

<b>2. To: (Receiving Organization) Distribution</b> W-320 TWRs/TCPN # D2991	<b>3. From: (Originating Organization) TWRs Projects/SST Retrieval</b> 6. Design Authority/ Design Agent/Cog. Engr.: JW Bailey, NHC	<b>4. Related EDT No.:</b> n/a <b>7. Purchase Order No.:</b> n/a <b>9. Equip./Component No.:</b> n/a <b>10. System/Bldg./Facility:</b> 241-C-106
<b>8. Originator Remarks:</b> For approval and release of a new supporting document. This document has been generated to ensure retrievability of the Project W-320 "Construction Specification W-320-C6".		<b>12. Major Assm. Dwg. No.:</b> n/a <b>13. Permit/Permit Application No.:</b> n/a <b>14. Required Response Date:</b>
<b>11. Receiver Remarks:</b> 11A. Design Baseline Document? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		

15. DATA TRANSMITTED					(F)	(G)	(H)	(I)
(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev. No.	(E) Title or Description of Data Transmitted	Approval Designator	Reason for Transmittal	Originator Disposition	Receiver Disposition
1	HNF-2535	-	0	Project W-320, 241-C-106 Sluicing, Construction Specification W-320-C6	NA			-

16. KEY						
Approval Designator (F)	Reason for Transmittal (G)			Disposition (H) & (I)		
E, S, Q, D or N/A (see WHC-CM-3-5, Sec.12.7)	1. Approval	4. Review	2. Release	5. Post-Review	1. Approved	4. Reviewed no/comment
	3. Information	6. Dist. (Receipt Acknow. Required)			2. Approved w/comment	5. Reviewed w/comment
					3. Disapproved w/comment	6. Receipt acknowledged

17. SIGNATURE/DISTRIBUTION (See Approval Designator for required signatures)											
(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN	(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN
2	1	Design Authority	<i>JW Bailey</i>	7/19/98	S2-48						
		Design Agent									
2	1	Cog. Eng.	<i>M.C. Davenport</i>	7/18/98	S2-48						
2	1	Cog. Mgr.	<i>JW Bailey</i>	7/18/98	S2-48						
		QA									
		Safety									
		Env.									

<b>18.</b> M.C. Davenport <i>M.C. Davenport</i> Signature of EDT Originator      Date 7/18/98	<b>19.</b> _____ Authorized Representative      Date for Receiving Organization	<b>20.</b> <i>JW Bailey</i> J.W. Bailey      Date 7/18/98 Design Authority/ Cognizant Manager	<b>21. DOE APPROVAL (if required) Ctrl. No.</b> <input type="checkbox"/> Approved <input type="checkbox"/> Approved w/comments <input type="checkbox"/> Disapproved w/comments
--	--	---	---

# Project W-320, 241-C-106 Sluicing, Construction Specification, W-320-C6

John W. Bailey  
Numatec Hanford Co., Richland, WA 99352  
U.S. Department of Energy Contract DE-AC09-96RL13200

EDT/ECN: 622269 UC: 506  
Org Code: 8C452 Charge Code: D2991/HANA0600  
B&R Code: EW3130010 Total Pages: 124

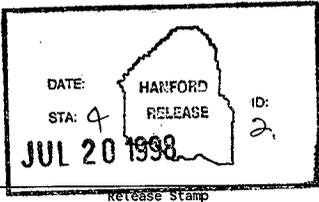
Key Words: W-320, Sluicing, Tank 241-C-106, Tank 241-AY-102,  
WRSS, Specifications, Construction.

Abstract: This supporting document has been prepared to make the construction specifications for Project W-320, readily available.

TRADEMARK DISCLAIMER. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors.

Printed in the United States of America. To obtain copies of this document, contact: Document Control Services, P.O. Box 950, Mailstop H6-08, Richland WA 99352, Phone (509) 372-2420; Fax (509) 376-4989.

*Kara J. Bost*  
\_\_\_\_\_  
Release Approval Date 7/20/98



Approved for Public Release

DR2 6/26/98

**ENGINEERING CHANGE NOTICE**

Page 1 of 3

1. ECN 649181  
 Proj. ECN W-320-808

2. ECN Category (mark one)  Supplemental <input type="checkbox"/> Direct Revision <input checked="" type="checkbox"/> Change ECN <input type="checkbox"/> Temporary Standby <input type="checkbox"/> Supersedure <input type="checkbox"/> Cancel/Void <input type="checkbox"/>	3. Originator's Name, Organization, MSIN, and Telephone No. <b>DL. Evans, FDNW, S2-47, 373-2688</b>	4. USQ Required? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <i>CHUBB (See block 14b) 6/29/98</i>	5. Date <b>6/25/98</b>	
	6. Project Title/No./Work Order No. <b>W320 Waste Retrieval for Tank 241-C-106 /W320 / Pkg 5</b>	7. Bldg./Sys./Fac. No. <b>Tank 241-C-106</b>	8. Approval Designator <b>SQ/SC</b>	
	9. Document Numbers Changed by this ECN (includes sheet no. and rev.) <b>W-320-C6, Rev 1</b>	10. Related ECN No(s). <b>none</b>	11. Related PO No. <b>NA</b>	

12a. Modification Work <input type="checkbox"/> Yes (fill out Blk. 12b) <input checked="" type="checkbox"/> No (NA Blks. 12b, 12c, 12d)	12b. Work Package No. <b>NA</b>	12c. Modification Work Complete <b>NA</b> Design Authority/Cog. Engineer Signature & Date	12d. Restored to Original Condition (Temp. or Standby ECN only) <b>NA</b> Design Authority/Cog. Engineer Signature & Date
---	------------------------------------	---	---

13a. Description of Change

13b. Design Baseline Document?  Yes  No GS

**As-Built and General Revisions of the construction specification W-320-C6. Changes to include:**

Section	Pg	Paragraph	Change
01010	1	1.1.1	delete " Sh 8"
01010	1	1.3.1	delete " Sh 8"
13440	15	item 28	change model # from "43050" to "43230S"
13440	16	PDISH-13614	change table entries as follows: Adj Range from "0-10 PSID" to "0-30 PSID"; Set Point from "5 PSID" to "18 PSID"; and Scale or Chart from "0-10 PSID" to "0-30 PSID"
13440	16	PDISH-13615	change table entries as follows: Adj Range from "0-50 in H <sub>2</sub> O" to "0-30 PSID"; Set Point from "30 in H <sub>2</sub> O" to "18 PSID"; and Scale or Chart from "0-50 in H <sub>2</sub> O" to "0-30 PSID"

Continued on Page 3

14a. Justification (mark one)

Criteria Change <input type="checkbox"/>	Design Improvement <input type="checkbox"/>	Environmental <input type="checkbox"/>	Facility Deactivation <input type="checkbox"/>
As-Found <input checked="" type="checkbox"/>	Facilitate Const <input type="checkbox"/>	Const. Error/Omission <input type="checkbox"/>	Design Error/Omission <input type="checkbox"/>

14b. Justification Details

**As-Built construction specification for project turnover.**

**No USQ required because categorical exclusion (TF-96-0690, Rev 2) applies.**

**No project calculations are affected by this work.**

**An independent review of this design change was performed by FDNW in accordance with HNF-PRO-445.**

15. Distribution (include name, MSIN, and no. of copies)

CDC, S2-53, 1  
 TJ Kasnick, S2-47, 1

JW Bailey, S2-48, 1  
 RL Powers, S5-13, 1

Project Files, R1-29,

RELEASE STAMP

DATE: **JUL 08 1998**

STA: **4**



HANFORD  
RELEASE

ID: **2**

# ENGINEERING CHANGE NOTICE

1. ECN (use no. from pg. 1)

W-320-808

Page 2 of 3

16. Design Verification Required  
 Yes  
 No

17. Cost Impact

ENGINEERING		CONSTRUCTION	
Additional	<input type="checkbox"/> \$ NA	Additional	<input type="checkbox"/> \$ NA
Savings	<input type="checkbox"/> \$	Savings	<input type="checkbox"/> \$

18. Schedule Impact (days)

Improvement  NA  
 Delay

19. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 13. Enter the affected document number in Block 20.

SDO/DDO <input type="checkbox"/> Functional Design Criteria <input type="checkbox"/> Operating Specification <input type="checkbox"/> Criticality Specification <input type="checkbox"/> Conceptual Design Report <input type="checkbox"/> Equipment Spec. <input type="checkbox"/> Const. Spec. <input type="checkbox"/> Procurement Spec. <input type="checkbox"/> Vendor Information <input type="checkbox"/> O&M Manual <input type="checkbox"/> FSAR/SAR <input type="checkbox"/> Safety Equipment List <input type="checkbox"/> Radiation Work Permit <input type="checkbox"/> Environmental Impact Statement <input type="checkbox"/> Environmental Report <input type="checkbox"/> Environmental Permit <input type="checkbox"/>	Select/Stress Analysis <input type="checkbox"/> Stress/Design Report <input type="checkbox"/> Interface Control Drawing <input type="checkbox"/> Calibration Procedure <input type="checkbox"/> Installation Procedure <input type="checkbox"/> Maintenance Procedure <input type="checkbox"/> Engineering Procedure <input type="checkbox"/> Operating Instruction <input type="checkbox"/> Operating Procedure <input type="checkbox"/> Operational Safety Requirement <input type="checkbox"/> IEPD Drawing <input type="checkbox"/> Cell Arrangement Drawing <input type="checkbox"/> Essential Material Specification <input type="checkbox"/> Fac. Proc. Stamp. Schedule <input type="checkbox"/> Inspection Plan <input type="checkbox"/> Inventory Adjustment Request <input type="checkbox"/>	Tank Calibration Manual <input type="checkbox"/> Health Physics Procedure <input type="checkbox"/> Spares Multiple Unit Listing <input type="checkbox"/> Test Procedures/Specification <input type="checkbox"/> Component Index <input type="checkbox"/> ASME Coded Item <input type="checkbox"/> Human Factor Consideration <input type="checkbox"/> Computer Software <input type="checkbox"/> Electric Circuit Schedule <input type="checkbox"/> ICRS Procedure <input type="checkbox"/> Process Control Manual/Plan <input type="checkbox"/> Process Flow Chart <input type="checkbox"/> Purchase Requisition <input type="checkbox"/> Tickler File <input type="checkbox"/> <i>None 6/25/98</i> <input checked="" type="checkbox"/>
---	---	--

20. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision	Document Number/Revision
NA	

21. Approvals

Signature	Date	Signature	Date
Design Authority <i>[Signature]</i>	6/22/98	Design Agent <i>[Signature]</i>	6/25/98
Cog. Eng. <i>[Signature]</i>	6/29/98	PE <i>[Signature]</i>	6-25-98
Cog. Mgr. <i>[Signature]</i>	6/29/98	QA - NA	NA
QA <i>[Signature]</i>	6-29-98	Safety - NA	NA
Safety <i>[Signature]</i>	7-7-98	Design - DL Evans <i>[Signature]</i>	6/25/98
Environ.		Environ. - NA	NA
Other <i>[Signature]</i>	02-08-98	Checker - <i>[Signature]</i>	6/25/98
		Other -	

DEPARTMENT OF ENERGY

Signature or a Control Number that tracks the Approval Signature

ADDITIONAL



EXPIRES: 7/21/00

## ENGINEERING CHANGE NOTICE CONTINUATION SHEET

Page 3 of 3

ECN W-320-808

Date 6/25/98

Block 13a, continued:

Section	Pg	Paragraph	change
15493	12	PIPE CODE M-5	change "Safety Class 3" to "General Service"
15493	13	PIPE CODE M-5	change "Safety Class 3" to "General Service"
15493	14	PIPE CODE M-7	change "Safety Class 3" to "General Service"
15493	15	PIPE CODE M-9	change "Safety Class 3" to "General Service"
15493	15a	PIPE CODE M-9	change "Safety Class 3" to "General Service"
15493	16	PIPE CODE M-24	change "Safety Class 3" to "General Service"
15493	17	PIPE CODE M-31	change "Safety Class 3" to "General Service"
15493	18	PIPE CODE M-33a	change "Safety Class 3" to "General Service"
15507	17	PIPE CODE D-3	change "Safety Class 3" to "General Service"
15507	18	PIPE CODE M-4	change "Safety Class 3" to "General Service"
15507	19	PIPE CODE M-8	change "Safety Class 3" to "General Service"



AS-BUILT REV 2

TANK 241-C-166 SLUICING  
Process Building Skid Fabrication

Original Issue: 09/14/95

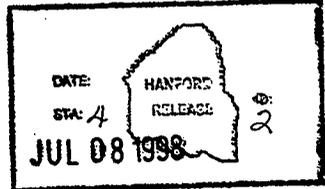
Prepared By

Fluor Daniel Northwest  
Richland, Washington

For

Numatec Hanford Corporation

Contract 651005



*[Signature]*  
 Client Concurrence \_\_\_\_\_ Date 6/25/98

*[Signature]*  
 Project Manager \_\_\_\_\_ Date 6-25-98

*[Signature]*  
 Lead Engineer \_\_\_\_\_ Date 6/25/98

*[Signature]*  
 Field Concurrence \_\_\_\_\_ Date 6/25/98

*[Signature]*  
 Checked By \_\_\_\_\_ Date 6/25/98

*[Signature]*  
 Prepared By \_\_\_\_\_ Date 6/25/98

The ECNs affecting specification are as follows:

HNF-2535 Rev. 0  
Page vi

ECN W-320-105

~~01019-1~~ Was a direct revision  
13440-2, 26, 27 ECN against Rev 0.  
15493-2, 11, 13 Changes were  
16400-2 incorporated into Rev 1.

ECN W-320-115

05500-1, 3, 4

ECN W-320-118

15493-15

ECN W-32-122

15493-2, 19

ECN W-320-132

13440-4, 16, 18, 19, 21, 23, 27, 30, 31  
35, 36, 37, 38

ECN W-320-144

154930-10, 14, 18

ECN W-320-168

13440-15, 37, 38

ECN W-320-174

05500-4

ECN W-320-191

15493-20

ECN W-320-197

15507-21

ECN W-320-201

15493-9

ECN W-320-203

15507-13

ECN W-320-253

15493-15

ECN W-320-261

15493-5

15507-7

ECN W-320-286

15493-15a

ECN W-320-320

15493-10,16

ECN W-320-336

15493-14

ECN W-320-347

15493-8

ECN W-320-358

15493-10

ECN W-320-446

15493-10

ECN W-320-454

15493-10

ECN W-320-458

13440-3, 4

ECN W-320-505

15493-14

ECN W-320-548

13440-38

15507-20

ECN W-320-597

05500-2

16400-9

ECN W-320-741

15493-10

ECN W-320-743

15507-14, 15

ECN W-320-808

01010-1

13440-15, 16

15493-12, 13, 14, 15, 15a, 16, 17, 18

15507-17, 18, 19

CONSTRUCTION SPECIFICATION

TANK 241-C-106 SLUICING  
PACKAGE 5 - PROCESS BUILDING SKID FABRICATION

KAISER ENGINEERS HANFORD	
CONTROLLED DOCUMENT	
STATION NO. 4	
DIST	
DATE	SEP 25 1995
PROJ / WO	W-320
NO	PLE-1

Work Order ER4319

Prepared By  
ICF Kaiser Hanford Company  
Richland, Washington

For Westinghouse Hanford Company  
Subcontract WHC 380393

APPROVED

ICF Kaiser Hanford Company (ICF KH)

Danny L Evans  
Principal/Lead Engineer

8/16/95  
Date

Charles Brown  
Technical Documents

8-15-95  
Date

Bill Carlson  
Safety

8-16-95  
Date

David Lyle Frit  
Environmental Engineering

8/16/95  
Date

C.E. Eaton  
Quality Engineering

8-16-95  
Date

Arthur S. Strudwick  
Construction

8/18/95  
Date

Andrew Decker  
Project Management

8/16/95  
Date

Westinghouse Hanford Company (WHC)

Thomas H. May  
Projects Department

8/31/95  
Date

OFFICIAL RELEASE BY WHC	(51)
DATE	SEP 14 1995
<u>Sta. 31</u>	

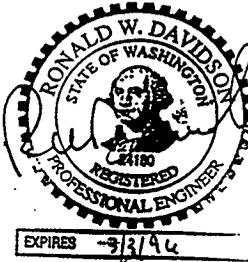
CONSTRUCTION SPECIFICATION

TANK 241-C-106 SLUICING  
PACKAGE 5 - PROCESS BUILDING SKID FABRICATION

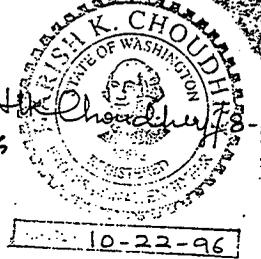
Prepared by  
ICF Kaiser Hanford Company  
Richland, Washington

CERTIFICATION

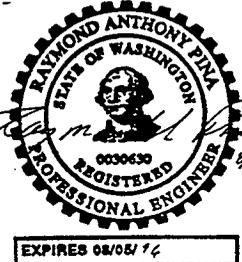
I certify that the indicated sections of this Specification were prepared by me or under my supervision and that I am a registered professional engineer under the laws of the State of Washington.



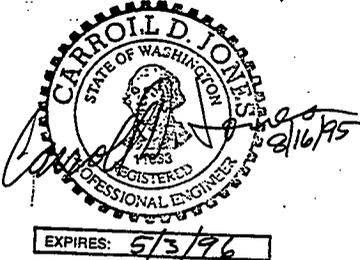
Ronald W. Davidson, PE  
Civil/Structural  
Section 05500



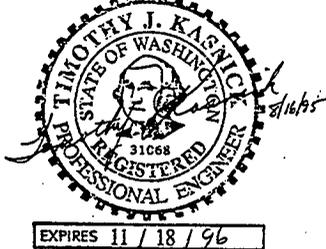
Harish K. Choudhry, PE  
Instrumentation  
Section 13440



Raymond A. Pina, PE  
HVAC  
Section 15507



Carrol D. Jones, PE  
Piping  
Section 15493



Timothy J. Kasnick, PE  
Electrical  
Section 16400

TABLE OF CONTENTS

	Page
Title and Approval Page	i
Certification Page	ii
Table of Contents	iii
	Total Pages
<u>DIVISION 1 - GENERAL REQUIREMENTS</u>	
Section 01010 Summary of Work	2
Section 01019 Items Furnished for Construction	1
Section 01300 Submittals	3
Section 01400 Quality Assurance	4
Section 01610 Delivery, Storage, and Handling	3
Section 01630 Product Options and Substitutions	3
Section 01720 Project Record Documents	3
<u>DIVISION 5 - METALS</u>	
Section 05500 Metal Fabrications	4a, 6
<u>DIVISION 13 - SPECIAL CONSTRUCTION</u>	
Section 13440 Instrumentation	23a, 38
<u>DIVISION 15 - MECHANICAL</u>	
Section 15493 Chemical Process Piping Systems	5a, 8a, 10a, 15a, 20
Appendix A Identification of Piping Systems	2
Section 15507 Contaminated Air HVAC Systems	21
Appendix A Identification of Piping Systems	2
<u>DIVISION 16 - ELECTRICAL</u>	
Section 16400 Service and Distribution	9

SECTION 01010  
SUMMARY OF WORK

PART 1 - GENERAL

1.1 INTRODUCTION

1.1.1 Project W-320, WASTE RETRIEVAL SLUICING SYSTEM (WRSS), is located as shown on Drawing H-2-818423. ~~Sh-8-~~

ECN-808

1.1.2 This Specification is for procurement of material, equipment, and components, fabrication of piping and supports, fabrication of the skid structure, and installation and wiring of the fabricated and procured equipment and components on the skid structure. The skid will be used as part of an HVAC system that will treat vent gas from an underground tank containing high level radioactive waste.

1.2 STATEMENT OF WORK

1.2.1 Scope: Work consists of furnishing labor, equipment, and materials to procure materials and equipment, fabricate items, and install equipment, piping, wiring, and structures in accordance with the Project Documents.

1.2.2 Work Included: The following itemization is intended to be broad in scope, and identify major work elements only.

1.2.2.1 Fabrication of the skid structure.

1.2.2.2 Fabrication of piping and an instrument rack.

1.2.2.3 Procurement of equipment and components.

1.2.2.4 Mounting of procured and fabricated equipment and components on the skid.

1.2.2.5 Mounting of equipment provided by others on the skid and providing installation of piping and tubing between the equipment and components.

1.2.2.6 Installation of wiring from instruments to terminal boxes, and on instrument rack.

1.2.2.7 Performing appropriate construction tests on the completed work, such as piping leak tests, and wiring continuity tests.

1.2.3 Work Not Included

1.2.3.1 Installation of the finished skid.

1.3 DRAWINGS

1.3.1 Drawings which show work required by the Project Documents are listed on Drawing H-2-818423. ~~Sh-8-~~

ECN-808

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01019

ITEMS FURNISHED FOR CONSTRUCTION

PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS: Not Used

1.3 GENERAL

1.3.1 Material and equipment furnished or made available for incorporation into the Work are identified in this Section.

1.4 EQUIPMENT

1.4.1 Items listed below will be furnished by the Construction Engineer for incorporation into the Work.

1.4.1.1 High Efficiency Metal Filter (HEMF), HMF-1361, Specification W-320-P3.

1.4.1.2 Heat Exchanger, HX-1361, Specification W-320-P4.

1.4.1.3 High Efficiency Mist Eliminator (HEME), HME-1361, Specification W-320-P5.

1.4.1.4 Recirculation Cooling Fan, FN-1361, Specification W-320-P6.

1.4.1.5 Electric Heating Coil, HC-1361, and Silicon-Controlled Rectifier (SCR) Control Panel, SCP-1361, Specification W-320-P7.

1.4.1.6 Moisture Separator, MS-1361, Specification W-320-P8.

1.4.2 Items noted in 1.4.1 are being procured and will be delivered to Project site. Notify the Construction Engineer 5 working days before need date to arrange for delivery.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01300

SUBMITTALS

PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS: Not Used (See the other sections requiring submittals)

1.3 SUBMITTAL CONDITIONS

1.3.1 Materials and equipment fabricated or installed without required approved submittals, or which differ from approved Drawings or vendor data, are subject to rejection and replacement.

1.4 SUBMITTALS REQUIRED

1.4.1 Required submittals are defined in Part 1, Article 1.2 of the specification sections.

1.4.2 Submittals are divided into two types; those requiring approval, and those not requiring approval. Included in the former are submittals of architectural material samples, where the Construction Engineer reserves the right to make final selections.

1.4.3 Submittals are required no later than the times indicated. Those requiring approval must be approved before further submittal-related procurement, fabrication, or construction is accomplished. This also applies for the Construction Engineer's selections made from samples submitted.

1.5 SUBMITTAL REVIEWS

1.5.1 Submittals requiring approval will be reviewed to verify completeness and conformance to requirements. Appropriate dispositions will be made as specified in 3.2.

1.5.2 Allow 21 calendar days for review and disposition of submittals. This time period will be measured from date of submittal receipt in the Construction Engineer's office to date of return.

1.5.3 Submittals not requiring approval will be reviewed to verify completeness and adequacy for their intended purposes. If acceptable, these items are filed, and finally delivered to the Operating Contractor. Unacceptable items will be handled as specified in 3.2.1.3.

1.5.4 If a submittal not requiring approval has not been returned within the time period specified in 1.5.2, and the Construction Engineer has not been informed that additional review time is necessary, consider it accepted.

PART 2 - PRODUCTS

Not Used

## PART 3 - EXECUTION

### 3.1 SUBMITTAL PROCEDURE

- 3.1.1 Transmit submittals using "Data Transmittal/Review," Form KEH-1838.
- 3.1.2 Identify each submittal by Specification Section/Paragraph Number and Submittal Title. The number of copies required includes 2 copies for return.
- 3.1.2.1 Approval Data (for products): Mark each line item package with the specification section and paragraph numbers specifying the product.
- 3.1.2.2 Vendor Information (for products): Mark each line item package with the specification section and paragraph numbers specifying the product, and the item name, manufacturer's name, model or part number, and tag number (if specified).
- 3.1.2.3 Items that require approval: Submit 6 copies, including one reproducible.
- 3.1.2.4 Samples for selections: Submit as required by the Sections of this Specification.
- 3.1.2.5 Items that do not require approval: Submit 10 copies.
- 3.1.3 Review each submittal for completeness, compliance with Project Documents, and proper identification, before sending to the Construction Engineer. Submittal data shall either be stamped, showing the review process has taken place, or the Data Transmittal form may be stamped "Reviewed for Compliance," and signed. Submittals not stamped or signed will be returned without consideration.
- 3.1.4 Procedures for performing certain types of work must be submitted for approval before work is commenced. Such procedures which have previously been approved, for work similar to that to be accomplished on this Project, may not need to be reapproved. Forward 1 copy of previously approved procedures to the Construction Engineer, by Data Transmittal form, and identify each by Section/Paragraph Number, Title, and either procedure number or project number for which the procedure was approved. Submittals will be reviewed by the Construction Engineer and, if acceptable, retained for record. If a previously approved procedure is not acceptable, the submittal will be returned, with requirements for resubmittal.

### 3.2 SUBMITTAL PROCESSING

- 3.2.1 Submittals requiring approval will be stamped by a representative of the Construction Engineer and marked "Approved," "Approved with Exception" or "Not Approved, Revise and Resubmit." Approval of submittals does not relieve the preparer of responsibility for errors contained therein.
- 3.2.1.1 Approved submittals are identified by the submittal stamp, with either the "Approved" or "Approved with Exception" box checked. "Approved"

signifies general concurrence of submittal conformance with Project design concepts and compliance with Project Document requirements. "Approved with Exception" signifies general concurrence, with noteworthy comments or clarifications. Approval of a specific item shall not be construed as approval of the system or assembly of which that item is a component.

- 3.2.1.2 A submittal which is not approved is identified as "Not Approved, Revise and Resubmit." The submittal is considered technically deficient, or incomplete, and therefore unacceptable. Resubmittal is required, hence fabrication, procurement, or performance of procedures shall not proceed.
- 3.2.1.3 Submittals not requiring approval that are found to be incomplete or inadequate will be returned marked "Resubmit." An explanation of the deficiencies will be included, for corrective action.
- 3.3 RESUBMITTAL
- 3.3.1 Upon receipt of deficient submittal data, make corrections noted on the transmittal, and resubmit data to the Construction Engineer.

END OF SECTION

SECTION 01400  
QUALITY ASSURANCE

PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS: Not Used

1.3 THE ONSITE CONSTRUCTION CONTRACTOR'S QAP WILL BE IMPLEMENTED

1.4 EXCLUDING MISREPRESENTED PRODUCTS

1.4.1 Take measures to prevent incorporation of misrepresented (ie, suspect/counterfeit) products into the work.

1.4.2 Methods to Detect and Exclude Misrepresented Products

1.4.2.1 Obtain products from original manufacturers, their authorized distributors, or other established and reliable sources only.

1.4.2.2 During the initial stages of procurement, be suspicious of quoted prices significantly lower, or delivery times significantly shorter, than those of competitors. Such quotations may be an indication that misrepresented products are being offered.

1.4.2.3 Products received should be in boxes or containers bearing original manufacturer's labels, except for bulk or lot materials that are repackaged for shipment in quantities ordered.

1.4.2.4 Screen newly procured products using screening information provided. Also, perform screening activities on previously procured (ie, stock on hand) products that are scheduled to be incorporated into the work. Screening activities should, at a minimum, include the following:

a. Screening to identify the source of the products (manufacturer, authorized distributor, or other reliable source).

b. Screening for false marking as to class, type or grade.

c. Screening for false labeling indicating qualification or approval by nationally recognized agencies (eg, UL Listed).

d. Screening for used products being represented as new.

e. Screening for falsified quality affecting documentation (eg, Certified Material Test Reports) being used as the basis for product acceptance.

1.4.3 Invoices and shipping documentation should be addressed to the contractor and should indicate that products were procured from the original manufacturer, authorized distributors, or other established/reliable sources.

- 1.4.4 Products identified are considered unacceptable and shall not be used in Project work.
- 1.4.5 Upon detection of suspect products, document the deficiencies and notify the Quality Control Inspector.
- 1.4.6 Segregate suspect products and maintain control to prevent use in Project work. Obtain direction from the Quality Control Inspector for disposal of suspect products.
- 1.4.7 If procurement/screening activities result in partial but inconclusive evidence of suspect products, contact the Quality Control Inspector for additional direction/assistance.

#### 1.5 INSPECTION AND WITNESS POINTS

- 1.5.1 Perform specified inspection and testing (see 1.5.3).
  - 1.5.1.1 Provide and maintain an inspection system that will ensure that work performed, including that performed by subcontractors and suppliers, conforms to requirements.
  - 1.5.1.2 Perform, or have performed, inspections and tests required to substantiate conformance to Project requirements. Such inspections shall be documented, indicating the inspector, date, item(s) inspected, and the results of inspection.
  - 1.5.1.3 Perform, or have performed, inspections required by referenced codes and standards. Such inspections shall be documented as in 1.5.1.2 above.
- 1.5.2 The customer will perform inspections and testing identified in this specification as the customer's responsibility, including the following.
  - 1.5.2.1 Inspection and witness points specified in 1.7.
  - 1.5.2.2 Final acceptance inspection.
- 1.5.3 Inspection Points: Adhere to inspection points. Personnel shall have completed inspections of, and approved portions of, work in accordance with Project requirements, before notifying the customer for inspection/witnessing.
  - 1.5.3.1 Listed inspection points define the type of inspections required to be performed, and are considered a minimum inspection level for customer involvement.
  - 1.5.3.2 Customer inspection points are defined as follows.
    - a. Receiving (R): Special items of fabrication, equipment, or material scheduled to be delivered to the Project site, or other designated location, which require inspection upon arrival and before installation. Notify the customer within four hours after item arrival.

b. Construction inspection (H): Required for witnessing of specific construction features, before further construction is allowed to proceed.

c. Witness (W): Selected for inspection at the option of the customer. Work may proceed upon verbal release by the customer, or upon expiration of one hour beyond the scheduled time of witnessing.

1.5.3.3 R, H, and W points apply to both onsite and offsite work. Except where a longer period is specified, notify the customer at least four working hours before each point for onsite work. For offsite work, notify the customer at least three working days before each required point.

1.5.3.4 R, H, and W points are specified in 1.7.

#### 1.6 OPEN ITEM AND NONCONFORMANCE REPORTING

1.6.1 Nonconformance Reports (NCRs) are used to document incomplete items or deviations from Project requirements.

1.6.1.1 Nonconformance reports: Documented on NCR forms, NCRs document deviations from Project requirements when characteristic, documentation, or procedure renders quality of an item or activity unacceptable, or indeterminate.

a. Nonconformances are identified by a red construction hold tag, or blue NCR tag.

b. A hold tag prohibits movement, installation, processing, or further fabrication of nonconforming items pending approval of the NCR disposition.

c. An NCR tag identifies a nonconformance, but allows work to proceed based on an approved NCR disposition. No action shall be taken to correct or alter an actual condition before receipt of an approved disposition.

d. Tags are not to be removed by anyone other than the agency who applied the tag.

1.6.2 Nonconformances reported during performance of the Project require resolution before completion.

1.7

SCHEDULE FOR R, H, AND W POINTS

SECTION NUMBER	SUBJECT	INSPECT POINT	OFFSITE	ONSITE
<b>METAL FABRICATION</b>				
05500-1	Torquing Swivel Hoist Rings	H		X
<b>INSTRUMENTATION</b>				
13440-1	Leak/Pressure Testing	W		X
13440-2	Electrical Testing	W		X
<b>CHEMICAL PROCESS PIPING SYSTEM</b>				
15493-1	Leak/Pressure Testing	W		X
15493-2	X-Ray Film Review	H		X
<b>CONTAMINATED AIR HVAC SYSTEM</b>				
15507-1	Leak/Pressure Testing	W		X
<b>SERVICE AND DISTRIBUTION</b>				
16400-1	Electrical Testing	W		X

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01610

DELIVERY, STORAGE, AND HANDLING

PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS: Not Used

1.3 SUMMARY

1.3.1 This section contains generally applicable requirements for delivery, inspection, marking, storage, and handling. Product unique requirements are contained in other sections.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 DELIVERY

3.1.1 Provide equipment and labor required for unloading, transporting, and handling delivered products.

3.2 RECEIVING INSPECTION

3.2.1 Arrange for immediate disposal and replacement of products found to be defective, damaged beyond repair, or in otherwise unacceptable condition.

3.2.2 Perform standard inspections, and additional inspections required by this specification.

3.2.3 Dry or clean products that have become wet or have accumulated foreign substances during shipment, but have not become damaged.

3.2.4 Perform additional identification marking of products when necessary to meet the requirements of this section, and other sections of this specification.

3.2.5 Inspect products and product marking and storage methods for compliance with specifications and the procedures required by this section, and other sections of this specification.

3.3 PRODUCT IDENTIFICATION AND SEGREGATION

3.3.1 Provide identification tags or markings for products of similar appearance, or intended for similar use, procured to different specifications, or from different manufacturers.

- 3.3.2 Include the following information, as applicable, on tags, with markings, and preexisting labels: Manufacturer's name, product brand name, specification number, and type, grade or class. Also include additional information required by other sections of this specification.
- 3.3.3 Segregate tagged or marked products, providing separate storage for each.
- 3.3.4 Preserve the identity of bulk and lot products (those consumed on an "as needed" basis during progress of the work) from the time of receipt at the worksite until use in construction.
  - 3.3.4.1 Control the identification and storage of welding materials in accordance with a written filler metal control procedure, maintained at the worksite. The procedure shall specify methods for control by heat or lot number, from receipt of material through consumption during fabrication, and for disposal of contaminated and partially used material.
  - 3.3.4.2 When pipe or tube is removed from storage and cut, clearly and permanently remark remaining pieces with either original markings or field code identification symbols, and return to storage.
  - 3.3.4.3 Use permanent marking methods on pipe and tube, including pens with water insoluble, indelible ink, crayon, paint, or paint stick. Vibratory etching equipment may be used with the approval of the Construction Engineer. Marking with steel stamps is not acceptable.

### 3.4 STORAGE

#### 3.4.1 Basic Storage

- 3.4.1.1 Store packaged products in their original, unbroken packages or containers, with seals and labels intact.
- 3.4.1.2 Store rolled products in an upright position.
- 3.4.1.3 Store products with finished surfaces in a manner to preclude surface damage by mechanical, atmospheric, or other effects.
- 3.4.1.4 Where contact between products could result in damage or rendering useless of one or both, store them far enough apart to prevent contact. If close proximity storage is necessary, provide a barrier between them.
- 3.4.1.5 Keep ports, nozzles, ends, and other openings on equipment, tanks, and lengths of pipe and tube capped or plugged during storage.
- 3.4.1.6 Follow manufacturer's recommendations for storage when such recommendations are given.
- 3.4.1.7 Remove, dispose of, and replace products with expired shelf-life dates.

3.4.2 Indoor Storage

3.4.2.1 Provide indoor storage for products that can be damaged by, or can deteriorate from, changes in temperature and relative humidity.

3.4.2.2 When required by other sections of this specification, or when recommended by product manufacturers, provide environmentally controlled storage. Maintain temperature 60 to 70°F, relative humidity below 55%, and provide ventilation.

3.4.3 Outdoor Storage

3.4.3.1 Provide skids, pallets, platforms, or other supports for products stored outdoors to prevent ground contact.

3.4.3.2 Provide sunshade protection for products that can be damaged by, or can deteriorate from, exposure to sunlight.

3.4.3.3 Provide weatherproof covers for products that can be damaged by, or can deteriorate from, the effects of contact with rain, snow, ice deposits, or blowing sand and debris.

3.4.3.4 Arrange stacks of stackable products so that condensation, which may accumulate during storage, will drain off.

3.5 HANDLING

3.5.1 Provide handling tools and equipment, and use methods designed to prevent occurrence of the following.

3.5.1.1 Impact, rubbing, or other contact damage to ends and surfaces of cylindrical (pipe and tube) type products, or to edges, corners, and surfaces of flat (panel and sheet) type products.

3.5.1.2 Twisting, racking, or other distortion of prefabricated structures and equipment assemblies.

3.5.1.3 Tearing or puncturing of wrappings or coverings, or breaking of seals on packages or cartons.

END OF SECTION

SECTION 01630

PRODUCT OPTIONS AND SUBSTITUTIONS

PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS

1.2.1 See Section 01300 for submittal procedures.

1.2.2 Approval Required

1.2.2.1 Substitution Approval Request(s): Before start of construction, submit request(s) as required by 1.3.4 and 1.3.5, prepared in accordance with 3.1.

1.2.3 Approval Not Required: None

1.3 SUBSTITUTIONS

1.3.1 Products include those items identified on the Drawings as well as in Part 2 of the Specification Sections.

1.3.2 Product options given in the Specification Sections represent functionally and physically equivalent items. In addition to generic type, materials, form and size, physical equivalence includes maintainability, reliability, and durability characteristics, as applicable for specific material or equipment items.

1.3.3 A substitute product may be used in place of a product or the product options identified in Specification Sections, without approval, if it is functionally and physically equivalent as defined above, and is not more hazardous.

1.3.4 Substitution of a product that is functionally but not physically equivalent, as defined above, or is more hazardous, requires submittal of a Substitution Approval Request.

1.3.5 Submittal of a Substitution Approval Request is also required when a product callout in the Specification Sections includes the phrase "or an approved substitute."

1.3.6 Total quantities of products required in specification sections shall be the same. Differences due to partial quantity substitutions are not acceptable.

1.3.7 Do not use materials and equipment removed from existing structure as substitutes for specified products, unless such use is required or allowed elsewhere in the Project Documents.

1.4 LIMITATIONS AND CONDITIONS

- 1.4.1 Substitutions will not be considered when indicated or implied on fabricator drawings, or product data submittals, without separate Substitution Approval Requests, when requested directly by subcontractors or suppliers, or when acceptance will require substantial revision of Project Documents.
- 1.4.2 Substitute products that require a substitution approval request shall not be ordered or installed before the request is approved.
- 1.4.3 Only one Substitution Approval Request for each product will be considered. When a substitution is not accepted, provide the specified product.
- 1.4.4 The Construction Engineer's representative will review and disposition requests for substitutions within 10 working days, unless evaluation requires extensive comparison or consultation.
- 1.4.5 The submittals for accepted substitute products, are the same as those specified in 1.2 for the original products of each Section.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 REQUEST PREPARATION

- 3.1.1 Submit a separate request for each substitution, using "Substitution Approval Request," Form KEH-1151.
- 3.1.2 Identify products by Specification Section and Article or Paragraph numbers. Provide manufacturer's name and address, trade name of product, and model or catalog number. List fabricators and suppliers as appropriate.
- 3.1.3 To each Substitution Approval Request attach descriptive information for substitute and original products. The information shall consist of drawings, calculations, and data as appropriate to define operational and physical characteristics of products, and establish a basis for comparison.
- 3.1.4 Give an itemized comparison of proposed substitution with specified product, listing variations, with reference to Specification Section and Article or Paragraph numbers.
- 3.1.5 Give quality and performance comparisons between proposed substitution and specified product.

- 3.1.6 Give cost data comparing proposed substitution with specified product, showing the Project Sum net change.
- 3.1.7 List availability of maintenance services and replacement materials.

END OF SECTION

SECTION 01720  
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS: Not Used

1.3 GENERAL

1.3.1 Hanford site work requires that certain documents, defined herein, be used to record the construction process, and administration of the Project.

1.3.2 Some data required for project records shall be delivered to the Construction Engineer during the course of construction and contract administration, while other data shall be assembled after completion of construction for delivery to the Construction Engineer. The Construction Engineer will assemble pertinent data for final disposition.

1.3.3 When information for project records is to be recorded on standard forms, copies of the forms will be supplied by the Construction Engineer. Samples of the appropriate required forms are included in the specification sections.

1.3.4 Project Record Documents required by the Project shall be prepared, preserved, and delivered to the Construction Engineer. These deliverable documents are in addition to submittals required in Section 01300.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 PROCEDURE

3.1.1 Identification and Marking: Mark documents that will become project records before use for construction. Upon completion, identify documents by title or number.

3.1.1.1 Notes or markings added by hand shall be legible, utilizing permanent nonsmearing marking media, such as ink or felt tip markers, in contrasting color.

3.1.1.2 Mark items to record actual construction, including changes to dimensions and details, manufacturer's name, catalog number, and substitute products.

- 3.1.2 Availability: Keep copies of project record documents, and make available to the Construction Engineer during progress of the Work.
- 3.1.3 Storage: Store 1 set, apart from documents used in construction, and maintain in clean, dry, and legible condition.
- 3.1.4 Delivery: Record delivery of documents by retaining copies of letters of transmittal itemizing delivered items, and reports delivered during the course of work. Retain until construction completion. An alternate means, acceptable to the Construction Engineer, may be used.
- 3.2 ACTIVITY AND ADMINISTRATIVE DOCUMENTS: Not Used
- 3.3 CONSTRUCTION, QUALITY ASSURANCE, AND SUPPORTING DOCUMENTS
- 3.3.1 Deliver in accordance with the following, when called for in specification sections.
- 3.3.2 Personnel Qualifications: Two copies of welder (bonder) qualifications, and NDE personnel qualifications, 5 days before start of fabrication. Maintain additional copies at the project site.
- 3.3.3 Procedures: Two copies of welding (bonding) and NDE procedures, 5 days before first use. Maintain additional copies at the project site.
- 3.3.4 Drawings: Three copies of weld (bond) identification drawings, 5 days before start of fabrication.
- 3.3.5 Expansion Anchor Inspection Results: One copy of inspection results within 5 days after completion.
- 3.3.6 NDE Records: One copy of weld (bond) NDE records within 5 days after NDE completion. These records may be either signed NDE record forms, or signed fabrication drawings with each weld (bond) bearing the inspector's stamp.
- 3.3.7 Material Properties Test Records: One copy of test results prior to delivery of material. These records are for acceptance tests of bulk materials and of lots or heats of preformed stock materials and parts.
- 3.3.8 Flushing Records: One copy of records verifying acceptable completion of flushing, before testing.
- 3.3.9 Leak/Pressure Testing Records: One copy of records verifying acceptable completion of leak and pressure testing, within 5 days after completion.
- 3.3.10 Disinfecting Records: One copy of records verifying acceptable completion of sanitary water line disinfecting, 5 days after completion.
- 3.3.11 Electrical Testing: One copy of records verifying acceptable completion of electrical insulation, continuity, and grounding tests, within 5 days after completion.

- 3.3.12 Operational Testing: One copy of records of component or subsystem operational testing, within 15 days before the start of acceptance testing.
- 3.3.13 Completed Acceptance Test Procedure (Test Results): One copy of Acceptance Test Procedure, with test results and other required information entered, within 5 days after completion.
- 3.3.14 Completed Certificate of Compliance: One copy of completed Certificate of Compliance, based on the completed Acceptance Test Procedure.
- 3.4 PRODUCT SAMPLES AND MANUFACTURER'S INSTRUCTIONS
- 3.4.1 In addition to submittals required in Section 01300, and requirements of this Section, information received by the Contractor (from suppliers) that documents products used, and how they were installed, shall be delivered to the Construction Engineer as Project Records.

END OF SECTION

SECTION 05500  
METAL FABRICATIONS

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 The following documents, including others referenced therein, form part of this Section to the extent designated herein.

1.1.1.1 American Institute of Steel Construction (AISC)

S329-85 Allowable Stress Design Specification  
for Structural Joints Using ASTM A 325  
or A 490 Bolts

ASD Allowable Stress Design, 9th Edition, ECN-115  
manual of Steel Construction ECN-115

1.1.1.2 American Society of Mechanical Engineers (ASME)

B&PVC Boiler and Pressure Vessel Code  
Section IX Welding and Brazing Qualifications

1.1.1.3 American Society for Nondestructive Testing (ASNT)

SNT-TC-1A Recommended Practice

1.1.1.4 American Society for Testing and Materials (ASTM)

A 36-91 Structural Steel

A 325-93 High-Strength Bolts for Structural  
Steel Joints

A 500-90a Cold-Formed Welded and Seamless Carbon  
Steel Structural Tubing in Rounds and  
Shapes

A 563-93 Carbon and Alloy Steel Nuts

F 436-93 Hardened Steel Washers

1.1.1.5 American Welding Society (AWS)

D1.1-94 Structural Welding Code - Steel

D1.3-89 Structural Welding Code - Sheet Steel

D9.1-90 Sheet Metal Welding Code

QC1-88 Certification of Welding Inspectors

1.1.1.6 Steel Structures Painting Council (SSPC)

- SP 2-82 Hand Tool Cleaning
- SP 3-82 Power Tool Cleaning
- SP 5-85 Blast Cleaning "White" Metal

1.2 SUBMITTALS

1.2.1 See Section 01300 for submittal procedures.

1.2.2 Approval Required

1.2.2.1 Drawings: For metal fabrications not shown on manufacturer's data sheets: Before fabrication, submit fabrication drawings and bill of materials. Include plans, elevations, details, sections, and connections. Show thickness, type, grade, class of metal, fasteners, anchorage, and accessory items where applicable.

~~1.2.2.2 Manufacturer's data: Before delivery, submit the following.~~

- ~~a. Copies of manufacturer's specifications.~~
- ~~b. Dimensioned diagrams.~~
- ~~c. Installation instructions for manufactured items.~~

ECN-597

ECN-597

1.2.3 Approval Not Required: None

1.3 QUALITY ASSURANCE

1.3.1 Misrepresented Products: See Section 01400 for required measures to prevent the use of misrepresented products.

1.3.2 Welding Processes - Structural Metal Work

1.3.2.1 Procedures for welding components shall have been qualified in accordance with the following.

- a. For structural steel, in accordance with AWS D1.1.
- b. For sheet steel (structural), in accordance with AWS D1.3.
- c. For sheet metal (seal welding), in accordance with AWS D9.1.

1.3.2.2 Qualification in accordance with the ASME B&PVC Section IX may be substituted for the above requirements.

1.3.3 Welding Personnel - Structural Metal Work

1.3.3.1 Personnel performing welding shall have been qualified in accordance with the respective Codes of 1.3.2.1.

- 1.3.3.2 Qualification in accordance with the ASME B&PVC Section IX may be substituted for the above requirements.
- 1.3.4 Welding Nondestructive Examination (NDE) Personnel
  - 1.3.4.1 Visual weld examinations shall be performed, and appropriate documentation prepared by Certified Welding Inspectors (CWI) who have received certification in accordance with AWS QC1. Certified Associate Welding Inspectors (CAWI), certified in accordance with the above standard, may perform examinations when under immediate direction of CWIs.
  - 1.3.4.2 Welding related examination documentation shall be signed or stamped by individuals performing examinations. Where CAWIs perform examinations, documentation shall be signed or stamped by both CAWIs and CWIs under whom examinations were performed.
- 1.3.5 Deliverable Documentation: The following documents and records, required by this Section, shall be delivered to Construction Document Control in accordance with Section 01720.

<u>Document</u>	<u>Paragraph</u>
Process and Personnel Qualifications	1.3.2, 1.3.3
Weld Examination Results	3.5.1

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 See Section 01610 for general requirements.

PART 2 - PRODUCTS

2.1 SUBSTITUTES

2.1.1 See Section 01630 for substitution approvals.

2.2 MATERIALS

2.2.1 Rolled Steel Shapes, Plates, and Bars: ASTM A 36.

2.2.2 Steel Tubing: ASTM A 500, Grade B.

2.2.3 Fasteners

2.2.3.1 Bolts: ASTM A 325, Type 1 or 2, plain (noncoated).

2.2.3.2 Nuts: ASTM A 563, Grade C, plain, heavy hex.

2.2.3.3 Washers: ASTM F 436, circular.

2.2.4 Welding Electrodes: E70XX or ER 70S-X.

ECN-115

- 2.2.5 Swivel Hoist Ring: Crosby Group Inc. "HR-125" (Stock No. 1016986), or approved substitute.
- 2.2.6 Supports: Interchangeable channels, channel spring nuts, and bolts; Uni strut Corporation "Uni strut."
- 2.2.6.1 Channels: 1-5/8 by 1-5/8 inches.
- 2.2.6.2 Channel spring nuts: Manufacturer's standard.
- 2.2.6.3 Bolts (for use with channel spring nuts): Manufacturer's standard.
- 2.2.7 Support Clamps (for rigid steel conduit): Manufacturer's standard.
- 2.2.8 Paint
- 2.2.8.1 Primer: *Ameron Coating Systems "Amerlock No. 400"*, ECN-174  
beige, (No. RT 8304).
- 2.2.8.2 Finish: *Ameron Coating Systems "Amercoat 450 HS PSX 700"*, ECN-174  
beige, (No. RT 8304).
- 2.2.9 Zinc-Rich Coating: Southern Coating Incorporated "Galvicon," or ZRC Products Company "ZRC."
- 2.3 FABRICATION
- 2.3.1 General
- 2.3.1.1 Verify measurements and take field measurements necessary before fabrication. Provide miscellaneous bolts and anchors, supports, braces, and connections necessary for completion of metal fabrications. Cut, reinforce, drill, and tap metal fabrications shown to receive finish hardware and similar items. Weld or bolt connections as shown on the Drawings.
- 2.3.1.2 Workmanship: Form metal fabrications to shape and size, with sharp lines, angles, and true curves. Drilling and punching shall produce clean, true lines and surfaces. Execute and finish work in accordance with fabrication drawings. *Tolerances shall be in accordance with AISC ASD.* ECN-115  
ECN-115
- 2.3.1.3 Jointing and intersections: Accurately made, tightly fitted, and in true planes with adequate fastenings.
- 2.3.1.4 Perform welding and inspection of steel fabrications in accordance with AWS D1.1 and AWS D1.3.
- 2.3.1.5 Connections using high strength bolts shall meet the requirements of AISC S329. ASTM A 490 bolts shall not be substituted for ASTM A 325 bolts.

2.3.1.6

Use high strength bolts for connections in structural framing.  
Tighten nuts using the "turn-of-the nut" method, *unless otherwise specified on the drawings* in accordance with AISC S329.

- 2.3.2 Miscellaneous Steel Items: Supply required clips, frames, equipment supports, and other fabrications shown on the Drawings. Fabricate parts from standard structural sections or shapes, to sizes required. Wherever miscellaneous parts are exposed, grind edges, corners, and rough cuts smooth and free of snags. Shop paint parts except those to be embedded in concrete or masonry, or those which require other specific finishes.
- 2.3.3 Finishes: Do not coat surfaces and edges to be field welded, or items to be galvanized.
- 2.3.4 Do not make holes in framing members for supporting equipment, unless shown on the Drawings, without approval from the Design Engineer.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- 3.1.1 Examine areas where metal fabrications are to be installed and notify the Construction Engineer in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- 3.2.1 Prepare setting drawings, diagrams, templates, and instructions for installation of anchorages, such as anchor bolts, and miscellaneous items having integral anchors, to be embedded in concrete. Coordinate with the Construction Engineer for delivery of items to Site.

#### 3.3 INSTALLATION

- 3.3.1 Install metal fabrications plumb, level or as shown on the Drawings.
- 3.3.2 Make field connections as neatly as possible with joints flush and smooth. Grind smooth exposed field welds and polish before field painting. Repair welds in galvanized work with 2 coats of zinc-rich coating.
- 3.3.3 Where dissimilar metals are in contact, or where aluminum is in contact with concrete, mortar, masonry, wet or pressure-treated wood, or absorptive materials subject to wetting, protect surfaces with isolating tape to prevent galvanic or corrosive action.
- 3.3.4 Shop Painting: After fabrication paint exposed carbon steel surfaces unless otherwise specified as follows:
- a. Surface preparation shall be in accordance with SSPC-SP 2, -SP 3, -SP 5, or in accordance with coating manufacturer's recommendations.
  - b. Apply one coat of primer in accordance with manufacturer's instructions.

- c. Apply a finish coat 2-3 mils thick, in accordance with manufacturer's instructions.
- d. Do not paint threaded surfaces prior to assembly.
- e. Do not paint nameplates, or other non-ferrous surfaces.
- f. Do not apply primer to surfaces within 3 inches of welds before welding.

### 3.4 APPLICATION

- 3.4.1 After installation has been approved, clean and paint connections with primer. Touch-up shop prime coat wherever damaged. Repair breaks in galvanized coatings with zinc-rich coating.

### 3.5 FIELD QUALITY CONTROL

- 3.5.1 Nondestructive Weld Examination (NDE): Perform visual examination of welds in accordance with AWS D1.1, paragraph 6.5.5, unless noted otherwise on the Drawings. Record the results.
- 3.5.2 Personnel performing other welding NDE shall be certified in accordance with the Contractor's written practice, which shall meet the requirements of ASNT SNT-TC-1A.

END OF SECTION



1.2.3 Approval Not Required

1.2.3.1 Vendor information: Before shipment, submit information listed in the Vendor Information List in this Section.

1.3 QUALITY ASSURANCE

1.3.1 Contractor's Quality Assurance Program: See Section 01400 for Quality Assurance Program Requirements.

1.3.1.1 Qualification of Personnel and Procedures: Personnel and procedures for performing work in accordance with ASME B31.3 shall be qualified in accordance with ASME B31.3, Paragraph 328.2.

1.3.2 Electrical/Electronic Product Acceptability

1.3.2.1 Each product shall be listed for intended use in 1 of following and shall bear listing organization's label. In absence of label, provide documentation that verifies product listing.

- a. UL Electrical Construction Materials Directory.
- b. UL Electrical Appliance and Utilization Equipment Directory.
- c. FM Approval Guide.

1.3.2.2 If product is not listed in above directories or guide, provide product which has been tested and certified by a laboratory which has been nationally recognized in accordance with 29 CFR 1910.7. Provide following.

- a. OSHA documentation which demonstrates recognition.
- b. Laboratory documentation that verifies testing in accordance with national code or standard.

1.3.2.3 If product is not listed by UL or FM and if a nationally recognized laboratory is not available, submit descriptive literature to ICF KH. Literature shall include product specification and description of intended application.

1.3.3 Misrepresented Products: See Section 01400 for required measures to prevent the use of misrepresented products.

1.3.4 Deliverable Documentation: The following documents and records, required by this Section, shall be delivered to Construction Document Control in accordance with Section 01720.

<u>Document</u>	<u>Paragraph</u>
Flushing Verification	3.1.10.2
Leak/Pressure Test Certification	3.2.2
Electrical Test Results	3.2.3.1, 3.2.3.2

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 See Section 01610 for general requirements.

1.4.2 Uncoil and cut tubing only in lengths needed; do not re-coil tubing. Cap or cover the ends of cut lengths.

PART 2 - PRODUCTS

2.1 SUBSTITUTES

2.1.1 See Section 01630 for substitution approvals.

2.2 MATERIALS

2.2.1 Tubing, Valves, and Fittings: See the Pipe Codes in this section, and details on the Drawings.

2.2.2 Antiseize Lubricant for Male Pipe Threads: Loctite Company No. 59290 pipe sealant, with teflon, or a Buyer-approved substitute, on pipe and fittings.

2.2.3 Wiring and other materials required to complete instrumentation installation are specified in Section 16400 and on the Drawings.

2.2.3.1 Instrument signal wire: No. 18 AWG (minimum) stranded tinned copper wire shielded and twisted unless otherwise recommended by the instrument manufacturer.

2.2.4 Instrument Identification Tags: 3/4 by 2 by 0.0478-inch (18-gage) minimum thickness stainless steel, with 1/4-inch stamped or engraved characters.

2.2.4.1 ~~Tags shall show the following:~~ Field Tags, as a minimum, shall show Equipment Part Number.

- a. ~~Equipment Part Number.~~
- b. ~~Instrument Range.~~
- c. ~~Purchase Order Number.~~
- d. ~~Project Number (W 320).~~

ECN-458

ECN-458

2.2.4.2 Tag attachment wire: ~~AWG No. 20~~ 20 gage, solid, stainless steel.

## 2.3 EQUIPMENT

2.3.1 Provide instruments consisting of individual instrument loops of compatible devices as specified in the Data Sheets.

## 2.4 FABRICATION

2.4.1 Fabricate and assemble instrument rack IR-1361 as shown on the Drawings. Paint as specified in Section 05500.

## 2.5 WORK NOT INCLUDED

2.5.1 Installation of magnetic flow element, FE-13616, as specified in data sheet Y-0615. This item shall be furnished to the Construction Engineer for installation by others (W-320-C5).

## PART 3 - EXECUTION

### 3.1 INSTALLATION

3.1.1 Mount the field-mounted instruments as shown on the Drawings.

3.1.2 Install the assembled instrument rack IR-1361 as shown on the Drawings. Mount instruments on the rack.

3.1.3 Install wiring between field mounted instruments and instruments mounted on the rack as shown on the Drawings and specified in Section 16400 in accordance with NFPA 70.

3.1.4 Install remaining material and equipment in accordance with the Drawings and manufacturer's instructions. Attach identification tags to instruments with wire.

3.1.5 ~~Equipment Nameplates~~ *Equipment/Instrument Nameplates.*

ECN-458

3.1.5.1 Laminated plastic 1/16-inch thick, white surface and black core as shown on Figure 1.

3.1.5.2 Engrave and attach the nameplates as shown on the Drawings and in accordance with Figure 1.

### 3.1.6 Tubing

3.1.6.1 Cut tubing with tube cutter and clean burrs and metal chips from ends. Blow clean with dry, oil-free air or nitrogen and re-cap or re-cover ends, if not installed immediately. Use open-end or tubing wrenches; do not use adjustable wrenches. Ensure that thread sealant does not intrude into tubing or fitting internals.

3.1.6.2 Bend tubing to radii as great or greater than minimum radii recommended by the manufacturer. Use methods and equipment which produce bends free of wrinkles, bulges, kinks, or flat spots.

- 3.1.6.3 Install exposed tubing on straight parallel runs laid flat against supports. Space supports 3 feet on centers. Gang tubes vertically wherever possible or support with tray. Stagger fittings on ganged runs as needed to prevent congestion.
- 3.1.6.4 Support tubing bundles as a unit to prevent separation of tubes from bundles.
- 3.1.6.5 Slope tubing runs 1/4 in/ft downward toward the process connection.
- 3.1.6.6 Provide expansion loops or slack as needed to prevent damage from expansion or contraction on tubing runs. Expansion loops shall retain the 1/4 in/ft slope.
- 3.1.7 Install temperature detector wells into the appropriate piping thredolets as shown on Drawings.
- 3.1.8 Paint exposed steel surfaces, fabricated tubing supports, stanchions and instrument rack as specified in Section 05500.
- 3.1.9 Instrument Rack
  - 3.1.9.1 Tubing runs shall be grouped together, clamped rigidly, and installed parallel to the supporting structure of the rack. Tubing shall be properly straightened and installed in a workmanlike manner. Bends shall be made with tube bending tools.
  - 3.1.9.2 Shutoff valves shall be installed to isolate instruments from the air supply lines.
  - 3.1.9.3 Isolation valves shall be installed at each sensing point and at the shield wall as shown on the Drawings.
  - 3.1.9.4 A plugged test tee shall be provided between the isolation valve and the instrument sensing lines to the pressure measuring instruments, except where valve manifolds are provided.
  - 3.1.9.5 Tubing shall be identified as shown on the Drawings at each end with a stamped metal tag and tied to the respective tubes.
  - 3.1.9.6 Mounting of instruments, tubing, and other equipment on instrument racks shall not interfere with access to connections, removal of adjacent instruments, and normal maintenance.
  - 3.1.9.7 Each instrument and valve shall be identified as shown on the Drawings with a nametag tied to the respective device.
  - 3.1.9.8 Electrical power wiring and signal wiring of the instrument rack shall be in accordance with NFPA 70, Section 16400, and the Drawings.
  - 3.1.9.9 Instrument and electrical equipment shall be grounded in accordance with NFPA 70 and as shown on the Drawings.

- 3.1.9.10 Instrument signal wiring routed in parallel with ac power, or control wiring shall be 6 inches minimum distant. Instrument signal wiring crossing power wiring shall be as close to right angles as possible.
- 3.1.9.11 Wiring within instrument rack shall be run in vented non-combustible or self-extinguishing non-metallic raceway. Metallic raceways are also acceptable. Raceways shall be securely fastened to the rack framework.
- 3.1.9.12 Wires shall be identified as shown on the Drawings, at each end, with imprinted tubular plastic wire markers as specified in Section 16400.
- 3.1.10 Flushing
  - 3.1.10.1 Flush instrument sensing lines with clean, dry, oil-free air or nitrogen before connecting to instruments. Test discharged air for cleanliness by blowing through clean white cloth over end of tube until cloth shows no visible trace of dirt, oil, or moisture.
  - 3.1.10.2 Provide documented evidence that flushing has been accomplished in accordance with this Section. Deliver to the Quality Control Inspector before leak/pressure testing.

### 3.2 FIELD QUALITY CONTROL

- 3.2.1 Use test instruments which bear valid calibration stamps showing dates of calibration and expiration dates of stamps. Calibration and accuracy of instruments shall be certified by an independent testing laboratory having standards traceable to the National Institute of Standards and Technology. Certification of instruments calibrated off-site and records of instruments calibrated on-site shall be accessible for review by the Quality Control Inspector.
- 3.2.2 Leak/Pressure Tests: Perform leak/pressure tests of instrument sensing lines in accordance with Section 15493 and document the results.
- 3.2.3 Electrical Tests: Test instrument wiring as specified in Section 16400, and the following.
  - 3.2.3.1 Disconnect wires from instruments and verify continuity of every wire from end to end. Resistance shall be 10 ohms maximum. Record the readings.
  - 3.2.3.2 With conductors disconnected from instruments, but with shields connected to ground, measure and record resistances between each conductor and its related shield. Resistance shall be greater than 10 megohms.
  - 3.2.3.3 Reconnect wires.

PIPE CODE I-31			
Service	Max Operating Pressure lb/in <sup>2</sup> gage	Test Pressure lb/in <sup>2</sup> gage	Max Operating Temp °F
Instrument Sensing Lines	160	See Note	200
Sizes	1/4-inch	3/8 and 1/2-inch	3/4, 1 and 1-1/2-inch
Tubing	ASTM A 269, Grade TP 304 or 304L or 316 annealed, seamless stainless steel.		
Wall Thickness	0.035-inch nominal	0.049-inch minimum	0.065-inch minimum
Fittings	Type 316 stainless steel, flareless type; Crawford Fittings "Swagelok", or Parker "CPI".		
Valves	Use valves shown on the Drawings.		
NOTE: Test pressure shall be the same as the pipe, tank, or vessel to which the sensing line is attached.			

**POSITIVE DISPLACEMENT METERS**  
 (Based on ISA S20.25)

1. Tag Number:	FQI-13629	
3. Line/Vessel No.:	1" FW-M9	
<b>METER</b>		
4. Type of Element:	Nutating Disc	
5. Size:	1"	
6. End Connections:	1" NPT	
7. Rating, Temp:	250°F	
Press:	200 lb/in <sup>2</sup> gage	
8. Flow Rate Range:	0-20 gal/min	
9. Totalized Units:	gallon	
12. Materials		
Outer Housing:	Mfg std	
13. Main Body Cover:	Bronze	
14. Rotating Element:	Rubber/neoprene	

<b>COUNTER</b>		
21. Register Type:	Digital mechanical	
22. Totalizer:	Digital mechanical	
23. Reset:	Manual	
24. Capacity:	999.9 gal	

<b>FLUID DATA</b>		
27. Fluid:	Water	
28. Min Flow Rate:	3 gal/min	
Max Flow Rate:	20 gal/min	
29. Normal Flow:	10 gal/min	
30. Opr Press:	150 lb/in <sup>2</sup> gage	
Temp:	180°F	
31. Mfg. & Mod.:	Badger Meter Type SC with totalizer Type TR, Resettable or an approved substitute	

**NOTES:**

- (1) Items 2, 10, 11, 15 through 20, 25, 26, and 32 through 46 are not required.
- (2) Accuracy: ± 2% of full scale.

**CONTROL VALVE**  
 (Based on ISA S20.50 Rev 1)

0. Tag Number: HV-13638

1. Fluid: WATER Critical Pressure \_\_\_\_\_

**SERVICE CONDITIONS**

	Units	Max	Normal	Min	Shut-off
2. Flow Rate:	GPM	100	40		-
3. Inlet Pressure:	PSIG	180	180		
4. Outlet Pressure:	PSIG	ATMO	ATMO		
5. Inlet Temperature:	°F	180	180		
9. *Required C <sub>v</sub> :					-
10. *Travel:	%				0

**PIPELINE**

13. Size: In 3" Out 3"

14. Schedule: In 40 Out 40

**VALVE BODY/BONNET**

16. Type: BALL

17. Size: 3" FULL PORT ANSI Class 300 LB

18. Max Press/Temp: 160 PSIG / 140°F

20. Body/Bonnet Matl: 316 STAINLESS STEEL

21.\* Liner Material/ID: \_\_\_\_\_

22. End Conn: In 3" Butt weld

23. Out 3" Butt weld

26.\* Flow Direction: \_\_\_\_\_

27.\* Type of Bonnet: \_\_\_\_\_

29.\* Packing Material: \_\_\_\_\_

30.\* Packing Type: \_\_\_\_\_

**TRIM**

32.\* Type: \_\_\_\_\_

33.\* Size: \_\_\_\_\_ Rated Travel \_\_\_\_\_

34.\* Characteristic: \_\_\_\_\_

35.\* Balanced: \_\_\_\_\_ Unbalanced \_\_\_\_\_

36.\* Rated: C<sub>v</sub> \_\_\_\_\_ F<sub>L</sub> \_\_\_\_\_ X<sub>T</sub> \_\_\_\_\_

37. Plug/Ball/Disk  
 Material: BALL, 316 STAINLESS STEEL

Y-0602  
Sheet 2 of 2**CONTROL VALVE (Continued)**

(Based on ISA S20.50 Rev 1)

38. Seat Material: GLASS FILLED TEFLON

40. Stem Material: 316 STAINLESS STEEL

**ACTUATOR**

53. Type: Spring return pneumatic piston single-acting  
actuator with remote electrical position indicator  
and pilot solenoid valve for 120 V, 60 Hz service.  
(See Note 3)

55.\* Size: \_\_\_\_\_ Eff Area \_\_\_\_\_

56. On/Off: ON/OFF Modulating \_\_\_\_\_

57. Spring Action  
Open/Close: CLOSE

58. Max Allowable  
Pressure: 150 PSIG

59. Min Required  
Pressure: 60 PSIG

60. Available Air  
Supply Pressure: Max 100 PSIG Norm 100 PSIG

**SWITCHES**

74. Type: Mech Limit Switches Quantity 2

76. Contacts/Rating: 4 A at 120 V ac / 2 A at 240 V ac, SPDT

77. Actuation Points: FULL OPEN & FULL CLOSED

79. Manufacturer: PBM

Model Number: Valve: 3"-SP-H-39-BW-2-H6 Actuator: DSR-60-116-4D,

with DML-50 Limit Switches and DMS-60 solenoid valve.

All of the above assembled as one complete unit

or with approved substitutes.

**NOTES:**

- (1) Items 6 through 8, 11, 12, 15, 19, 24, 25, 28, 31, 39, 41 through 52, 54, 61 through 73, 75, and 78 are not required.
- (2) \*Supplier to furnish with approval submittal.
- (3) Tag number for pilot solenoid valve: HY-13638.

**CONTROL VALVE**  
(Based on ISA S20.50 Rev 1)

0. Tag Number: HV-13669  
1. Fluid: WATER Critical Pressure \_\_\_\_\_

**SERVICE CONDITIONS**

	Units	Max	Normal	Min	Shut-off
2. Flow Rate:	GPM	100	40		-
3. Inlet Pressure:	PSIG	160	100		
4. Outlet Pressure:	PSIG	ATMO	ATMO		
5. Inlet Temperature:	°F	100	100		
9. *Required C <sub>v</sub> :					-
10. *Travel:	%				0

**PIPELINE**

13. Size: In 1" Out 1"  
14. Schedule: In 40 Out 40

**VALVE BODY/BONNET**

16. Type: BALL  
17. Size: 1" FULL PORT ANSI Class 150 LB  
18. Max Press/Temp: 160 PSIG / 140°F  
20. Body/Bonnet Matl: 316 STAINLESS STEEL  
21.\* Liner Material/ID: \_\_\_\_\_  
22. End Conn: In 1" Socket Weld  
23. Out 1" Socket Weld  
26.\* Flow Direction: \_\_\_\_\_  
27.\* Type of Bonnet: \_\_\_\_\_  
29.\* Packing Material: \_\_\_\_\_  
30.\* Packing Type: \_\_\_\_\_

**TRIM**

32.\* Type: \_\_\_\_\_  
33.\* Size: \_\_\_\_\_ Rated Travel \_\_\_\_\_  
34.\* Characteristic: \_\_\_\_\_  
35.\* Balanced: \_\_\_\_\_ Unbalanced \_\_\_\_\_  
36.\* Rated: C<sub>v</sub> \_\_\_\_\_ F<sub>L</sub> \_\_\_\_\_ X<sub>T</sub> \_\_\_\_\_  
37. Plug/Ball/Disk  
Material: BALL, 316 STAINLESS STEEL

**CONTROL VALVE (Continued)**  
(Based on ISA S20.50 Rev 1)

38. Seat Material: TFE  
40. Stem Material: 316 STAINLESS STEEL

**ACTUATOR**

53. Type: Spring return pneumatic piston single-acting actuator with remote electrical position indicator and pilot solenoid valve for 120 V, 60 Hz service. (See Note 3)

55.\* Size: \_\_\_\_\_ Eff Area \_\_\_\_\_

56. On/Off: ON/OFF \_\_\_\_\_ Modulating \_\_\_\_\_

57. Spring Action  
Open/Close: CLOSE

58. Max Allowable  
Pressure: 150 PSIG

59. Min Required  
Pressure: 60 PSIG

60. Available Air  
Supply Pressure: Max 100 PSIG Norm 100 PSIG

**SWITCHES**

74. Type: Mech Limit Switches Quantity 2

76. Contacts/Rating: 4 A at 120 V ac / 2 A at 240 V ac, SPDT

77. Actuation Points: FULL OPEN & FULL CLOSED

79. Manufacturer: PBM  
Model Number: Valve: 1"-SP-H-37-SW-2-H6  
Actuator: DSR-60-16-4D, with DML-50 Limit Switches  
and DMS-60 solenoid valve.  
All of the above assembled as one complete unit  
or with approved substitutes.

**NOTES:**

- (1) Items 6 through 8, 11, 12, 15, 19, 24, 25, 28, 31, 39, 41 through 52, 54, 61 through 73, 75, and 78 are not required.
- (2) \*Supplier to furnish with approval submittal.
- (3) Tag number for pilot solenoid valve: HY-13669.

**PRESSURE CONTROL VALVES  
 PILOTS AND REGULATORS  
 (Based on ISA S20.51)**

**GENERAL**

1. Tag Number:	PCV-13629	PCV-1367
2. Service:	Air	Water
3. Line/Vessel No.:	1"-1A (100#)-M-7	1"FW-M9
4. Line Size:	1"	1"
Sched No.:	40	40
5. Function:	Pressure Regulation	

**BODY**

6. Type:	Globe	Globe
7. Body Size:	1"	1"
Port Size:	1"	1"
9. End Conn and Rating:	1" NPT, 150 LB	1" NPT, 150 LB
10. Body Material:	Cast Iron	SST
18. Max Allow Sound - dBA:	90 dBA	90 dBA

**ACTUATOR/PILOT**

25. Spring Range:	See Note 2	See Note 2
26. Set Point:	20 psig	40 psig

**SERVICE**

34. Flow Units:	cfm	gpm
35. Fluid:	Air	Water
36. Maximum Quantity:	10	22
Corresponding C <sub>v</sub> :	See Note 2	See Note 2
38. Actual C <sub>v</sub> :	See Note 2	See Note 2
Actual F <sub>L</sub> :	See Note 2	See Note 2
39. Norm Inlet Press:	100 psig	160 psig
Differential Press:	80 psid	120 psid
40. Max Inlet Press:	100 psig	160 psig

**PRESSURE CONTROL VALVES  
 PILOTS AND REGULATORS  
 (Based on ISA S20.51)**

**SERVICE (cont)**

41. Max Shut Off Press:	100 psig	160 psig	
Differential Press:	80 psid	120 psid	
42. Max Temperature:	120° F	120° F	
Opr. Temperature:	70° F	70° F	
43. Opr Sp Gr:	1.0 @ 68° F	1.0 @ 68° F	
Mol Wt:			
47. Predicted Sound Level - dBA:	See Note 2	See Note 2	
48. Manufacturer:	Fisher Controls		
49. Model No:	95L	95H	
	or an approved substitute.		

**NOTES:**

- (1) Items 8, 11 through 17, 19 through 24, 27 through 33, 37 and 44 through 46 are not required.
- (2) Furnished by supplier in approval submittal.

**DIFFERENTIAL PRESSURE INSTRUMENTS**  
(Based on ISA S20.20a)

**GENERAL**

1. Tag Number: See Sheet 2 Service See Sheet 2  
2. Function: Record  Indicate  Control  Blind   
Trans  Integ  Other Alarm Switch  
3. Case: Mfr Std  Nom Size 6" OD x 9" Deep  
Color: Mfr Std  Other \_\_\_\_\_  
4. Mounting: Flush  Surface  Yoke  Other \_\_\_\_\_ ECN-168  
5. Enclosure Class: General Purpose  Weatherproof   
Explosion Proof  Class \_\_\_\_\_  
For use in intrinsically safe system  Other \_\_\_\_\_  
6. Power Supply: 117 V, 60 Hz  Other \_\_\_\_\_ V ac \_\_\_\_\_ V dc  
9. Scale: Type Linear Range: 1 See Sheet 2 2 \_\_\_\_\_ 3 \_\_\_\_\_

**UNIT**

17. Service: Flow  Level  Diff Pressure   
Other \_\_\_\_\_  
18. Element Type: Diaphragm  Bellows  Mercury  Other Mfr Std  
19. Material: Body Mfr Std Element Mfr Std for H<sub>2</sub>O  
20. Rating: Overrange 200% FS Body Rating 200 psig  
21. Diff Range: Fixed  Adjustable \_\_\_\_\_ Set At See Sheet 2  
23. Process Data: Fluid Water Max Temp 100° F Max Press 200 psig  
24. Process Conn: 1/2" npt  Other 1/4" NPT

**ALARMS**

25. Switches: Quantity 1 Form DPDT Rating 5 A  
26. Function: Measured Var  Deviation   
Contacts to close on increase in pressure.  
28. Mfr & Model No: Dwyer Capsu-Photohelic Model 43050 43230S or an ECN-808  
approved substitute



**DIFFERENTIAL PRESSURE INSTRUMENTS**  
(Based on ISA S20.20a)

**GENERAL**

1. Tag Number: See Sheet 3 Service See Sheet 3
2. Function: Record  Indicate  Control  Blind   
Trans  Integ  Other \_\_\_\_\_
3. Case: Mfr Std  Nom Size \_\_\_\_\_  
Color: Mfr Std  Other \_\_\_\_\_
4. Mounting: Flush  Surface  Yoke  Other \_\_\_\_\_
5. Enclosure Class: General Purpose  Weatherproof   
Explosion Proof  Class \_\_\_\_\_  
For use in intrinsically safe system  Other \_\_\_\_\_
6. Power Supply: 117 V, 60 Hz  Other \_\_\_\_\_ V ac 24 V dc

**TRANSMITTER**

10. Output: 4-20 mA  10-50 mA  21-103 kPa (3-15 psig)   
Other 2 Wire system (dc power input & signal output)

**UNIT**

17. Service: Flow  Level  Diff Pressure   
Other \_\_\_\_\_
18. Element Type: Diaphragm  Bellows  Mercury  Other \_\_\_\_\_
19. Material: Body 300 Series SST Element Mfr Std
20. Rating: Overage 200% FS Body Rating 200 psig
21. Diff Range: Fixed  Adjustable (See Sh 3) Set At (See Sh 3)
22. Elevation (See Note 3) Suppression (See Note 3)
23. Process Data: Fluid Air Max Temp 100° F Max Press 200 psig
24. Process Conn: 1/2" npt  Other \_\_\_\_\_

**DIFFERENTIAL PRESSURE INSTRUMENTS**  
(Based on ISA S20.20a)

27. Options:      Pressure Element \_ Range \_\_\_\_\_ Material \_\_\_\_\_  
                    Temp Element \_ Range \_\_\_\_\_ Type \_\_\_\_\_  
                    Filter-Rgltr \_ Supply Gage \_  
                    Output Gage \_ \_\_\_\_\_ Charts  
                    Valve Manifold \_\_\_\_\_  
                    Cond Pot \_      Adj Damp \_  
                    Integral Sqrt Extr \_ Integrator \_\_\_\_\_  
                    Other See Note 4

28. Mfr:                      Rosemount or an approved substitute  
Model No:                  3051C D Series w/ Model 268 Series 3051CD1A22A1JB2

ECN-132

**NOTES:**

- (1) Items 7 through 9, 11 through 16, 25 and 26 are not required.
- (2) Accuracy:  $\pm 0.5\%$  or less of calibrated span.
- (3) Adjustable zero, elevation and suppression.
- (4) A *One portable smart family interface transmitter configurator/calibrator model 268 shall be provided if required.*

ECN-132  
ECN-132



**PRESSURE GAGES**  
(Based on ISA S20.41a)

**GENERAL**

1. Type: Direct Reading  3-15 lb receiver \_\_\_\_\_  
Other \_\_\_\_\_
2. Mounting: Surface \_\_\_\_\_ Local  Flush \_\_\_\_\_
3. Dial: Diameter 4-1/2" (NOM) Color WHITE
4. Case: Cast Iron \_\_\_\_\_ Aluminum \_\_\_\_\_ Phenol   
Other \_\_\_\_\_
5. Ring: Screwed \_\_\_\_\_ Hinged \_\_\_\_\_ Slip \_\_\_\_\_ Std   
Other \_\_\_\_\_
6. Blow-Out Prot: None \_\_\_\_\_ Back  Disc \_\_\_\_\_ Solid Front \_\_\_\_\_  
Other \_\_\_\_\_
7. Lens: Glass \_\_\_\_\_ Plastic
9. Nom Accuracy Req'd: ±1%
10. Mfr & Model No: U.S. Gauge 1981 or an approved substitute
11. Press Element: Bourdon \_\_\_\_\_ Bellows \_\_\_\_\_ Other Mfr Std
12. Element Matl: Bronze \_\_\_\_\_ Steel \_\_\_\_\_ SST Other Mfr Std
13. Socket Matl: Bronze \_\_\_\_\_ Steel \_\_\_\_\_ SST Other Mfr Std
14. Connection: 1/4" npt \_\_\_\_\_ 1/2" npt  Other \_\_\_\_\_  
Bottom  Back \_\_\_\_\_
15. Movement: Bronze \_\_\_\_\_ SST \_\_\_\_\_ Nylon \_\_\_\_\_  
Other Mfr Std

TABLE

Qty	Tag Number	Range	Operating Pressure	Service
1	PI-13629	0-30 PSIG	20 PSIG	AIR
1	PI-13630	0-160 PSIG	100 PSIG	AIR
1	PI-13631	0-60 PSIG	40 PSIG	WATER

NOTE: Items 8 and 16 are not required.

**PRESSURE INSTRUMENTS**  
(Based on ISA S20.40a)

**GENERAL**

1. Tag Number: PIT-1361 Service TANK C-106 PRESSURE ECN-132
2. Function: Record  Indicate  Control  Blind   
Trans  Other \_\_\_\_\_
3. Case: Mfr Std  Nom Size \_\_\_\_\_
- Color: Mfr Std  Other \_\_\_\_\_
4. Mounting: Flush  Surface  Yoke  Other \_\_\_\_\_
5. Enclosure Class: General Purpose  Weather Proof  Explosion Proof   
Class \_\_\_\_\_  
For use in intrinsically safe system  Other \_\_\_\_\_
6. Power Supply: 117 V, 60 Hz  \_\_\_\_\_ V ac 24 V dc
9. Scale: Type: 4 digit LCD meter

**TRANSMITTER**

10. Output: 4-20 mA  10-50 mA  21-103 kPa (3-15 psig)   
Other 2 Wire System (dc power input & signal output)  
For receiver, see form Y-\_\_\_\_\_

**ELEMENT**

17. Service: Gage Press  Vacuum  Absolute  Compound
18. Element Type: Diaphragm  Helix  Bourdon  Bellows   
Other \_\_\_\_\_
19. Material: 316 SST  Ber Copper  Other \_\_\_\_\_
20. Range: Fixed  Adj Range 0-250 in H<sub>2</sub>O 0-25 in H<sub>2</sub>O ECN-132  
Set at -10 in H<sub>2</sub>O to +5 in H<sub>2</sub>O  
Overrange protection to 300 psig +15 psig ECN-132
21. Process Data: Press: Normal -5 in H<sub>2</sub>O Max 0 psig  
Element Range -250 in H<sub>2</sub>O to +250 in H<sub>2</sub>O 0 to +25 in H<sub>2</sub>O ECN-132  
H<sub>2</sub>O ECN-132
22. Process Conn: 1/4" npt  1/2" npt  Other \_\_\_\_\_  
Location: Bottom  Back  Other \_\_\_\_\_

**PRESSURE INSTRUMENTS**  
(Based on ISA S20.40a)

**OPTIONS**

25. Options: Filter-Rgltr  Supply Gage  Output Gage   
 \_\_\_\_\_ Charts Diaph Seal  Type \_\_\_\_\_  
 Diaph \_\_\_\_\_ Bot Bowl \_\_\_\_\_ Conn \_\_\_\_\_  
 Capillary: Length \_\_\_\_\_ Matl \_\_\_\_\_  
 Other \_\_\_\_\_

26. Mfr & Model No: Rosemount 3051CG2A22A1JB2M6 or an approved substitute

---

NOTES:

- (1) Items 7 and 8, 11 through 16, 23 and 24 are not required.
- (2) Accuracy:  $\pm 0.25\%$  or less of calibrated span.
- (3) Adjustable zero, elevation and suppression.

PRESSURE INSTRUMENTS  
(Based on ISA S20.40a)

GENERAL

1. Tag Number: PT-13611 Service HX-1361 Inlet Press  
2. Function: Record  Indicate  Control  Blind   
Trans  Other \_\_\_\_\_  
3. Case: Mfr Std  Nom Size \_\_\_\_\_  
Color: Mfr Std  Other \_\_\_\_\_  
4. Mounting: Flush  Surface  Yoke  Other \_\_\_\_\_  
5. Enclosure Class: General Purpose  Weather Proof  Explosion Proof   
Class \_\_\_\_\_  
For use in intrinsically safe system  Other \_\_\_\_\_  
6. Power Supply: 117 V, 60 Hz  \_\_\_\_\_ V ac 24 V dc

TRANSMITTER

10. Output: 4-20 mA  10-50 mA  21-103 kPa (3-15 psig)   
Other 2 Wire System (dc power input & signal output)  
For receiver, see Form Y-\_\_\_\_\_

ELEMENT

17. Service: Gage Press  Vacuum  Absolute  Compound   
18. Element Type: Diaphragm  Helix  Bourdon  Bellows   
Other \_\_\_\_\_  
19. Material: 316 SST  Ber Copper  Other \_\_\_\_\_  
20. Range: Fixed  Adj Range 0 to 25 inH<sub>2</sub>O Set at -10 to +5 inH<sub>2</sub>O  
Overrange protection to 1,000 PSIG ±15 PSID ECN-132  
21. Process Data: Press: Normal -5 inH<sub>2</sub>O XX Max -10 inH<sub>2</sub>O  
Element Range 0 to 25 inH<sub>2</sub>O ±25 in H<sub>2</sub>O ECN-132  
22. Process Conn: 1/4" npt  1/2" npt  Other \_\_\_\_\_  
Location: Bottom  Back  Other \_\_\_\_\_  
26. Mfr & Model No: Rosemount 3051CG Series 3051CG2A22A1JB2 or an ECN-132  
approved substitute

NOTES:

- (1) Items 7 through 9, 11 through 16, and 23 through 25 are not required.

- (2) Accuracy:  $\pm 0.25\%$  or less of calibrated span.
- (3) Adjustable zero, elevation and suppression.

**PRESSURE RELIEF VALVES**  
 (Based on ISA S20.53)

**GENERAL**

1. Tag Number:	PSV-13629			
2. Service:	Air Relief			
3. Line/Vessel No.:	1"IA(20#)710-M7			
4. Full Nozzle / Semi Nozzle:	FULL			
5. Safety or Relief:	Safety			
7. Bonnet Type:	Closed			

**CONNECTION**

8. Size: Inlet	1" (Male)			
Outlet:	1-1/4" (F)			
9. Flange Rating or Screwed:	Screwed (NPT)			

**MATERIALS**

11. Body & Bonnet:	Bronze			
12. Seat & Disc:	Brass/SST			
14. Guide & Rings:	Brass			
15. Spring:	SST			

**OPTIONS**

18. Cap: Screwed or Bolted:	Bolted			
19. Lever: Plain or Packed:	Plain			

**PRESSURE RELIEF VALVES**  
(Based on ISA S20.53)

**FLUID DATA**

28. Fluid & State:	Air			
29. Req'd Capacity:	10 SCFM			
30. Mol Wt   Oper SG:	1.0			
31. Press: Oper:	20 PSIG			
Set:	25 PSIG			
32. Temp: Oper:	60°F			
Relief:	300°F			
33. Back Press Const:	1 PSI			
34. Back Press Var:	0			
35. Back Press Total:	1 PSI			
40. Ratio of Specific Heats:	1.4			
45. *Calc Area in <sup>2</sup> :				
46. *Selected Area:				
47. *Orifice Designation:				
48. Manufacturer:	Kunkle Valve			
49. Model No:	6010FE01-KM0025			
	or an approved substitute			

**NOTES:**

- (1) Items 6, 10, 13, 16, 17, 20 through 27, 36 through 39, and 41 through 44 are not required.
- (2) \*Supplier to furnish with approval submittal.

INSTRUMENT DATA SHEET  
PROCESS BUILDING AREA RADIATION MONITORING SYSTEM

GAMMA DETECTOR ASSEMBLY

1. Tag Number: RE-1361
2. Type: Gamma detector sensitive to gamma radiation only between the energy ranges of 80 KeV to 2.0 MeV with amplification and check source integrated in a single cylindrical housing.
3. Range: 10  $\mu$ R/h to 100 R/h Nominal (See Note 2)
4. Assembly Envelope: Mfr. Std. chrome plated aluminum, moisture proof
5. Size: Approximately 2-1/2-inch diameter by 16-inches long
6. Mounting: Surface
7. Signal Output: Compatible with local ratemeter alarm (see Item 17 below)
8. Accuracy:  $\pm 10\%$
9. Response: 5 seconds (nominal)
10. Check Source: A solenoid actuated source, internally mounted, to indicate a known range above background radiation (20 mR/hr Maximum).
11. Recommended Type: Nuclear Research Corporation Model GP-100C or approved substitute.

LOCAL RATEMETER/ALARM SWITCH MODULE

12. Tag Number: RIT-1361/RSH-1361/RXS-1361
13. Function: Record, Indicate, Alarm (See Note 1)
14. Case: Mfr. Std. Nom. Size: Mfr. Std.
15. Enclosure Class: General Purpose, NEMA 12
16. Mounting: Wall Mounted
17. Input: Accept and convert signal from detector (see item 7 above)
18. Power Supply: 120 V ac, 60 Hz Nominal

INSTRUMENT DATA SHEET  
PROCESS BUILDING AREA RADIATION MONITORING SYSTEM (Continued)

LOCAL RATEMETER/ALARM SWITCH MODULE (Continued)

19. **Alarm Switches:** Quantity: 3 Form: DPDT Rating: 5 A at 120 V ac for use by Buyer.
20. **Function:** Under normal operating conditions, the relays shall be energized and shall de-energize on alarm. Contacts to open on increasing radiation, contacts to open on radiation detection failure (fail safe)
21. **Connectors and Cables:** Mfr. Std. furnished with matching connectors. The prefabricated cables shall be 30 feet in length, and a connector shall be pre-installed on one end only to facilitate pulling through a conduit. The connector shall be provided loose for installation by Buyer.
22. **Representative Type:** Nuclear Research Corporation Model ADM-610A or approved substitute.

---

NOTES:

- (1) Recording of data stored in nonvolatile memory.
- (2) Environmental Radiation range for detector: 2 mRem/h to  
10 mRem/h nominal,  
20 mRem/h maximum

RESISTANCE TEMPERATURE SENSORS  
(Based on ISA S20.13a)

GENERAL

1. Complete Assembly:  Other For Tag Number and Service. See Sheet 2

HEAD

2. Screwed Cover:  Other \_\_\_\_\_

4. Material: Aluminum Conduit Conn 1/2" NPT

5. Nipple Size: 1/2" NPT Dim "N" 5-1/2" Union \_\_\_\_\_

ELEMENT

6. Material: Platinum  Nickel \_\_\_\_\_ Other \_\_\_\_\_

Length see table

7. Ice Point

Resistance: 100 Ohms,  $\alpha = 0.00385 \Omega/\Omega/^\circ\text{C}$

8. Temperature Range: 33 to 180° F

9. Leads: Std  Potted \_\_\_\_\_ Herm Sealed \_\_\_\_\_

10. Sheath Material: 316 SST OD 1/4"

12. Connection: 2-Wire \_\_\_\_\_ 3-Wire  4-Wire \_\_\_\_\_

Lead Wires \_\_\_\_\_ Receptacle \_\_\_\_\_ Bayonet Lock \_\_\_\_\_

Other Terminal Block in Head

WELL OR TUBE

13. Material: 316 SST

14. Construction: Tapered  Straight \_\_\_\_\_ Drilled \_\_\_\_\_

Built-Up \_\_\_\_\_ Closed-End Tube \_\_\_\_\_

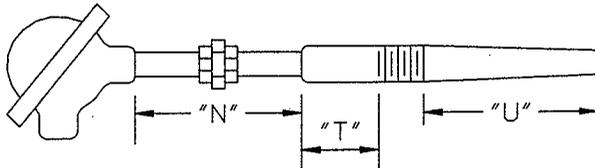
15. Dim: Mfr Std  OD \_\_\_\_\_ ID 1/4"

Extension Length "T" See Table

Well Length "U" See Table

17. Process Conn: See Table

**RESISTANCE TEMPERATURE SENSORS**  
 (Based on ISA S20.13a)



TABLE

Tag Number	Process Conn	Well Dim		Element Length	Single or Dual	Service/Notes
		U	T			
TE-13620	1/2" NPT	5"	2"		DUAL	Heat Exchanger Inlet
TE-13621	1/2" NPT	4"	2"		DUAL	Heat Exchanger Outlet
TE-13622	1/2" NPT	4"	2"		DUAL	Recir Fan Inlet
TE-13625	1/2" NPT	4"	2"		DUAL	Mist Eliminator Outlet

NOTES:

- (1) Items 3, 11, and 16 are not required.
- (2) Mfr & Model No: RdF Corp, Type 21D Series or an approved substitute.
- (3) Accuracy:  $\pm 0.5^{\circ}\text{C}$  from 0 to  $100^{\circ}\text{C}$ .

TEMPERATURE INSTRUMENTS (FILLED SYSTEM)

(Based on ISA S20.11a)

GENERAL

1. Tag No.: See Sheet 3 Service: Process Bldg Room Air
2. Function: Record  Indicate  Control  Blind   
Trans  Other High/Low Alarm Switch
3. Case: Mfr Std  Nom Size \_\_\_\_\_  
Color: Mfr Std  Other \_\_\_\_\_
4. Mounting: Flush  Surface  Yoke  Other
5. Enclosure Class: General Purpose  Weatherproof  Explosion Proof   
Class \_\_\_\_\_  
For Use in Intrinsically Safe System  Other \_\_\_\_\_

ELEMENT

17. Fill: SAMA Class IIC Compensation \_\_\_\_\_
18. Process Data: Temp: Normal 75°F Max 120°F Max Press 1 ATM
19. Range: Fixed  Adj Range See Table Set At See Table  
Overrange Protection to 360° F
20. Bulb: Type Vapor Pressure Thermal System Rigid (see Note 2) ECN-132  
Material 316 SST  
Extension: Length None Type \_\_\_\_\_  
Size: Diameter Mfr Std Length Mfr Std  
Insertion None  
Conn: None  
Location 0 feet above/below instrument.

OTHER

23. Alarm Switches: Quantity 2 Form C Rating 15 A/120 V ac
24. Function: Temp  Deviation  Contacts to See Note 3 on temp  
increase/decrease.
26. Mfr & Model No: SOR 201V1-AA125-C7A-TT 201V1-AA125-U9-C7A-TT ECN-132  
or an approved substitute

**TEMPERATURE INSTRUMENTS (FILLED SYSTEM)**  
 (Based on ISA S20.11a)

**NOTES:**

- (1) Items 6 through 16, 21, 22, and 25 are not required.
- (2) Item 20: The bulb will be exposed to the room, and will be used for freeze and overtemperature monitoring. The bulb shall be direct mounted.
- (3) Item 24: Alarm switches to be independently adjustable; one Form C contact to close on temp increase, and; one Form C contact to open on temp decrease.
- (4) Accuracy: Setpoint is repeatable  $\pm 2^{\circ}\text{F}$  over the full range of 40 to 225 $^{\circ}\text{F}$ .

**TEMPERATURE INSTRUMENTS (FILLED SYSTEM)**  
 (Based on ISA S20.11b)

Rev.	Tag No.	Adj. Range	Set Range	Well Conn	Insert Length	Cap Length	Service	Note
								ECN-132
0	TE/TSHL-13623	40 to 225 $^{\circ}\text{F}$	Field Set	N/A	N/A	NONE	Room 1 Air	
								ECN-132
0	TE/TSHL-13624	40 to 225 $^{\circ}\text{F}$	Field Set	N/A	N/A	NONE	Room 2 Air	
								ECN-132

**MAGNETIC FLOWMETERS**  
 (Based on ISA S20.23)

- 1. Tag Number: FE-13616 (See Note 3)
- 2. Service: Slurry Transfer
- 3. Location: 241-C-06A Pit

**METERING ELEMENT - CONN**

- 4. Line Size-Sched: 4" Sched 40S
- 5. Line Material: 304L SST
- 6. Connection Type: 300# Raised face mating flanges (Wafer Type)
- 7. Connection Matl: Mfg Std

**METERING ELEMENT - METER**

- 8. Tube Material: 303 SST
- 9. Liner Material: Tefzel
- 10. Electrode Type: Mfr Std
- 11. Electrode Matl: Tantalum
- 12. Meter Casing: Mfr Std
- 13. Power Supply: Compatible w/Xmtr below  
 Elec Code: \_\_\_\_\_
- 14. Grounding, Type  
& Material: Mfr Std
- 15. Enclosure Class: NEMA 4X

**METERING ELEMENT - FLUID**

- 17. Fluid: Slurry (Aqueous mixed waste)
- 18. Max Flow: 350 GPM (Reversible)
- 19. Max Velocity: 10 ft/sec
- 20. Normal Flow: 350 GPM  
 Minimum Flow: 0 GPM
- 21. Maximum Temp: 180° F  
 Minimum Temp: 40° F
- 22. Maximum Press: 480 PSIG  
 Minimum Press: 0 PSIG
- 23. Min Fluid  
 Conductivity: 10 micromhos/cm

**MAGNETIC FLOWMETERS**  
(Based on ISA S20.23)

**ASSOCIATED INSTRUMENT**

26. Tag Number:	<u>FIT/F01-13616</u>
27. Function:	<u>Indicate/Transmit</u>
28. Mounting:	<u>Surface, Remote</u>
29. Enclosure Class:	<u>NEMA 4</u>
30. Length Signal Cable:	<u>100 Feet</u>
31. Type Span Adj:	<u>ft/sec</u>
32. Power Supply:	<u>115 V AC 60 Hz (nominal)</u>

**ASSOCIATED INSTR - TRANSMITTER**

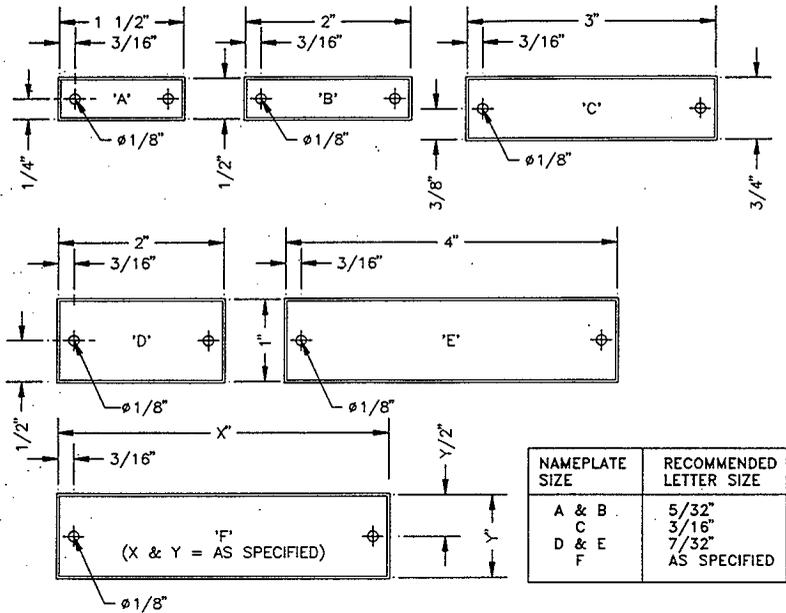
33. Output:	<u>4-20 mA DC</u>
-------------	-------------------

**ASSOCIATED INSTR-DISPLAY**

35. Scale Size:	<u>Mfr Std</u>
Range:	<u>0 - 500 GPM</u>
38. Integrator:	<u>8 Digit, gals.</u>
45. Mfr.:	<u>Brooks Instrument</u>
46. Meter Model No.:	<u>7400 Series (7404C5BIF6AACA) or an approved substitute</u>
47. Instr. Model No.:	<u>3560 Series (356232A3C1) or an approved substitute</u>

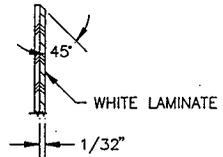
**NOTES:**

- (1) Items 16, 24, 25, 34, 36, 37, and 39 through 44 are not required.
- (2) Accuracy:  $\pm 0.5\%$  of full scale flow range.
- (3) FE-13616 shall be furnished to the Construction Engineer for installation by others (W-320-C5). See Section 2.5.



3/32" SAMPLE 7/32" SAMPLE  
 1/8" SAMPLE  
 5/32" SAMPLE 1/4" SAMPLE  
 3/16" SAMPLE 5/16" SAM

SAMPLE LETTERING SIZES



NOTES:

1. MATERIAL SHALL BE 1/16" THICK LAMINATED PLASTIC STOCK WITH WHITE SURFACE AND BLACK CORE.
2. EDGES OF NAMEPLATES SHALL BE BEVELED AS SHOWN AND SHALL BE SMOOTH AND WITHOUT BURRS. LETTERS SHALL BE SHARP AND CLEAR, SIMILAR TO THE STYLE SHOWN.
3. USE 4-40 x 3/8" LONG, BINDING HEAD, SELF-TAPPING MACHINE SCREWS OR PULL STEM RIVETS TO FASTEN PLATES TO PANELS. DRILL NO. 39 HOLES IN PANEL. CONTACT ADHESIVE SHALL NOT BE USED.

EQUIPMENT NAMEPLATE

Figure 1

APPROVAL DATA LIST  
("X" Indicates Required Data)

Project No. W-320  
Project Title Tank 241-C-106 Sluicing  
Specification Section 13440

1	2	3	4	5							6				
				DESCRIPTION	REFERENCE DRAWING	SPECIFICATION PARAGRAPH (DATA SHEET)	Drawings	Equipment	Specifications	Material		Description	Data	Circuit or Control Diagrams	Data Sheets
	EPN IDENTIFICATION	DESCRIPTION	REFERENCE DRAWING	SPECIFICATION PARAGRAPH (DATA SHEET)	Drawings	Equipment	Specifications	Material	Description	Data	Circuit or Control Diagrams	Data Sheets	Illustrative Cuts	Instructions	REMARKS
	FQI-13629	FLOW INTEGRATOR INDICATOR		Y-0601			X						X		
	HV-13638/ HY-13638 HV-13669/ HY-13669	CONTROL VALVE/SOLENOID VALVE		Y-0602 Y-0603 Y-0604			X						X		
	PCV-13629 PCV-1367	PRESSURE REGULATOR		Y-0605			X						X		ECN-132
	POISH-13614 POISH-13615	PRESSURE DIFFERENTIAL SWITCH		Y-0606			X						X		
	PDI-13611 PDI-13612 PDI-13613	PRESSURE DIFFERENTIAL XMTR		Y-0607			X						X		
	PI-13629 PI-13630 PI-13631	PRESSURE GAGE		Y-0608			X						X		
	PII-1361 PII-13616	PRESS INDICATOR XMTR		Y-0609			X						X		ECN-132
	PT-13611	PRESSURE TRANSMITTER		Y-0610			X						X		
	PSI-13629	PRESSURE SAFETY VALVE		Y-0611			X						X		
	RE-1361 RIT-1361	GAMMA RADIATION ELEMENT RADIATION INDICATOR		Y-0612			X						X		
	TE-13620 TE-13621 TE-13622 TE-13625	RESISTANCE TEMP SENSOR		Y-0613			X						X		



**VENDOR INFORMATION LIST**  
 ("X" Indicates Required Data)

Project No. W-320

Project Title Tank 241-C-106 Sluicing

Specification Section 13440

1	2	3	4	5	VENDOR INFORMATION (VI)										ECN		
					Dimensional Drawings	Equipment Weights	Specifications	Certified Test Data	Control or Diagram	Installation	Operation	Maintenance	Spare Parts List	Data Sheets		Illustrative Cuts	
F01-13629	FLOW INTEGRATOR INDICATOR		Y-0601	X	X	X	X	X	X	X	X	X	X	X	X	X	ECN-168
HW-13638/ HY-13638	CONTROL VALVE/SOLENOID VALVE		Y-0602	X	X	X	X	X	X	X	X	X	X	X	X	X	ECN-132 ECN-168
HW-13669/ HY-13669			Y-0603														ECN-132
PCV-13629 PCV-1367	PRESSURE REGULATOR		Y-0605	X	X	X	X	X	X	X	X	X	X	X	X	X	ECN-168
POISH-13614 POISH-13615	PRESSURE DIFFERENTIAL SWITCH		Y-0606	X	X	X	X	X	X	X	X	X	X	X	X	X	ECN-168
PDT-13611 PDT-13612 PDT-13613	PRESSURE DIFFERENTIAL XMTR		Y-0607	X	X	X	X	X	X	X	X	X	X	X	X	X	ECN-168
P1-13629 P1-13630 P1-13631	PRESSURE GAGE		Y-0608	X	X	X	X	X	X	X	X	X	X	X	X	X	
PIT-1361 PIT-13646	PRESS INDICATOR XMTR		Y-0609	X	X	X	X	X	X	X	X	X	X	X	X	X	ECN-132 ECN-168
PT-13611	PRESSURE TRANSMITTER		Y-0610	X	X	X	X	X	X	X	X	X	X	X	X	X	ECN-168
PSV-13629	PRESSURE SAFETY VALVE		Y-0611	X	X	X	X	X	X	X	X	X	X	X	X	X	ECN-168
RE-1361 RIT-1361	GAMMA RADIATION ELEMENT RADIATION INDICATING XMTR		Y-0612	X	X	X	X	X	X	X	X	X	X	X	X	X	ECN-168

KEH 1985.00 (03/88) KEF07  
 HZ 2535 Rev. 0  
 Page 64



SECTION 15493

CHEMICAL PROCESS PIPING SYSTEMS

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 The following documents, including others referenced therein, form part of this Section to the extent designated herein.

1.1.1.1 American National Standard Institute (ANSI)

A13.1-1981 Scheme for the Identification of Piping Systems

1.1.1.2 American Society of Mechanical Engineers (ASME)

B16.3-1992 Malleable Iron Threaded Fittings, Classes 150 and 300

B16.9-1993 Factory-Made Wrought Steel Buttwelding Fittings

B16.11-1991 Forged Steel Fittings, Socket Welded and Threaded

B31.3-1993 Chemical Plant and Petroleum Refinery Piping

1.1.1.3 American Society for Nondestructive Testing (ASNT)

ASNT-TC-1A Recommended Practice (1988 Edition)

1.1.1.4 American Society for Testing and Materials (ASTM)

A 47-90 Ferritic Malleable Iron Castings

A 53-90b Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

A 106-91 Seamless Carbon Steel Pipe for High-Temperature Service

A 197-87 (1992) Cupola Malleable Iron

A 234-92a Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures

A 269-92 Seamless and Welded Austenitic Stainless Steel Tubing for General Service

- A 312-92a Seamless and Welded Austenitic Stainless Steel Pipes
- A 351-91b Castings, Austenitic, Austenitic-Ferritic (Duplex), for Pressure-Containing Parts
- A 403-91 Wrought Austenitic Stainless Steel Piping Fittings
- B 62-93 Composition Bronze or Ounce Metal Castings
- B 68-92a Seamless Copper Tube, Bright Annealed
- C 449-88 Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
- C 547-77 Mineral Fiber Preformed Pipe Insulation
- 1.1.1.5 Federal Standard
  - FED-STD-595 Colors Used In Government Procurement
- 1.1.1.6 Federal Specifications (FS)
  - TT-E-489 Enamel, Alkyd, Gloss, Low VOC Content
- 1.1.1.7 Manufacturers Standardization Society of the Valve and Fittings Industry (MSS)
  - SP-58, 1988 Pipe Hangers and Supports - Materials, Design and Manufacture
  - SP-69, 1991 Pipe Hangers and Supports - Selection and Application
  - SP-80, 1987 Bronze Gate, Globe, Angle and Check Valves
  - SP-89, 1991 Pipe Hangers and Supports - Fabrication and Installation Practices
- 1.2 SUBMITTALS
  - 1.2.1 See Section 01300 for submittal procedures.
  - 1.2.2 Approval Required: *None* ECN-122
  - ~~1.2.2.1 Approval data: Before delivery, submit information listed in the Approval Data List in this Section. ECN-122  
ECN-122~~

1.2.3 Approval Not Required

1.2.3.1 Certificates of conformance: With delivery, submit a legible certificate, certified by equipment manufacturer or supplier, stating that materials used in fabrication of valve bodies and bonnets, and equipment pressure boundary surfaces meet requirements of the Drawings and this Section, for pipe codes and services listed below.

- a. Pipe Code M-5; Service, Raw Water (RAW).
- b. Pipe Code M-7; Service, Instrument Air (IA).
- c. Pipe Code M-9; Service, Drain (DR) and Filtered Water (FW).
- d. Pipe Code M-24; Service, Drain (DR).
- e. Pipe Code M-31; Service, Instrument Sensing Lines (I).

1.2.3.2 Vendor information: Before installation, submit information listed in the Vendor Information List in this Section.

1.3 QUALITY ASSURANCE

1.3.1 Misrepresented Products: See Section 01400 for required measures to prevent the use of misrepresented products.

1.3.2 Welding Qualifications

1.3.2.1 Qualification of welding personnel and procedures: Personnel and procedures for welding pressure retaining components along with attachments hereto, and pipe supports, shall be qualified in accordance with ASME B31.3, Paragraph 328.2.

1.3.2.2 Qualification of Nondestructive Examination (NDE) Personnel:

- a. Visual weld examination shall be performed in accordance with ASME B31.3. Visual weld examiners shall be qualified in accordance with ASME B31.3, Section 342.
- b. Personnel performing other NDE shall be certified in accordance with Contractor's written practice, which shall meet the requirements of ASNT-TC-1A, before performing NDE. Use level II or III personnel to interpret test results.

1.3.2.3 Extent of application: The above qualification requirements also apply for preliminary fabrication of parts from materials specified in 2.2, when fabrication is accomplished in shops other than the material suppliers shops, but not necessarily at the worksite.

- 1.3.4 Deliverable Documentation: The following documents and records, required by this Section, shall be delivered to Construction Document Control in accordance with Section 01720.

<u>Document</u>	<u>Paragraph</u>
Welding Qualification	1.3.2.1
Welding Examination Documentation	3.2.1.6
Flushing/Mechanical Cleaning Verification	3.2.3.5
Leak/Pressure Test Certification	3.2.4.1b

1.4 DELIVERY, STORAGE AND HANDLING

- 1.4.1 See Section 01610 for general requirements.

PART 2 - PRODUCTS

2.1 SUBSTITUTES

- 2.1.1 See Section 01630 for substitution approvals.

- 2.1.2 Manufacturer's standard equipment nameplates may be used instead of those specified herein, if they display the required information, and are equivalent in quality and legibility. They need not be of the same material or have the same form of imprinting.

2.2 MATERIALS

- 2.2.1 Piping, Tubing, and Fittings: See the Pipe Codes in this Section, and details on the Drawings.

- 2.2.1.1 Close or butt nipples are not permitted, unless shown on the Drawings.

- 2.2.2 Pipe Joint Sealant (Lubricant) for Threaded Joint: For design temperatures up to 500°F, use nonhardening teflon paste: Chesterton "Goldend" No. 7298, Federal Process Company "JC-30," or Lake Chemical Company "Slic-Tite."

- 2.2.3 Painting: Piping identification shall be in accordance with Appendix A.

- 2.2.4 Pipe Supports: Pipe supports shall be as shown, with standard components selected in accordance with MSS SP-69, that satisfy the criteria of MSS SP-58.

2.2.5 Pipe Insulation

- 2.2.5.1 ASTM C 547, sectional, rigid fiberglass pipe covering, complete with factory applied laminated jacket of kraft paper outer surface bonded to vapor barrier film furnished with pressure sensitive closure system.

- 2.2.5.2 Insulating cement for forming insulation covering over fittings and valves: ASTM C 449. Cements that contains asbestos are not acceptable.

Service	Pipe Size (inches)	Insulation Paragraph Reference	Insulation Thickness (inches)
Drain (DR)	All*	2.2.5	1"

\* Except 3/8" vent drain

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

##### 3.1.1 General

- 3.1.1.1 Fabricate and install pipe and tubing in accordance with ASME B31.3 (for normal service), Drawings and this Section. *Pipe codes M-5, M-7, and M-24 piping systems shall be fabricated using threaded connections and piping code M-9 piping system shall be fabricated using welded connections unless otherwise shown on the drawings.*
- 3.1.1.3 Cut pipe and tubing using methods which result in clean, straight cuts.
- 3.1.1.4 Ream pipe and tubing to nominal inside diameter after cutting. Remove burrs from threads before assembly.
- 3.1.1.5 Tools marked for stainless steel shall be used on stainless steel only.
- 3.1.1.6 Bend pipe and tubing in accordance with ASME B31.3, and meet tolerances given in ASME B31.3. Use methods and equipment which produce bends free of wrinkles, bulges, or kinks. When wall thickness, diameter, and bend radius indicate possibility of wall collapse during bending, fill pipe or tubing with clean silica sand or fusible material similar to Cerrobend, manufactured by Cerro Corporation.
- a. Application of heat to facilitate a pipe bend shall be brought to the attention of the Responsible Engineer for direction and disposition prior to the application of heat.
- b. Cold springing pipe permitted only if specified on the Drawings.
- 3.1.1.7 Make joints in threaded piping systems with joint sealant specified. Apply sealant to male threads only.
- 3.1.1.8 Install tubing fittings in accordance with the manufacturer's instructions.

ECN-261

ECN-261

3.1.1.9 Keep piping systems clean. Piping systems shall be inspected before, during and after installation. Once fabrication has started, plug or cap ends of piping when installation is not in progress. Cap or plug openings in fabricated pipe spool assemblies until installation in the piping system. Leave ends of spare lines capped or blind flanged when installation has been completed.

- 3.1.1.10 Provide drain taps at low points to ensure complete drainage and drying Page 72 in piping systems using water for cleaning and leak/pressure testing.
- 3.1.1.11 Pipe supports: Install as shown on the Drawings, in accordance with manufacturer's instructions, and applicable recommended procedures of MSS SP-89.
- 3.1.1.12 Survey piping systems for elevation and location before final tie-in welds to risers or fixed items. Complete placement of supports and meet Specification and Drawing requirements before survey. Elevation and location shall be in accordance with the Drawings. After final tie-ins survey piping system again for final acceptance.
- 3.1.2 Welding
- 3.1.2.1 Weld piping, attachments to pressure retaining components, and pipe supports in accordance with ASME B31.3 and Project Drawings.
- 3.1.2.2 Complete piping welds before tie-in welds to risers or fixed items.
- 3.1.2.3 Remove backing strips if used.
- 3.1.3 Weld Identification
- 3.1.3.1 Prepare weld maps using Project Drawings or sketches, which show relative positions of pressure containing welds and attachment welds to pressure retaining components.
- 3.1.3.2 Assign and record weld numbers on weld maps as welds are made.
- 3.1.3.3 Place the welder identification symbol and weld number adjacent to welds upon completion. Place the identification symbol approximately every 3 feet on long seams or large weldments, using one of the marking methods specified in Section 01610.
- 3.1.3.4 Do not reuse weld numbers. If a weld bond is completely replaced, assign a new number.
- 3.1.4 Perform NDE, flushing, leak/pressure testing specified in 3.2.4 before coating application.
- 3.1.5 Piping Insulation
- 3.1.5.1 Preformed:
- a. Apply after leak/pressure testing of lines has been completed. Apply to pipe surfaces free of water, oil, dirt, loose scale or other foreign materials.
  - b. Abut sections and fill broken corners with insulating cement.

c. Apply molded sectional, rigid fiberglass with factory applied non-metallic jacketing for indoor applications, with adhesive surface clean. Seal lap and end joints with factory applied pressure sensitive lap strip and factory furnished pressure sensitive butt strips.

d. Insulate valves and fittings in pipe lines with insulating cement. Apply cement in accordance with manufacturer's recommendations.

e. Mitered sections of straight jacketed pipe insulation maybe used for fittings and elbows as an alternative. Cement mitered metal jacketed insulation joints with weatherproof seal and specified tape. Cement nonmetallic jacketed insulation joints with weatherproof seal and apply seal strip with lap adhesive.

3.1.6 Piping Identification: Identify exposed piping systems as to fluid carried and direction of flow in accordance with Appendix A.

3.1.7 Equipment Tag Features

3.1.7.1 Blanks: 3/4 by 2-inch (unless legends require longer tags), with a 1/8-inch attachment wire hole, 3/16-inch in from one end.

3.1.7.2 Characters: Use 1/8-inch stamped or engraved characters.

3.1.7.3 Legends: Provide the following information, unless otherwise specified in the Drawings.

a. ICF KH part number

3.1.7.4 Attach identification tags to valves and other equipment as required.

3.2 FIELD QUALITY CONTROL

3.2.1 Nondestructive Examination (NDE) of Welds shall be performed to the extent defined in ASME B31.3, Paragraph 341.4.

3.2.1.1 Perform NDE for each pipe code listed in the schedule in 3.3.

3.2.1.2 Visual examination: Perform in accordance with ASME B31.3, Paragraph 344.2. Acceptance criteria shall be in accordance with ASME B31.3, Table 341.3.2A.

3.2.1.3 Radiographic examination (RT): Perform in accordance with ASME B31.3, Paragraph 344.5. Acceptance criteria shall be in accordance with ASME B31.3, Table 341.3.2A.

a. Identify radiographic film with weld identification number and project or work order number assigned to work covered by this Section.

b. Prepare radiographic examination reports as follows.

1) List each radiographic exposure location (0-1, 1-2, ...) individually on radiographic examination report.

2) Indicate location acceptability or rejectability and note discontinuities whether rejectable or not.

3) When report includes radiographs of welds which have been repaired, indicate which welds are repair welds and how many times each weld has been repaired.

c. If additional welding is performed on weld area which has already been examined radiographically, this area is repair area. Identify subsequent radiographs by "R-1, R-2," etc.

3.2.1.4 In-process examination: Perform in accordance with ASME B31.3, Paragraph 344.7.

3.2.1.5 Perform random visual examination of piping support welds in accordance with ASME B31.3, Paragraph 344.2.

3.2.1.6 NDE documentation:

a. Document examination of pressure containment welds and welds to pressure containing components for piping systems on NDE/Weld Record Form KEH-0433. See Form KEH-0433 for instructions for recording weld maps, weld numbers, welder identification, welding procedure numbers, weld filler material, visual examinations, nondestructive examinations, and for noting satisfactory completion of leak/pressure testing.

b. Required NDE shall be completed and documented before starting leak/pressure testing.

c. NDE/Weld Record information and weld maps specified in 3.1.3 may be incorporated on a single format or traveler for a specific work package.

d. Document examination of pipe supports by recording on sketches or NDE/Weld Record form.

3.2.1.7 *Liquid Penetrant (dye penetrant) Examination (PT): Perform in accordance with ASME B31.3, paragraph 344.4. Acceptance criteria shall conform to ASME B31.3, paragraph 341.3.2.*

ECN-347

ECN-347

3.2.2 Flushing/Testing Preparation: Obtain direction from the Operating Contractor for disposal of waste flushing and testing water.

3.2.3 Cleaning and Flushing

3.2.3.1 After NDE is complete and before leak/pressure testing the system, or before connecting the system into existing systems, clean piping internal surfaces mechanically or by flushing.

3.2.3.2 Mechanical cleaning: Remove loose dirt, scale, and debris by brushing, wiping, high pressure water jetting, or other mechanical method approved.

a. When high pressure water jetting or other mechanical cleaning method utilizing water is used, and leak/pressure testing will not be performed immediately after cleaning, dry piping systems by blowing dry oil-free air or nitrogen through lines.

b. Dry until the relative humidity of discharge air is equal to that of inlet air. Use drain taps at low points of piping system to ensure complete drainage and drying. Cap lines or reconnect to system to maintain cleanliness.

### 3.2.3.3 Water flushing:

a. Remove strainer screens before flushing, except those protecting control equipment. Clean screens protecting control equipment before flushing, if necessary, and after flushing is complete. Remove steam traps from line before flushing.

b. Flush piping with water for 1 minute minimum, and until effluent is clean and contains no visible particulate matter. Flushing pressure shall not exceed maximum operating pressure specified in pipe codes. Flushing water supply shall have sufficient capacity to produce a flow velocity of 4 to 6 ft/s in largest pipe size, with pipe full. Provide flow measurement in flushing water supply line to be used as basis for verification of flow velocities in piping system by the Construction Engineer.

### 3.2.3.4 Pneumatic flushing: For Instrument Air (IA)(Pipe Codes M-7 and M-33a) only.

a. Isolate instruments by valving, plugging, or disconnecting.

b. Blow lines clean with dry, oil-free air or nitrogen at 20 to 30 lb/in<sup>2</sup> gage, until discharge air has no visible particulate matter, or for 5 minutes minimum. If Pipe Code maximum operating pressures are lower, use those pressures.

c. If leak/pressure testing is not performed immediately after flushing, cap lines or reconnect to system to maintain cleanliness.

### 3.2.3.5 Provide documented evidence that flushing or mechanical cleaning has been accomplished as specified in this Section.

### 3.2.4 Leak/Pressure Testing

#### 3.2.4.1 General:

a. After completion of flushing, perform leak/pressure testing of pipe in accordance with ASME B31.3 and this Section. Use calibrated gages with ranges 1-1/2 to 2 4 times the test pressure.

ECN-201

b. Document testing of each piping system on "Leak/Pressure Test Certification" Form KEH-1757. Use separate forms to describe and record each piping system. Under "Description" describe piping system in enough detail for correlation to weld identification drawings, shop fabrication drawings, or Project Drawings as applicable. For systems tested segmentally, indicate continuity in "Description" to assure that entire systems have been tested.

- c. Pipe joints, fittings, welds, and other potential leak sources to be tested shall be visible and accessible during tests.
- d. Install one temporary relief valve during testing. Relief valve shall have a discharge capacity of 125% of capacity of the pressurizing device, and be set to operate at 1-1/3 maximum of the test pressure for hydrostatic testing and not higher than test pressure plus the lesser of 50 lb/in<sup>2</sup> or 10% of the test pressure for pneumatic testing. Tag each relief valve used to show serial number, inspector, date, and pressure setting.
- e. Install necessary restraining devices, before applying test pressure, to prevent distortion or displacement of piping.
- f. Isolate instruments and other items which could be damaged by test pressures.
- g. Continuously maintain test pressure for 10 minutes minimum. Examine joints, welds, and connections. Piping system, shall show no visual evidence of weeping or leaking.
- h. Visually examine piping and tubing joints, fittings, welds, and other potential leak sources, including welds which attach wear plates, anchors, etc to piping systems, during testing.
- i. Complete testing of piping before field application of insulation or protective coating. Pipe with factory applied protective coating shall be considered as having been tested before protective coating application.

3.2.4.2 Hydrostatic pressure testing:

- a. Perform in accordance with ASME B31.3, Paragraph 345.4.
- b. Purge air from piping systems during filling, before applying pressure.
- c. Coat welded piping joints, fittings, and other potential leak sources, including welds attaching wear plates, anchors, etc, to piping systems, with a mixture of powdered blue chalk and water or isopropyl alcohol. Allow to dry before filling piping with water and inspecting for leaks.
- d. Remove water from tabulated piping systems after testing and dry by blowing dry, oil-free air or nitrogen through lines. Dry until the relative humidity of discharge air is equal to that of inlet air. Use drain taps at low points of piping systems to ensure complete drainage and drying.

3.2.4.3 Pneumatic Pressure Testing: For Instrument Air (IA) lines, M-7, M-24, and M-33a only.

- a. Perform in accordance with ASME B31.3, paragraph 345.5

ECN-144  
ECN-320  
ECN-144

b. Perform test with dry, oil-free air or nitrogen on piping systems.

3.2.4.3 4

**Final Connections:**

Final connections, as defined in this section, shall be exempt from the requirements of Leak/Pressure Testing and shall be In-Process Examined. Welds shall have their first and last pass Liquid Penetrant Examined. See paragraphs 3.2.1.4 and 3.2.1.7 respectively. Connection welds are defined as follows:

ECN-358/  
ECN-454

**Welds in the Process Building as follows:**

- a. 2"-DR-306-M9 where it welds to the Drip Pan and where it welds to the Seal Pot.
- b. 3/8"-DR-317-M9 where it welds to 2"-DR-306-M9.
- c. 1"-DR-309-M9 where it welds to the Seal Pot.
- d. 1 1/2"-310-M9 where it welds to the Seal Pot.
- e. 1"-DR-308-M9 where it welds to the Seal Pot.
- f. 1"-DR-311-M9 where it welds to the Seal Pot.
- g. 1/2"-RAW-607-M5 where it welds to the Seal Pot.
- h. 1"-DR-307-M9 where it welds to the Seal Pot Valve HV-136119.
- i. 1"-DR-318-M9 where it welds to the Seal Pot Existing 1/2" HEME Pipe.
- j. 3/4"-VT-1073-M8 where it welds to 3" DR-302-M9.
- k. ~~Attachment weld to the 2" Radiation Monitor Port A and Port B.~~
- l. ~~Attachment weld to the 6" Vent Port.~~
- m. ~~Attachment weld where the Chain Guide Supports weld to 2" DR 308 M9.~~

ECN-454

ECN-358

ECN-358/  
ECN-741

ECN-358/  
ECN-741

ECN-358

ECN-358  
ECN-446

ECN-358  
ECN-446

3.3 SCHEDULES

3.3.1 Schedule of Pipe Weld NDE/Testing

NDE/NDT Method	Pipe Codes						
	M-5	M-7	M-9	M-24			
Visual							
Fitup							
Root Pass							
Cover Pass	(C)(D)	(C)(D)	(C)(D)	(C)(D)			
Liquid Penetrant							
Root Pass							
Cover Pass							
Magnetic Particle							
Root Pass							
Cover Pass							
Radiographic							
Completed Weld	(E)(B)	(E)(B)	(E)(B)	(E)(B)			
Leak/Pressure							
Completed Weld	A	A	A	A			
Other							

Legend:

- A. Requires witnessing and acceptance by Title III Acceptance Inspection prior to recording.
- B. Requires acceptance of radiographs and documentation by Title III Acceptance Inspector prior to recording.
- C. Random visual examination for 5% of all circumferential welds, full penetration weld on branch connections and attachment welds to pipe.
- D. 100% visual examination of longitudinal welds.
- E. Random radiography for 5% of all primary circumferential welds for 2" and larger only. In-process examination may be performed in lieu of radiography.

PIPE CODE M-5 (Safety Class 3) General Service			
Service	Max Operating Pressure lb/in <sup>2</sup> gage	Test Pressure lb/in <sup>2</sup> gage	Max Operating Temp °F
Raw Water (RAW)	160	240	100
Sizes	all		
Pipe	ASTM A 53, Type E, Grade B black steel, or ASTM A 106, Grade B.		
Wall Thickness	Schedule 40		
Nipples	Same schedule as pipe, close or butt not permitted.		
Fittings (1)	Class 150, ASTM A 47, Grade 32510 or 35018, or ASTM 197, threaded in accordance with ASME B16.3.		
Unions	Class 150, ASTM A 47, Grade 32510 or 35018, or A 197, threaded in accordance with ASME B16.3, bronze to iron seat. No buried unions.		
Valves	Class 150, ASTM B 62, bronze body, threaded ends, in accordance with MSS SP-80 for globe.		
Globe	Union bonnet, composition disc, rising stem.  Crane No. 7TF  Powell Fig. 150		

(1) For inaccessible lines use ASME B16.9, material in accordance with ASTM A 234, Grade WPB, wall thickness to match pipe.

PIPE CODE M-5 (Safety Class 3) General Service

Ball	3 piece, brass body, 316 stainless steel ball, teflon seats and body seal, threaded ends.  Powell Fig. 4301T  Worcester No. 416TSE
Back flow Preventer	175 Psi, screwed bronze body with ball type block valves. The unit must be approved by the Washington State Board of Health.  Watts Regulator Series 909QT

PIPE CODE M-7 (Safety Class 3) General Service			
Service	Max Operating Pressure lb/in <sup>2</sup> gage	Test Pressure lb/in <sup>2</sup> gage	Max Operating Temp °F
Instrument Air (IA)	100	150 110	100
Instrument Air (IA)	20	30 22	100
Instrument Air (IA)	10	11	100
Sizes	All		
Pipe	ASTM A 53, Type E, Grade B, or ASTM A 106, Grade B.		
Wall Thickness	Schedule 40		
Nipples	Schedule 40		
Fittings (1)	Class 150, ASTM A 47, Grade 32510 or 35018, or A 197, threaded in accordance with ASME B16.3.		
Unions	Class 150, ASTM A 47, Grade 32510 or 35018, or A 197, threaded in accordance with ASME B16.3, bronze to iron seat.		
Ball Valves	Class 150, ASTM B 62, 3-piece, brass body, teflon seats and body seal, threaded ends.  Powell Fig. 4301T  Worcester No. 416TSE		

ECN-144

ECN-144

ECN-336/  
505

(1) For inaccessible lines use ASME B16.9, material in accordance with ASTM A 234, Grade WPB, wall thickness to match pipe.

PIPE CODE M-9 (Safety Class 3) General Service

Service	Max Operating Pressure lb/in <sup>2</sup> gage	Test Pressure lb/in <sup>2</sup> gage	Max Operating Temp °F
Filtered Water (FW)	160	240	100
Drain (DR)	20	30	100
Flush Water (FL)	150	225	200
Sizes	All		
Pipe	ASTM A 312, Grade TP 304L, seamless.		
Wall Thickness	Schedule 40S		
Fittings	<p>a. For FW, ASTM A 403, Class WP 304L, buttwelding for sizes over 1" in accordance with ASME B16.9 and ASTM A182, GR F 304L, socket welding for 1" and smaller, in accordance with ASME B 16.11. Wall thickness to match pipe.</p> <p>b. For DR, ASTM A 403, Class WP 304L, buttwelding in accordance with ASME B16.9. Wall thickness to match pipe.</p>		
Valves	ASTM A 351, Grade CF8M, Class 150, teflon gaskets and seals:		
Check	<p>Bolted cover, swing, integral seat.</p> <p>Crane No. 374, 1/2 to 2-inch sizes</p> <p>Powell Fig. 2342, 1/2 to 8-inch sizes</p>		
Ball	<p>a. For FW, 2-way with stainless steel ball (butt welded ends for sizes over 1" and socket welded ends for 1" and under).</p> <p>b. For DR, 2-way with stainless steel ball, butt welded ends.</p> <p>Worcester Series 59</p> <p>PBM Valves SP series, PBM Code H</p>		

ECN-253

ECN-118

ECN-286

ECN-286

PIPE CODE M-9 ( <del>Safety Class 3</del> ) General Service	
Flanges	ASTM A 182, Grade F 304L, Class 150, forged, raised face, weld neck in accordance with ASME B16.5 Bore to match pipe ID Use flat face where mating to flat face flanges.
Bolting	ASTM A 193, Grade B8, alloy steel studs, and ASTM A194, Grade 8F, heavy hex nuts.
Gaskets	Spiral-wound, nonasbestos, 0.175-inch thick, with 1/8-inch thick carbon steel gage ring; Garlock Guardian Type CR, or Flexitallic Style CG with flexite super filler. Use full face gaskets with flat face flanges; Garlock "Blue-Gard" Style 3000, or Anchor Packing "clean Leaf" No. 443.

PIPE CODE M-24 ( <del>Safety Class 3</del> ) General Service			
Service	Max Operating Pressure lb/in <sup>2</sup> gage	Test Pressure lb/in <sup>2</sup> gage	Max Operating Temp °F
Drain (DR)	Ø 100	Ø 110	100
Size	all		
Pipe	Carbon Steel, ASTM A 106, Grade B		
Wall Thickness	Schedule 40		
Fittings	Class 150, ASTM A 47, Grade 32510 or 35018, or A 197, threaded in accordance with ASME B16.3.		
Ball Valve	Class 150, ASTM B 62, 3-piece brass body, teflon seats and body seal, threaded ends.  Powell Fig. 4301T  Worcester No. 416TSE		

ECN-320

PIPE CODE M-31 ( <del>Safety Class 3</del> ) General Service			
Service	Max. Operating Pressure lb/in <sup>2</sup> gage	Test Pressure lb/in <sup>2</sup> gage	Max. Operating Temperature °F
Instrument Sensing Lines (I)	160	See Note	200
Sizes	1/4"	3/8" and 1/2 "	3/4", 1" and 1 1/2"
Tubing	ASTM A 269, Grade TP 304 or 304L or 316 annealed, seamless stainless steel		
Wall Thickness	0.035" nominal	0.049" minimum	0.065" minimum
Fittings	Type 316 stainless steel, flareless type; Crawford "Swagelok" or Parker "CPI"		

NOTE: Test pressure shall be the same as the pipe, tank or vessel to which the sensing line is attached.

PIPE CODE M-33a (Safety Class 3) General Service			
Service	Max. Oper. Press. Psig	Test Pressure Psig	Max. Oper. Temp. °F
Instrument Air (IA)	100	<del>150</del> 110	100
Size	1/2"		
Tube	ASTM B 68, seamless, bright red		
Wall Thickness	0.032"		
Fittings	Wrought or bar stock brass, flareless grip, compression type, Imperial Eastman or Parker Hannifin		

ECN-144





## APPENDIX A - IDENTIFICATION OF PIPING SYSTEMS

### 1. GENERAL

The identification of piping systems shall be in accordance with the American Standard Scheme for the Identification of Piping Systems, ANSI A13.1, as supplemented herein.

### 2. LOCATION

a. Except as provided below, identification shall be located adjacent to outlets, valves, flanges, unions, changes-in-direction, where pipes pass through walls, floors, or ceilings, and along an uninterrupted length of pipe at maximum intervals of 50 feet. Each line or branch in a room shall have at least one identification.

b. Where a number of outlets, valves, flanges, unions, or changes of direction make identification at each item impracticable, they may be spaced at approximate 6 foot intervals, preferably adjacent to valves.

c. Legend shall be located on the pipe so that it can be read easily from the operator's normal viewing position. Labels shall be placed on the readily visible lower quadrant of overhead pipes, and on an upper quadrant of pipes below normal eye level. Above ceilings, labels shall be placed in locations most readily visible from access positions.

### 3. LEGEND

a. Positive identification of a piping system content shall be by lettered legend giving the name of the content in full or abbreviated form. Legends may also be as specified on drawings or in other specifications.

b. Abbreviation of words in the legend may be used only where unavoidable due to space limitations.

c. The legend shall include the nominal operating pressure for steam, compressed air, and when specified, the pressure or temperature for other materials.

d. An arrow indicating the direction of flow shall be placed near the legend on pipes normally having a flow in one direction only. The color and size of the arrow shall be consistent with the color and size of the legend letters.

e. Legend shall be located on or adjacent to the classification color band.

4. APPROVED LABELS

a. Legend and color classification may be accomplished by the use of approved labels conforming to this Standard and which are suitable for the temperature of the surface to which they are to be applied. Approved labels include the following.

ALL-TEMPERATURE PIPE MARKERS  
W. H. Brady Company  
727 West Glendale Avenue  
Milwaukee, Wisconsin 53201

TEL-A-PIPES  
Westline Products Division  
Thomas & Betts Company  
220 South Rose Street  
Los Angeles, California 90012

b. Single-word labels may be combined to form complete legends. Individual-letter labels shall not be so combined.

c. Labels shall be installed after painting is complete.

5. CLASSIFICATION COLOR

a. When use of classification colors is specified, they shall conform to Table 1.

Table 1			
Classification	Band or Label Color	Legend/Arrow Color	Approximate Color No. (FED-STD-595)
Dangerous	Yellow	Black (17038)	13655 (yellow)
Safe	Green	Black (17038)	14260 (green)

b. Paint, if used, shall conform to FS TT-E-489, Class A, for synthetic gloss enamel.

c. Classification colors shall conform to Table 2.

Table 2. Classification Colors.	
Material	Color
Steam	Yellow
Sanitary Water (SW)	Green
Process Sodium Hydroxide (NaOH)	Yellow
Raw Water (RW)	Green

END OF APPENDIX

SECTION 15507

CONTAMINATED AIR HVAC SYSTEMS

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 The following documents, including others referenced therein, form part of this Section to the extent designated herein.

1.1.1.1 American National Standards Institute (ANSI)

A13.1-1981 Scheme for the Identification of Piping Systems

1.1.1.2 American Society of Mechanical Engineers (ASME)

B16.5-1992 Pipe Flanges and Flanged Fittings

B16.9-1993 Factory-Made Wrought Steel Butt welding Fittings

B31.3-1993 Chemical Plant and Petroleum Refinery Piping

1.1.1.3 American Society for Testing and Materials (ASTM)

A 53-93a Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

A 105-93b Forgings, Carbon Steel, for Piping Components

A 182-92a Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service

A 193-93a Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service

A 194-93a Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service

A 234-88b Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures

A 240-88a Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels

- A 276-89 Stainless and Heat Resisting Steel Bars Page 93  
and Shapes
- A 312-93 Seamless and Welded Austenitic  
Stainless Steel Pipes
- A 403-93 Wrought Austenitic Stainless Steel  
Piping Fittings
- C 449-88 Mineral Fiber Hydraulic-Setting Thermal  
Insulating and Finishing Cement
- C 547-77 Mineral Fiber Preformed Pipe Insulation
- 1.1.1.4 American Society for Nondestructive Testing (ASNT)  
SNT-TC-1A Recommended Practice (December  
1992 Edition)
- 1.1.1.5 American Welding Society (AWS)  
D9.1-90 Sheet Metal Welding Code  
QC1-88 Qualification and Certification of  
Welding Inspectors
- 1.1.1.6 Federal Specifications (FS)  
HH-I-558 Insulation, Blankets, Thermal (Mineral  
Fiber, Industrial Type)  
TT-E-489 Enamel, Alkyd, Gloss, Low VOC content  
TT-S-00230C, AMD 2 Sealing Compound: Elastomeric Type,  
Single Component (For Caulking, Sealing  
and Glazing In Buildings and Other  
Structures)
- 1.1.1.7 Manufacturers Standardization Society of the Valve and Fittings Industry  
(MSS)  
SP-89, 1991 Pipe Hangers and Supports - Fabrication  
and Installation Practices
- 1.1.1.8 Underwriters Laboratories (UL)  
Building Materials Directory 1994
- 1.2 SUBMITTALS
- 1.2.1 See Section 01300 for submittal procedures.

1.2.2 Approval Required

1.2.2.1 Approval Data: Before delivery, submit information listed in the Approval Data List in this Section.

1.2.3 Approval Not Required

1.2.3.1 Vendor Information: Before installation, submit information listed in the Vendor Information List in this Section.

1.3 SYSTEM DESCRIPTION

1.3.1 Systems are stainless steel piping and duct for exhaust air of Tank C-106 that contains radioactive contaminants. In addition, there is carbon steel piping for a chill water system which supports the ventilation system.

1.4 QUALITY ASSURANCE

1.4.1 Duct insulating materials shall be listed in the UL Building Materials Directory, and carry the UL mark.

1.4.2 Misrepresented Products: See Section 01400 for required measures to prevent the use of misrepresented products.

1.4.3 Welding Qualifications:

1.4.3.1 Qualification of welding and procedures (Pipe Code M-4, M-8): Personnel and procedures for welding pressure retaining components along with attachments hereto, and pipe supports, shall be qualified in accordance with ASME B31.3, Paragraph 328.2.

1.4.3.2 Qualification of welding and procedures (Duct Code D-3): Personnel and procedures for welding pressure retaining components along with attachments hereto, and duct supports, shall be qualified in accordance with AWS D9.1, Sections 3 and 4.

1.4.3.3 Qualification of Nondestructive Examination (NDE) Personnel:

a. Visual weld examination shall be performed in accordance with ASME B31.3. Visual weld examiners shall be qualified in accordance with ASME B31.3, Section 342.

b. Welding related examination documentation shall be signed or stamped by individuals performing examination. Where CAWIs perform examinations, documentation shall be signed or stamped by both CAWI and CWI under whom examination were performed.

c. Personnel performing other NDE shall be certified in accordance with Contractor's written practice, which shall meet the requirements of ASNT-TC-1A. Use Level II or III personnel to interpret results.

- 1.4.3.4 Extent of Application: The above qualification requirements also apply for preliminary fabrication of parts, when fabrication is accomplished in shops other than the materials supplier shops, but not necessarily at the worksite.
- 1.4.4 Deliverable Documentation: The following documents and records, required by this Section, shall be delivered to Construction Document Control (Buyer) in accordance with Section 01720.

<u>Document</u>	<u>Paragraph</u>
Welding Qualification	1.4.3
Welding Examination Documentation	3.2.1.5a
Flushing/Mechanical Cleaning Verification	3.2.5.1
Leak/Pressure Test Certification	3.2.7.1b
Leak/Pressure Test (duct) Certification	3.2.7.4e, 3.2.7.5e

## 1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 See Section 01610 for general requirements.

## 1.6 FURNISHED EQUIPMENT

1.6.1 See Section 01019 for items furnished for construction.

## PART 2 - PRODUCTS

### 2.1 SUBSTITUTES

2.1.1 See Section 01630 for substitution approvals.

### 2.2 MATERIALS

2.2.1 Pipe and Fittings: See the Pipe Codes in this Section, and details on the Drawings.

2.2.1.1 Material and weight shall be as specified in the Pipe Code for each piping system.

2.2.1.2 Close or butt nipples are not permitted, unless shown on the Drawings.

2.2.2 Pipe Joint Sealant (Lubricant) for Threaded Joints

2.2.2.1 Use nonhardening teflon paste: Chesterton "Goldend" No. 7298, Federal Process Company "JC-30," or Lake Chemical Company "Slc-Tite."

- 2.2.3 Ductwork insulation: Provide uniform thickness for each duct size and piece of equipment.
- 2.2.3.1 Insulation and adhesive shall have UL fire hazard classifications of 25 maximum for flame spread and 50 maximum for smoke developed.
- 2.2.3.2 Insulation corrosive and moisture adsorption characteristics shall be in accordance with FS HH-I-558.
- 2.2.3.3 Insulation for exterior surfaces of indoor duct: 1-1/2-inch thick; Manville rigid 800 Series Spin-Glass Fiberglass, 6 lb/ft<sup>3</sup> density, with AP facing.
- 2.2.3.4 Weatherproofing: Foster "Sealfas" G.P.M. 35-00 mastic, with "Mast-A-Fab" reinforcing membrane.
- 2.2.3.5 Accessories: As specified below.
  - a. Mechanical fasteners: Stick-Clips, Gemco insulation hangers with washers or type recommended by insulation manufacturer.
  - b. Cement: ASTM C 449; Pabco Pabcote No. 127.
- 2.2.4 Painting: See Section 05500.
- 2.2.5 Pipe Insulation
  - 2.2.5.1 Indoor applications: ASTM C 547 molded, sectional, rigid fiberglass pipe covering, Class 1 complete with factory applied laminated jacket of kraft paper outer surface bonded to vapor barrier film furnished with pressure sensitive closure system.
  - 2.2.5.2 Insulating cement for forming insulation covering over fittings and valves: ASTM C 449. Cements that contain asbestos are not acceptable.
  - 2.2.5.3 Piping insulation schedule:

Service	Pipe Size (inches)	Insulation Paragraph Reference	Insulation Thickness (inches)
Ventilation M-8	all sizes	2.2.6.1	1.5
Chill Water M-4	all sizes	2.2.6.1	1.25

- 2.2.7 Pipe Supports: Standard, manufactured components as shown on the Drawings. Pipe supports and attachments welded to pressure containment boundaries may be noncertified material, provided the material bears a type identifying mark, is suitable for welding, and compatible with the material to which it is attached.

2.2.8 Material Limitations for Stainless Steel Components:

- 2.2.8.1 Tape and adhesive leachable chloride content shall not exceed 15 ppm, and leachable fluoride content not to exceed 10 ppm. Use 3M Company preservation sealing tape No. 481, 9 mil thick, or Kendall Company Polyken Division No. 226. Materials which contact stainless steel piping and components during fabrication and shipping shall not exceed these limits.
- 2.2.8.2 Grinding or machining of stainless steel shall be done only with tools which are allocated specifically for use on stainless steel. Use of grinding compounds containing halogens is strictly prohibited. Wire brushing of stainless steel shall be done with stainless steel brushes that are new or have not been used on material other than stainless steel.
- 2.2.8.3 Demineralized water used for cleaning or flushing shall be limited to a chloride content of 25 ppm maximum. Cleaning solutions shall not contain halogenated compounds.
- 2.2.9 Penetration Sealants: FS TT-S-00230, Type II, Class A, 1-component polyurethane, nonsag type, light-colored.
- 2.2.10 Identification Tags: 0.0478-inch (18-gage) minimum thickness stainless steel. Tag Attachment Wire: 20-gage, solid, stainless steel.

2.3 EQUIPMENT

- 2.3.1 Valves: Specified in Pipe Codes, unless shown otherwise on the Drawings.
- 2.3.2 Butterfly valves specified in Pipe Code M-8:

Valve No.	Size, inches	Type-Keystone	Operator
HV-13644 HV-13646 HV-13649	6	Model 999	notch plate handle
HV-13645	6	Model 999	notch plate handle, extension 3'-6"
HV-13648	6	Model 999	notch plate handle, extension 3'
HV-13647	6	Model 999	notch plate handle, extension 3'
HV-136142 HV-13639	10	Model 992	notch plate handle

- 2.3.3 Steel shielding shot: Abrasives Northwest, Inc., cast steel, size 230, or approved substitute

PART 3 - EXECUTION

3.1 INSTALLATION

3.1.1 Equipment

3.1.1.1 Install as shown on the Drawings and in accordance with the manufacturer's instructions.

3.1.1.2 Prime and paint carbon steel supports in accordance with Section 05500. Paint containing lead is not acceptable.

3.1.1.3 Fill High Efficiency Metal Filter (HMF-1361) and High Efficiency Mist Eliminator (HME-1361) with shielding shot of 2.3.3.

3.1.2 Piping

3.1.2.1 Fabricate and install pipe and tubing in accordance with ASME B31.3 (for normal service), the Drawings, and this Section. *Pipe codes M-4 and M-8 piping system shall be fabricated using welded connections unless otherwise shown on the drawings.*

ECN-261

ECN-261

3.1.2.2 Cut pipe and tubing using methods which result in clean, straight cuts. Do not use tubing cutters on tubing utilizing compression fittings.

3.1.2.3 Ream pipe and tubing to nominal inside diameter after cutting. Remove burrs from threads before assembly.

3.1.2.4 Tools marked for stainless steel shall be used on stainless steel only.

3.1.2.5 Bend pipe and tubing in accordance with ASME B31.3, and meet tolerances given in ASME B31.3. Use methods and equipment which produce bends free of wrinkles, bulges, or kinks. When wall thickness, diameter, and bend radius indicate possibility of wall collapse during bending, fill pipe or tubing with clean silica sand or fusible material similar to Cerrobend, manufactured by Cerro Corporation.

a. Application of heat to facilitate a pipe bend shall be brought to the attention of the Construction Engineer for direction and disposition.

b. Cold springing pipe permitted only if specified on the Drawings.

3.1.2.6 Make joints in threaded piping systems with joint sealant specified. Apply sealant to male threads only.

3.1.2.7 Install tubing fittings in accordance with the manufacturer's instructions.

3.1.2.8 Carbon steel embedded in concrete shall be bare.

3.1.2.9 Keep piping systems clean. Once fabrication has started, plug or cap ends of piping when installation is not in progress. Cap or plug openings in fabricated pipe spool assemblies until installation in the

pipng system. Leave ends of spare lines capped or blind flanged when installation has been completed.

- 3.1.2.10 Provide vents at high points to purge air pockets and drain taps at low points to ensure complete drainage and drying in piping systems using water for cleaning and leak/pressure testing. Venting may be provided by loosening flanges having minimum of 4 bolts.
- 3.1.2.11 Pipe supports: Install as shown on the Drawings, in accordance with manufacturer's instructions, and applicable recommended procedures of MSS SP-89.
- 3.1.3 Welding
  - 3.1.3.1 Weld piping, attachments to pressure retaining components, and pipe supports in accordance with ASME B31.3.
    - a. Protect outdoor welding operation from rain and wind by using barriers to protect welder and weld joint.
    - b. Complete piping welds before tie-in welds to valve pits, risers, or fixed items.
    - c. Remove backing strips if used.
  - 3.1.3.2 Weld duct and duct support in accordance with AWS D9.1.
  - 3.1.4 Weld Identification
    - 3.1.4.1 Prepare weld maps using Project Drawings or sketches, which show relative positions of pressure containing welds and attachment welds to pressure retaining components.
    - 3.1.4.2 Assign and record weld numbers on weld maps as welds are made..
    - 3.1.4.3 Place the welder identification symbol adjacent to welds upon completion. Place the identification symbol approximately every 3 feet on long seams or large weldments, using one of the marking methods specified in Section 01610.
    - 3.1.4.4 Do not reuse weld numbers. If a weld is completely replaced, assign a new number.
    - 3.1.4.5 Maintain material traceability (including heat/lot numbers) through fabrication.
  - 3.1.5 Perform NDE, flushing, and leak/pressure testing specified in 3.2 before coating application.
  - 3.1.6 Piping Insulation
    - 3.1.6.1 Preformed:
      - a. Apply after leak/pressure testing of line has been completed. Apply to pipe surfaces free of water, oil, dirt, loose scale, or other foreign material.

- b. Abut sections and fill broken corners with insulating cement.
  - c. Apply molded, sectional, rigid fiberglass with factory applied nonmetallic jacketing for indoor applications, with adhesive surface clean. Seal lap and end joints with factory applied pressure sensitive lap strip and factory furnished pressure sensitive butt strips.
  - d. Insulate valves and fittings in pipe lines smaller than 4 inches with insulating cement. Apply cement in accordance with manufacturer's recommendations.
  - e. Insulate valves and fittings in 4 to 14-inch pipe lines with sectional or block insulation of same material used on adjacent pipe, with same total thickness. Securely wire in place with 16-gage wire, and cover with 20-gage, 1 by 1-inch wire mesh, or glass fabric, stretched tightly over surface and fastened in place. Top insulation with 1/2 inch minimum thickness coating of insulating cement to present a smooth surface.
  - f. Mitered sections of straight jacketed pipe insulation may be used for fittings and elbows as an alternative to 3.1.6.1d and 3.1.6.1e. Cement mitered metal jacketed insulation joints with weatherproof seal and specified tape. Cement nonmetallic jacketed insulation joints with weatherproof seal and apply seal strips with lap adhesive.
  - g. Insulate flanges with sectional or block insulation of same material used on pipe. Terminate insulation on pipe adjacent to flanges with bevel far enough from flanges to permit removal of flange bolts. Insulate flanges to a thickness of 1/2 inch less than adjacent pipe covering to allow for 1/2 inch cement finish. Flange insulation shall extend 2 inches over ends of pipe insulation. Wire flange insulation in place and cover with 1/2 inch minimum thickness layer of insulating cement.
  - h. Seal penetrations of jacket for hanger rods and clamps with weatherproof sealant.
  - i. Seal joints between saddles and insulation with factory applied pressure sensitive lap strip. Fill gaps with insulating cement.
- 3.1.7 Piping Identification: Identify exposed piping systems as to fluid carried and direction of flow as specified in Appendix A.
- 3.1.8 Duct
- 3.1.8.1 Fabricate duct in accordance with Drawings and Duct Code D-3.
- 3.1.8.2 Test as specified in 3.2.7.4 before installing external insulation.
- 3.1.9 Duct Insulation
- 3.1.9.1 Surfaces to receive insulation shall be clean, free of moisture, oil, dirt, scale, rust, and other foreign material.

- 3.1.9.2 Insulation and finish materials shall be dry when installed.
- 3.1.9.3 Install a uniform thickness of insulation on each duct size and piece of equipment.
- 3.1.9.4 Make installations continuous through sleeves and prepared openings, unless shown otherwise on the Drawings. Terminate insulation at flanges.
- 3.1.9.5 Score or groove insulation to fit contours of duct. Fill and seal scores, grooves, joints, and penetrations with insulating cement.
- 3.1.9.6 Where insulation abuts uninsulated surfaces, seal joints with mastic.
- 3.1.9.7 Indoor duct and equipment: Install insulation, described in 2.2.3.3, of 1-1/2 inches on exterior surfaces. See 2.2.3.3. Apply in accordance with the manufacturer's instructions.
- 3.1.9.8 Attach insulation to metal duct and equipment surfaces with adhered clips and washers of 2.2.3.5, and 100% coverage of insulation cement. Space clips 12 inches maximum on centers.
- 3.1.9.9 Seams, joints, penetrations and damages to the facing shall be sealed with vapor retardant mastic.
- 3.1.10 Identification Tag Features
  - 3.1.10.1 Blanks: 3/4 by 2-inches (unless legends require longer tags), with a 1/8-inch attachment wire hole 3/16 inches in from one end.
  - 3.1.10.2 Characters: Use 1/8-inch stamped or engraved characters.
  - 3.1.10.3 Legends: Provide the following information, unless otherwise specified on the Drawings. Obtain information from the data sheets in this specification, or the Drawings.
    - a. ICF KH part number.
  - 3.1.10.4 Attach identification tags to valves, instruments and other equipment, as required.
- 3.2 FIELD QUALITY CONTROL
  - 3.2.1 Nondestructive Examination (NDE) of Welds for piping
    - 3.2.1.1 Perform NDE for each pipe code listed in the schedule in 3.3. Extent of required examination shall be in accordance with ASME B31.3, Paragraph 341.4.1. Acceptance criteria for NDE shall be in accordance with ASME B31.3, Paragraph 341.3.2.
    - 3.2.1.2 Visual examination: Perform in accordance with ASME B31.3, Paragraph 344.2.

3.2.1.3 Radiographic examination (RT): Perform in accordance with ASME B31.3, Paragraph 344.5.

a. Identify radiographic film with weld identification number and project or work order number assigned to work covered by this Section. In process examination in accordance with ASME B31.3, Paragraph 344.7 may be substituted for Radiography.

b. Prepare radiographic examination reports as follows.

1) List each radiographic exposure location (0-1, 1-2, ...) individually on radiographic examination report.

2) Indicate location acceptability or rejectability and note discontinuities whether rejectable or not.

3) When report includes radiographs of welds which have been repaired, indicate which welds are repair welds and how many times each weld has been repaired.

c. If additional welding is performed on weld area which has already been examined radiographically, this area is repair area. Identify subsequent radiographs by "R-1, R-2," etc.

3.2.1.4 Perform 5% random examination of piping supports in accordance with ASME B31.3, Paragraph 344.2.

3.2.1.5 NDE documentation:

a. Document examination of pressure containment welds and welds to pressure containing components for piping systems on NDE/Weld Record Form KEH-0433 or similar. See Form KEH-0433 for instructions for recording weld maps, weld numbers, welder identification, welding procedure numbers, weld filler material, visual examinations, nondestructive examinations, and for noting satisfactory completion of leak/pressure testing.

b. Required NDE shall be completed and documented before starting leak/pressure testing.

c. NDE/Weld Record information and weld maps specified in 3.1.4 may be incorporated on a single format or traveler for a specific work package.

d. Document examination of pipe supports by recording on sketches or NDE/Weld Record form.

3.2.2 Nondestructive Examination (NDE) of welds for ducting.

3.2.2.1 Production welds shall be visually inspected in accordance with AWS D9.1.

3.2.2.2 Acceptance criteria for welds shall be in accordance with AWS D9.1.

3.2.3 Flushing/Testing Preparation: Obtain direction for disposal of waste flushing and testing water, prior to generation of wastes, from the Operating Contractor.

3.2.4 Cleaning and Flushing

3.2.4.1 After NDE is complete and before leak/pressure testing the system, or before connecting the system into existing systems, clean piping internal surfaces mechanically or by flushing as follows.

Service	Pipe Code	Cleaning Method
Chill Water	M-4	Water Flush or 3.2.5
Ventilation	M-8	Water Flush or 3.2.5

3.2.4.2 Mechanical cleaning: Remove loose dirt, scale, and debris by brushing, wiping, high pressure water jetting, or other mechanical method approved by the Construction Engineer (Buyer).

a. When high pressure water jetting or other mechanical cleaning method utilizing water is used, and leak/pressure testing will not be performed immediately after cleaning, dry piping systems by blowing dry oil-free air or nitrogen through lines.

b. Dry until the relative humidity of discharge air is equal to that of inlet air. Use drain taps at low points of piping system to ensure complete drainage and drying. Cap lines or reconnect to system to maintain cleanliness. Note, humidity measurements from inlet and exhaust shall be converted to the same pressure to verify equality.

3.2.4.3 Water flushing:

a. Remove strainer screens before flushing, except those protecting control equipment. Clean screens protecting control equipment before flushing, if necessary, and after flushing is complete.

b. Flush piping with water for 1 minute minimum, and until effluent is clean and contains no visible particulate matter. Flushing pressure shall not exceed maximum operating pressure specified in pipe codes. Flushing water supply shall have sufficient capacity to produce a flow velocity of 4 to 6 ft/s in largest pipe size, with pipe full. Provide flow measurement in flushing water supply line to be used as basis for verification of flow velocities in piping system by the Construction Engineer (Buyer).

c. See 2.2.8.3 for flush water requirements.

3.2.5 Mechanical cleaning may be substituted for flushing if approved by the Construction Engineer (Buyer).

3.2.5.1 Provide documented evidence that flushing or mechanical cleaning has been accomplished as specified in this Section.

3.2.6 Duct Cleaning

3.2.6.1 Provide necessary equipment and materials for cleaning ductwork.

3.2.6.2 Remove debris from inside of new duct, then vacuum to remove small particles of rubbish and dust.

3.2.6.3 Replace duct section(s) removed for cleaning and those that have been damaged.

3.2.7 Leak/Pressure Testing of Piping

3.2.7.1 General:

a. After completion of flushing, perform leak/pressure testing of pipe in accordance with ASME B31.3, Paragraph 345 and this Section. Use calibrated gages with ranges 1-1/2 to  $\pm 4$  times the test pressure.

ECN-203

b. Document testing of each piping system on "Leak/Pressure Test Certification" Form KEH-1757. Use separate forms to describe and record each piping system. Under "Description" describe piping system in enough detail for correlation to weld maps, shop fabrication drawings, and Project Drawings as applicable. For systems tested segmentally, indicate continuity in "Description" to ensure that entire systems have been tested.

c. Pipe joints, fittings, and other potential leak sources to be tested shall be visible and accessible during tests.

d. Install one temporary relief valve during testing. Relief valve shall have a discharge capacity of 125% of capacity of the pressurizing device, and be set to operate at 1-1/3 maximum of the test pressure for hydrostatic testing and not higher than test pressure plus the lesser of 50 lb/in<sup>2</sup> or 10% of the test pressure for pneumatic testing. Tag each relief valve used to show serial number, inspector, date, and pressure setting.

e. Install necessary restraining devices, before applying test pressure, to prevent distortion or displacement of piping.

f. Isolate instruments and other items which could be damaged by test pressures.

g. Continuously maintain test pressure for 10 minutes minimum. Examine joints and connections. Piping system, exclusive of possible localized instances at pump or valve packing, shall show no visual evidence of weeping or leaking.

h. Visually examine piping and tubing joints, fittings, and other potential leak sources, including welds which attach wear plates, anchors, etc to piping systems, during testing.

i. Complete testing of piping before field application of insulation or protective coating. Pipe with factory applied protective coating shall be considered as having been tested before protective coating application.

3.2.7.2 Pneumatic pressure testing of Piping:

- a. Perform in accordance with ASME B31.3, Paragraph 345.5. Leaks may be detected by bubble method or equivalent method.
- b. Perform testing with dry, oil-free air or nitrogen on tabulated piping systems.

Service	Pipe Code
Ventilation	M-8

3.2.7.3 Hydrostatic pressure testing:

- a. Perform in accordance with ASME B31.3, Paragraph 345.4.
- b. Purge air from piping systems during filling, before applying pressure.
- c. Coat welded piping joints, fittings, and other potential leak sources, including welds attaching wear plates, anchors, etc, to piping systems, with a mixture of powdered blue chalk and water or isopropyl alcohol. Allow to dry before filling piping with water and inspecting for leaks.
- d. Remove water from tabulated piping systems after testing and dry by blowing dry, oil-free air or nitrogen through lines. Dry until the relative humidity of discharge air is equal to that of inlet air. Use drain taps at low points of piping systems to ensure complete drainage and drying.

Service	Pipe Code
Chill Water	M-4

~~3.2.7.4 Leak/Pressure Testing of Ductwork: Perform in the presence of the Quality Control Inspector unless otherwise instructed in writing. Test ductwork in accordance with the following.~~

- ~~a. Pressurize the duct to a pressure of 20"W.G. With test boundary under continuous pressure, examine pressure boundaries duct for leaks.~~
- ~~b. Test duration shall be 15 minutes minimum, plus additional time necessary for finding leaks.~~

ECN-743

ECN-743

~~e. No leakage is allowed at -20"W.G.~~

~~d. Examine joints and other potential leak sources during testing. Leaks may be detected by bubble method or electronic sound detection. Repair detectable leaks and retest the system.~~

~~e. Document ductwork testing on "Leak/Pressure Test Certification," Form KEH 1757 or similar form.~~

### 3.2.7.4 Leak/Pressure Testing of Ductwork:

3.2.7.4.1 Shop Testing: Perform in the presence of the Quality Control Inspector unless otherwise instructed in writing. Test ductwork in accordance with the following:

a. Pressurize the duct to a pressure of -20" W.G. With test boundary under continuous pressure, examine pressure boundaries for leaks.

b. Test duration shall be 15 minutes minimum, plus additional time necessary for finding leaks.

c. No leakage is allowed at -20" W.G.

d. Examine joints and other potential leak sources during testing. Leaks may be detected by bubble method or electronic sound detection. Repair detectable leaks and retest the system.

e. Document ductwork testing on "Leak/Pressure Test Certification," Form KEH-1757 or similar form.

3.2.7.4.2 Field Testing: Perform in the presence of Quality Control Inspector unless otherwise instructed in writing. Pressurize the duct to a pressure of +20 W.G. Maintain pressure and examine all field assembled connections, repairs, or modifications for leaks using the bubble method. No leakage is allowed at +20" W.G. Repair detectable leaks and retest the system. Document testing on "Leak/Pressure Test Certification," Form KEH-1757 or similar form.

ECN-743

3.2.7.5 Structural Integrity Testing of Ductwork  
Test ductwork in accordance with the following: Perform in the presence of the Quality Control Inspector unless otherwise instructed in writing.

a. Pressurize the duct to a pressure of -50"W.G. With the test boundary under continuous pressure, examine pressure boundaries for distortion or breach of integrity.

b. Maintain pressure as required to examine pressure boundary.

c. Release pressure and inspect for permanent distortion.

d. Document ductwork testing on "Leak/Pressure Test Certification," Form KEH-1757 or similar form.

3.3 SCHEDULES

3.3.1 Schedule of Pipe Weld NDE/Testing

NDE/NDT Method	Pipe Codes						
	M-4	M-8					
Visual	B	B					
Fitup							
Root Pass							
Cover Pass							
Liquid Penetrant							
Root Pass							
Cover Pass							
Magnetic Particle							
Root Pass							
Cover Pass							
Radiographic							
Completed Weld	C	C					
Leak/Pressure							
Completed Weld	A	A					
Other							
<p>Legend: A. Requires witnessing and acceptance by Buyer Title III Acceptance Inspection prior to recording.</p> <p>B. Visual examination of at least 5% of fabrication welds.</p> <p>C. Not less than 5% of circumferential butt welds shall be examined fully by random radiography. In-process visual examination may be performed in lieu of radiography.</p>							

DUCT CODE D-3 (Safety Class 3) General Service			
Service	Max Operating Pressure " W.G.	Test Pressure " W.G.	Max Operating Temp °F
Ventilation (VT) Package 5 only	-40	-50	120
Duct Material	Gage as shown on Drawings. Stainless steel sheet, ASTM A 240, Type 304L. Stainless steel shapes, ASTM A 276, Type 304L. Slip-on flanges: Light weight, stainless steel, Alaskan Copper Works SK-37, or an approved substitute.		
Duct Construction	As shown on the Drawings.		
Duct Welding	Butt type welding with full penetration weld on seams. companion angle flanges shall be seal welded to duct, or as noted on the Drawings.		
Duct Support	As specified on Drawings.		
Gaskets	Ethylene Propylene Rubber (EPR), 1/16" thick. Use full face gaskets with flat face flanges. Garlock "Blue-Gard" style 3700.		
Fasteners	Bolts, ASTM A 193, Grade B8. Heavy hex nuts, ASTM A 194, Grade 8F, UNC threads.		

PIPE CODE M-4 (Uncontaminated) ( <del>Safety Class 3</del> ) General Service			
Service	Max Operating Pressure lb/in <sup>2</sup> gage	Test Pressure lb/in <sup>2</sup> gage	Max Operating Temp °F
Examples: Chilled Water (CW) Package 5	75	113	60
Sizes	All sizes		
Pipe	ASTM A 53, Type E or S, Grade B black steel or ASTM A 106, Grade B		
Wall Thickness	Schedule 40		
Nipples	Same schedule as pipe.		
Fittings	ASTM A 234, Grade WPB, wrought steel, buttwelding in accordance with ASME B16.9. Wall thickness to match pipe.		
Unions	See Drawing		
Flanges	ASTM A 105, Class 150, raised face, weld neck, in accordance with ASME B16.5. Bore to match pipe ID. Use flat face where mating to flat face flanges.		
Bolting	ASTM A 193, Grade B6, alloy steel studs, and ASTM A 194, Grade 2, heavy hex nuts.		
Gaskets	Compressed fiber, nonasbestos, 1/16-inch thick sheet; Garlock "Blue-Gard" Style 3000. Use full face gaskets with flat face flanges.		
Valves			
Ball	Pittsburg Brass Manufacturing Co., Model SP, standard trim, carbon steel, Class 150, BW ends		
Automatic Air Vent	Armstrong, Model AAE-750, standard trim, FNPT ends, or approved substitute		
Flange Isolation Sets	F. H. Maloney or approved substitute. Type E, Neoprene coated phenolic, polyethylene sleeve, single washers.		

PIPE CODE M-8 (Safety Class 3) General Service

Service	Max Operating Pressure psig	Test Pressure lb/in <sup>2</sup> gage	Max Operating Temp °F
Ventilation (VT) See Notes 1 and 2 Package 5	-2/+2	15	120
Sizes	All sizes		
Pipe	ASTM A 312, Grade TP 304L, seamless.		
Wall Thickness	Schedule 40S		
Fittings	ASTM A 403, Class WP 304L, buttwelding in accordance with ASME B16.9, wall thickness to match pipe.		
Flanges	ASTM A 182, Grade F 304L, Class 150, forged, raised face, weld neck in accordance with ASME B16.5. Bore to match pipe ID. Use flat face where mating to flat face flanges.		
Bolting	ASTM A 193, Grade B8, alloy steel studs, and ASTM A 194, Grade 8F, heavy hex nuts.		
Gaskets	Ethylene Propylene Rubber (EPR), 1/16" thick. Use full face gaskets with flat face flanges. Garlock "Blue-Gard" style 3700.		
Valves	Butterfly Keystone, Model 992 and 999 or approved substitute. Stainless Steel, Class 150, EPR/EPDM Seats.  Expansion Joint EZ-FLO, Model 206 or approved substitute, spool type, EPDM liner. Provide one special 10" NPS with 6" flange to flange dimension, remaining standard flange to flange dimension.		

NOTES:

- (1) Do not pressure test, flush with water or pneumatically clean the Recirculation Fan FN-1361 and Heating Coil HC-1361 (with ducting).
- (2) Butterfly Valves HV-13648 and HV-13647 isolating HEMF (HMF-1361) will be exposed to a maximum temperature of 180°F and operating pressure of -2/+150 psig, and a maximum test pressure of 15/165 psig.





## APPENDIX A - IDENTIFICATION OF PIPING SYSTEMS

### 1. GENERAL

The identification of piping systems shall be in accordance with the American Standard Scheme for the Identification of Piping Systems, ANSI A13.1, as supplemented herein.

### 2. LOCATION

a. Except as provided below, identification shall be located adjacent to outlets, valves, flanges, unions, changes-in-direction, where pipes pass through walls, floors, or ceilings, and along an uninterrupted length of pipe at maximum intervals of 50 feet. Each line or branch in a room shall have at least one identification.

b. Where a number of outlets, valves, flanges, unions, or changes of direction make identification at each item impracticable, they may be spaced at approximate 6 foot intervals, preferably adjacent to valves.

c. Legend shall be located on the pipe so that it can be read easily from the operator's normal viewing position. Labels shall be placed on the readily visible lower quadrant of overhead pipes, and on an upper quadrant of pipes below normal eye level. Above ceilings, labels shall be placed in locations most readily visible from access positions.

### 3. LEGEND

a. Positive identification of a piping system content shall be by lettered legend giving the name of the content in full or abbreviated form. Legends may also be as specified on drawings or in other specifications.

b. Abbreviation of words in the legend may be used only where unavoidable due to space limitations.

c. The legend shall include the nominal operating pressure for steam, compressed air, and when specified, the pressure or temperature for other materials.

d. An arrow indicating the direction of flow shall be placed near the legend on pipes normally having a flow in one direction only. The color and size of the arrow shall be consistent with the color and size of the legend letters.

e. Legend shall be located on or adjacent to the classification color band.

4. APPROVED LABELS

a. Legend and color classification may be accomplished by the use of approved labels conforming to this Standard and which are suitable for the temperature of the surface to which they are to be applied. Approved labels include the following.

ALL-TEMPERATURE PIPE MARKERS  
W. H. Brady Company  
727 West Glendale Avenue  
Milwaukee, Wisconsin 53201

TEL-A-PIPES  
Westline Products Division  
Thomas & Betts Company  
220 South Rose Street  
Los Angeles, California 90012

b. Single-word labels may be combined to form complete legends. Individual-letter labels shall not be so combined.

c. Labels shall be installed after painting is complete.

5. CLASSIFICATION COLOR

a. When use of classification colors is specified, they shall conform to Table 1.

Table 1			
Classification	Band or Label Color	Legend/Arrow Color	Approximate Color No. (FED-STD-595)
Dangerous	Yellow	Black (17038)	13655 (yellow)
Safe	Green	Black (17038)	14260 (green)

b. Paint, if used, shall conform to FS TT-E-489, Class A, for synthetic gloss enamel.

c. Classification colors shall conform to Table 2.

Table 2. Classification Colors.	
Material	Color
Ventilation (VT)	Yellow
Chill Water (CW)	Green

END OF APPENDIX

SECTION 16400

SERVICE AND DISTRIBUTION

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 The following documents, including others referenced therein, form part of this Section to the extent designated herein.

1.1.1.1 American National Standards Institute (ANSI)

C80.1-1990 Rigid Steel Conduit--Zinc Coated

C80.3-1983 Electrical Metallic Tubing-Zinc Coated

1.1.1.2 Factory Mutual System (FM)

Approval Guide 1994 Edition

1.1.1.3 Federal Specifications (FS)

W-F-406E Fittings For Cable, Power, Electrical And Conduit, Metal, Flexible

TT-S-00230C  
AMD 2 Sealing Compound: Elastomeric Type, Single Component (For Caulking, Sealing, And Glazing In Buildings And Other Structures)

WW-C-566C Conduit, Metal, Flexible

1.1.1.4 National Electrical Manufacturers Association (NEMA)

FB 1-1988 Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies

ICS 6-1993 Enclosures

1.1.1.5 National Fire Protection Association (NFPA)

70 (1993) National Electrical Code (NEC)

1.1.1.6 Underwriters Laboratories (UL)

Electrical Appliance and Utilization Equipment Directory 1994

Electrical Construction Materials Directory 1994

797-1993 Electrical Metallic Tubing

1.2 SUBMITTALS

1.2.1 See Section 01300 for submittal procedures.

1.2.2 Approval Required: None

1.2.3 Approval Not Required

1.2.3.1 Vendor information: Before installation, submit information listed in the Vendor Information List in this Section.

1.3 QUALITY ASSURANCE

1.3.1 Electrical/Electronic Product Acceptability

1.3.1.1 Each product shall be listed for intended use in one of the following, and shall bear the organization's label. In the absence of a label, provide documentation that verifies product listing.

- a. UL Electrical Construction Materials Directory.
- b. UL Electrical Appliance and Utilization Equipment Directory.
- c. FM Approval Guide.

1.3.1.2 If product is not listed in above directories or guide, provide product which has been tested and certified by a laboratory which has been nationally recognized in accordance with 29 CFR 1910.7. Provide following.

- a. OSHA documentation which demonstrates recognition.
- b. Laboratory documentation that verifies testing in accordance with national code or standard.

1.3.1.3 If product is not listed by UL or FM and if a nationally recognized laboratory is not available, submit descriptive literature to ICF KH. Literature shall include product specification and description of intended application.

1.3.2 Misrepresented Products: See Section 01400 for required measures to prevent the use of misrepresented products.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 See Section 01610 for general requirements.

PART 2 - PRODUCTS

2.1 SUBSTITUTES

2.1.1 See Section 01630 for substitution approvals.

## 2.2 MATERIALS

- 2.2.1 Solderless Connectors and Terminal Lugs: Pressure type, rated for use with copper or aluminum conductors, with insulating caps or covers rated for system utilization voltage. Connectors shall be following types.
- 2.2.1.1 For conductors No. 8 AWG and smaller:
- Ideal Industries, Incorporated "Wire-Nuts."
  - Thomas and Betts Company "Sta-Kon."
  - 3M Company "Scotchlok."
- 2.2.1.2 For terminal blocks to be used for instrumentation and control circuits see 2.3.3.
- 2.2.2 Conduit, Fittings, and Boxes
- 2.2.2.1 Conduit: ANSI C80.1, C80.3, FS WW-C-566 and UL 797.
- 2.2.2.2 Conduit shall have an integral ground conductor.
- 2.2.2.3 Fittings for rigid steel and EMT conduit: NEMA FB 1. Use compression type, threadless fittings with EMT.
- 2.2.2.4 Fittings for flexible metal conduit: FS W-F-406, squeeze type.
- 2.2.2.5 Couplings: Erickson type.
- 2.2.3 Conductors: Stranded copper, rated for 90°C, with type THWN/THHN or XHHW insulation, of type and AWG size specified on the Drawings.
- 2.2.4 Wiremarkers: Imprinted tubular plastic.
- 2.2.5 Wire Pulling Compound: Electro Compound Company "Y-er Eas," or American Polywater Corporation "Polywater."
- 2.2.6 Tape
- 2.2.6.1 Plastic insulating tape: 3M Company "Scotch No. 33+."
- 2.2.6.2 Conduit protection tape: 3M Company "Scotchrap No. 50."
- 2.2.7 Insulating Putty: 3M Company "Scotchfil," General Electric Company No. 8389, or Kearney Company "Airseal."
- 2.2.8 Duct Sealing Compound: Porcelain Products Company "Sealex."
- 2.2.9 Penetration Sealants: FS TT-S-00230, Type II, Class A, 1-component polyurethane, nonsag type, light-colored.

2.2.10 Supports

2.2.10.1 Individual conduit hangers: Factory made springable wrought steel clamps, or malleable iron split and hinged rings. For suspended conduit, clamps or rings shall be bolted to, or interlocked with threaded suspension rod.

2.2.10.2 Conduit supports: 1-hole clamps with clampbacks, or Unistrut with clamps.

2.2.12 Equipment Nameplates

2.2.12.1 Laminated plastic, 1/16-inch thick with white surface and black core.

2.2.12.2 Manufacturer's standard equipment nameplates may be used instead of those specified herein, if they display the required information, and are equivalent in quality and legibility. They need not be of the same material, or have the same form of imprinting.

2.2.12.3 Nameplate Features

a. Blanks: Select sizes appropriate for required characters and legends. Smooth edges and bevel 1/32-inch at 45 degrees.

b. Characters: Use 3/16 to 5/16-inch characters for equipment names, and 3/32 to 3/16-inch characters for other information. Engrave sharp and clear.

c. Legends: Provide the following information, unless otherwise specified on the Drawings. For equipment names use the generic/functional designations shown on the Drawings.

- 1) Equipment name.
- 2) Manufacturer's identification.
- 3) Manufacturer's model or assembly number.
- 4) Serial number.

2.2.12.4 Make sheet steel nameplates for equipment items that do not have surfaces suitable for attachment of plastic nameplates. Make nameplates when cylindrical surfaces of adequate size are available. When not, make nametags. Provide the information required above.

2.3 EQUIPMENT

2.3.1 Electrical equipment shall be PCB free.

2.3.2 Junction Boxes: NEMA ICS 6 Type 12, unless shown otherwise on the Drawings, size for JB1, JB2 and JB3 16 by 16 by 6 inches, Hoffman A-16166GSC, NEMA type 3R; size all other boxes as required.

2.3.3 Terminal Blocks

- 2.3.3.1 For No. 10 AWG conductors and smaller: As shown on the Drawings. Terminal ratings shall be equal to or greater than conductor ampacities.
- 2.3.3.2 Provide covers to cover live parts of terminations for circuits of 150 V or more to ground. Provide with means for ready inspection and full width marking areas.
- 2.3.4 Ground Pads: Ground pads shall be provided for grounding of the skid in three locations; one shall be on the instrument rack side of the shield wall; the other two shall be on opposite diagonal corners of the skid. Use Erico Products Model No. B-122-DE.

PART 3 - EXECUTION

3.1 PREPARATION

- 3.1.1 Field Measurements: Scale dimensions on Drawings show desired and approximate locations of equipment. Actual locations, distances, and levels shall be governed by field conditions.

3.2 INSTALLATION

3.2.1 General

- 3.2.1.1 Perform work in accordance with NFPA 70.
- 3.2.1.2 Fasten equipment to metal supports. Use clamping devices for attaching to structural steel. When clamping is impracticable, obtain approval from the Construction Engineer before drilling, punching, cutting or welding structural members for support attachment.
- 3.2.1.3 Locate equipment, boxes, and conduit approximately where shown in relation to equipment served.
- 3.2.1.4 Do not install conduit and boxes in positions that interfere with work done by other trades.
- 3.2.1.5 Identify components with nameplates bearing legends shown on the Drawings.
- 3.2.1.6 Attach nameplates on or near equipment, with metal screws.
- 3.2.1.7 Use appropriate calibrated special tools when installing devices for which special installation tools are recommended by manufacturers.
- 3.2.2 Grounding Systems
  - 3.2.2.1 Static grounding: Motor frames and other equipment shall be grounded to the skid in accordance with the Drawings and NFPA 70. Skid construction shall provide a continuous ground.

### 3.2.3 Conduit

- 3.2.3.1 Use rigid steel where subject to mechanical damage, or installed in concrete floors and walls, exposed to weather, or 4 feet maximum above floors. Electrical metallic tubing may be used elsewhere, when connecting electrical equipment separated 2 feet maximum, and when entering tops of electrical equipment 4 feet minimum above floors.
- 3.2.3.2 Install 14-gage galvanized steel pull wire or 1/8-inch polyethylene rope in spare conduits.
- 3.2.3.3 Install concealed conduits as directly as possible and with bend radii as long as possible. Install exposed conduit parallel with or at right angles to skid lines. Where conditions permit, maintain continuous exposed horizontal runs along walls at 9 feet minimum above floor level or grade.
- 3.2.3.4 Permanently label conduits with numbers shown on the Drawings using Brady marking film, at both ends. For 10 foot maximum length conduits, place one label at the center.
- 3.2.3.5 Make elbows, offsets, and bends uniform and symmetrical. Bend conduit with approved bending devices.
- 3.2.3.6 Cut conduit ends square, ream, and remove burrs. Conduit shall be clean, dry, and free of debris. Immediately after installation, plug or cap exposed ends with standard accessories until wires are installed.
- 3.2.3.7 Use galvanized steel locknuts and insulated bushings for attachment to enclosures except threaded hubs or sealing type locknuts shall be used outdoors or where moisture is present. Threadless fittings will not be permitted for rigid conduit. Use couplings where required. Do not use running threads.
- 3.2.3.8 Install without moisture traps wherever possible. Where practicable, provide drain holes in pullboxes or fittings at low points in raceway systems and remove burrs from drilled holes.
- 3.2.3.9 Flexible conduit:
- a. Use to make connections to motors and other equipment subject to vibration. Use liquidtight flexible metal conduit where conduit and fittings are installed outdoors or exposed to moisture or chemical fumes indoors.
  - b. Use in 4 foot maximum lengths for other equipment, with approval of the Construction Engineer.
- 3.2.3.10 Seal openings around conduit at Process Building interior shield wall and penetrations of walls which form boundaries between adjoining ventilation zones, using specified sealant. Make seals waterproof, and finish sealant flush with surrounding wall surfaces.
- 3.2.3.11 Apply duct sealing compound after installation of conductors, at boxes, in conduits that penetrate walls or floors.

- 3.2.4 Metal Raceway Other Than Conduit: Install complete with necessary fittings, connectors and parts, in accordance the manufacturer's instructions.
- 3.2.5 Boxes, Enclosures, and Wiring Devices
  - 3.2.5.1 Install boxes firmly in position and plumb.
  - 3.2.5.2 Install extension ring with blank cover on flush mounted junction boxes where box serves permanently installed equipment.
  - 3.2.5.3 Flush mount junction boxes served by concealed conduit.
  - 3.2.5.4 Install dust covers on junction, pull, and outlet boxes, and other types of wiring outlets at initial installation. Replace with permanent covers or devices after wires are installed.
- 3.2.6 Conductors
  - 3.2.6.1 Identify conductors, by wire numbers shown on the Drawings, with wiremarkers. Attach wiremarkers at termination points within 2 inches of wire terminations. Marker nomenclature shall be visible without moving wires or markers.
  - 3.2.6.2 Use lubricant recommended by the cable manufacturer, or wire pulling compound specified, when pulling wire and cable through conduit.
  - 3.2.6.3 Do not install or handle wires with thermoplastic insulation or jacket when ambient temperature is 15°F or below.
- 3.2.7 Splices, Taps, and Cable Terminations
  - 3.2.7.1 Make splices and taps in skid wiring with solderless connectors specified in 2.2.1. Use connectors in accordance with the manufacturer's instructions.
  - 3.2.7.2 Use plastic insulating tape for uninsulated splices and taps. Apply tape to thickness at least equal to conductor insulation. Where bolted splice or connection presents irregular surface, apply insulating putty to joints before taping.
  - 3.2.7.3 Use crimp-on type ring or spade lugs with turned up legs for wire terminations of stranded conductors to binder screw or stud type terminals. Lugs shall have insulated sleeves.
  - 3.2.7.4 Strip wires for use with pressure plate terminal strips so that no more than 1/8 inch of bare conductor is exposed after insertion beneath the plate.
- 3.3 FIELD QUALITY CONTROL
  - 3.3.1 Testing
    - 3.3.1.1 Furnish equipment and instruments required to perform testing.

- 3.3.1.2 Use instruments which bear calibration stamps showing dates of calibration and expiration dates of stamps for testing. Calibration and accuracy of instruments shall be certified by an independent testing laboratory having standards traceable to the National Institute of Standards and Technology.
- 3.3.1.3 Test wiring for continuity and unintentional ground. Resistance shall not exceed 1 ohm on continuity checks.
- 3.3.2 Reconnect devices disconnected during testing.



### DISTRIBUTION SHEET

To Distribution	From JW Bailey	Page 1 of 1			
Project Title/Work Order Project W-320, 241-C-106 Sluicing, Construction Specification, W-320-C6		Date 17 July 1998			
		EDT No. 622269			
		ECN No. n/a			
Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
JW Bailey	S2-48				
W-320 Project Files	RI-29				