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ACCEPTANCE TEST REPORT FOR 241AN107 MIXER PUMP  
SERIAL NO N-20801 WATER FLUSH SYSTEM

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1	1	QA JJ Verderber	<i>[Signature]</i>	11/17/95	S1-57	RL Triebwasser			S2-39	3	
		Safety				EG Rensink			S2-24	3	
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3		RS Nicholson			S5-05						
3		KG Carothers			R1-51						

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Water Flush System

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**SUPPORTING DOCUMENT**

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6. Author

Name: G. A. Leshikar

*G. A. Leshikar*  
Signature

Organization/Charge Code 74750/E49967

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*KMB 11/16/95*

7. Abstract

This report presents the functional test results for the modified 241-AN-107 mixer pump water flush system and for the mixer pump vibration sensing equipment (accelerometer and cable).

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## ACCEPTANCE TEST REPORT FOR 241-AN-107 MIXER PUMP WATER FLUSH SYSTEM

Equipment No. HAZLETON MIXER PUMP, N-20801

Building: 241-AN

Project: 107-AN CAUSTIC ADDITION

Prepared By: G. A. Leshikar  
TWRS Mechanical Systems & Equipment Engineering

### SUMMARY

The acceptance criteria defined in WHC-SD-WM-ATP-144 were successfully met during testing. Testing consisted of a hydrostatic pressure test of the AN-107 mixer pump water flush system per ANSI B31.3, a flow test to ensure that the system's solenoid valves opened and closed as expected, and a functional test of the mixer pump vibration sensing equipment (accelerometer and cable). Testing was performed on the shop floor at the 272-E Rotating Equipment Shop. Electrical continuity of the solenoid valves and vibration sensing equipment was indirectly verified through the functional testing of the equipment. During fabrication, the manufacturer-installed accelerometer/cable connection was discovered to have been very poorly wired. Replacement of this connection should be a major improvement to the overall reliability of the vibration monitoring equipment.

TABLE OF CONTENTS

1.0 INTRODUCTION . . . . .	2
2.0 TEST DESCRIPTION . . . . .	2
3.0 TEST RESULTS . . . . .	2
4.0 DISCUSSION OF VIBRATION SENSING EQUIPMENT . . . . .	3

Appendix A: WHC-SD-WM-ATP-144 (signed off copy)

## 1.0 INTRODUCTION

An acceptance test of the water flush system and vibration sensing equipment for the 241-AN-107 mixer pump (75 horsepower Hazleton submersible, serial # N-20801) was conducted during July of 1995 in the Rotating Equipment Shop (Bldg 272E). The acceptance criteria defined in WHC-SD-WM-ATP-144 were successfully met. A copy of the work-completed test procedure is included as Appendix A of this document.

The equipment tested was installed per WHC-CM-6-1, EP-2.4, "Developmental Control Requirements", for items with facility-use potential. Work plan WHC-SD-WM-WP-301 identified tasks, material requirements, inspection/fabrication criteria, testing requirements, funding information, and a delivery date. The work package number was Kaiser Fabrication Services 2H-9500499/F.

## 2.0 TEST DESCRIPTION

The test consisted of a pressure test of the AN-107 mixer pump water flush system, a flow test to ensure that the system's solenoid valves open and shut as expected, and a functional test of the mixer pump vibration sensing equipment (accelerometer and cable). Background and description of the equipment involved in the test (see Figure 1) is contained in Appendix A.

## 3.0 TEST RESULTS

The test requirements and acceptance criteria are shown in Appendix A, along with the completed test procedure.

The test results were:

- The water flush piping passed a hydrostatic pressure test per ANSI B31.3 Section 345.4. Several leaks were discovered and fixed. Test pressure was 225 psig and hold time was 10 minutes.
- For a driving pressure of  $\approx 40$  psig, flow exited the mixer pump inlet screen nozzle when solenoid valves #2 (WST-SOV-140G) and #3 (WST-SOV-141G) were energized. No flow exited the discharge nozzles.  
  
(The flow test implicitly tested electrical continuity of the solenoid valves).
- For a driving pressure of  $\approx 40$  psig, flow exited only one mixer pump discharge nozzle when solenoid valves #1 (WST-SOV-142G) and #3 (WST-SOV-141G) were energized. No flow exited the other discharge nozzle or the inlet screen nozzle.
- For a driving pressure of  $\approx 40$  psig, flow exited only one mixer pump discharge nozzle when solenoid valves #1 (WST-SOV-142G) and #2 (WST-

SOV-140G) were energized. No flow exited the other discharge nozzle or the inlet screen nozzle.

The vibration sensing equipment (accelerometer and cable) was functionally tested by attaching the cable leads atop the mixer pump flange to a vibration/sound level analyzer and rapping sharply on the bottom of the pump. The needle on the analyzer was observed to spike when the pump was rapped. Thus electrical continuity of the vibration sensing equipment was indirectly verified. See the Discussion section for important information regarding the vibration sensing equipment's original configuration.

#### 4.0 DISCUSSION OF VIBRATION SENSING EQUIPMENT

See Figure 2 (or CVI 22528) for a drawing of the mixer pump accelerometer connection and protective casing.

During fabrication, the Hazleton-installed accelerometer/cable connection was discovered to have been very poorly wired. The solder between the wires and the connector plug to the accelerometer was extremely poor quality, the connection was not fused properly and the wires fell right out when the cable was lightly tugged; there was no strain protection on the plug (no amphenol); exposed wire (within the metal casing designed to prevent fluid intrusion and immersion of the accelerometer) was simply wrapped with electrical tape rather than with shrink-wrap; and the cable's shield was not connected. Although none of these things would pose a safety concern because the equipment is low voltage / low current instrumentation, the manufacturer's poor workmanship could have caused early failure of the mixer pump's vibration sensing capability after installation in Tank AN-107.

This knowledge also casts doubt on the theory determined during overall caustic addition system testing (see WHC-SD-WM-TRP-222) that electromagnetic interference from the motor power cable was the sole cause of bad vibration readings during variable speed operation of the pump.

The new accelerometer/cable connection should be much improved. The solder between the wires and the connector plug appeared to be better (at least the wires didn't come loose when the cable was lightly tugged); strain protection on the plug was used; exposed wire (within the metal casing designed to prevent fluid intrusion and immersion of the accelerometer) was heat shrink-wrapped; and the new cable's shield was connected to the accelerometer. Replacement of this connection should be a major improvement to the overall reliability of the vibration monitoring equipment.

Note: (This is not the first time that the manufacturer's workmanship on this mixer pump's instrumentation was discovered to be poor quality. During the pump run-in test performed in August 1993 (see WHC-SD-WM-TRP-149) the strain instrumentation did not work. The instrumentation cable

contained six wires. When the load cell / cable connection plug was examined, it was discovered that a bare, unused wire was sticking out of the plug, approximately 1/2" long. This bare wire rested against the exposed portion of a "hot" wire and shorted out the strain signal.)

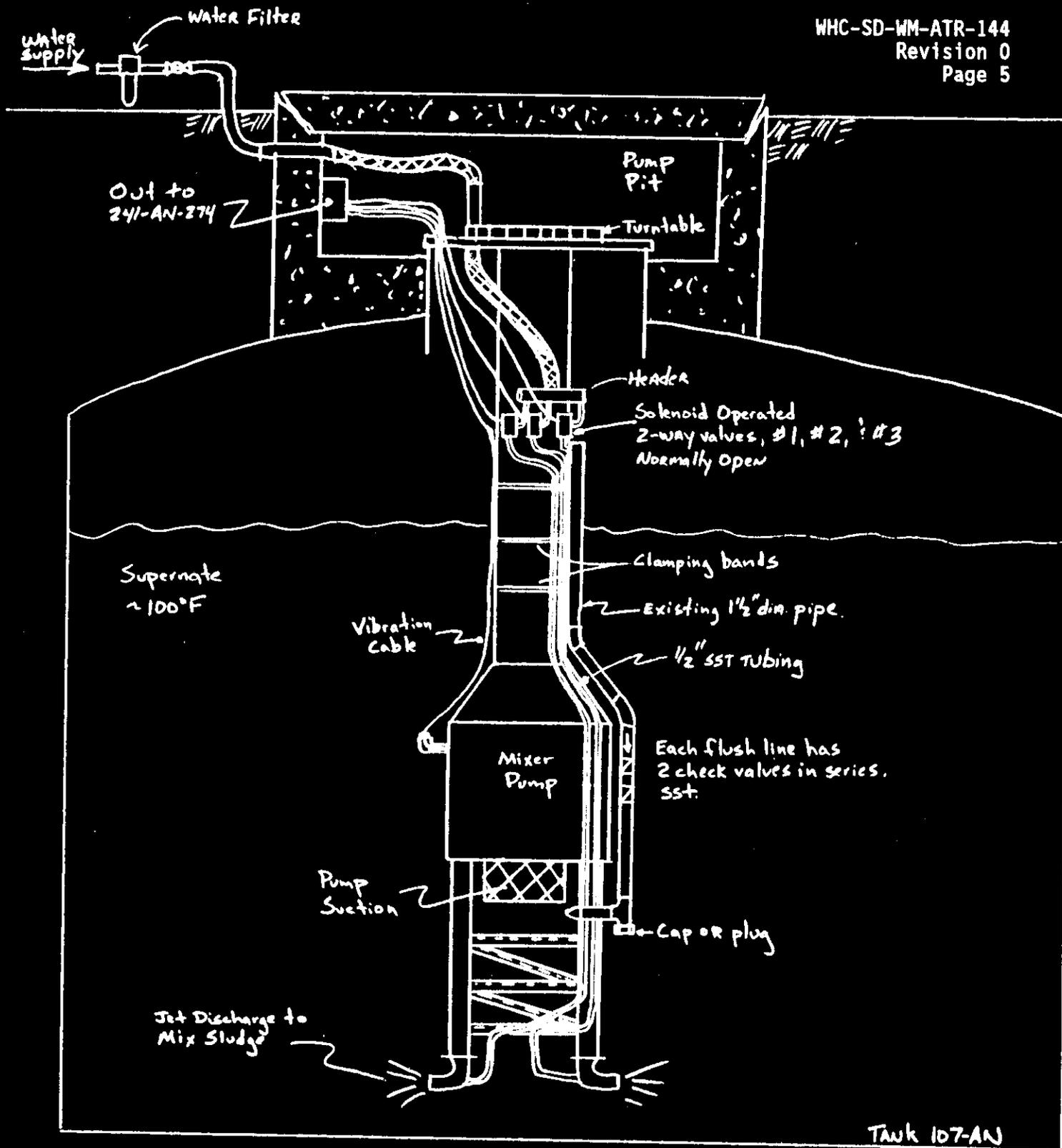
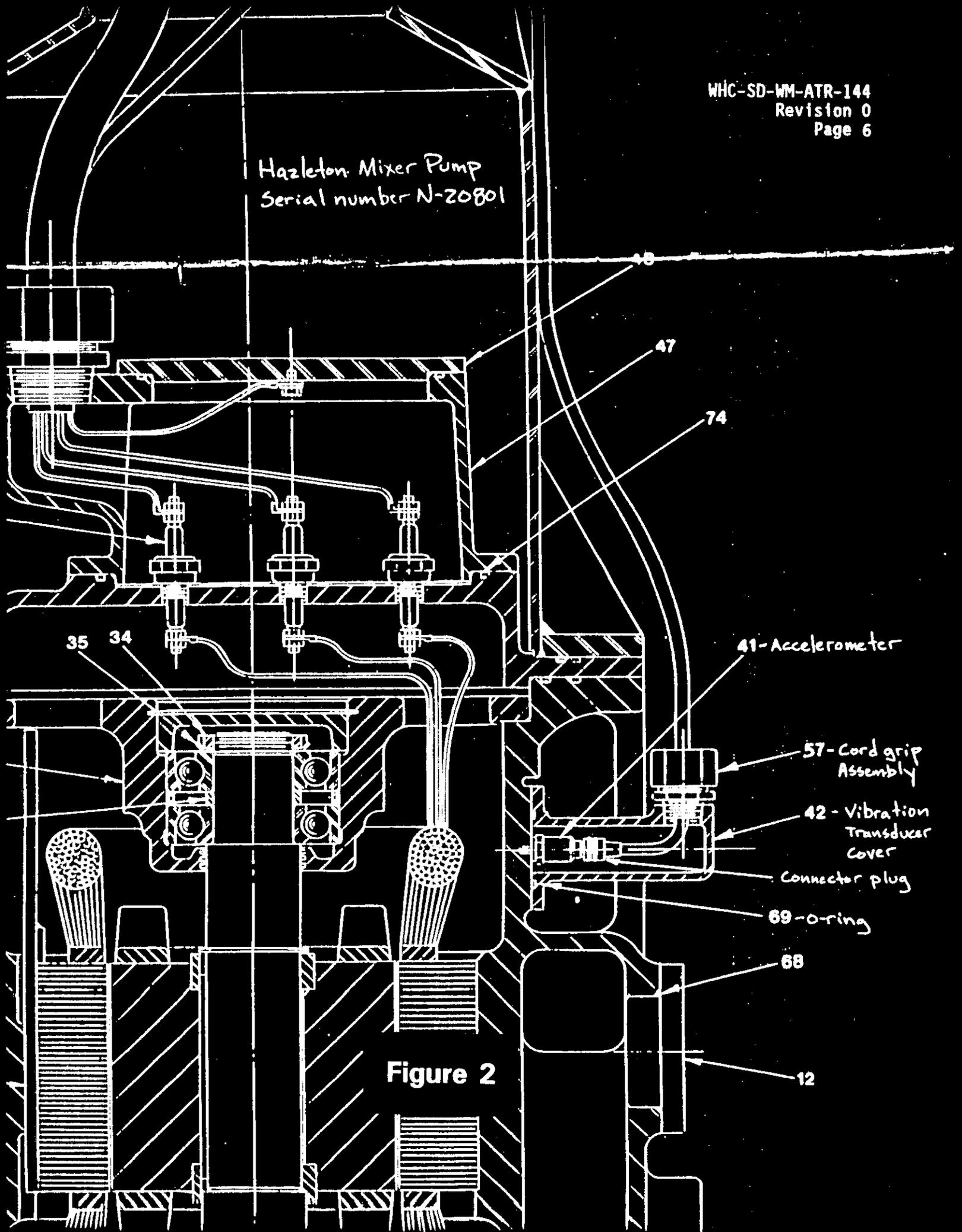


Figure 1 - Water Flush System Sketch

Hazleton Mixer Pump  
Serial number N-20801



35 34

47

74

41 - Accelerometer

57 - Cord grip Assembly

42 - Vibration Transducer Cover

Connector plug

69 - O-ring

68

12

Figure 2

**APPENDIX A**

**WHC-SD-WM-ATP-144**  
**(signed off copy)**

JUL 24 1995  
STA-3

ENGINEER

2. To: (Receiving Organization) Waste Storage Engineering K. G. Carothers	3. From: (Originating Organization) Mechanical Equipment R. K. Brown, Mgr.	4. Related EDT No.: 609706
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1	1	Cog. Mgr. RK Brown <i>[Signature]</i> 7-24-95 83-27	3
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		Safety	
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APPENDIX A

SUPPORTING DOCUMENT

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ACCEPTANCE TEST PROCEDURE FOR  
241-AN-107 MIXER PUMP WATER FLUSH SYSTEM

ETN-94-0010

MECHANICAL SYSTEMS & EQUIPMENT

AUTHOR: GA LSHIKAR

## 1.0 INTRODUCTION

A mixer pump (75 horsepower Hazleton submersible, serial # N-20801) is to be installed in the central pump pit of Double-Shell Tank (DST) 241-AN-107 for the Caustic Addition Project. The mixer pump will be used as a platform to inject, mix, and entrain caustic with the waste, in order to bring the waste OH<sup>-</sup> ion concentration into compliance with Tank Farm operating specifications.

The mixer pump and caustic addition system were tested together in November of 1994. Testing revealed that the mixer pump's vibration cable picks up electromagnetic interference from the motor power cable during variable speed operation of the pump. Also it was noted that the mixer pump's water flush system may not be as effective as it could be because individual branches could not be isolated. A higher sludge level exists in the tank than previously reported making plugging of the pump discharge more likely. The pressure potentially applied to a plugged pump discharge nozzle could be greatly increased if flow out the other, open branches could be controlled. A decision was then made to modify the water flush system to provide this capability.

## 2.0 SCOPE

This test shall consist of a pressure test of the AN-107 mixer pump water flush system, a flow test to ensure that the system's solenoid valves open and shut as expected, and a continuity test on the mixer pump vibration sensing equipment (accelerometer and cable).

The equipment to be tested was installed per WHC-CM-6-1, EP-2.4, "Developmental Control Requirements", for items with facility-use potential. Work plan WHC-SD-WM-WP-301 identified tasks, material requirements, inspection/fabrication criteria, testing requirements, funding information, and a delivery date. The work package number is Kaiser Fabrication Services 2H-9500499/F.

## 3.0 CONFIGURATION

The AN-107 mixer pump water flush system has three branches: one branch sprays across the pump suction inlet screen and two other branches are routed to feed the back of each of the two discharge nozzles. Flush water flows through a jumper to the top of the mixer pump, then runs thru a flexhose down along the pump column to a header where the flow can be split three ways. Each of the three lines leaving the header enter a solenoid valve (normally open), then continue through piping and/or tubing and two check valves in series to their final destination. The header is installed on the middle section of the pump column, above the waste level. The solenoid cables are routed up thru three penetrations in the pump mounting flange. See Figure 1 for a sketch of the system.

A new vibration cable is to be routed entirely outside the mixer pump support column pipe, up thru a new penetration in the pump mounting flange. The existing penetration in the side of the pipe is to be plugged. Increasing the distance between power and vibration instrument

## APPENDIX A

~~cable may reduce or eliminate electro-magnetic interference to the  
communications.~~

### TESTING REQUIREMENTS / ACCEPTANCE CRITERIA

Work plan WMC-SD-WM-WP-301 identified the following testing requirements:

- Pressure test the water flush piping per ANSI B31.3 Section 345.4. Test pressure is 225 psig. The test shall be QC verified.
- Perform a continuity test on the solenoid valves and vibration cable. The test shall be QC verified.

The acceptance criteria is as follows:

- Completion of a pressure test of the water flush piping per ANSI B31.3 Section 345.4. Test pressure is 225 psig and hold time is 10 minutes.
- For a driving pressure of  $\approx 40$  psig, flow must exit the mixer pump inlet screen nozzle when solenoid valves #2 (WST-SOV-140G) and #3 (WST-SOV-141G) are energized. No flow shall exit the discharge nozzles.
- For a driving pressure of  $\approx 40$  psig, flow must exit only one of the mixer pump discharge nozzle when solenoid valves #1 (WST-SOV-142G) and #3 (WST-SOV-141G) are energized. No flow shall exit the other discharge nozzle or the inlet screen nozzle.
- For a driving pressure of  $\approx 40$  psig, flow must exit only one of the mixer pump discharge nozzle when solenoid valves #1 (WST-SOV-142G) and #2 (WST-SOV-140G) are energized. No flow shall exit the other discharge nozzle or the inlet screen nozzle.

(The above three criteria implicitly tests electrical continuity of the solenoid valves).

- Electrical continuity of the mixer pump vibration sensing equipment (accelerometer and cable) is verified.

### 5.0 TEST PROCEDURE

The cognizant engineer shall sign after satisfactory completion of each step. QC shall sign and stamp where designated. The cognizant engineer may make changes to this test procedure as required to facilitate testing. Changes shall be made in red ink, initialed, and dated.

1. Hydrostatic test water flush system to 225 psig for 10 minutes per HS-BS-0090 with solenoid valves de-energized. See "Pressure/Leak Test Certification" sheet which is included in work package 2H-9500499/F.

*[Signature]*  
Engineer

**QC INSPECTION RECORD**

*[Signature]* 1/23/92  
QC

# APPENDIX A

2. After hydrostatic test completion, ensure that water flush system is depressurized.

*[Signature]*

3. Ensure that each flush branch exit is unblocked and flush system reassembled per fabrication drawings.

*[Signature]*

4. Energize solenoid valves #2 (WST-SOV-140G) and #3 (WST-SOV-141G).

*[Signature]*

5. Turn on water supply ( $\approx 40$  psig) and verify flow exits suction screen nozzle only. No flow should be exiting the discharge nozzles.

*[Signature]*  
Cog Engineer

7/28/95  
QC



6. De-energize solenoid valve #2.

*[Signature]*

7. Energize solenoid valve #1 (WST-SOV-142G). Verify that flow exits one discharge nozzle only. No flow should be exiting the suction screen nozzle.

*[Signature]*  
Cog Engineer

7/28/95  
QC



8. De-energize solenoid valve #3.

*[Signature]*

9. Energize solenoid valve #2. Verify that flow exits the other discharge nozzle. No flow should be exiting the suction screen nozzle.

*[Signature]*  
Cog Engineer

7/28/95  
QC



10. De-energize all three solenoids.

*[Signature]*

11. Turn off water supply.

*[Signature]*

12. Test electrical continuity of the mixer pump vibration sensing equipment (accelerometer and cable). Functional test will suffice as continuity check on equipment. Use vibration/sound level meter and set display to VEL (16/13). Rap sharply on bottom of pump and verify at .63 in/s or less.

*[Signature]*  
Cog Engineer

7/28/95  
QC



Instrument 110-84-05  
Cal. Due Date 4-5-96

## QC INSPECTION RECORD

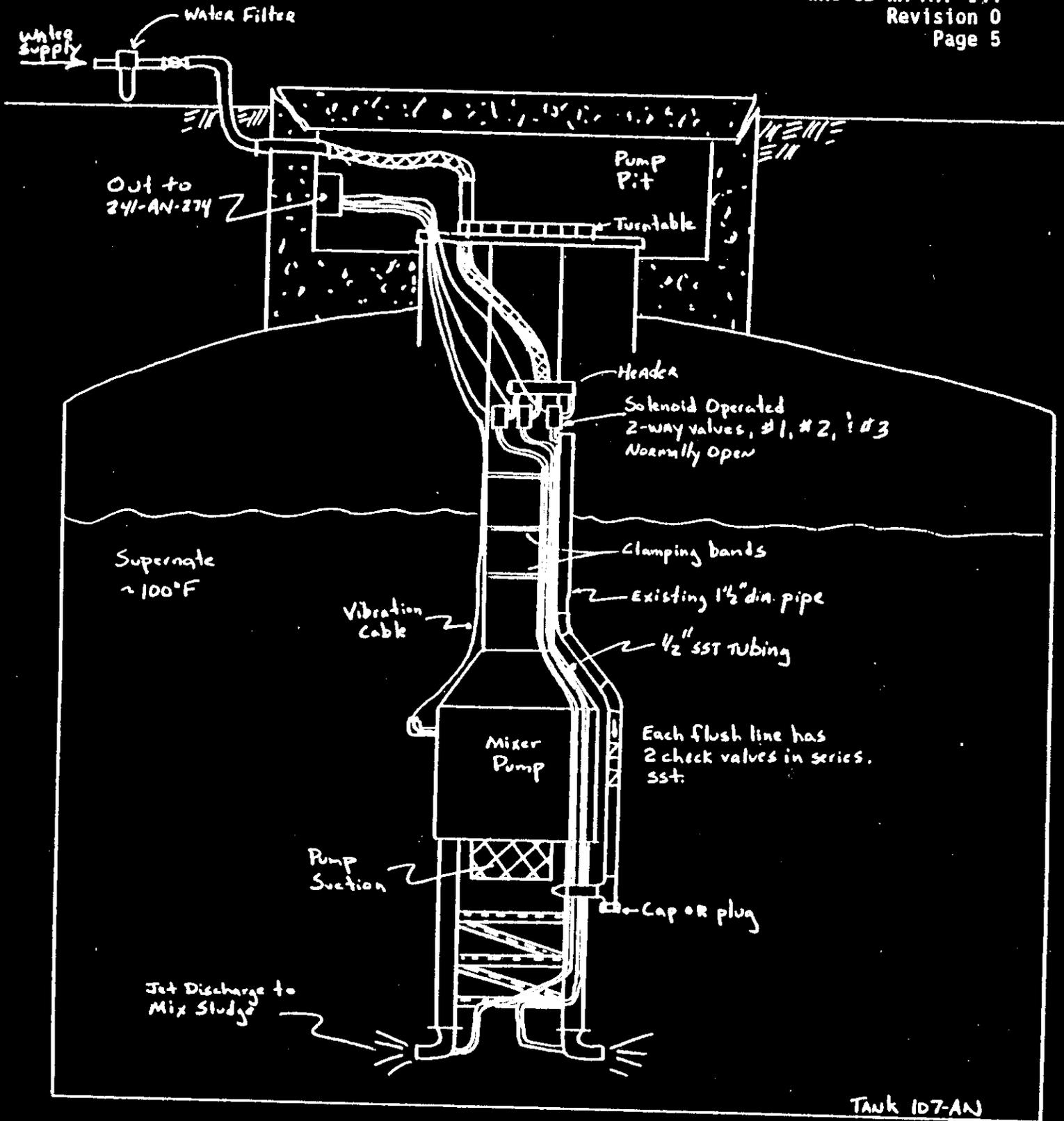


Figure 1 - Water Flush System Sketch