4400 or III-4500.	III-4300	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No.Ops. Step	Division IV – Testing Procedures Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
180	Bubble Leak Location Method…(see this article in AG-1 for test procedure)	III-4400	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
181	Audible Leak Location Method…(see this article in AG-1 for test procedure)	III-4500	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
	Airflow Distribution Test Procedure Guidelines (for measuring the air flow distribution across the face of moisture separator, pre-filter, HEPA filter, and adsorber banks.)	Mandatory Appendix TA-IV					
182	Summary of Method: The system is operated at design flow rate. Airflow velocity readings are measured downstream of each moisture separator, pre-filter, and HEPA filter in the bank. For adsorbers, readings shall be taken in line with the flow slots. Each reading is compared to the average for the bank.	IV-1100	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No.Ops. Step	Division IV – Testing Procedures *Requirement Text*	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
183	Prerequisites: System operating within +/-10% design flow rate.	IV-2000	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
184	*Procedural Guidelines...(see this article in AG-1 for test procedure)*	IV-4000	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
	Air-Aerosol Mixing Test Procedure Guidelines	Mandatory Appendix TA-V					
185	System Test: Injection and sample port location shall be located so that the entire system, including housing bypass ducts and associated dampers, is challenged for inadvertent bypass flow paths around the HEPA filter or adsorber banks. If this cannot be accomplished, and integrated system test shall be included in addition to the bank tests outlined in Mandatory Appendices TA-VI, TA-VII, and TA-4940.	V-1100	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
186	Injection Port Selection Criteria: *Injection ports should be located upstream of a flow disturbance to* maximize mixing. The challenge gas will pass through the HEPA bank and challenge the adsorber bank. For systems with two or more HEPA filter banks in series, or two or more adsorber banks in series, separate injection ports must be qualified for each bank. Use of injection manifolds may be necessary when there is insufficient room between banks to provide adequate mixing.	V-1300	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No.Ops. Step	Division IV -- Testing Procedures Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
187	Prerequisites: The system is operating within +/-10% of design flow rate. The airflow distribution has been verified in accordance with Mandatory Appendix TA-IV.	V-2000	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
188	Procedural Guidelines...(see this article in AG-1 for test procedure)	V-4000	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
	HEPA Filter Bank In-Place Leak Test Procedural Guidelines	Mandatory Appendix TA-VI					
189	Prerequisites: Airflow distribution shall be verified in accordance with Appendix TA-IV. The injection port shall be qualified to provide uniform air-aerosol mixing in accordance with Mandatory Appendix TA-V.	VI-2000	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
190	Procedural Guidelines...(see this article in AG-1 for test procedure)	VI-4000	These HVAC systems have been installed in the applicable Tank Farms since the late 70's and early 80's, therefore, it is unsure whether this requirement was met at the time or not. Documentation to verify this requirement was not available for review however, based on past operating performance, these systems are considered acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No.Ops. Step	Division IV – Testing Procedures Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
	Adsorber Bank In-Place Leak Test Procedural Guidelines	Mandatory Appendix TA-VII					
191	Prerequisites: Airflow distribution shall be verified in accordance with Appendix TA-IV. The injection port shall be qualified to provide uniform air-aerosol mixing in accordance with Mandatory Appendix TA-V.	VII-2000	There are no Type II or Type III Adsorber Cell Banks in these systems.	NA	NA	NA	NA
192	*Procedural Guidelines…(see this article in AG-1 for test procedure)*	VII-4000	There are no Type II or Type III Adsorber Cell Banks in these systems.	NA	NA	NA	NA
	Refrigerant Piping and Coil System Leak Test Procedural Guidelines	Mandatory Appendix TA-VIII					
193	Prerequisites: (a) All flare, flange solder, braze, weld, or thread fittings mechanically tight. (b) All seals, packing glands, and service valve packing nuts mechanically tight. (c) All service, purge, and charging valves closed to the atmosphere. (d) Wire brush and wipe flux and oxides from all heated joints.	VIII-2000	There are no refrigerant components associated with these systems.	NA	NA	NA	NA
194	Leak Test Procedural Guidelines…(see this article in AG-1 for test *procedure)*	VIII-4100	There are no refrigerant components associated with these systems.	NA	NA	NA	NA
195	Evacuation and Dehydration Procedure…(see this article in AG-1 for test procedure)	VIII-4200	There are no refrigerant components associated with these systems.	NA	NA	NA	NA
196	Deep Vacuum Method…(see this article in AG-1 for test procedure)	VIII-4210	There are no refrigerant components associated with these systems.	NA	NA	NA	NA

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Attachment 18

ASME N509

Compliance Matrix

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Rqmt No./Ops. Step	ASME N509-1989 Nuclear Power Plant Air-Cleaning Units and Components Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
1 (D)	Habitability systems (as defined in ASME N509), must meet the requirements of 10 Code of Federal Regulation (CFR), Appendix A, general design criteria 4,5, and 19.	ASME N509 3					
2 (D)	Prefilters are required in air-cleaning units when design inlet particulate concentrations and particle size are such that the HEPA filter may be rendered ineffective prematurely.	ASME N509 4.1.a	See Section FB of the AG-1 Matrix for compliance to requirements associated with Pre-Filters.	NA	NA	NA	NA
3 (D)	HEPA filters are required in all air-cleaning units when filtration of inlet particulate matter requires a minimum efficiency of 99.97% for particles equal to 0.3 micrometer in size.	ASME N509 4.1.b	See Section FC of the AG-1 Matrix for compliance to requirements associated with HEPA Filters.	NA	NA	NA	NA
4 (D)	Adsorbers are required when air cleaning units are designed for removal of iodine and iodine compounds.	ASME N509 4.1.c	This requirement is not applicable. Adsorbers were not installed on these HVAC Systems.	NA	NA	NA	NA
5 (D)	Moisture separators (demisters) are required when entrained water droplet concentration may be greater than 1 lb of water per 1000 cfm of airflow.	ASME N509 4.1.d	See Section FA of the AG-1 Matrix for compliance to requirements associated with Moisture Separators.	NA	NA	NA	NA
6 (D)	Heaters should be utilized for air-cleaning units with adsorbers exceeds 70% based upon the 1% percentile meteorological conditions (where applicable). For nuclear air treatment systems which are unaffected by outside air meteorological conditions, heaters should be utilized when an accident would result in an air-stream exceeding 70% relative humidity for more than 1 hr.	ASME N509 4.1.e	See Section CA of the AG-1 Matrix for compliance to requirements associated with HVAC Heaters.	NA	NA	NA	NA
7 (D)	When adsorbers are used in ESF air-cleaning units, provision shall be made for a postfilter to retain carbon fines.	ASME N509 4.1.f	This requirement is not applicable. Adsorbers were not installed on these HVAC Systems.	NA	NA	NA	NA
8 (D)	Values of the following design parameters shall be specified when invoking this standard and shall be used whenever referenced: (a) Volumetric air flow rate, acfm; 1) minimum flow rate; 2) maximum flow rate; 3) design flow rate; (b) design pressures, in. w.g.; 1) maximum operating pressure; 2) leak test pressure; 3) maximum design pressure; 4) structural capability pressure;	ASME N509 4.2	See Section DA of the AG-1 Matrix for compliance to requirements associated with the Valves/Dampers.	NA	NA	NA	NA

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Rqmt No./Ops. Step	ASME N509-1989 Nuclear Power Plant Air-Cleaning Units and Components Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
9 (D)	Values of the following design parameters shall be specified when invoking this standard and shall be used whenever referenced: c) pressure-time transient (if applicable), in. w.g./sec; d) maximum and minimum gas temperature (F) and density, lb/ft3; e) maximum inlet relative humidity (percent); f) entrained liquid water (mass flow rate), lb/min; g) concentrations of specific contaminants in airstream; h) required decontamination factors for each contaminant; i) component radiation integrated life dose and maximum dose rate (rad.); j) maximum dirty filter pressure differential, in. w.g.;	ASME N509 4.2	See Section DA of the AG-1 Matrix for compliance to requirements associated with the Valves/Dampers.	NA	NA	NA	NA
10 (D)	Values of the following design parameters shall be specified when invoking this standard and shall be used whenever referenced: k) structural loadings; l) duct and housing maximum permissible leak rate (scfm) and associated operating pressure, in. w.g.; m) environmental design conditions including temperature, pressure, and relative humidity; n) expected duration and environmental conditions of storage area; (o) particle size distribution and quantity of aerosols and contaminants under normal and accident conditions (if known); (p) safety classification (ESF or non-ESF); (q) number of adsorber test cannisters per adsorber bank; (r) heater capacity, watts, voltage, temperature differential, if applicable.	ASME N509 4.2	See Section DA of the AG-1 Matrix for compliance to requirements associated with the Valves/Dampers.	NA	NA	NA	NA
11 (D)	The installed capacity (cfm) of the air cleaning unit shall be no greater than the limiting installed capacity of any bank of components contained in the air cleaning unit through which the airflow must pass. The installed capacity of any bank or stage of components shall not exceed the number of components in the bank times the rated capacity of the individual components.	ASME N509 4.3	This requirement is being met.	CC	CC	CC	CC
12 (D)	Test cannisters shall not be included in determining the installed capacity of any bank or stage of adsorbers.	ASME N509 4.3	No adsorbers	NA	NA	NA	NA

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13 (D)	All parts and components of the air-cleaning unit shall be selected or designed to operate under the environmental conditions (temperature, relative humidity, pressure, radiation, etc.) specified in para. 4.2.	ASME N509 4.4	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
14 (D)	Materials of construction and components shall be selected or treated to limit generation of combustibles and contaminants and to resist corrosion and degradation that would result in loss of function when exposed to the specified environmental conditions for the design life of the component. Environmental qualification requirements are contained in 10 CFR 50.49 and IEEE 323.	ASME N509 4.4	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
15 (D)	Engineered Safety Feature (ESF) systems and all of their components shall be shown, either by testing or by a mathematical technique, to remain functional under the structural loading specified in para. 4.2(k) and described in para. 5.10.3 of ASME N509.	ASME N509 4.5	These are Non-ESF systems	NA	NA	NA	NA
16 (D)	The nuclear air treatment system shall be designed to withstand the normal and transient pressures, to which the system may be subjected during its design life, without loss of its ability to perform its design function.	ASME N509 4.6.1	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
17 (D)	Nuclear air treatment system operating (static) pressure shall be determined by summing the losses in total pressure of all air path components between the open atmosphere and the point in the system *under consideration and deducting one velocity head from the total* pressure, if positive, and adding one velocity head to the total pressure, if negative. Losses shall be based on the most severe condition of resistance to rated air flow for the design basis operating condition and will vary throughout the nuclear air treatment system.	ASME N509 4.6.3	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW *however, based on past operating* performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No./Ops. Step	ASME N509-1989 Nuclear Power Plant Air-Cleaning Units and Components Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
18 (D)	The engineer (as defined in paragraph 3 of ASME N509) shall review the system operation and determine the maximum operating pressure to which the components may be subjected to due to off-normal conditions.	ASME N509 4.6.3	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
19 (D)	An engineer (as defined in paragraph 3 of ASME N509) shall include the maximum operating (static) pressure in specifications for all nuclear air treatment system components, including ducts.	ASME N509 4.6.3	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
20 (D)	Fan specification requirements shall be based on either total pressure or Fan Static Pressure as defined in para. 5.7 and AMCA 201.	ASME N509 4.6.3	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
21 (D)	Calculations shall document the operating pressure as the basis for determining the required test pressure (refer to para. 4.6.4) and for determination of allowable pressure boundary leakage (para. 4.14).	ASME N509 4.6.3	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
22 (D)	The pressure to be used to shop and/or field test air-cleaning units and components (such as ducts, housings, and component mounting frames) to determine air leak rates shall be specified by the engineer (as defined in paragraph 3 of ASME N509).	ASME N509 4.6.4	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

Best Available Image

Rqmt No./Ops. Step	ASME N509-1989 Nuclear Power Plant Air-Cleaning Units and Components Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
23 (D,T)	The test pressure shall be the static pressure, acting in the direction of the operating pressure.	ASME N509 4.6.4	Systems AN, AP, and AW are non-compliant based on the fact that the test pressure was tested in the direction of positive and the operating pressure is negative. However, based on past operating performance, these systems are considered acceptable as-is. SY system complied with this requirement completely.	NC	NC	NC	CC
24 (D,T)	The test pressure shall not be less than 4 in. w.g. for duct and housing leak tests and not less than I in. w.g. for mounting frame leak tests and shall not exceed the structural capability of the component (para. 4.6.6).	ASME N509 4.6.4	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
25 (D,T)	The test pressure for each component to be tested shall be documented by the engineer (as defined in paragraph 3 of ASME N509) along with the operating pressure (para. 4.6.3) and included by the testing organization in the test procedures.	ASME N509 4.6.4	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
26 (D)	Nuclear air treatment systems shall be structurally designed to withstand the maximum pressure differential which each component may experience due to normal operating pressure; test pressure; or transient pressure conditions due to rapid closure of dampers, or anticipated system upsets which would render the system inoperable.	ASME N509 4.6.5.1	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
27 (D)	The maximum design pressure shall be equal to or greater than the maximum pressure differential after allowing for the venting effect of permanent openings and pressure relief devices in the system.	ASME N509 4.6.5.1	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No./Ops. Step	ASME N509-1989 Nuclear Power Plant Air-Cleaning Units and Components Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key)			
				AN	AP	AW	SY
28 (D)	Engineered Safety Feature (ESF) nuclear air treatment systems located inside a containment structure shall be designed either to withstand the maximum differential between the primary containment structure design pressure and the normal primary containment structure operating pressure as specified in para. 4.3 of ASME N509; or be equipped with a self-restoring pressure-relief device to limit the pressure differential from the initial post-accident transient to levels that will not cause collapse, structural damage, or loss of function.	ASME N509 4.6.5.2	These are Non-ESF systems.	NA	NA	NA	NA
29 (D)	Positive Pressure. Air-cleaning units and components including ducts located on the discharge side of fan(s) which can be isolated by closure of a downstream damper, or potentially plugged components shall be designed to withstand a positive internal pressure equal to or greater than the peak pressure of the fan(s).	ASME N509 4.6.5.4a	This requirement is not applicable. These systems were designed to withstand negative pressures.	NA	NA	NA	NA
30 (D)	Positive Pressure. If provision is made to deenergize fan(s) on high differential pressure or low flow, the components shall be designed to withstand the trip point design pressure plus a margin to include the rate of pressure rise between reaching the pressure setpoint and the time for the instrumentation response, or 10 %, whichever is greater.	ASME N509 4.6.5.4a	This requirement is not applicable. These systems were designed to withstand negative pressures.	NA	NA	NA	NA
31 (D)	Negative Pressure. Air-cleaning units and components located on the inlet side of fan(s) which can be isolated by closure of an upstream damper, or potentially plugged components shall be designed to withstand a negative internal pressure equal to or more negative than the peak pressure of the fan(s).	ASME N509 4.6.5.4b	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
32 (D)	Negative Pressure. If provision is made to deenergize fan(s) on high differential pressure or low flow, the components shall be designed to withstand the trip point design pressure plus a margin to include the rate of pressure rise between reaching the pressure setpoint and the time for the instrumentation response or 10 %, whichever is greater.	ASME N509 4.6.5.4b	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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Rqmt No./Ops. Step	ASME N509-1989 Nuclear Power Plant Air-Cleaning Units and Components Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key)			
				AN	AP	AW	SY
33 (D,P)	The maximum design pressure shall be documented by an engineer (as defined in paragraph 3 of ASME N509) by calculation, including the basis for the condition, and included in procurement specifications for manufacturer's design.	ASME N509 4.6.5.6	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
34 (D)	The structural design capability pressure shall equal or exceed the maximum design pressure and shall be the static pressure to which the air-cleaning unit can be safely loaded without permanent distortion. This pressure is typically a minimum of 1.25 times the maximum design pressure.	ASME N509 4.6.6.1	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
35 (D,P)	The engineer (as defined in paragraph 3 of ASME N509) and/or component manufacturer shall document the structural design capability pressure for each component. This documentation shall be provided to the owner.	ASME N509 4.6.6.2	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
36 (D)	Once-through nuclear air treatment systems with air-cleaning unit located in a clean interspace, exhaust fan shall be located downstream of air-cleaning unit in order to keep air-cleaning unit under negative pressure. Any leakage through fan shaft will be from clean interspace.	ASME N509 4.7.1b	Not Applicable	NA	NA	NA	NA
37 (D)	Once-through nuclear air treatment systems with air-cleaning units located in contaminated spaces or interspaces, the fan shall be located upstream of the air-cleaning unit to prevent infiltration of contaminated air through fan shaft, or into the filter housing downstream of filters thereby bypassing filters.	ASME N509 4.7.1c	Not Applicable	NA	NA	NA	NA
38 (D)	Habitability system outside air ducts routed through clean spaces or interspaces that may convey radioactive air following a release shall be under a negative pressure relative to the spaces.	ASME N509 4.7.2a	Not Applicable	NA	NA	NA	NA

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39 (D)	Habitability system makeup air fans shall be located: (1) upstream of air-cleaning unit if air-cleaning unit is in a contaminated space. (2) downstream of air-cleaning unit if air-cleaning unit is in a clean space.	ASME N509 4.7.2b	Not Applicable	NA	NA	NA	NA
40 (D)	The air-cleaning unit shall be designed to keep radiation exposures during maintenance, testing and As Low As Is Reasonably Achievable (ALARA).	ASME N509 4.8.1	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
41 (D)	The area in which the air-cleaning unit is located shall be served by a clear aisle wide enough to accommodate servicing of internal components and equipment.	ASME N509 4.8.1c	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	CC	CC	CC	CC
42 (D)	A sufficiently wide clear area adjacent to the air-cleaning unit housing door or hatch shall be provided to allow servicing.	ASME N509 4.8.1d	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	CC	CC	CC	CC
43 (D)	Elevated work galleries servicing air-cleaning units shall be designed in accordance with Occupational Safety and Health Act (OSHA) requirements.	ASME N509 4.8.1f	Not Applicable	NA	NA	NA	NA

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44 (D)	Air-cleaning system ducts that will have to be cleaned out periodically shall be equipped with low leakage access hatches at strategic points.	ASME N509 4.8.1g	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	DR
45 (D)	As minimum, the designer shall provide the appropriate monitoring instruments, alarms and hand switches on or adjacent to each air-cleaning unit and redundant instruments, alarms and hand switches at a remote manned control panel in accordance with tables 4-1 for Engineered Safety Feature (ESF) air-cleaning units and 4-2 for non-ESF air-cleaning units of ASME N509.	ASME N509 4.9.2a	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	CC	CC	CC	CC
46 (D)	For non-Engineered Safety Feature (ESF) air-cleaning units, a common alarm of all local alarms shall be provided on the main control room panel for each air-cleaning unit.	ASME N509 4.9.2b	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	CC	CC	CC	CC
47 (D)	For Engineered Safety Feature (ESF) air-cleaning units, local controls shall be secured to prevent unauthorized use.	ASME N509 4.9.2c	These systems are Non-ESF	NA	NA	NA	NA
48 (D)	Local instrumentation and associated mountings (excluding transmitter, hand switches, limit switches, and associated mountings) for Engineered Safety Feature (ESF) air-cleaning units shall be qualified to remain intact, but not necessarily functional under the structural loading and environment specified in paragraph 4.2 (k) of ASME N509.	ASME N509 4.9.3a	These systems are Non-ESF	NA	NA	NA	NA
49 (D)	Local transmitters, hand switches, limit switches and associated mountings for Engineered Safety Feature (ESF) air-cleaning units shall be qualified to remain intact and completely functional under the structural loading and environment specified in paragraph 4.2 (k) of ASME N509.	ASME N509 4.9.3b	These systems are Non-ESF	NA	NA	NA	NA

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50 (D)	Instrumentation, alarms and handswitches at the remote manned control panel shall be qualified to remain intact and functional for the structural loadings that may occur in the area in which the panel is located.	ASME N509 4.9.3c	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, SY and AW however, based on past operating performance, these systems are considered to be acceptable as-is.	DR	DR	DR	DR
51 (D)	Engineered Safety Feature (ESF) air-cleaning unit instrumentation, alarms and hand switches at the remote manned control panel shall be qualified to remain intact and functional for the structural loading that may occur in the area in which the panel is located.	ASME N509 4.9.3	These systems are Non-ESF	NA	NA	NA	NA
52 (D)	Each item powered or controlled electrically (fan motor, valve or damper operator, fire protection systems, solenoid valves, etc.) shall be provided with status indication for the energized mode, located in accordance with tables 4-1 for Engineered Safety Feature (ESF) air-cleaning units and 4-2 for non-ESF air-cleaning units of ASME N509, to show the operational status of the item.	ASME N509 4.9.4	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	CC	CC	CC	CC
53 (D)	Where heat or radioactive decay or heat of oxidation or both may be significant, means shall be provided to remove this heat from the adsorbent beds to limit temperatures to values below 300 degrees F to prevent significant iodine desorption. For this purpose, a minimum circulatory air flow shall be available for all operational modes of the air-cleaning unit and shall be based on the maximum possible radioactivity loading on the adsorbent beds.	ASME N509 4.10	No Adsorbers	NA	NA	NA	NA
54 (D)	Nuclear air treatment systems shall be designed, fabricated, and installed so as to minimize the use of combustibles. Filter media, sealants, gaskets, and insulation shall meet the requirements of ASME N509, section 5.	ASME N509 4.11.1	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	CC	CC	CC	CC

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55 (D)	When air-cleaning units are provided with adsorbers, a fire detection system shall be installed downstream of each carbon adsorber bank to detect either abnormally elevated temperature or products of combustion. The fire detection system shall be designed to be responsive to the unique features of the installation and application (e.g., low air velocity, stratification). A two-stage alarm shall be provided. The fire detection system shall operate an alarm (first stage) upon detection of temperature above a prearranged set-point and automatically trip fan(s) and isolate the air-cleaning unit. The second stage shall operate an alarm when a fire is detected. Documentation shall be provided to the owner which shows that the fire detection system is designed to be responsive to a fire within the carbon adsorber bed.	ASME N509 4.11.2	No Adsorbers	NA	NA	NA	NA
56 (D)	A fire hazard analysis shall be performed for all air-cleaning units and components in accordance with 10 Code of Federal Regulations (CFR) 50, Appendix R and National Fire Protection Agency (NFPA) 803, except that for adsorbers consideration shall be given to the type of carbon (or other media) utilized in adsorbers and the potential for fire.	ASME N509 4.11.4	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	CC	CC	CC	CC
57 (D)	For air-cleaning units provided with fire protection by water deluge systems, nozzles shall be piped to an accessible location outside the housing and provided with redundant leak-tight isolation (O.S. & Y) valves and a connection suitable for manual attachment to the plant's fire protection system.	ASME N509 4.11.6	No fire protection in systems	NA	NA	NA	NA
58 (D)	When air-cleaning units are provided with permanently connected fire protection systems, provisions shall be made to activate an alarm upon initiation of flow of extinguishing agent (e.g., water, halon, CO2).	ASME N509 4.11.8	No fire protection system in systems	NA	NA	NA	NA
59 (O)	If carbon does become wet, the wet carbon shall be removed from the adsorber to prevent structural damage to the adsorber due to chemical interaction. Before placing the air-cleaning unit back in service, the adsorber shall be thoroughly dried and visually inspected for corrosion damage. Dried carbon shall be laboratory tested per paragraph 5.2.3 of ASME N509 and adsorber leak testing shall be performed per ASME N510-1989.	ASME N509 4.11.9	No Adsorbers	NA	NA	NA	NA

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60 (D)	Acoustic linings, thermal insulation, and similar materials shall not be applied to the inside of air treatment system ducts and housings. Materials applied to the outside of ducts and housings shall not prevent access to any bolted construction joint, door, access hatch, or instrument in the housing or ducts or result in penetrations through the pressure boundary which would result in exceeding allowable leakage rates in accordance with paragraph 4 .14. of ASME N509.	ASME N509 4.12	Met.	CC	CC	CC	CC
61 (D,P)	To ensure that the testing requirements of ASME N509 can be met, sufficient permanently installed halide and dioctyl phthalate (DOP) injection and sampling ports shall be provided to permit accurate testing in accordance with ASME N510.	ASME N509 4.13a	Met	CC	CC	CC	CC
62 (D,P)	Where required for proper challenge agent mixing and/or sampling, multiple inlet or outlet distribution manifolds shall be provided to allow injection and sampling per ASME N510.	ASME N509 4.13a	Met	CC	CC	CC	CC
63 (D,P)	Sufficient test canisters, of type and quantity, as specified in paragraph 4.13 (b) of ASME N509, or other means of obtaining samples (see Appendix A) of used adsorbent shall be installed, as directed in paragraph 4.13 (b), of ASME N509, in the adsorber system to provide *a representative determination of the response of the adsorbent to the* service environment over the predicted life of the adsorbent.	ASME N509 4.13b	No adsorbers	NA	NA	NA	NA
64 (D)	Access shall be provided between banks of components in the air-cleaning unit housing to permit physical inspection of both sides of each bank. Components shall not be installed back-to-back on the same or opposite sides of the same mounting frame, or on adjacent mounting frame, or on adjacent mounting frames which are so close as not to permit adequate access space between banks.	ASME N509 4.13c	Met	CC	CC	CC	CC
65 (D)	Maximum allowable leakage across the pressure boundary of any portion of a nuclear air treatment system shall be based on health physics requirements.	ASME N509 4.14.1	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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66 (D)	The system designer (engineer) shall determine leakage criteria and allowable leakage to meet governing codes, standards, regulations, and plant-specific requirements for required portions of the nuclear air treatment system pressure boundary (ducts, housing, dampers, fans, etc.). The basis for determining the leak rate, the leak rate value (s) and coincident operating (static) pressure shall be documented and provided to the owner.	ASME N509 4.12.2	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement *completely*.	DR	DR	DR	CC
67 (D)	Air treatment system components shall be designed, fabricated, and installed so as not to exceed allowable leakage at specified operating pressure. Where shop and/or field tests are required by Table 9-1 of ASME N510, the system designer shall specify the test pressure and corresponding maximum allowable leak rate (SCFM).	ASME N509 4.14.3	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
68 (D,T)	Test pressure shall be selected based on the test procedures in ASME N510 and the maximum operating (static) pressure. If the leak rates are measured at a test pressure not equal to the operating static pressure, the measured leak rates shall be converted as shown in Section 4.14.3 of ASME N509 to allow comparison to allowable unit leak rates at operating pressure.	ASME N509 4.14.3	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
69 (P)	High efficiency particulate air (HEPA) filters shall meet the construction, material, test, and qualification requirements of military specification MIL-F-51068, except that listing of manufacturer's HEPA filter products on the U.S. Army's Qualified Products List is not required. Glass fiber media shall conform to the requirements of military specification MIL-F-51079. To be acceptable, filters shall have documentation showing that they have passed designated MIL-F-51068 tests as required in paragraph 5.1 of ASME N509.	ASME N509 5.1	See Section FC of the AG-1 Matrix for compliance to the requirements associated with the HEPA Filters for these systems.	NA	NA	NA	NA
70 (P)	High Efficiency Particulate Air (HEPA) filters for use in containment or in Engineered Safety Feature (ESF) systems shall be metal case type (type II frames as defined by MIL-F-51068) and shall be compatible *with the chemical composition of the air stream. Filter systems* exposed to temperatures greater than 200 degrees F shall have steel cell sides.	ASME N509 5.1.1	See Section FC of the AG-1 Matrix for compliance to the requirements associated with the HEPA Filters for these systems.	NA	NA	NA	NA

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71 (P)	Radiation resistance by High Efficiency Particulate Air (HEPA) filter media shall meet the requirements of MIL-F-51079 and the conditions listed in paragraph 4.2.1 of ASME N509.	ASME N509 5.1.2	See Section FC of the AG-1 Matrix for compliance to the requirements associated with the HEPA Filters for these systems.	NA	NA	NA	NA
72 (P)	A Certificate of Conformance for High Efficiency Particulate Air (HEPA) filters shall be provided to the owner certifying that: (a) the filter assembly has been designed in accordance with para. 5.1; (b) the materials of construction comply with paras. 5.1, 5.1.1, and 5.1.2; (c) the filters and filter media have been qualified in accordance with para. 5.1; (d) the filters and filter media have been tested in accordance with para. 5.1; (e) the filters have been packaged in accordance with para. 6.	ASME N509 5.1.3.1	See Section FC of the AG-1 Matrix for compliance to the requirements associated with the HEPA Filters for these systems.	NA	NA	NA	NA
73 (P)	The following documentation for High Efficiency Particulate Air (HEPA) filters shall be provided to the owner: (a) copies of the production test results required by Military Standards; (b) copies of all filter case material certifications, if required by the owner's purchasing documents.	ASME N509 5.1.3.2	See Section FC of the AG-1 Matrix for compliance to the requirements associated with the HEPA Filters for these systems.	NA	NA	NA	NA
74 (P)	Tray-type and deep bed adsorber cells shall meet the requirements for Type II or Type III cells, respectively, of ASME/ANSI AG-1-1988, Sections FD, Type II Adsorbers, and FE, Type III Adsorbers; and shall be filled with an adsorbent, each batch of which meets the requirements of para. 5.2.3 of ASME N509.	ASME N509 5.2.1	This requirement is not applicable. Adsorber cells were not associated with the design of these systems.	NA	NA	NA	NA
75 (D,P,F)	Adsorber cells shall be designed and fabricated in accordance with the requirements of paragraph 5.2.2 of ASME N509.	ASME N509 5.2.2	This requirement is not applicable. Adsorber cells were not associated with the design of these systems.	NA	NA	NA	NA
76 (P)	Adsorbent media used in Engineered Safety Feature (ESF) and non-ESF adsorbers shall meet the requirements of ASME /ANSI AG-1-1988, section FF, Adsorbent Media.	ASME N509 5.2.3.1, 5.2.3.2	This requirement is not applicable. Adsorber cells were not associated with the design of these systems.	NA	NA	NA	NA
77 (D,T)	For Engineered Safety Feature (ESF) and non-ESF adsorbent, tests shall be conducted on unused adsorbent for the conditions specified in the plant's technical specifications. These tests shall be referred to as benchmark surveillance test. Acceptance criteria shall be in accordance with Technical Specifications.	ASME N509 5.2.3.3	This requirement is not applicable. Adsorber cells were not associated with the design of these systems.	NA	NA	NA	NA

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78 (D,P)	Outline drawings showing major dimensions, dimensional tolerances, methods of sealing and baffling and method of installation shall be furnished. The drawings for all adsorbers shall show the materials of construction and screen details (hole diameter and spacing, open area) in accordance with the IPA Designers, Specifiers, and Buyers handbook for Perforated Metal.	ASME N509 5.2.4	This requirement is not applicable. Adsorber cells were not associated with the design of these systems.	NA	NA	NA	NA
79 (P)	A report giving the information specified in sections FD,FE, and FF of ASME/ANSI AG-1-1988 shall be furnished to the owner. A detailed written procedure for filling and emptying the adsorber shall also be furnished.	ASME N509 5.2.5.1, 5.2.5.2	This requirement is not applicable. Adsorber cells were not associated with the design of these systems.	NA	NA	NA	NA
80 (D,P)	Air-cleaning unit prefilters and postfilters shall be replaceable, extended media, dry type, meeting the requirements for group III filters of Air Conditioning and Refrigeration Institute (ARI) 680, and shall be listed as Class I filters in the current UL building materials directory. *Media shall be moisture resistant.*	ASME N509 5.3	See Section FB of the AG-1 Matrix for compliance to the requirements associated with the Pre-Filters and Post-Filters.	NA	NA	NA	NA
81 (P)	Air-cleaning unit prefilters and postfilters shall have published ratings, in accordance with Air Conditioning and Refrigeration Institute (ARI) 680 as follows: (a) average atmospheric dust-spot efficiency in accordance with ASHRAE Standard 52, for postfilters of 95 %, and 45 % for prefilters; (b) airflow capacity: same as or greater than HEPA filters for the same filter frame face area.	ASME N509 5.3.1	See Section FB of the AG-1 Matrix for compliance to the requirements associated with the Pre-Filters and Post-Filters.	NA	NA	NA	NA
82 (P)	A report giving the air-cleaning unit prefilter and postfilter outline dimensions, description of construction, materials of construction, certification of conformance with UL900, and certification of efficiency in accordance with ASHRAE Standard 52 shall be furnished to the owner.	ASME N509 5.3.3	See Section FB of the AG-1 Matrix for compliance to the requirements associated with the Pre-Filters and Post-Filters.	NA	NA	NA	NA
83 (P,T)	Air-cleaning unit moisture separators shall be of a design that has been qualified by testing in accordance with the procedures described in MSAR-71-45, NYO-3250-6, or an equivalent program. Moisture separators shall be found by test to be capable of performing as specified in paragraph 5.4 (a) and (b) of ASME N509.	ASME N509 5.4	See Section FA of the AG-1 Matrix for compliance to the requirements associated with the moisture separators.	NA	NA	NA	NA

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84 (P)	Drawings showing the air-cleaning unit moisture separators details of construction, methods of sealing, baffling, and draining, dimensions, dimensional tolerances, resistance characteristics, and method of installation shall be furnished to the owner. The locations and sizes of drains to remove collected water, materials of construction, and other information required to properly install, use, and maintain the moisture separators shall be included on the drawings.	ASME N509 5.4.1	See Section FA of the AG-1 Matrix for compliance to the requirements associated with the moisture separators.	NA	NA	NA	NA
85 (DP,T)	A report showing the results of satisfactory qualifications testing of the type of air-cleaning unit moisture separator proposed shall be furnished to the owner if the equipment has not been previously satisfactorily tested and reported in available published literature as in MSAR-71-45, NYO-3250-6, or other documents of comparable detail.	ASME N509 5.4.2	See Section FA of the AG-1 Matrix for compliance to the requirements associated with the moisture separators.	NA	NA	NA	NA
86 (D,P)	Air-cleaning unit heaters shall be electric and capable of meeting the requirements of paragraph 4.5 of ASME N509 . Heaters shall be designed for replacement without metal cutting or welding. Heaters shall not be attached directly to or grounded to the adsorber mounting frame. Heaters shall be physically sized such that face velocity exceeds manufacturer's minimum requirement.	ASME N509 5.5	See Section CA of the AG-1 Matrix for compliance to the requirements associated with the Air-cleaning Unit Heaters.	NA	NA	NA	NA
87 (D,P)	The air-cleaning unit heater stage shall be sized on the basis of heat transfer calculations showing a capability of reducing the maximum expected relative humidity of the entering air stream mixture to approximately 70% in the housing space between the moisture separator or housing inlet (whichever is applicable) and the prefilter stage, at the system design flow rate. The sensible heat produced by the heater stage shall not result in increasing air temperatures to more that 225 degrees F. An over temperature cutoff switch set at this valve shall be provided.	ASME N509 5.5.1	See Section CA of the AG-1 Matrix for compliance to the requirements associated with the Air-cleaning Unit Heaters.	NA	NA	NA	NA
88 (P)	Drawings showing the details of construction, dimensions, dimensional tolerances, size and location of services (i.e., electrical connections) and method of installation of the air-cleaning unit heaters shall be furnished to the owner.	ASME N509 5.5.2	See Section CA of the AG-1 Matrix for compliance to the requirements associated with the Air-cleaning Unit Heaters.	NA	NA	NA	NA
89 (P)	Heaters in Engineered Safety Feature (ESF) air-cleaning units shall be qualified to meet the requirements of Institute of Electrical and Electronics Engineers (IEEE) 323 and IEEE 344.	ASME N509 5.5.3	See Section CA of the AG-1 Matrix for compliance to the requirements associated with the Air-cleaning Unit Heaters.	NA	NA	NA	NA

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90 (P,T)	A report containing description and results of qualifications testing and the resistance, certification and serial number (s) of the air-cleaning unit heaters purchased shall be furnished to the owner. If small scale model tests are the bases of design, scaled-up calculations must be provided. Heat transfer calculations shall be submitted to the owner if requested.	ASME N509 5.5.4	See Section CA of the AG-1 Matrix for compliance to the requirements associated with the Air-cleaning Unit Heaters.	NA	NA	NA	NA
91 (D,P)	Air-cleaning unit filter housings shall be designed and constructed to meet the structural and pressure loadings of section 4 of ASME N509. Welding shall conform with paragraph 7.3 of ASME N509. Layout of the housing and banks of components within the housing shall provide for access to both sides of each bank of components for maintenance and testing. For uniform airflow (within plus/minus 20% of average) through each bank of components; the completed housing shall meet the requirements of the airflow uniformity test of ASME N510.	ASME N509 5.6.1	See Section HA of the AG-1 Matrix for compliance to the requirements associated with the Filter Housings.	NA	NA	NA	NA
92 (D,P,T)	Air-cleaning unit High Efficiency Particulate Air (HEPA) filter and adsorber mounting frames shall meet the requirements of paragraph 5.6.3 of ASME N509, and shall be sealed into the housing by welding; no mastics, sealants, or caulking compounds shall be used to seal the mounting frame. Duct and fan connections shall be located with respect to the air distribution uniformity requirement specified (within plus/minus 20% of average). Housings shall be tested by the manufacturer in accordance with paragraph 5.6.5 of ASME N509.	ASME N509 5.6.1	See Section FG of the AG-1 Matrix for compliance to the requirements associated with the HEPA Filter Mounting Fames.	NA	NA	NA	NA
93 (D,P)	The mechanical design of air-cleaning unit housings shall be in accordance with the requirements of ASME N509 paragraph 5.6.2 (a) housing doors; (b) lighting; (c) drains; (d) housing penetrations; (e) housing connections; (f) flexible connections; and (g) housing drawings.	ASME N509 5.6.2	See Section HA of the AG-1 Matrix for compliance to the requirements associated with the Filter Housings.	NA	NA	NA	NA
94 (D,P)	Air-cleaning unit mounting frames for all components (moisture separators, prefilters, heaters, HEPA filters, adsorbers, and postfilters) shall be all-welded construction and seal-welded into the housing to prevent trapping of contamination between frame and housing and shall be fabricated in accordance with paragraph 5.6.3 of ASME N509. Drawings of clamping devices for HEPA filters and type II adsorbers cells shall be submitted to the owner prior to fabrication.	ASME N509 5.6.3	See Section FG of the AG-1 Matrix for compliance to the requirements associated with the HEPA Filter Mounting Fames.	NA	NA	NA	NA

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95 (D,P,F)	Carbon, stainless, and galvanized steel, aluminum, copper, bronze, or glass used for the fabrication of parts, components, air-cleaning units, and systems covered by ASME N509 shall meet the requirements of and be furnished in accordance with American Society of Testing and Materials (ASTM) Standards applicable to the type of material or item. The ASTM number (s) for all such materials and copies of supporting documentation (i.e., test reports and/or materials-manufacturer's certification) shall be filed by the fabricator and made available to the owner. Where a specific ASTM standard is required, the designer shall specify and the fabricator shall use such material. Where post accident spray chemistry may cause H2 generation, the use of any material incompatible with the spray chemistry shall be avoided.	ASME N509 5.6.4.1	See "Materials" of the applicable sections of the AG-1 Matrix for compliance to the requirements associated with materials used in the fabrication of Air Cleaning Units.	NA	NA	NA	NA
96 (D,P)	Internal and external surfaces of both Engineered Safety Feature (ESF) and non-ESF duct housings located inside containment shall be stainless steel or be treated with a paint or protective coating that meets the requirements of ANSI N101.2 (for light-water reactors) or the requirements for "Severe Exposure" of ANSI N512 (for nuclear facilities other than light-water reactors): the selection, application, and inspection of paints and coatings shall conform to and be documented in accordance with the requirements of American Society of Testing and Materials (ASTM) D3843.	ASME N509 5.6.4.2	See Section HA of the AG-1 Matrix for compliance to the requirements associated with the Filter Housings.	NA	NA	NA	NA
97 (D,P)	Internal surfaces of Engineered Safety Feature(ESF) systems located outside of containment shall be stainless steel, galvanized or electrolytic-zinc-coated steel, or treated with a paint or protective coating meeting the requirements of Service Level I of ANSI N512 and table 5-1 of ASME N509. The selection, application, and inspection of paints and protective coatings (including zinc to the extent applicable) shall conform to and be documented in accordance with the requirements of American Society of Testing and Materials (ASTM) 3843.	ASME N509 5.6.4.3	See Section AA of the AG-1 Matrix for compliance to the requirements associated with Coatings.	NA	NA	NA	NA
98 (D,P)	Internal surfaces of normally operating Engineered Safety Feature (ESF) air cleaning systems shall be treated to meet the requirements of Service Level II of ANSI N512, if environmental conditions do not significantly change between normal and postaccident operation.	ASME N509 5.6.4.3	See Section AA of the AG-1 Matrix for compliance to the requirements associated with Coatings.	NA	NA	NA	NA

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99 (D,P)	Nongalvanized carbon steel external surfaces shall be coated or painted for corrosion resistance. Where conditions exist outside of containment (e.g., in systems containing sprays with chemical additives) which restrict the use of aluminum, galvanized or electrolytic-zinc-coated steel, external and internal surfaces of Engineered Safety Feature (ESF) housings shall be in accordance with paragraph 5.6.4.2 of ASME N509.	ASME N509 5.6.4.3	See Section AA of the AG-1 Matrix for compliance to the requirements associated with Coatings.	NA	NA	NA	NA
100 (D,P,F)	Galvanized surfaces of Engineered Safety Feature (ESF) air cleaning systems shall meet the requirements of American Society of Testing and Materials (ASTM) A123; electrolytic-zinc-coated surfaces shall meet the requirements of type GS of ASTM A164. Edges of steel sheared after coating, welds, and areas in which the galvanized coating has been removed for any reason shall be treated with inorganic zinc rich paint (qualified to ANSI N101.2) to restore the corrosion resistance of those areas. Galvanized surfaces that have been damaged shall be repaired with an appropriate qualified material per ANSI N101.2. The damaged areas shall be coated to provide an equivalent to the original coating.	ASME N509 5.6.4.5	See Section AA of the AG-1 Matrix for compliance to the requirements associated with Coatings.	NA	NA	NA	NA
101 (D,P)	If permanently installed sampling and injection manifolds cannot be provided the air-cleaning unit, then manifolds shall be designed to be removable with each manifold's piece numbered, tagged with permanent metal tags and marked for reinstallation prior to each test.	ASME N509 5.6.5.1	See Section HA of the AG-1 Matrix for compliance to the requirements associated with the Filter Housings.	NA	NA	NA	NA
102 (D,P)	As a minimum, injection and sampling manifolds are required between each pair of HEPA filter banks and between each pair of carbon adsorber banks.	ASME N509 5.6.5.1	See Section HA of the AG-1 Matrix for compliance to the requirements associated with the Filter Housings.	NA	NA	NA	NA
103 (D,P)	For air-cleaning systems with no inlet ducts or no outlet ducts, injection manifolds and sampling manifolds shall be located within the housing.	ASME N509 5.6.5.1	See Section HA of the AG-1 Matrix for compliance to the requirements associated with the Filter Housings.	NA	NA	NA	NA
104 (D,P)	Manifolds shall be: (a) located to provide uniform mixing and sampling of the test agent, (b) located to allow for maintenance of the filter elements, and (c) designed such that they do not impair the function of the adjacent filter banks or the structural integrity of the filter frames or housing when subjected to the structural loadings listed in para. 4.2 of ASME N509.	ASME N509 5.6.5.1	See Section HA of the AG-1 Matrix for compliance to the requirements associated with the Filter Housings.	NA	NA	NA	NA

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105 (D,P,T)	Each injection and sampling manifold shall be shown on a drawing which indicates location within the air-cleaning unit housing, distance from components, support detail, tube diameters, hole locations and diameters, location of valves and plugs, manifold identification number, and manifold internal volume. Drawings shall be submitted to the owner for review prior to fabrication and final as-built drawings submitted to the owner after shop testing. Manifold design and location *shall be qualified by shop tests per paragraphs 5.6.5.5 and 5.6.5.6 of* ASME N509.	ASME N509 5.6.5.1	See Section HA of the AG-1 Matrix for compliance to the requirements associated with the Filter Housings.	NA	NA	NA	NA
106 (P,I)	Air-cleaning unit housings shall be visually inspected in the shop prior to shipping. Visual inspection shall be performed in accordance with applicable sections of ASME N510-1989 section 5. Observed deficiencies shall be documented on a visual inspection checklist, required corrective action noted, and results of reinspection documented. Visual inspection documentation shall be transmitted to the owner for his records.	ASME N509 5.6.5.2	See Section HA of the AG-1 Matrix for compliance to the requirements associated with the Filter Housings.	NA	NA	NA	NA
107 (T,P)	All High Efficiency Particulate Air (HEPA) filter frame and adsorber bed welds which could result in leakage bypassing HEPA filters or adsorber beds shall be shop tested with magnetic particle or liquid penetrant in accordance with the requirement in paragraph 7.3 of ASME N509. In *addition, each HEPA and adsorber frame shall be pressure leak tested* in the shop in accordance with ASME N510, section 7. Leakage shall not be greater than 0.10. of rated flow.	ASME N509 5.6.5.3	See Section FG of the AG-1 Matrix for compliance to the requirements associated with the HEPA Filter Mounting Frames.	NA	NA	NA	NA
108 (T,P)	Air-cleaning unit housings or housing sections shall be leak tested in the shop prior to shipment, in accordance with ASME N510, section 6. Leakage shall be no greater than acceptance criteria provided by the owner. Results of housing leak tests shall be transmitted to the owner for his records.	ASME N509 5.6.5.4	See Section HA of the AG-1 Matrix for compliance to the requirements associated with the Filter Housings.	NA	NA	NA	NA

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109 (T,P)	Airflow distribution testing shall be performed in the shop prior to air-cleaning unit shipment in accordance with ASME N510, section 8 to provide assurance that manufacturer's design provides uniform air distribution. Shop tests shall simulate actual field entrance and exit duct connections as closely as possible. Field testing shall also be conducted in accordance with ASME N510. Acceptance criteria shall be as given in ASME N510. Results of airflow distribution tests shall be documented and transmitted to the owner for his records.	ASME N509 5.6.5.5	See Section HA of the AG-1 Matrix for compliance to the requirements associated with the Filter Housings. Also, see Section TA of the AG-1 Matrix for compliance to the requirements for Field Testing.	NA	NA	NA	NA
110 (P,T)	Air-aerosol mixing uniformity tests shall be performed in the shop for each manifold which is provided by the manufacturer to be mounted within the air-cleaning unit filter housing. Qualification testing of sampling manifolds shall be conducted in accordance with Appendix D of ASME N509. Qualification testing of injection manifolds shall be performed in accordance with ASME N510, Section 9. Results of tests shall be documented and transmitted to the owner. These results shall qualify the design and installation of the sample manifolds prior to shipment. Acceptance criteria shall be as given in ASME N510. Field testing shall also be conducted in accordance with ASME N510 after installation.	ASME N509 5.6.5.6	See Section HA of the AG-1 Matrix for compliance to the requirements associated with the Filter Housings.	NA	NA	NA	NA
111 (P,D)	Air-cleaning unit fans shall be selected on the basis of detailed system pressure loss calculations, and shall be capable of producing the specified design flow rates. The system designer shall, in accordance, with Air Movement and Control Association, Inc. (AMCA) 201, prepare a system characteristic curve for design and limiting conditions under which the fans will be required to operate. Fan selection shall also be consistent with the conditions specified in paragraph 5.7.1 of ASME N509.	ASME N509 5.7.1	See Section BA of the AG-1 Matrix for compliance to the requirements associated with the Air-Cleaning Unit Fans.	NA	NA	NA	NA

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112 (P,T)	Engineered Safety Features (ESF) fans shall be tested in accordance with Air Movement and Control Association, Inc. (AMCA) 210 and the applicable special sections of AMCA 211A. Only one fan of each size and type must be tested. Non-ESF fans shall be either rated and listed in accordance with AMCA 211A or tested the same as ESF fans. The rating or fan test shall be based on the standard test configuration most closely representative of the manner in which the fan will be installed in the Nuclear Air Treatment System.	ASME N509 5.7.2	See Section BA of the AG-1 Matrix for compliance to the requirements associated with the Air-Cleaning Unit Fans	NA	NA	NA	NA
113 (P,T)	Copies of the rating report or test report shall be obtained from the fan manufacturer, together with copies of pertinent catalog data, performance data, and operating and service manuals for inclusion with the documentation for the air-cleaning system. Sound ratings for the fan, based on data obtained in accordance with Air Movement and Control Association, Inc. (AMCA) 300 and reported in accordance with AMCA 301, shall be furnished.	ASME N509 5.7.2	See Section BA of the AG-1 Matrix for compliance to the requirements associated with the Air-Cleaning Unit Fans	NA	NA	NA	NA
114 (P)	Air-cleaning unit fan wheels shall be dynamically balanced prior to final assembly of the fan. Records shall be maintained in the vendor's file. The double amplitude of vibration in any plane measured on the bearing cap at the rotational rotor speed shall not exceed the following: Rotational Speed (rpm) Double Amplitude (mil) 600 3.2 720 2.7 900 2.1 1200 1.6 1800 1.1 3600 0.5 Displacement may be interpolated for other speeds. Final balancing shall be performed after fan installation is completed.	ASME N509 5.7.3	See Section BA of the AG-1 Matrix for compliance to the requirements associated with the Air-Cleaning Unit Fans	NA	NA	NA	NA

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115 (P)	Certified drawings showing outline dimensions, base or mounting dimensions, dimensional tolerances, duct connections, method or details of motor attachment and other information necessary to install, use, and maintain the air-cleaning unit fan shall be furnished to the owner and included in the documentation. The drawings shall also show the recommended motor, belts (if any), couplings, drive units, materials of construction, protective coatings, and lubricants.	ASME N509 5.7.4	See Section BA of the AG-1 Matrix for compliance to the requirements associated with the Air-Cleaning Unit Fans	NA	NA	NA	NA
116 (P,T)	A report giving a description and results of the air-cleaning unit fan qualification tests shall be furnished to the owner. The report shall include all calculations and descriptions of any analytical or mathematical modeling techniques, a description of any computer codes used with reference to computer code validation documentation, or other tests made in conjunction with the certification or qualification of the fan or fan assembly.	ASME N509 5.7.5	See Section BA of the AG-1 Matrix for compliance to the requirements associated with the Air-Cleaning Unit Fans	NA	NA	NA	NA
117 (P,T)	Air-cleaning unit fan drive motors shall comply with and be tested and rated in accordance with applicable requirements of National Electrical Manufacturers' Association (NEMA) MG-1, and Institute of Electrical and Electronics Engineers (IEEE) 112A. Performance shall be verified by either test or certification as specified for each requirement. Rated service factor shall be a minimum of 1.0 unless specified otherwise. Motors shall be of the type specified for the intended service and shall have operating characteristics and other criteria as outlined in paragraph 5.8.1 of ASME N509.	ASME N509 5.8.1	See Section BA of the AG-1 Matrix for compliance to the requirements associated with the Air-Cleaning Unit Fans	NA	NA	NA	NA
118 (P,D)	Fan drives in Engineered Safety Feature (ESF) systems shall comply with Institute of Electrical and Electronic Engineers (IEEE) 323. In addition, drives of ESF systems located inside containment shall be qualified in accordance with IEEE 334. ESF fan drives shall be qualified in accordance with IEEE 344. Motor supports and hangers shall be designed to withstand all seismic and operating loads with the motor in its normal operating orientation without impairment of operating characteristics.	ASME N509 5.8.2	See Section BA of the AG-1 Matrix for compliance to the requirements associated with the Air-Cleaning Unit Fans	NA	NA	NA	NA

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119 (P)	Certified fan drive motor data sheets and dimension drawings showing major dimensions, dimensional tolerances, base or mounting dimensions, and other data needed for installation of the motor shall be furnished to the owner. Documentation specified in Institute of Electrical and Electronic Engineers (IEEE) 323 shall also be furnished for Engineered Safety Feature (ESF) system motors.	ASME N509 5.8.3	See Section BA of the AG-1 Matrix for compliance to the requirements associated with the Air-Cleaning Unit Fans	NA	NA	NA	NA
120 (P,D)	Supplemental parameters, as outlined in paragraph 5.9.2 of ASME N509, shall be considered for each air-cleaning unit damper when established design requirements, in addition to those delineated in paragraph 4.2 of ASME N509.	ASME N509 5.9.2	See Section DA of the AG-1 Matrix for compliance to the requirements associated with the Air-Cleaning Unit Dampers.	NA	NA	NA	NA
121 (P,F)	Construction of Class A air-cleaning unit dampers shall meet the requirements for valves of ANSI/ASME B31.1.	ASME N509 5.9.3.1	See Section DA of the AG-1 Matrix for compliance to the requirements associated with the Air-Cleaning Unit Dampers.	NA	NA	NA	NA
122 (P,F)	Construction Class B air-cleaning unit dampers shall be industrial quality construction: all parts, including frame, blades, pivots, shafts, bearings, linkages and operator, shall be designed to the minimum criteria as outlined in paragraph 5.9.3.2 of ASME N509 (a) frame; (b) blade and shaft; (c) linkage; (d) bearings; and (e) stress.	ASME N509 5.9.3.2	See Section DA of the AG-1 Matrix for compliance to the requirements associated with the Air-Cleaning Unit Dampers.	NA	NA	NA	NA
123 (P,F)	Welding of Construction Class A air-cleaning unit dampers shall comply with the requirements of ANSI/ASME B31.1. Welding of Construction Class B dampers shall comply with paragraph 7.3 of ASME N509.	ASME N509 5.9.4	See Section DA of the AG-1 Matrix for compliance to the requirements associated with the Air-Cleaning Unit Dampers.	NA	NA	NA	NA
124 (P,D)	Operator torque requirements shall be specified by the air-cleaning unit damper manufacturer. Operators shall be designed to provide a minimum of 1.5 times to torque to meet specified maximum leak rate requirements or dynamic requirements, whichever are greater. Electrically powered operators, solenoid valves, and limit switches used in Engineered Safety Feature (ESF) systems shall be qualified to meet the requirements of Institute of Electrical and Electronic Engineers (IEEE) 323 and IEEE 334. Positive locking devices shall be provided on balancing damper manual operators.	ASME N509 5.9.5	See Section DA of the AG-1 Matrix for compliance to the requirements associated with the Air-Cleaning Unit Dampers.	NA	NA	NA	NA

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				AN	AP	AW	SY
125 (P,D)	Air-cleaning unit dampers with external rotating shafts shall have a mechanical position indicating arm and escutcheon plate; dampers which will be remotely indicated shall also have the necessary switches, relays, or other devices necessary to meet the requirements of paragraph 4.8 of ASME N509. Electrical switches used for remote indication of the damper position in the Engineered Safety Feature (ESF) system which are specified to perform additional safety-related functions shall be required to meet the requirements of Institute of Electrical and Electronic Engineers (IEEE) 323.	ASME N509 5.9.6	See Section DA of the AG-1 Matrix for compliance to the requirements associated with the Air-Cleaning Unit Dampers.	NA	NA	NA	NA
126 (P,T)	Flow characteristics and pressure drop qualification tests for air-cleaning unit dampers shall be determined in accordance with Air Movement and Control Association (AMCA) 500. Leakage rates and test reports for leakage Classes I, II, and III shall conform to the requirements of paragraph 5.9.7.1 of ASME N509.	ASME N509 5.9.7.1	See Section DA of the AG-1 Matrix for compliance to the requirements associated with the Air-Cleaning Unit Dampers.	NA	NA	NA	NA
127 (P,T)	Each air-cleaning unit damper (except manual balancing dampers) and its accessories shall, as a shop test, be cycled at least 10 times from the full-open to the full-closed position to check the free operation of all parts and correct adjustment, positioning and seating of blades. On completion of cycling, the alignment shall be reworked, if necessary to correct deficiencies before shipment. When shop leakage tests are required, they shall be performed after the cycling test and after the deficiencies have been corrected.	ASME N509 5.9.7.2	See Section DA of the AG-1 Matrix for compliance to the requirements associated with the Air-Cleaning Unit Dampers.	NA	NA	NA	NA
128 (P,T)	The following described bubble test shall be conducted on each air-cleaning unit leakage Class I damper assembly. The damper assembly shall be bolted to a sealed chamber which is then pressurized to the specified pressure; there shall be no bubbles when tested with a soap solution in accordance with the bubble method of leak detection in ASME N510-1989.	ASME N509 5.9.7.3	See Section DA of the AG-1 Matrix for compliance to the requirements associated with the Air-Cleaning Unit Dampers.	NA	NA	NA	NA

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129 (P,T)	The manufacturer of the air-cleaning unit dampers shall furnish the following items to the owner: (a) pressure drop, in. w.g., at design airflow capacity, with AMCA 500 apparatus setup figure; (b) air leakage rate, cfm/ft^2, in full-closed position at specified pressure differential, and torque with AMCA 500 apparatus setup figure; (c) maximum torque required by damper, ft-lb; (d) operator torque available in position corresponding to maximum damper torque; (e) shop leak test report when required; (f) IEEE qualification reports on electric-powered operators and electric accessories. All reports, data, and manuals furnished by the manufacturer shall be marked to show the manufacturer's name and damper identification.	ASME N509 5.9.8	See Section DA of the AG-1 Matrix for compliance to the requirements associated with the Air-Cleaning Unit Dampers.	NA	NA	NA	NA
130 (P)	Certified drawings showing the general arrangement and principal dimensions of the air-cleaning unit damper equipment including operators and accessories, and cross sections through the equipment shall be submitted to the owner. This shall include size, type, and location of all support connections and other information as required by paragraph 5.9.9 of ASME N509.	ASME N509 5.9.9	See Section DA of the AG-1 Matrix for compliance to the requirements associated with the Air-Cleaning Unit Dampers.	NA	NA	NA	NA
131 (P,O)	Air-cleaning unit dampers shall be prepared for shipment in accordance with paragraph 6.1 of ASME N509.	ASME N509 5.9.10	See Section DA of the AG-1 Matrix for compliance to the requirements associated with the Air-Cleaning Unit Dampers.	NA	NA	NA	NA
132 (P,D)	Coatings for air-cleaning unit dampers shall be in accordance with paragraph 5.6.4 of ASME N509.	ASME N509 5.9.11	See Section DA of the AG-1 Matrix for compliance to the requirements associated with the Air-Cleaning Unit Dampers.	NA	NA	NA	NA
133 (D)	*The air-cleaning unit duct system shall be designed and constructed to* meet the structural and pressure loading and leak tightness of section 4 of ASME N509, while transporting a possibly contaminated or treated air or gas stream from the point (s) of collection to the points (s) of intersection with plant ventilation system or discharge to a plant vent stack.	ASME N509 5.10.1	*See Section SA of the AG-1 Matrix for* compliance to the requirements associated with the Duct System.	NA	NA	NA	NA
134 (D)	The following supplemental parameters shall be considered for the duct system when establishing design requirements in addition to those delineated in paras. 4.2,4.4,4.5, and 4.6 of ASME N509: (a) duct size (b) methods of support (c) system operating pressure.	ASME N509 5.10.2	See Section SA of the AG-1 Matrix for compliance to the requirements associated with the Duct System.	NA	NA	NA	NA

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135 (D)	Air-cleaning unit duct system transverse joints and longitudinal seams shall be designed to retain their structural and sealing integrity when subject to the design loads .	ASME N509 5.10.3.1	See Section SA of the AG-1 Matrix for compliance to the requirements associated with the Duct System.	NA	NA	NA	NA
136 (D)	Air- cleaning unit duct system stresses and deflections, or charts used to determine them, shall be based on calculation that consider the loads as described in paragraph 5.10.3.2 of ASME N509.	ASME N509 5.10.3.2	See Section SA of the AG-1 Matrix for compliance to the requirements associated with the Duct System.	NA	NA	NA	NA
137 (D)	Air-cleaning unit duct system allowable stress shall be 0.6 of the yield stress for loads encountered during normal plant operation and shutdown and shall be 0.9 of the yield stress for combined loads which include the Safe Shutdown Earthquake and Design Basis Tornado.	ASME N509 5.10.3.3	See Section SA of the AG-1 Matrix for compliance to the requirements associated with the Duct System.	NA	NA	NA	NA
138 (D)	Air-cleaning unit duct system allowable static deflections shall not exceed the following values: (a) plate or sheet: 1/8 in. per ft of the maximum unsupported panel span in direction of airflow but not more than 3/4 in. relative to stiffeners; (b) stiffeners and flange connections: 1/8 in. per ft of span but not more than 3/4 in; (c) flange connection to dampers and fans: 1/360 of the span or 1/8 in. maximum.	ASME N509 5.10.3.4	See Section SA of the AG-1 Matrix for compliance to the requirements associated with the Duct System.	NA	NA	NA	NA
139 (F,D)	Air -cleaning unit duct construction shall be in accordance with the requirements of paragraph 5.10.4 of ASME N509.	ASME N509 5.10.4	See Section SA of the AG-1 Matrix for compliance to the requirements associated with the Duct System.	NA	NA	NA	NA
140 (F,D)	Welding of air-cleaning units ducts shall be in accordance with paragraph 7.3 of ASME N509.	ASME N509 5.10.5	See Section SA of the AG-1 Matrix for compliance to the requirements associated with the Duct System.	NA	NA	NA	NA
141 (F,D)	Materials used in the fabrication of air-cleaning unit duct work shall conform to the requirements of paragraph 5.10.6 of ASME N509.	ASME N509 5.10.6	See Section SA of the AG-1 Matrix for compliance to the requirements associated with the Duct System.	NA	NA	NA	NA
142 (F,D)	Air-cleaning unit duct coatings shall be in accordance with paragraph 5.6.4 of ASME N509.	ASME N509 5.10.7	See Section SA of the AG-1 Matrix for compliance to the requirements associated with the Duct System.	NA	NA	NA	NA
143 (T)	Except where excluded in paragraph 5.10.8.1 of ASME N509, air-cleaning unit duct sections shall be subjected to air leak tests as described in ASME N510-1989 using the criteria given in paragraph 4.14 of ASME N509.	ASME N509 5.10.8.1	See Section SA of the AG-1 Matrix for compliance to the requirements associated with the Duct System.	NA	NA	NA	NA

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144 (T)	A duct section need not be subjected to quantitative measurement of leakage if one of the conditions of (a) – (f) of paragraph 5.10.8.1 of ASME N509 is satisfied. However, a procedure to pressurize the system and locate and seal all audible leaks shall be applied.	ASME N509 5.10.8.1	See Section SA of the AG-1 Matrix for compliance to the requirements associated with the Duct System.	NA	NA	NA	NA
145 (T)	A pressure test shall be performed on those portions of ducts and housings of once-through and recirculation nuclear air treatment systems which could be subjected to fan peak pressure due to closure of dampers on suction or discharge of fan. The test shall be performed at the structural capability pressure established in paragraph 4.6.6 of ASME N509. If required, ducts shall be tested in accordance with structural capability pressure test of ASME N510. Upon completion of the pressure test, ductwork exhibiting permanent distortion or breach of integrity shall be repaired or replaced. The pressure test shall be repeated after repairs until no permanent distortion or breach of integrity is observed.	ASME N509 5.10.8.2	See Section SA of the AG-1 Matrix for compliance to the requirements associated with the Duct System. Also, see Section HA for compliance to the requirements associated with the Housings.	NA	NA	NA	NA
146 (T,SU)	Prior to declaring the nuclear air treatment system operable, all duct systems shall be balanced to achieve design flow rate at the fan (s) and maintain spaces at the required pressure differential. Upper and lower flow limits shall be established by owner such that design function of the system is maintained and equipment capabilities are not exceeded.	ASME N509 5.10.9	See Section SA of the AG-1 Matrix for compliance to the requirements associated with the Duct System.	NA	NA	NA	NA
147 (O)	Air-cleaning unit adsorber cells (Type I or II) shall be prepared for shipping in accordance with applicable section of ANSI/ASME AG-1-1988. Prefilters and after filters shall be packaged in accordance with manufacturer's standard practice. Moisture separators, High Efficiency Particulate Air (HEPA) filters, heaters, Type III adsorbers, motors, fans, and dampers shall be crated or skidded, or both in a manner that will protect the item from physical damage and exposure to dirt, weather, (including road spatter), and vibration during shipment and subsequent storage at the installation site for conditions in paragraph 4.2 of ASME N509. Panels shall be bolted to flanges or otherwise attached so they cannot be torn loose during shipping. Unpainted carbon steel surfaces shall be located with a rust inhibitor before packaging. Openings shall be covered in accordance with paragraph 6.1 of ASME N509.	ASME N509 6.1	See "Packaging, Shipping, and Handling" requirements in applicable Sections of the AG-1 Matrix for compliance to this requirement.	NA	NA	NA	NA

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148 (O)	Air- cleaning unit materials and components shall be moved and handled in a manner that does not damage the item or its packaging. Receiving and storage personnel shall be informed of the necessity of proper handling of all components, especially the High Efficiency Particulate Air (HEPA) filters and carbon adsorber cells. Adsorbent shall be packaged, and stored in accordance with ANSI/ASME AG-1 section FE. Materials and components shall be stored in accordance with the requirements of paragraph 6.2 of ASME N509.	ASME N509 6.2	See "Packaging, Shipping, and Handling" requirements in applicable Sections of the AG-1 Matrix for compliance to this requirement.	NA	NA	NA	NA
149 (D)	Complete air-cleaning system layout drawings showing the location of housing, ducts, fan dampers, and the other external components in each of three mutually perpendicular planes shall be prepared prior to the start of erection. Drawings shall show all connections, hangers, and anchors, the location and joint details for all welds, and the procedure specification for each weld. The layout drawings shall reference dimension and shop drawings of components, as applicable. Layout shall be checked for interferences with other items to be installed in the area, and conflicts shall be resolved before installation.	ASME N509 7.1	This requirement is acceptable based on a review of the associated CVI data and the applicable drawings for each system.	CC	CC	CC	CC
150 (F)	All air-cleaning system ducts, housings, fans, dampers, hangers, anchors, and services (electrical, steam, drains, etc.) shall be installed in strict conformance with the layout drawings; deviations of more than the design tolerance from the location in any plane from the position shown in the drawings shall be approved by the system designer or other responsible engineer, and shall be documented by "As-Built" drawings. Assembly and erection of the system shall be in accordance with section 7.2 of ASME N509.	ASME N509 7.2	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
151 (T,F)	Welding procedures, welders, and welding operators installing and erecting the air-cleaning system shall be qualified in accordance with ANSI/ASME AG-I-1988. Production welds shall be visually inspected in accordance with American Welding Society (AWS) D1.1 standards. Acceptance criteria for welds produced per ASME BPVC Section IX, shall be in accordance with the applicable ASME design section of the Code. Performance qualification tests and samples shall be in conformance with paragraph 7.3 of ASME N509.	ASME N509 7.3	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

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152 (F)	The position and alignment of air-cleaning system foundations, anchors, hangers, ducts, housings, dampers, fans, motors, and other components shall be checked and their locations shall be within tolerance as shown on the drawings. Pleats of High Efficiency Particulate Air (HEPA) filters shall be vertical, gaskets of HEPA filters and adsorbers shall be securely affixed so that they are not displaced during installation. Clamping devices shall be in place and completely tightened to produce the required gasket compression. Installation personnel shall be instructed in the proper handling of the HEPA filters and carbon cell adsorbers prior to the installation and clamping of the filters. See Paragraph 7.4 of ASME N509 for additional installation requirements.	ASME N509 7.4	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC
153 QA	The design organization, manufacturers of components, and constructors (including subcontractors) shall each establish and comply with a comprehensive quality assurance program and plan which meets the requirements of ANSI/ASME NQA-1-1986.	ASME N509 8.1	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

Best Available Image

Rqmt No./Ops. Step	ASME N509-1989 Nuclear Power Plant Air-Cleaning Units and Components Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
154 (P)	As a minimum, the following shall be documented and submitted to the owner: Documentation (N509 Section) Design Parameters (4.2) Maximum Operating Pressure (4.6) Test Pressure (4.6) Structural Capability Pressure (4.6) Test Cannister Qualification (4.11) Basis and Quantity for Maximum Allowable Leakage (4.14) HEPA Filter Qualification Report (5.1.3) Adsorber Drawings and Qualification Report (5.2.4/5.2.5) Prefilter and Postfilter Qualification Reports (5.4.1) Moisture Separator Drawings and Qualification Report (5.4.1/5.4.2) Heater Drawings and Qualification Report (5.5.2/5.5.4) Housing Drawings (5.6.2g) HEPA and Adsorber Clamping Device Drawings (5.6.3) Manifold Drawings (5.6.5.1) Factory Visual Inspection Reports (5.6.5.2) Factory Housing Leak Test Results (5.6.5.4) Factory Airflow Distribution Test Results (5.6.5.5) Factory Air-Aerosol Mixing Uniformity Test Results (5.6.5.6) Fan Drawings and Qualification Test Report (5.7.4/5.7.5) Fan Motor Drawings and Data Sheets (5.8.3) Damper Drawings and Reports (5.9.8) Test Acceptance Criteria (Table 9-1) System Layout Drawings (7.1)	ASME N509 8.2	This requirement could not be verified by a review of the documentation that was available for systems AN, AP, and AW however, based on past operating performance, these systems are considered to be acceptable as-is. System SY complied with this requirement completely.	DR	DR	DR	CC

Best Available Image

Rqmt No./Ops. Step	ASME N509-1989 Nuclear Power Plant Air-Cleaning Units and Components Requirement Text	Rqmt Source / Sec #	Rqmt Compliance	Status Indicators: (See Legend for Key) AN	AP	AW	SY
155 (T)	Acceptance tests of the air-cleaning system shall be made in accordance with the procedures of ASME N510. All dampers, valves, and controls shall be exercised through their full operating range and shown to be in good operating condition before the start of testing. After completion of acceptance testing, the system shall be sealed and the fan controls locked out to protect the components during the remainder of construction operations at the site. The system designer (engineer) shall provide the acceptance criteria in Table 9-1 of ASME N509 to the owner to incorporate in his acceptance and surveillance test procedure and project specification in accordance with ASME N510 requirements.	ASME N509 9	See ASME N510 Matrix for compliance to this requirement.	DR	DR	DR	CC

Best Available Image

Attachment 19

ASME AG-1

Compliance Matrix

Legend

Best Available Image

Compliance Matrix Legend

For the

ALARACT Demonstration

For Tank Farms

AN, AP, AW, and SY

STATUS INDICATORS:

CC	Complies Completely
DR	Deviation Required
NA	Not Applicable
NC	Non-Compliant