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ENGINEERING DATA TRANSMITTAL

Page 1 of 1

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Project W-151 Checkout-Testing Report

E. M. Nordquist

Numatec Hanford Company, Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-96RL13200

EDT/ECN: 610579
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Key Words: Project W-151, mixer pumps, 101-AZ, retrieval system, checkout testing, test report

Abstract: This document contains the completed checkout testing plan along with the exception log documenting exceptions which occurred during the test and their closure. This document also contains several minor open exceptions which will be closed upon installation of the radiation-sensitive equipment.

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Kara J. Broe 1/31/97
Release Approval Date

Approved for Public Release

Project W-151 Checkout-Testing Plan

E. M. Nordquist
Westinghouse Hanford Company, Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-87RL10930

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Key Words: Project W-151, mixer pumps, 101-AZ, retrieval system

Abstract: This document contains the steps necessary to document checkout of the Project W-151 equipment in preparation for the mixer pump process test (TF-210-OTP-001).

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Execution and Plan Approval

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Date

Project W-151 Construction Checkout-Testing

1. Purpose

This Construction Checkout-Testing Plan (Plan) has been prepared to demonstrate and document that the Project W-151 equipment has been installed as designed.

2. References

2.1 Drawing List - H-2-78870

2.2 Specifications

- 2.2.1 WHC-S-0040 Mixer Pump Specification
- 2.2.2 V-W151-0002 Variable Frequency Drives
- 2.2.3 V-W151-0004 Sludge Monitoring Cable and Cable Reel
- 2.2.4 W-151-C2 Construction Specification (Construction Forces)
- 2.2.5 W-151-C3 Construction Specification (Mixer Pump Control Facility)

2.3 Vendor Information (VI) - VI# 22515

- 2.3.1 Supplement 15 - Variable frequency drives
- 2.3.2 Supplement 16 - Sludge mobilization monitoring system
- 2.3.3 Supplement 17 - Control room console
- 2.3.4 Supplement 20 - Transformer and switchgear
- 2.3.5 Supplement 32 - Mixer pumps

2.4 Engineering Change Notices (ECN)

Prior to documenting final execution and Plan approval, log ECN numbers written against this Plan. ECN 635012, 163866, 635093,
635095 - 1-28-97

3. Responsibilities

- 3.1 General - Any of the below designated individuals may record items in this Plan. These recorded items include the names of participants, instrument identification numbers and expiration dates, each step as it is completed, and any objections and exceptions.
- 3.2 Project Engineer - responsible for designating Checkout-Testing (C-T) Director, coordinating activities with the facility, and acts as a liaison between participants.

- 3.3 C-T Director - coordinates and directs checkout-testing, ensures the system is left in a safe mode during outages, approves changes to this Plan, may alter C-T sequence (after verifying no adverse impacts), and signs on the final acceptance page.
- 3.4 C-T performer(s) - performs the actual step using equipment and instruments as necessary (this person may change depending on the craft resource needed for the step, generally expected to be an electrician).
- 3.5 Witness(es) - observes the C-T, reviews the results, and signs on the final acceptance page.

4. Change Control

Required changes to this Plan shall be by the redline method, approved by the C-T Director.

5. Execution

Individuals shall carry out their assigned work in a safe manner per the process control package to protect themselves and others from undue hazards and to prevent damage to property and the environment. Facility line managers shall assure the safety of activities within their areas to prevent injury, property damage, or interruption of operation. Performance of C-T activities shall always include safety and health aspects. C-T step sequence may only be altered by the C-T Director after verifying no adverse impacts.

6. Exceptions

Exceptions to the required C-T results are sequentially numbered and recorded. Errors in the C-T test shall be processed per Section 4, not as C-T exceptions. Actions taken to resolve the exceptions shall be documented and approved by the C-T Director. Rechecking of the step(s) shall be performed and documented on the exception form. The exception form is included in Appendix A.

7. Prerequisites

7.1 Conditions

- 7.1.1 Systems inspected for compliance with construction documents.

- 7.1.2 Reference documents verified for latest revision and outstanding ECNs.
- 7.1.3 Pre-job safety analysis completed and a pre-job safety meeting conducted.
- 7.1.4 Instruments have a valid calibration stamp attached and instrument identification numbers and calibration expiration dates recorded in 7.2.

7.2 Equipment/Instruments

- 7.2.1 Volt-ohm-meter (VOM): Digital, portable, 0-1000 V ac/dc
Instrument No. 950-45-08-027 Cal Exp Date 4/30/97
Instrument No. _____ Cal Exp Date _____
- 7.2.2 Test leads with insulated covers for wire clips.
- 7.2.3 Pressure gauge, analog or digital, range 0-100 psi minimum, accuracy ± 2 psi. Inst No. 950-31-04-067 Cal Exp Date 8/14/97
- 7.2.4 Portable DC power supply, 0 to 10 volts.

8. Equipment Checks - The following sections check the installed equipment to verify correct terminal wiring within the individual junction boxes and the various instruments respond correctly when a known signal is applied. All power feeding each piece of equipment shall be locked out per WHC-CM-1-10, WKS 8.2, prior to opening the boxes.

8.1 Check Rotation Drive WST-M-704A - Pump 1 (WST-P-702A)

Exception ✓ JCH
11/19/96

- 8.1.1 Verify terminal identification and continuity check to meters and controls - wiring checklist (Appendix B, first page).

✓ JCH
11/19/96

- 8.1.2 Verify emergency stop - continuity check

8.2 Check Rotation Drive WST-M-703A - Pump 2 (WST-P-701A)

Exception ✓ JCH
11/19/96

- 8.2.1 Verify terminal identification and continuity check to meters and controls - wiring checklist (Appendix C, first page).

✓ JCH
11/19/96

- 8.2.2 Verify emergency stop - continuity check

8.3 Check Main Pump Drive - Pump 1 (WST-P-702A)

Exception

JCH
12-13-96

8.3.1 Verify terminal identification and continuity check to meters and controls - checklist (Appendix D).

JCH
12-13-96

8.3.2 Verify start, stop, and emergency stop pushbuttons - continuity check.

8.4 Check Main Pump Drive - Pump 2 (WST-P-701A)

Exception

JCH
12-13-96

8.4.1 Verify terminal identification and continuity check to meters and controls - checklist (Appendix E).

JCH
12-13-96

8.4.2 Verify start, stop, and emergency stop pushbuttons - continuity check.

8.5 Check pressure switches

8.5.1 Verify indicator lights in 241-AZ-801A and on control console. Note the lights are identical in both 801A and on the console; to accept each step the lights must actuate in both places. Valves SW-V-767 and SW-V-770 are closed. Valve SW-V-758 (outside hose line) is also closed. Follow appropriate radiation control procedures for breaking of water lines and disposal of water. If the alarm trips do not occur within the ranges indicated, adjust the trip settings and retest.

JCH
12-12-96

8.5.1.1 Differential pressure (dp) SW-PDIS-750. Verify normal light (green) for 0 psi, and high dp light (red) at 5 psi $\pm$ 1 psi. Record pressure for high dp light trip. 5 psi.

Exception

Ech
11-21-96

8.5.1.2 Pressure switch SW-PSL-750 - verify normal light (green) at ~~60~~ ⁵⁸ psi and low alarm light (red) at 40 psi (+0 psi, -20 psi). Record pressure for low alarm light (red). 37 psi

Exception

Ech
11/21/96

8.5.1.3 Pressure switch SW-PSL-751 - verify normal light (green) at ~~60~~ ⁵⁸ psi and low alarm light (red) at 40 psi (+0 psi, -20 psi). Record pressure for low alarm light (red). 38 psi

8.5.2 Refer to wiring checklist if problems occur (Appendix F).

8.6 Check vibration switches

8.6.1 Verify indication occurs on console screens by backing off the setpoint adjusting screw two turns CCW, press the reset

button, and turning the setpoint screw CW slowly until actuation occurs (armature assembly contacts the latch magnet). Confirm lights on console turn on to indicate a vibration problem. Mark final setting on Vibraswitch cases as "zero vibration point." Press reset button.

Pump 1 upper ~~JW 12/13/96~~ Pump 1 lower ✓ JW 12/13/96
Pump 2 upper ~~JW 12/13/96~~ Pump 2 lower ✓ JW 12/13/96

8.6.2 Refer to wiring checklist (Appendix G) if problems occur.

8.7 Check computer data acquisition wiring and terminal connections

✓ JW 1/7/97

8.7.1 Control console digital panel meters - wiring checklist (Appendix H).

✓ JW 1/7/97

8.7.2 Motor bearing temperatures - wiring checklist (Appendix I).

Exception

8.7.3 Strain gages - wiring checklist (Appendix J).

Exception

8.7.4 Sludge mobilization cart data via JB101-100 & JB101-101 - wiring checklists (Appendix K).

8.7.5 Indicator light status - note all lights were checked in steps 8.5 and 8.6 above.

8.8 Checkout signals to monitoring console - use Appendix L, checking for each step identified for each instrument.

9. Mixer Pump Rotation Checks - The following sections check the rotation of the mixer pump assemblies. Breaker A3 in MCC-702 is closed and the local disconnect switches DS-703A and DS-704A are closed. Check operation of mixer pump rotation drives & control console functions. Control console will be plugged in and operational.

9.1 Verify function & setting for Pump 1's rotation motor (WST-M-704A) as follows:

~~9.1.1 Position potentiometer, should read zero when console is turned on and operable. If not, adjust panel meter scale factor as needed per VI 22515 Supplement 17, Owner's guide 2.0 Process (second tab in Supplement 17 binder), Section 8. THIS STEP IS COVERED BY 9.1.7 JW 1-16-97~~

✓ JW 1/19/96

9.1.2 Power up and adjust the variable frequency drive per Instruction Manual D2-3166-7, Sections 4 and 5 (VI 22515 Supplement 15, ninth tab in binder). Check all VFD parameters and record values in Appendix B.

- ✓ JCH 11/19/96 9.1.2.1 Set VFD deceleration to 1.5 Seconds -- page 5.16, change function 45 of menu 2 to 1 (enable) first, then change function 2 of menu 1 to 1.5 seconds.
- ✓ JCH 11/19/96 9.1.3 Verify that all VFD parameters and accesses are secured.
- 9.1.4 Limit switches - turn motor on at control console by pressing start switch. [Note, control switch on console will always be run in the manual setting (manual/automatic) and in the forward setting (forward/reverse).] Speed should be set a min value on control knob on console.
- ~~9.1.4.1 Actuate first limit switch by hand. Verify rotation changes to the other direction. JCH 12-23-96~~
- ~~9.1.4.2 Actuate the second limit switch (90° out from the first) by hand, and verify rotation again changes. JCH 12-23-96~~
CAN'T BE DONE BY HAND BECAUSE THEY ARE IN THE MOTOR TO REVERSE MOTOR - GO TO STEP 9.1.5
- ✓ JCH 1/10/97 9.1.5 Verify direction of rotation is depicted correctly on monitoring console. CFW → (4)
- ✓ JCH 12/23/96 9.1.6 Verify emergency stop function stops rotation motor.
- ✓ JCH 1/10/97 9.1.7 Limits switches - Turn motor back on and allow turntable to proceed to first limit switch and verify the limit switch actuates and changes direction at 90° to 92° -- Reduce VFD ramp-down time if needed. Allow turntable to proceed to the second switch and verify limit switch actuates and changes turntable direction at -90° to -92°. 92.2 90.7 100.0 -98.2
- ✓ JCH 1/16/97 9.1.8 Verify position in the field is within 5° of control console indication. (CW (r))
- ✓ JCH 1/10/97 9.1.9 Overtravel -- manually actuate each overtravel switch to verify rotation motor shutdown.
- ✓ JCH 1/10/97 9.1.10 Observe overhead cable behavior -- 6 cycles minimum (either during previous operations or turn motor back on). Note if twisting appears excessive, if bending is smaller than the minimum bend radius for the specific cable (6.64" for 4/0 cable and 4.88" for 1/0 grounding cable), any excessive rubbing, and that the cables have enough slack. If problems occur, notify C-T Director and/or open local disconnect (DS-704A).

9.2 Verify function & setting for Pump 2's rotation motor (WST-M-703A) as follows:

- ~~9.2.1 Position potentiometer, should read zero when console is turned on and operable. If not, adjust panel meter scale factor as needed per VI 22515 Supplement 17, Owner's guide Process (second tab in Supplement 17 binder), Section 8. THIS STEP IS COVERED IN 9.2.7 JCH 1-16-97~~
- ✓ JCH 11/19/96 9.2.2 Power up and adjust the variable frequency drive per Instruction Manual D2-3166-7, Sections 4 and 5 (VI 22515 Supplement 15). Check all VFD parameters and record values in Appendix C.
- ✓ JCH 11/19/96 9.2.2.1 Set VFD deceleration to 1.5 Seconds -- page 5.16, change function 45 of menu 2 to 1 (enable) first, then change function 2 of menu 1 to 1.5 seconds.
- ✓ JCH 11/19/96 9.2.3 Verify that all VFD parameters and accesses are secured.
- 9.2.4 Limit switches - turn motor on at control console by pressing start switch. [Note, control switch on console will always be run in the manual setting (manual/automatic) and in the forward setting (forward/reverse).] Speed should be set on min value on control knob on console.
- ~~9.2.4.1 Actuate first limit switch by hand. Verify rotation changes to the other direction. JCH 12-23-96~~
- ~~9.2.4.2 Actuate the second limit switch (90° out from the first) by hand, and verify rotation again changes. (CAN'T BE DONE BY HAND BECAUSE THEY ARE SUBSTITUTED TO POTENTIOMETER - GO TO STEP 9.2.5) JCH 12-23-96~~
- ✓ JCH 11/16/97 9.2.5 Verify direction of rotation is depicted correctly on monitoring console.
- ✓ JCH 11/16/97 9.2.6 Verify emergency stop function stops rotation motor.
- ✓ JCH 11/16/97 9.2.7 Limit switches - Turn motor back on and allow turntable to proceed to first limit switch and verify the limit switch actuates and changes direction at 90° to 92° -- reduce VFD ramp-down time if needed. Allow turntable to proceed to the second switch and verify limit switch actuates and changes turntable direction at -90° to -92°.
- ✓ JCH 11/16/97 9.2.8 Verify position in the field is within 5° of monitoring console indication.
- ✓ JCH 11/16/97 9.2.9 Overtravel -- manually actuate each overtravel switch to verify rotation motor shutdown.

✓ JCH
11/16/97

9.2.10 Observe overhead cable behavior -- 6 cycles minimum (either during previous operations or turn motor back on). Note if twisting appears excessive, if bending radius is smaller than the minimum bend radius for the specific cable (6.64" for 4/0 cable and 4.88" for 1/0 grounding cable), any excessive rubbing, and that the cables have enough slack. If problems occur, notify C-T Director and/or open local disconnect (DS-703A).

10. Mixer Pump Wiring Checks - Visual and continuity check the motor wiring for both mixer pumps. Note for these steps breakers B7 and B8 in MCC-701 are open and locked out.

10.1 Visual and continuity check Pump 1 motor wiring

✓ JCH
11/14/96

10.1.1 Perform continuity check of wiring between VFD-702A and Breaker B8, and between VFD and DS-702A.

✓ JCH
11/14/96

10.1.2 Isolate motor from VFD by opening DS-702A, and megger check motor and wiring.

✓ JCH
11/14/96

10.1.3 Verify connections are tight.

✓ JCH
11/14/96

10.1.4 Verify pump heater has been turned on - 5 days minimum before motor operation. (Record date 11/7/96)

10.2 Visual and continuity check Pump 2 motor wiring

✓ JCH
11/14/96

10.2.1 Perform continuity check of wiring between VFD-701A and Breaker B7, and between VFD and DS-701A.

✓ JCH
11/14/96

10.2.2 Isolate motor from VFD by opening DS-701A, and megger check motor and wiring.

✓ JCH
11/14/96

10.2.3 Verify connections are tight.

✓ JCH
11/14/96

10.2.4 Verify pump heater has been turned on - 5 days minimum before motor operation. (Record date 11/7/96)

11. Check operation of main Pump 1 drive - observe for interference with instrumentation signals (e.g., harmonic interference). Note breaker B8 in MCC-701 is closed, DS-702A is closed, and pump coupler is removed and locked out. (Note, any Vibraswitch lights turning on should be ignored as the final adjustment will be performed in Step 11.4 below.)

✓ JCH
12/1/96

11.1 Power up and adjust the variable frequency drive per VI 22515 Supplement 15, Instruction Manual D2-3233, Invertron VGI AC Drive

Controller Quick Start-Up Guide. Check all VFD parameters and record values in Appendix D.

11.2 Verify pump has been decoupled, bump motor, and verify direction as viewed from the top of the motor is clockwise.

11.3 Check phase rotation.

11.4 Perform motor tuning per vendor instructions (Instruction Manual D2-3233, page 3-3).

Exception 11.5 With motor operating, back off the Vibraswitch setpoint screw one turn CCW and press reset button. If it does not reset, continue backing one turn and resetting until it does reset. Record the number of full CCW turns needed prior to being able to reset. After it resets, slowly turn screw CW until activation occurs. Mark this position as "normal." If the "normal" setpoint screw position is less than 1.0 g (one full revolution), rotate the screw 0.5 g CCW. If "normal" is greater than 1.0 g, refer to VI 22515 Supplement 32, book 3, tab 12, last page for final setpoint adjustment.

11.6 Check emergency stop function stops motor operation.

Exception 11.7 Check control console start and stop functions.

12. Check operation of main Pump 2 drive - observe for interference with instrumentation signals (e.g., harmonic interference). Note breaker B7 in MCC-701 is closed, DS-701A is closed, and pump coupler is removed and locked out. (Note, any Vibraswitch lights turning on should be ignored as the final adjustment will be performed in Step 12.4 below.)

12.1 Power up and adjust the variable frequency drive per VI 22515 Supplement 15, Instruction Manual D2-3233, Invertron VGI AC Drive Controller Quick Start-Up Guide. Check all VFD parameters and record values in Appendix E.

12.2 Verify pump has been decoupled, bump motor, and verify direction as viewed from the top of the motor is clockwise.

12.3 Check phase rotation.

12.4 Perform motor tuning per vendor instructions (Instruction Manual D2-3233, page 3-3).

Exception 12.5 With motor operating, back off the Vibraswitch setpoint screw one turn CCW and press reset button. If it does not reset, continue backing one turn and resetting until it does reset. Record the

number of full CCW turns needed prior to being able to reset. ____
After it resets, slowly turn screw CW until activation occurs. ____
Mark this position as "normal." If the "normal" setpoint screw
position is less than 1.0 g (one full revolution), rotate the
screw 0.5 g CCW. If "normal" is greater than 1.0 g, refer to
VI 22515 Supplement 32, book 3, tab 12, last page for final
setpoint adjustment.

ann 12/14/90 12.6 Check emergency stop function stops motor operation.

JCH 12/14/90 12.7 Check control console start and stop functions.

Appendix A - Checkout-Testing Exceptions

CHECKOUT-TESTING EXCEPTION			
STEP NO	DESCRIPTION OF PROBLEM	ACTION TAKEN	RECHECK COMPLETED
8.1.1	WIRES ARE MIS-LABELLED ON EMERGENCY STOP SWITCH	RE-LABELLED WIRES : ACTUATED EMERGENCY STOP SWITCH & VERIFY CORRECTLY.	11/19/96
8.2.1	" "	"	11/19/96
8.3.1	" "	"	11/19/96
8.4.1	" "	"	11/19/96
8.5.2	WIRES ARE MISLABELED IN JB10-02 TO PUMP 1. SHOULD BE TO TB-4, 13, 18, 19, 20		12/12/96
11.4	REPLACE GUY SHOOTED OUT WIRE IN VED	REPLACED WIRE	12/4/96
12.7 } 11.7 }	CONTROL CONSOLE START/STOP BUTTONS ARE SWITCHED BETWEEN PUMP #1 & PUMP #2	REWORKED SIGNAL CABLES FROM CONTROL CONSOLE (ECN-see 2A) JB TO 150-1	12/13/96
8.5.1.2	LOW/NORM LIGHTS ARE REVERSED IN 150 BLDG FROM 801 BLDG	REVERSED WIRES @ CONSOLE (ECN-see 2A)	12/12/96
8.5.1.3			
8.5.1.1	TUBING IS REVERSED GOING INTO DIFFERENTIAL PRESSURE SWITCH, NO POWER WIRE GOES TO SWITCH	REVERSED TUBING, ADDED WIRE FOR POWER (ECN-see 2A)	12/12/96
8.6.1	PUMP 1 LOWER VIBRATION SWITCH WOULD NOT SHOW ACTIVATION ON CONSOLE CONSOLE	ELECTRICIANS INSTALLED JUMPER THAT WAS MISSING	12/13/96
9.1.5	DIRECTION OF ROTATION ON CONSOLE SHOWS CCW AS (+). SHOULD BE (-)	CORRECTED METER ON CONSOLE	1/10/97
9.1.9	OVERTRIP SWITCH WON'T ACTIVATE UNLESS BOTH ARE TRIGGERED AT SAME TIME	ECN - WIRED THEM IN SERIES (see 2A)	1/10/97
9.2.10	CABLE (OVERHEAD) IS TOO SHORT TO ALLOW FULL ROTATION	PULLED SLACK OUT OF CABLE TO INCREASE THE LENGTH ON TOP	1/16/97
8.7	CABLE BETWEEN PUMP 1: PUMP 2 JB'S IS BAD	RE-PULLED NEW WIRE	1/7/97
8.7	DIGITAL TRANSMITTER IN JB10-10 DOESN'T FUNCTION	REPLACE DIGITAL TRANSMITTER	

Appendix B - Pump 1 Rotation Drive Checklist

CONTROL CONSOLE TO VFD-704A WIRING CHECK LIST			
FROM	TO	VIA	✓
DM2 P9-2	VFD 2TB-110	TB4-12, J156-6 M, 6-RED	✓
DM2 P9-3	VFD 2TB-111	TB4-11, J156-6 L, 6-BLK	✓
DM3 20	VFD T2-20	TB4-7, J156-6 G, 4-BLK	✓
DM3 31	VFD 31	TB4-1, J156-6 A, 1-BLK	✓
DM3 32	VFD 32	TB4-3, J156-6 C, 2-BLK	✓
DM3 33	VFD 33	TB4-5, J156-6 E, 3-BLK	✓
DM3 34	VFD 34	TB4-2, J156-6 B, 1-RED	✓
DM3 34	VFD 34	TB4-4, J156-6 D, 2-RED	✓
DM3 34	VFD 34	TB4-6, J156-6 F, 3-RED	✓
DM3 34	VFD 21	TB4-8, J156-6 H, 4-RED	✓
DM3 34	VFD 36	TB4-10, J156-6 K, 5-RED	✓
DM3 35	VFD 35	TB4-9, J156-6 J, 5-BLK	✓
DM1 1	VFD 1	TB2-1, J156-5 A, 1-BLK	✓
DM1 2	VFD 2	TB2-2, J156-5 B, 1-RED	✓
DM1 3	VFD 3	TB2-3, J156-5 C, 2-BLK	✓
DM1 4	VFD 4	TB2-4, J156-5 D, 2-RED	✓
DM1 12	VFD 12	TB2-7, J156-5 G, 4-BLK	✓
DM1 13	VFD 13	TB2-8, J156-5 H, 4-RED	✓
DM1 14	VFD 14	TB2-9, J156-5 J, 5-BLK	✓
DM1 15	VFD 15	TB2-10, J156-5 K, 5-RED	✓
DM1 16	VFD 2TB6	TB2-11, J156-5 L, 6-BLK	✓
EMERG STOP 5	VFD 11	TB2-5, J156-5 E, 2-BLK	✓
EMERG STOP 6	VFD 3CR WIRE 6	TB2-6, J156-5 F	✓

REFERENCES VENDOR DATA, H-2-78948 SHT 6, H-2-78991 SHT4, H-2-78983 SHT 1-4

PERFORMED BY John Penner DATE(S) 11-5-96

Table 8-4. Record of User's Parameter Selections/Adjustments.

WARNING

TABLE 8-4 IS TO BE USED AS A RECORD OF THE USER'S PARAMETER SELECTIONS/ADJUSTMENTS. BEFORE MAKING ANY ADJUSTMENTS TO THE DRIVE, REFER TO THE APPROPRIATE FUNCTION DESCRIPTION IN CHAPTER 5. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

Function Number	Functional Descriptions	Parameter Selection/Adjustment Range	Initial Factory Setting	User Data	
				Date	Setting
First Menu	0 Local/Remote Operation Control (Note: The Rail Interface Card is required with selection 2.)	0 = Local Control 1 = Remote Control/Terminal Strip 2 = Remote Control/I/O Port	0		1.0
	1 Acceleration Time (See Function 44)	5.0 - 360.0 Seconds	20.0	11/19	20.0
	2 Deceleration Time (See Function 45)	5.0 - 360.0 Seconds	20.0	11/19	1.5
	3 Minimum Hz (See Function 43)	5.0 - 60 Hz	5.0	11/19	0
	4 Maximum Hz (See Function 38)	15 - Overfrequency Limit	60.0	11/19	60
	5 Current Limit	50 - 150% Current	150	11/19	150
Second Menu	6 Expand to Second Menu (First Password Necessary)	0 = Basic (First Menu Only) 1 = Expand to Second Menu	0	11/19	1
	7 Manual Torque Boost	0 - 10% Voltage	2	11/19	2
	8 Jog Frequency	0.0 - 60.0 Hz (Note: The actual jog frequency automatically is limited between minimum Hz and maximum Hz.)	5.0	11/19	5.0
	9 Stop Mode Selection	0 = Coast-to-rest 1 = Ramp-to-rest	0	11/19	0
	10 Automatic Flux Control	0 - 5% Rated Voltage	0	11/19	0
	11 Base Frequency Selection (Volts/Hz Ratio)	30.0 - 400.0 Hz	60.0	11/19	60.0
	12 Electronic Thermal Overload Selection	0 = Normal Motor 1 = Forced Cooled Motor	0	11/19	0
	13 Electronic Thermal Overload Level	20 - 100% Current	100	11/19	100
	14 Linear/S-Curve Acceleration	0 = Linear Acceleration 1 = S-Curve Acceleration	0	11/19	0
	15 Linear/S-Curve Deceleration	0 = Linear Deceleration 1 = S-Curve Deceleration	0	11/19	0
	16 Multi-Speed Preset ⁽¹⁾ MS1	0.0 - 400.0 Hz (Note: The actual output frequency automatically is limited between minimum Hz and maximum Hz.)	5.0	11/19	N/A
	17 Multi-Speed Preset ⁽¹⁾ MS2		5.0	11/19	N/A
	18 Multi-Speed Preset ⁽¹⁾ MS3		5.0	11/19	N/A
	19 Avoidance Frequency 1 AF1	0.0 - 400.0 Hz (Note: The actual output frequency automatically is limited between minimum Hz and maximum Hz.)	0.0	11/19	0
	20 Avoidance Frequency 2 AF2		0.0	11/19	0
	21 Avoidance Frequency 3 AF3		0.0	11/19	0
	22 Avoidance Frequency Band AFB	0.2 - 10.0 Hz	0.2	11/19	.2
	23 Variable Torque Volts/Hz Curve Selection	0 = Constant Torque Curve 1 = Variable Torque Curve	0	11/19	0
	24 D-C Braking Operation Time ⁽²⁾	0.0 - 10.0 Seconds	0.0	11/19	N/A
	25 D-C Braking Voltage ⁽²⁾	0 - 20% Voltage	0	11/19	N/A
	26 D-C Braking Start Frequency ⁽²⁾	0.5 - 10.0 Hz	1.0	11/19	N/A
	27 Line-Dip-Ride-Through	15 - 500 milliseconds	15	11/19	15

Table B-4. Record of User's Parameter Selections/Adjustments (continued).

Function Number	Functional Descriptions	Parameter Selection/Adjustment Range	Initial Factory Setting	User Data	
				Date	Setting
Second Menu (cont.)	28 Output Relay 1 (Form C Contact) (Note: Requires the Remote Meter Interface Card.)	0 = Not Used 1 = Zero Speed Detect 2 = Reserved 3 = Output Contactor 4 = Frequency Level Detection 1 5 = Frequency Level Detection 2 6 = Current Level Detection 7 = Reverse Rotation 8 = D-C Braking Operation ^(*) 9 = Reserved	0	11/19	0
	29 Output Relay 2 (Form A Contact) (Note: Requires the Remote Meter Interface Card.)		0	11/19	0
	30 Slip Compensation ^(*)	0.0 - 5.0 Hz	0.0	11/19	0.0
	31 Inverse Reference ^(*) (Second Password Necessary)	0 = Normal 1 = Inverse	0	11/19	N/A
	32 Function Loss Selection (Second Password Necessary)	0 = IET at Function Loss 1 = Coast-to-rest without an IET output at Function Loss	0	11/19	0
	33 Frequency Level Detection 1 ^(*)	0.5 - 405.0 Hz	0.5	11/19	N/A
	34 Frequency Level Detection 2 ^(*)	0.5 - 405.0 Hz	0.5	11/19	N/A
	35 Current Level Detection ^(*)	30 - 150% Current	100	11/19	N/A
	36 Reverse Disable ^(*)	0 = Forward/Reverse Enable 1 = Reverse Disable on Keypad	0	11/19	0
	37 Automatic (Process Control) ^(*) Disable on Local Control	0 = AUTO/MAN key Enable 1 = AUTO Disable on Keypad	0	11/19	0
	38 Overfrequency Limit (Second Password Necessary)	50.0 - 405.0 Hz	90.0	11/19	90.0
	39 D-C Offset Enable (Second Password Necessary)	0 = Offset Disable 1 = Offset Enable	0	11/19	0
	40 Auto-reset Enable (Second Password Necessary)	0 = Auto-reset Disable 1 = Auto-reset Enable	0	11/19	0
	41 Auto-reset Time ⁽¹⁾	0 - 10 Times	0	11/19	N/A
	42 Auto-reset Interval Time ⁽¹²⁾	1 - 60 Seconds	1	11/19	N/A
	43 Extended Minimum Hz Range (Second Password Necessary)	0 = Disable (5 - 60 Hz) 1 = Enable (0 - 60 Hz)	0	11/19	1
	44 Extended Acceleration Time Range	0 = 5.0 - 360.0 Seconds 1 = 0.1 - 360.0 Seconds	0	11/19	0
	45 Extended Deceleration Time Range	0 = 5.0 - 360.0 Seconds 1 = 0.1 - 360.0 Seconds	0	11/19	1
	46 RPM Monitor Display Enable	0 = Disable 1 = Enable	0	11/19	0
	47 RPM Monitor Range Selection (Second Password Necessary)	0 = 150 - 9999 RPM 1 = 0 - 9999 RPM	0	11/19	N/A
	48 RPM Monitor Base Frequency Selection (See Function 47)	150 - 9999 RPM	1750	11/19	N/A
	49 Output Voltage Regulation Mode Selection (See Function 50)	0 = Proportional to Input 1 = Fixed to Max Voltage	0	11/19	0
	50 Maximum Voltage	190.0 - 230.0 ⁽¹³⁾ 380.0 - 460.0 ⁽¹⁴⁾ 475 - 575 ⁽¹⁵⁾	230.0 ⁽¹³⁾ 460.0 ⁽¹⁴⁾ 575 ⁽¹⁵⁾	11/19	N/A
	51 Jog Acceleration Value	0.1 - 360.0 Seconds	20.0	11/19	20.0
	52 Jog Deceleration Value	0.1 - 360.0 Seconds	20.0	11/19	20.0

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WHC-SD-W151-IP-003, Rev. 0

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Appendix B - Rotation Drive Pump 1 Record
Table 8-4. Record of User's Parameter Selections/Adjustments (continued).

Function Number	Functional Descriptions	Parameter Selection/Adjustment Range	Initial Factory Setting	User Data	
				Date	Setting
Second Menu (cont.)	53 Jog Acceleration Selection	0 = Linear Acceleration 1 = S-Curve Acceleration	0	11/19	0
	54 Jog Deceleration Selection	0 = Linear Deceleration 1 = S-Curve Deceleration	0	11/19	0
	55 Current Limit Deceleration Rate	0 - 100 Hz/Seconds	90	11/19	90
	56 Start into a Rotating Motor	0 = Enable 1 = Disable (Quick Start)	0	11/19	0
	57 MS Terminals Selection ⁽¹⁴⁾ (Second Password Necessary)	0 = Multi-Speed Preset 1 = Static MCP	0	11/19	N/A
	98 Reserved			11/19	38
99				11/19	FF10

(14) Effective when "1" is selected in Function 0 and "1" is selected in Function 57.

(15) Effective when "1" is selected in Function 9.

(16) Ineffective when 0.0 is set in Function 24.

(17) Effective when "0" is selected in Function 39.

(18) Effective when "1" is selected in Function 0, or when "0" is selected in Function 0 while AUTO mode on key pad is selected.

(19) Effective when "4" is selected in Function 28 or 29.

(20) Effective when "5" is selected in Function 28 or 29.

(21) Effective when "6" is selected in Function 28 or 29.

(22) Effective when "0" is selected in Function 0.

(23) Effective when "0" is selected in Function 0.

(24) Effective when "1" is selected in Function 40.

(25) Ineffective when 0 is set in Function 41.

(26) Effective when the controller is 230 VAC.

(27) Effective when the controller is 460 VAC.

(28) Effective when the controller is 575 VAC.

(29) Effective when "1" is selected in Function 0.

99

FF10

Appendix C - Pump 2 Rotation Drive Checklist

CONTROL CONSOLE TO VFD-703A WIRING CHECK LIST			
FROM	TO	VIA	✓
DM8 P9-2	VFD 2TB-110	TB9-12, J156-8 M, 6-RED	✓
DM8 P9-3	VFD 2TB-111	TB9-11, J156-8 L, 6-BLK	✓
DM9 20	VFD T2-20	TB9-7, J156-8 G, 4-BLK	✓
DM9 31	VFD 31	TB9-1, J156-8 A, 1-BLK	✓
DM9 32	VFD 32	TB9-3, J156-8 C, 2-BLK	✓
DM9 33	VFD 33	TB9-5, J156-8 E, 3-BLK	✓
DM9 34	VFD 34	TB9-2, J156-8 B, 1-RED	✓
DM9 34	VFD 34	TB9-4, J156-8 D, 2-RED	✓
DM9 34	VFD 34	TB9-6, J156-8 F, 3-RED	✓
DM9 34	VFD 21	TB9-8, J156-8 H, 4-RED	✓
DM9 34	VFD 36	TB9-10, J156-8 K, 5-RED	✓
DM9 35	VFD 35	TB9-9, J156-8 J, 5-BLK	✓
DM7 1	VFD 1	TB7-1, J156-7 A, 1-BLK	✓
DM7 2	VFD 2	TB7-2, J156-7 B, 1-RED	✓
DM7 3	VFD 3	TB7-3, J156-7 C, 2-BLK	✓
DM7 4	VFD 4	TB7-4, J156-7 D, 2-RED	✓
DM7 12	VFD 12	TB7-7, J156-7 G, 4-BLK	✓
DM7 13	VFD 13	TB7-8, J156-7 H, 4-RED	✓
DM7 14	VFD 14	TB7-9, J156-7 J, 5-BLK	✓
DM7 15	VFD 15	TB7-10, J156-7 K, 5-RED	✓
DM7 16	VFD 2TB6	TB7-11, J156-7 L, 6-BLK	✓
EMERG STOP 7	VFD 11	TB7-5, J156-7 E, 2-BLK	✓
EMERG STOP 8	VFD 3CR WIRE 6	TB7-6, J156-7 F	✓

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w/acc.

REFERENCES VENDOR DATA, 78948 SHT 6, 78991 SHT3, 78983 SHT 1-4

PERFORMED BY John Stenman DATE(S) 11-5-96

Table 8-4. Record of User's Parameter Selections/Adjustments.

WARNING
 TABLE 8-4 IS TO BE USED AS A RECORD OF THE USER'S PARAMETER SELECTIONS/ADJUSTMENTS. BEFORE MAKING ANY ADJUSTMENTS TO THE DRIVE, REFER TO THE APPROPRIATE FUNCTION DESCRIPTION IN CHAPTER 5. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

Function Number	Functional Descriptions	Parameter Selection/Adjustment Range	Initial Factory Setting	User Data
First Menu	0 The Rail Interface Card is required with selection 2.)	0 = Local Control 1 = Remote Control/Terminal Stop 2 = Remote Control/O Port	0	1.0
	1 Acceleration Time (See Function 44)	5.0 - 360.0 Seconds	20.0	20.0
2	Deceleration Time (See Function 45)	5.0 - 360.0 Seconds	20.0	1.5
3	Minimum Hz (See Function 43)	5.0 - 60 Hz	5.0	0
4	Maximum Hz (See Function 38)	15 - Overfrequency Limit	60.0	60
5	Current Limit	50 - 150% Current	150	150
6	Expand to Second Menu (First Password Necessary)	0 = Basic (First Menu Only) 1 = Expand to Second Menu	0	1
7	Manual Torque Boost	0 - 10% Voltage	2	2
8	Log Frequency	0 - 60.0 Hz (Note: The actual log frequency and maximum Hz.)	5.0	5.0
9	Stop Mode Selection	0 = Coast-to-rest 1 = Ramp-to-rest	0	0
10	Automatic Flux Control	0 - 5% Rated Voltage	0	0
11	Base Frequency Selection (Volts/Hz Ratio)	30.0 - 400.0 Hz	60.0	60
12	Electronic Thermal Overload Selection	0 = Normal Motor 1 = Forced Cooled Motor	0	0
13	Electronic Thermal Overload Level	20 - 100% Current	100	100
14	Linear/S-Curve Acceleration	0 = Linear Acceleration 1 = S-Curve Acceleration	0	0
15	Linear/S-Curve Deceleration	0 = Linear Deceleration 1 = S-Curve Deceleration	0	0
16	Multi-Speed Preset ⁽¹⁾	MS1	5.0	N/A
17	Multi-Speed Preset ⁽¹⁾	MS2	5.0	N/A
18	Multi-Speed Preset ⁽¹⁾	MS3	5.0	N/A
19	Avoidance Frequency 1	AF1	0.0	0
20	Avoidance Frequency 2	AF2	0.0	0
21	Avoidance Frequency 3	AF3	0.0	0
22	Avoidance Frequency Band	AFB	0.2 - 10.0 Hz	-2
23	Variable Torque Volts/Hz Curve Selection	0 = Constant Torque Curve 1 = Variable Torque Curve	0	0
24	D-C Braking Operation Time ⁽²⁾	0.0 - 10.0 Seconds	0.0	N/A
25	D-C Braking Voltage ⁽²⁾	0 - 20% Voltage	0	N/A
26	D-C Braking Start Frequency ⁽²⁾	0.5 - 10.0 Hz	1.0	N/A
27	Line-Dip-Ride-Through	15 - 500 milliseconds	15	15

Table 8-4. Record of User's Parameter Selections/Adjustments (continued).

Function Number	Functional Descriptions	Parameter Selection/Adjustment Range	Initial Factory Setting	User Data	
				Date	Setting
Second Menu (cont.)	28 Output Relay-1 (Form C Contact) (Note: Requires the Remote Meter Interface Card.)	0 = Not Used 1 = Zero Speed Detect 2 = Reserved 3 = Output Contactor 4 = Frequency Level Detection 1 5 = Frequency Level Detection 2 6 = Current Level Detection 7 = Reverse Rotation 8 = D-C Braking Operation ⁽²⁾ 9 = Reserved	0	11/19	0
	29 Output Relay 2 (Form A Contact) (Note: Requires the Remote Meter Interface Card.)	0 = Normal 1 = Inverse	0		0
	30 Slip Compensation ⁽⁴⁾	0.0 - 5.0 Hz	0.0		0
	31 Inverse Reference ⁽⁵⁾ (Second Password Necessary)	0 = Normal 1 = Inverse	0		N/A
	32 Function Loss Selection (Second Password Necessary)	0 = IET at Function Loss 1 = Coast-to-rest without an IET output at Function Loss	0		0
	33 Frequency Level Detection 1 ⁽⁶⁾	0.5 - 405.0 Hz	0.5		N/A
	34 Frequency Level Detection 2 ⁽⁷⁾	0.5 - 405.0 Hz	0.5		N/A
	35 Current Level Detection ⁽⁸⁾	30 - 150% Current	100		N/A
	36 Reverse Disable ⁽⁹⁾	0 = Forward/Reverse Enable 1 = Reverse Disable on Keypad	0		0
	37 Automatic (Process Control) ⁽¹⁰⁾ Disable on Local Control	0 = AUTO/MAN key Enable 1 = AUTO Disable on Keypad	0		0
	38 Overfrequency Limit (Second Password Necessary)	50.0 - 405.0 Hz	90.0		90
	39 D-C Offset Enable (Second Password Necessary)	0 = Offset Disable 1 = Offset Enable	0		0
	40 Auto-reset Enable (Second Password Necessary)	0 = Auto-reset Disable 1 = Auto-reset Enable	0		0
	41 Auto-reset Time ⁽¹¹⁾	0 - 10 Times	0		N/A
	42 Auto-reset Interval Time ⁽¹²⁾	1 - 60 Seconds	1		N/A
	43 Extended Minimum Hz Range (Second Password Necessary)	0 = Disable (5 - 60 Hz) 1 = Enable (0 - 60 Hz)	0		1
	44 Extended Acceleration Time Range	0 = 5.0 - 360.0 Seconds 1 = 0.1 - 360.0 Seconds	0		0
	45 Extended Deceleration Time Range	0 = 5.0 - 360.0 Seconds 1 = 0.1 - 360.0 Seconds	0		1
	46 RPM Monitor Display Enable	0 = Disable 1 = Enable	0		0
	47 RPM Monitor Range Selection (Second Password Necessary)	0 = 150 - 9999 RPM 1 = 0 - 9999 RPM	0		N/A
	48 RPM Monitor Base Frequency Selection (See Function 47)	150 - 9999 RPM	1750		N/A
	49 Output Voltage Regulation Mode Selection (See Function 50)	0 = Proportional to Input 1 = Fixed to Max Voltage	0		0
	50 Maximum Voltage	190.0 - 230.0 ⁽¹³⁾ 380.0 - 460.0 ⁽¹⁴⁾ 475 - 575 ⁽¹⁵⁾	230.0 ⁽¹³⁾ 460.0 ⁽¹⁴⁾ 575 ⁽¹⁵⁾		N/A
	51 Jog Acceleration Value	0.1 - 360.0 Seconds	20.0		20.0
	52 Jog Deceleration Value	0.1 - 360.0 Seconds	20.0		20.0

Appendix C - Rotation Drive Pump 2 Record

Table 8-4. Record of User's Parameter Selections/Adjustments (continued).

Function Number	Functional Descriptions	Parameter Selection/Adjustment Range	Initial Factory Setting	User Data	
				Date	Setting
Second Menu (cont.)	53 Jog Acceleration Selection	0 = Linear Acceleration 1 = S-Curve Acceleration	0	11/19	0
	54 Jog Deceleration Selection	0 = Linear Deceleration 1 = S-Curve Deceleration	0		0
	55 Current Limit Deceleration Rate	0 - 100 Hz/Seconds	90		90.0
	56 Start into a Rotating Motor	0 = Enable 1 = Disable (Quick Start)	0		0
	57 MS Terminals Selection ⁽¹⁸⁾ (Second Password Necessary)	0 = Multi-Speed Preset 1 = Static MOP	0		N/A
	98 Reserved				38
99					FF10

(1) Effective when "1" is selected in Function 0 and "1" is selected in Function 57.

(2) Effective when "1" is selected in Function 9.

(3) Ineffective when 0.0 is set in Function 24.

(4) Effective when "0" is selected in Function 39.

(5) Effective when "1" is selected in Function 0, or when "0" is selected in Function 0 while AUTO mode on key pad is selected.

(6) Effective when "4" is selected in Function 28 or 29.

(7) Effective when "5" is selected in Function 28 or 29.

(8) Effective when "6" is selected in Function 28 or 29.

(9) Effective when "0" is selected in Function 0.

(10) Effective when "0" is selected in Function 0.

(11) Effective when "1" is selected in Function 40.

(12) Ineffective when 0 is set in Function 41.

(13) Effective when the controller is 230 VAC.

(14) Effective when the controller is 480 VAC.

(15) Effective when the controller is 575 VAC.

(16) Effective when "1" is selected in Function 0.

Appendix D - Pump 1 Main Drive Checklist

CONTROL CONSOLE TO VFD-702A WIRING CHECK LIST			
FROM	TO	VIA	
DM10 P9-2	VFD TB X9-552 (AMPS)	TB7-17, RED, J/P156-9B, P/J156-14B, JB156-01 TB2-17, RED	✓
DM10 P9-3	VFD TB X9-550 (COM)	TB7-16, BLK, J/P156-9A, P/J156-14A, JB156-01 TB2-16, BLK	✓
DM11 P9-2	VFD TB X9-551 (VOLTS)	TB7-20, RED, J/P156-9E, P/J156-14E, JB156-01 TB2-20, RED	✓
DM11 P9-3	VFD TB X9-550 (COM)	TB7-19, BLK, J/P156-9D, P/J156-14D, JB156-01 TB2-19, BLK	✓
DM12 P9-2	VFD TB X9-553 (FREQ)	TB7-23, RED, J/P156-9H, P/J156-14H, JB156-01 TB2-23, RED	✓
DM12 P9-3	VFD TB X9-550 (COM)	TB7-22, BLK, J/P156-9G, P/J156-14G, JB156-01 TB2-22, BLK	✓
METER WIRING SHIELDS NC AT METERS	VFD TB X9-157 (SHIELDS)	TB7-18, 21, 24; J/P156-9C, F, J; P/J156-14C, F, J; JB156-01 TB2-18, 21, 24; DRAIN WIRES	✓
DS4-1 (PUMP FAULT)	VFD TB X7-F1	TB10-1, 1 BLK, J/P156-4A, P/J156-13A, JB156-01 TB2-1, 1 BLK	✓
DS4-2	VFD PACS X8-20	TB10-2, 1 RED, J/P156-4B, P/J156-13B, JB156-01 TB2-2, 1 RED	✓
DS3-1 (PUMP RUNNING)	VFD PACS X8-28	TB10-3, 2 BLK, J/P156-4C, P/J156-13C, JB156-01 TB2-3, 2 BLK	✓
DS3-2	VFD PACS X8-20	TB10-4, 2 RED, J/P156-4D, P/J156-13D, JB156-01 TB2-4, 2 RED	✓
DS3-1, DS4-1	WT-156-01 802, 803	(RS-485 INTERFACE)	✓
WT-156-01 DATA, DATA*	PC-1 RS-485 PORT TX/RX+, TX/RX-	TB3-2, TB3-1	✓
S4-1 (STOP)	VFD PACS X8-23	TB10-5, 3 BLK, J/P156-4E, P/J156-13E, JB156-01 TB2-5, 3 BLK	✓
S4-2	VFD PACS X8-24	TB10-6, 3 RED, J/P156-4F, P/J156-13F, JB156-01 TB2-6, 3 RED	✓
S3-1 (START)	VFD PACS X8-29 (JUMPER TO PACS X8-25)	TB10-7, 4 BLK, J/P156-4G, P/J156-13G, JB156-01 TB2-7, 4 BLK	✓
S3-2	VFD PACS X8-23	TB10-8, 4 RED, J/P156-4H, P/J156-13H, JB156-01 TB2-8, 4 RED	✓
ES1-3 (EMERG. STOP)	VFD AUX TERM STRIP - 904	TB10-9, 5 BLK, J/P156-4J, P/J156-13J, JB156-01 TB2-9, 5 BLK	✓
ES1-4	VFD AUX TERM STRIP - 22	TB10-10, 5-RED, J/P156-4K, P/J156-13K, JB156-01 TB2-10, 5 RED	✓
SPARE	SPARE	TB10-11, 6 BLK, J/P156-4L, P/J156-13L, JB156-01 TB2-11, 6 BLK	✓
SPARE	SPARE	TB10-12, 6 RED, J/P156-4M, P/J156-13M, JB156-01 TB2-12, 6 RED	✓
SHIELD FOR RED, BLK-1-6	SHIELD	TB10-13, DRAIN, J/P156-4N, P/J156-13N, JB156-01 TB2-13, DRAIN	✓

REFERENCES H-2-78983 SHT 8, 78983 SHT 1-4, 78981 SHT 3, VENDOR DATA

PERFORMED BY John Kenzie DATE(S) 11/5/96

Table 2-1. VGI Motor and Line Voltage Data and Volts/Hz Parameter Quick Setup List.

Parameter Number	Password Required: C = customer S = service	Parameter Name	Description	Initial Factory Setting for 460 VAC Controller	Set to equal	Check-list ☒
274	C or S	F_MAX	maximum output frequency at 100% reference * 10	500	610 for 60 Hz	✓
275	C or S	MOTOR_I	sum of all motor nameplate currents FLA * 10	See Note (1)	FLA * 10	✓
300	C or S	U_LINE	input AC line voltage	460	380 or 460	✓
277	C or S	MOTOR_U	motor nameplate voltage (VAC)	460	380 or 460	✓
278	C or S	F1	frequency at the end when boosted voltage returns to a constant v/Hz curve	200	freq. at end of voltage boost * 10	✓
281	C or S	F3	motor nameplate frequency * 10	500	60 Hz * 10	✓
279	C or S	F2	motor nameplate nominal frequency * 10	500	60 Hz * 10	✓
282	C or S	U_MIN	voltage boost at zero frequency Note: This value is usually set = 0 for constant torque applications. U_MIN is also used in the tuning procedure.	0	0 = 0 V 1 = 1V, etc.	✓
284	C or S	U3	maximum output voltage when F3 is reached (VAC)	460	380 or 460 (U2 - 1)	✓
283	C or S	U2	nominal motor voltage minus 1 (VAC)	459	459 or 379	✓
295	C or S	UDC1	DC Bus voltage at which current limit starts to be reduced: (1.56 * U_LINE)	717	U_LINE = 460 = 717 U_LINE = 380 = 592	✓
296	C or S	UDC2	DC bus voltage at which current limit is reduced to zero (UDC_TRIP-30)	770	800 - 30 = 770	✓
299	S only	UDC_TRIP	High DC bus IET trip voltage **Do not exceed 300V**	800	800	✓
335	C or S	U_MODE	Sets either the constant or variable torque load characteristics.	0	1 = squared (pumps and fans) 0 = linear	✓

set @ 620
 set @ 360
 set @ 460
 set @ 460
 set @ 200
 set @ 610
 set @ 600
 set @ 0
 set @ 460
 set @ 459
 set @ 717
 set @ 770
 set @ 800
 set @ 0

- (1) 1800 for 150HP rating
 2400 for 200HP rating
 3000 for 250HP rating
 3600 for 300 HP rating
 4200 for 350HP rating
 4800 for 400HP rating

- d. Recheck that all parameters in Table 2-1 have been entered correctly. If you need all parameters values permanently stored, check that each parameter shows an "=" sign next to the parameter value. If it does not - (a slash mark "/" is displayed instead), re-enter the value and press the F1 key.

- ② Set pointer parameter 499 to a value of 512 to prevent reverse rotation selection
 or keypad. the 11/15/96
 2-2
 ③ Final adjustment to register 368 to a value of 2289 to set min speed for 640 rpm (36 Hz)
 2450 rpm 11/15/96

Table 3-1. VCI Application Specific Parameter Settings.

Parameter	Required:	Parameter	Description	Initial	Factory	Min	Max	Check
Number	C = customer	S = service	Name					
363	C or S		MAX_MOT_CL	4096	0	4096	4096	✓
364	C or S		MAX_REGO_CL	4096	0	4096	4096	✓
Motor Pot. Acceleration and Deceleration Parameters								
365	C or S		MOPACC	200	10	32767		✓
366	C or S		MOPDEC	200	10	32767		✓
Remote Reference Acceleration and Deceleration Parameters								
372	C or S		R_ACC_TDM	200	10	32767		✓
373	C or S		R_DEC_TDM	200	10	32767		✓
SIP Compensation Parameter								
385	C or S		SLIP_C	0	0	400		✓
Avoidance Frequency Parameters - See section on "Setting up Avoidance Frequencies"								
338	C or S		AVF_FREQ_1	0	0	F_MAX		✓
339	C or S		AVF_BAND_1	0	0	50		✓
340	C or S		AVF_FREQ_2	0	0	F_MAX		✓
341	C or S		AVF_BAND_2	0	0	50		✓
342	C or S		AVF_FREQ_3	0	0	F_MAX		✓
343	C or S		AVF_BAND_3	0	0	50		✓
DC Brake Parameters								
430	C or S		DCB_FLIM	0	0	100		✓
431	C or S		DCB_TIME	0	0	100		✓
432	C or S		DCB_I	0	0	0.8 * PU_MAX_I		✓
Current Limit Parameters - See section on "Current/Torque Limits"								
363	C or S		MAX_MOT_CL	4096	0	4096	4096	✓
364	C or S		MAX_REGO_CL	4096	0	4096	4096	✓
Motor Pot. Acceleration and Deceleration Parameters								
365	C or S		MOPACC	200	10	32767		✓
366	C or S		MOPDEC	200	10	32767		✓
Remote Reference Acceleration and Deceleration Parameters								
372	C or S		R_ACC_TDM	200	10	32767		✓
373	C or S		R_DEC_TDM	200	10	32767		✓
SIP Compensation Parameter								
385	C or S		SLIP_C	0	0	400		✓
Avoidance Frequency Parameters - See section on "Setting up Avoidance Frequencies"								
338	C or S		AVF_FREQ_1	0	0	F_MAX		✓
339	C or S		AVF_BAND_1	0	0	50		✓
340	C or S		AVF_FREQ_2	0	0	F_MAX		✓
341	C or S		AVF_BAND_2	0	0	50		✓
342	C or S		AVF_FREQ_3	0	0	F_MAX		✓
343	C or S		AVF_BAND_3	0	0	50		✓
DC Brake Parameters								
430	C or S		DCB_FLIM	0	0	100		✓
431	C or S		DCB_TIME	0	0	100		✓
432	C or S		DCB_I	0	0	0.8 * PU_MAX_I		✓

Table 3-1. VGI Application Specific Parameter Settings. (Continued)

Parameter Number	Password Required: S = customer S = service	Parameter Name	Description	Initial Factory Setting	Min Setting	Max Setting	Check-list ✓	
Tuning Parameters								
103	C or S: Monitor Only	COS_FIF	Voltage and current feedback. At minimum speeds, value should be between ~ 150 .	N/A	—	—	✓	N/A
392	C or S	U_MIN	Voltage boost when frequency = 0. Increase for high initial breakaway torque. See also 348, UFI_GAIN.	0	0	30	✓	5000
316	C or S	OVER_SF1	overfrequency limit: $5192=100\text{Hz}$; if actual frequency exceeds this value, inverter will trip on IET.	5407 55 Hz 600	0	3276 30 1200	✓	5000
336	C or S	RES_1	Used to adjust the power factor of COS_FIF. Higher values decrease COS_FIF. The biggest affect is at low frequencies without load. This should be near zero.	30	—	4096	✓	5000
348	C or S	UFI_GAIN	Load dependent voltage boost. For applications with sudden load changes, set value up to 6000. A value too high can cause a current limit condition. 328 = 1% of maximum voltage	2000	0	3000	✓	2000
351	C or S	SFG_GAIN	Current stability for regenerative modes only. If current reference (Parameter 69, IS_REF) is oscillating $\sim 30\%$, increase SFG_GAIN to stabilize. 5192 = gain of 1	2000	0	30000	✓	2000
354	C or S	DELTA_ADD	Set to 0, increase in increments of 1 if switching frequency errors occur at low speed. (Parameter 25, CORE_CODE = 231.)	0	—	—	✓	0
356	C or S	F_STAB	Frequency stabilization proportional to motor slip. 450 = 1.7% slip Ex.: For 2% slip: $450/2.7*2 = 330$	450	0	2000	✓	150
357	C or S	SYN_STAB	For synchronous motors only. This increases current and speed stability.	0	0	30000	✓	0
359	C or S	SINGLE_HYS	Voltage percentage where $3\text{ETA} = \text{DELTA}$. Reduce when Parameter 25, (CORE_CODE) = 231.	3276	2048	16000	✓	3276
383	C or S	U_KP	Voltage regulator proportional gain.	30	1	10000	✓	3276
Catching Circuit Parameters								
393	C or S	FIND_MODE	Defines how the controller will search for the motor frequency after a line dip or a start command. Line dips will always start at the last frequency setpoint running at $\sim 20\text{Hz}$. -1 = no catching circuit function 0 = catching circuit function starts after a line dip. 1 and 3 = search starts in a positive reference direction. 2 and 4 = search starts in a negative reference direction (if running in reverse direction.)	-1	—	—	✓	-1
394	C or S	FIND_TIME	The amount of time the controller will cover a 50 Hz span once the FIND_MODE has started. Set to equal 1/2 of decel time. 2000 = 2 sec. If FIND_TIME is reduced, increase FIND_LFA.	2000	500	3000	✓	2000
395	C or S	FIND_LFA	The amount of current fed to the motor during FIND_TIME. If bus overvoltage trip, decrease value. 1024 = Motor current.	512	341	1024	✓	512

Table 3-1. VGI Application Specific Parameter Settings. (Continued)

Parameter Number	Password Required: C = customer S = service	Parameter Name	Description	Initial Factory Setting	Min Setting	Max Setting	Check-list
397	C or S	AF_ACC_TIM	Ramp time for frequency change after synchronization. (Acceleration 0 to F_MAX). 100= .10s If current limit occurs immediately after search, increase the time.	100	10	10000	☒
Ramp or Coast Stop Parameter							
425	C or S	RAMPSTP_EN	Coast stop (immediate) or ramp to rest stop. 0 = coast stop 1 = ramp to rest	1	00	00	☒

4. **Calculating Torque Limits.** If the drive and the motor are not matched in HP rating, or if there are multiple motors, the torque limits must be calculated.

Example Calculation:

VGI controller is rated at 20 HP.

Motor FLA (from nameplate) = 14 A.

Parameter 305 (PU_MAX_I) = 400. (The maximum output of the controller is 40 amps.)

Motor overcurrent limit = 150%, or $14 \times 1.5 = 21$ amps

In this case, the controller's output current (40 amps) can be greater than the motor's rated current (21 amps).

The maximum torque limits for parameters 263 (MAX_MOT_CL), and 264 (MAX_REG_CL) is 4096. You need to calculate a new number for the torque limits for Parameters 263 (MAX_MOT_CL), and 264 (MAX_REG_CL) using the following equation:

$$\frac{4096}{\text{Max. Controller Output (Amps)}} = \frac{X}{\text{Motor full load amps}}$$

$$\text{Example: } \frac{4096}{40} = \frac{X}{21}$$

$$x = 2150$$

Enter 2150 into parameters 263 and 264 to limit the output of the controller to 21 amps.

For multiple motors: Use the sum of the full load motor amps of the motors.

5. Tuning

Note: It is recommended that this tuning procedure be performed with an unloaded motor. If the motor cannot be unloaded, Parameter 282 (U_MIN) might have to be increased significantly to boost the starting torque.

Note: The motor will have to be warm to perform this tuning procedure correctly. It could take 1-2 hours to warm the motor field properly. Perform Step a before continuing with the rest of the tuning procedure.

- a. Run the motor, unloaded at 10 Hz. Perform the following steps:

1. Monitor the OUTP AMPS using the display mode on the keypad

***Note: You cannot change Parameter 282 (U_MIN) while the controller is running. You have to stop the controller, change U_MIN, and restart. ***

Appendix E - Pump 2 Main Drive Checklist

CONTROL CONSOLE TO VFD-701A WIRING CHECK LIST			
FROM	TO	VIA	
DM4 P9-2	VFD TB X9-552 (AMPS)	TB2-17, RED, J/P156-2B, P/J156-11B, JB-156-01 TB1-17, RED	✓
DM4 P9-3	VFD TB X9-550 (COM)	TB2-16, BLK, J/P156-2A, P/J156-11A, JB 156-01 TB1-16, BLK	✓
DM5 P9-2	VFD TB X9-551 (VOLTS)	TB2-20, RED, J/P156-2E, P/J156-11E, JB156-01 TB1-20, RED	✓
DM5 P9-3	VFD TB X9-550 (COM)	TB2-19, BLK, J/P156-2D, P/J156-11D, JB156-01 TB1-19, BLK	✓
DM6 P9-2	VFD TB X9-553 (FREQ)	TB2-23, RED, J/P156-2H, P/J156-11H, JB156-01 TB1-23, RED	✓
DM6 P9-3	VFD TB X9-550 (COM)	TB2-22, BLK, J/P156-2G, P/J156-11G, JB156-01 TB1-22, BLK	✓
METER WIRING SHIELDS NC AT METERS	VFD TB X9-157 (SHIELDS)	TB2-18, 21, 24; J/P156-2C, F, J; P/J156-11C, F, J; JB156-01 TB1-18, 21, 24; DRAIN WIRES	✓
DS2-1 (PUMP FAULT)	VFD TB X7-F1	TB3-17, 1 BLK, J/P156-3A, P/J156-12A, JB156-01 TB1-1, 1 BLK	✓
DS2-2	VFD PACS X8-20	TB3-18, 1 RED, J/P156-3B, P/J156-12B, JB156-01 TB1-2, 1 RED	✓
DS1-1 (PUMP RUNNING)	VFD PACS X8-28	TB3-19, 2 BLK, J/P156-3C, P/J156-12C, JB156-01 TB1-3, 2 BLK	✓
DS1-2	VFD PACS X8-20	TB3-20, 2 RED, J/P156-3D, P/J156-12D, JB156-01 TB1-4, 2 RED	✓
DS1-1, DS2-1	WT-156-01 B00, B01	(RS-485 INTERFACE)	✓
WT-156-01 DATA, DATA*	PC-1 RS-485 PORT TX/RX*, TX/RX*	TB3-2, TB3-1	✓
S2-1 (STOP)	VFD PACS X8-23	TB3-21, 3 BLK, J/P156-3E, P/J156-12E, JB156-01 TB1-5, 3 BLK	✓
S2-2	VFD PACS X8-24	TB3-22, 3 RED, J/P156-3F, P/J156-12F, JB156-01 TB1-6, 3 RED	✓
S1-1 (START)	VFD PACS X8-29 (JUMPER TO PACS X8-25)	TB3-23, 4 BLK, J/P156-3G, P/J156-12G, JB156-01 TB1-7, 4 BLK	✓
S1-2	VFD PACS X8-23	TB3-24, 4 RED, J/P156-3H, P/J156-12H, JB156-01 TB1-8, 4 RED	✓
ES1-1 (EMERG. STOP)	VFD AUX TERM STRIP - 904	TB5-1, 5 BLK, J/P156-3J, P/J156-12J, JB156-01 TB1-9, 5 BLK	✓
ES1-2	VFD AUX TERM STRIP - 22	TB5-2, 5 RED, J/P156-3K, P/J156-12K, JB156-01 TB1-10, 5 RED	✓
SPARE	SPARE	TB5-3, 6 BLK, J/P156-3L, P/J156-12L, JB156-01 TB1-11, 6 BLK	✓
SPARE	SPARE	TB5-4, 6 RED, J/P156-3M, P/J156-12M, JB156-01 TB1-12, 6 RED	✓
SHIELD FOR RED, BLK 1-6	SHIELD	TB5-5, DRAIN, J/P156-3N, P/J156-12N, JB156-01 TB1-13, DRAIN	✓

REFERENCES: H-7898B SHT 8, 78983 SHT 1-4, 78981 SHT 3, VENDOR DATA

PERFORMED BY

DATE(S)

11/6/96

Table 2-1. VGI Motor and Line Voltage Data and Volts/Hz Parameter Quick Setup List.

Parameter Number	Password Required: C = customer S = service	Parameter Name	Description	Initial Factory Setting for 460 VAC Controller	Set to equal	Check-list ☒	
274	C or S	F_MAX	maximum output frequency at 100% reference * 10	600	610 for 60 Hz	✓	SET @ 620
275	C or S	MOTOR_I	sum of all motor nameplate currents FLA * 10	See Note (1)	FLA * 10	✓	SET @ 3640
300	C or S	U_LINE	input AC line voltage	460	380 or 460	✓	SET @ 460
277	C or S	MOTOR_U	motor nameplate voltage (VAC)	460	380 or 460	✓	SET @ 460
278	C or S	F1	frequency at the end when boosted voltage returns to a constant v/Hz curve	200	freq. at end of voltage boost * 10	✓	SET @ 200
281	C or S	F3	motor nameplate frequency * 10	600	60 Hz * 10	✓	SET @ 610
279	C or S	F2	motor nameplate nominal frequency * 10	600	60 Hz * 10	✓	SET @ 600
282	C or S	U_MIN	voltage boost at zero frequency Note: This value is usually set = 0 for constant torque applications. U_MIN is also used in the tuning procedure.	0	0 = 0 V 1 = 1V, etc.	✓	SET @ 0
284	C or S	U3	maximum output voltage when F3 is reached (VAC)	460	380 or 460 (U2 + 1)	✓	SET @ 460
283	C or S	U2	nominal motor voltage minus 1 (VAC)	459	459 or 379	✓	SET @ 459
295	C or S	UDC1	DC Bus voltage at which current limit starts to be reduced: (1.56 * U_LINE)	717	U_LINE = 460 = 717 U_LINE = 380 = 592	✓	SET @ 717
296	C or S	UDC2	DC bus voltage at which current limit is reduced to zero (UDC_TRIP-30)	770	800 - 30 = 770	✓	SET @ 770
299	S only	UDC_TRIP	High DC bus IET trip voltage **Do not exceed 300V**	300	300	✓	SET @ 300
335	C or S	U_MODE	Sets either the constant or variable torque load characteristics.	0	1 = squared (pumps and fans) 0 = linear	✓	SET @ 0

- (1) 1800 for 150HP rating
2400 for 200HP rating
3000 for 250HP rating
3600 for 300 HP rating
4200 for 350HP rating
4800 for 400HP rating

d. Recheck that all parameters in Table 2-1 have been entered correctly. If you need all parameters values permanently stored, check that each parameter shows an "=" sign next to the parameter value. If it does not - (a slash mark "/" is displayed instead), re-enter the value and press the F1 key.

② SET POINTER PARAMETER 499 TO A VALUE OF 512 TO PREVENT REVERSE ROTATION SELECTION OF KEYPAD.

2-2

③ FINAL ADJUSTMENT TO REGISTER 368 TO A VALUE OF 2458 TO SET MIN. SPEED FOR 712 rpm (26 Hz.)

Table 3-1. VGI Application Specific Parameter Settings.

Parameter Number	Password Required: C = customer S = service	Parameter Name	Description	Initial Factory Setting	Min Setting	Max Setting	Check- list ☒	
Current Limit Parameters - See section on "Choosing Torque Limit"								
153	C or S	MAX_MOT_	Maximum motoring torque limit. If the motor and drive HP are not equal, this should be calculated. 4096 = PU_MAX_1 / 10	4096	0	4096	✓	SET @ 4096
154	C or S	MAX_REG_	Maximum regenerative torque limit. If the motor and drive HP are not equal, this should be calculated. 4096 = PU_MAX_1 / 10	4096	0	4096	✓	SET @ 4096
Motor Pot Acceleration and Deceleration Parameters								
165	C or S	MCPACC	Motor Pot acceleration time from zero or minimum speed to maximum speed. MCP (sec) = seconds * 10	100	10	32767	✓	200
166	C or S	MCPDEC	Motor Pot deceleration time from maximum speed to zero or minimum speed. MCP (sec) = seconds * 10	100	10	32767	✓	200
Remote Reference Acceleration and Deceleration Parameters								
172	C or S	R_ACC_TM	Run reference acceleration time. accel = seconds * 10	100	10	32767	✓	SET @ 200
173	C or S	R_DEC_TM	Run reference deceleration time. decel = seconds * 10	100	10	32767	✓	SET @ 200
Slip Compensation Parameter								
185	C or S	SLIP_	Calculate slip according to motor nameplate information: SLIP_ = 1 - Vnom * 4096 / Nsynch 40 = 1% slip compensation	0	0	400	✓	0
Avoidance Frequency Parameters - See section on "Setting to Avoidance Frequencies"								
138	C or S	AVF_FREQ_1	Avoidance frequency 1. Frequency is avoided when bandwidth 1 is specified.	0	0	F_MAX	✓	0
139	C or S	AVF_BAND_1	Avoidance bandwidth 1.	0	0	50	✓	0
140	C or S	AVF_FREQ_2	Avoidance frequency 2. Frequency is avoided when bandwidth 2 is specified.	0	0	F_MAX	✓	0
141	C or S	AVF_BAND_2	Avoidance bandwidth 2.	0	0	50	✓	0
142	C or S	AVF_FREQ_3	Avoidance frequency 3. Frequency is avoided when bandwidth 3 is specified.	0	0	F_MAX	✓	0
143	C or S	AVF_BAND_3	Avoidance bandwidth 3.	0	0	50	✓	0
DC Brake Parameters								
430	C or S	DCB_FLM	After a stop command in run mode, the motor frequency falls below this frequency, and the DC brake is applied. If DCB_FLM = 0, no DC brake is applied. 100 = 10 Hz	0	0	100	✓	0
431	C or S	DCB_TIME	Length of time DC brake is to be activated. 100 = 10 Hz	0	0	100	✓	0
432	C or S	DCB_	Current supplied during DC braking. 100 = 10A	0	0	0.3 * PU_MAX_1	✓	0

Table 3-1. VGI Application Specific Parameter Settings. (Continued)

Parameter Number	Password Required: S = customer S = service	Parameter Name	Description	Initial Factory Setting	Min Setting	Max Setting	Check-list	
Tuning Parameters								
103	C or S: Monitor Only	COS_FIP	Voltage and current feedback. At minimum speeds, value should be between +/- 150.	N/A	---	---	✓	N/A
182	C or S	U_MIN	Voltage boost when frequency = 0. Increase for high initial breakaway torque. See also 348, UFI_GAIN.	0	0	50	✓	set @ 0
316	C or S	OVER_SF1	Overfrequency limit: 3192=100Hz; if sensor frequency exceeds this value, inverter will trip on SET.	5407=66 Hz 600=90 Hz	0	32767 1200	✓	set @ 850
336	C or S	RES_1	Used to adjust the power factor of COS_FIP. Higher values decrease COS_FIP. The biggest effect is at low frequencies without load. This should be near zero.	30	-	-096	✓	set @ 123
348	C or S	UFI_GAIN	Load dependent voltage boost. For applications with sudden load changes, set value up to 6000. A value too high can cause a current limit condition. 323 = 1% of maximum voltage	2000	0	3000	✓	2000
351	C or S	SPG_GAIN	Current stability for regenerative modes only. If current reference (Parameter 69, IS_REF) is oscillating +/- 30%, increase SPG_GAIN to stabilize. 3192 = gain of 1	2000	0	30000	✓	2000
354	C or S	DELTA_ADD	Set to 0. Increase in increments of 1 if switching frequency errors occur at low speed. (Parameter 25, CORE_CODE = 231.)	0	---	---	✓	0
356	C or S	F_STAB	Frequency stabilization proportional to motor slip. 450 = 1.7% slip Ex: For 2% slip: 450/2.7*2 = 330	450	0	2000	✓	450
357	C or S	SYN_STAB	For synchronous motors only. This increases current and speed stability.	0	0	30000	✓	0
359	C or S	SINGLE_HYS	Voltage percentage where BETA = DELTA. Reduce when Parameter 25, (CORE_CODE) = 231.	3276	2048	16000	✓	3276
383	C or S	U_KP	Voltage regulator proportional gain.	30	1	10000	✓	set @ 250
Catching Circuit Parameters								
393	C or S	FIND_MODE	Defines how the controller will search for the motor frequency after a line dip or a start command. Line dips will always start at the last frequency setpoint running at > 20Hz. -1 = no catching circuit function 0 = catching circuit function starts after a line dip. 1 and 3 = search starts in a positive reference direction. 2 and 4 = search starts in a negative reference direction (if running in reverse direction.)	-1	---	---	✓	-1
394	C or S	FIND_TIME	The amount of time the controller will cover a 50 Hz span once the FIND_MODE has started. Set to equal 1/2 of decel time. 2000 = 2 sec. If FIND_TIME is reduced, increase FIND_I_FA.	2000	500	3000	✓	2000
395	C or S	FIND_I_FA	The amount of current fed to the motor during FIND_TIME. If bus overvoltage trip, decrease value. 1024 = Motor current.	512	341	1024	✓	512

Table 3-1. VCI Application Specific Parameter Settings. (Continued)

Parameter Number	Parameter Name	Description	Initial Setting	Min Setting	Max Setting	Check
197	AF_ACC_TM	Ramp time for frequency change after synchronization. (Acceleration 0 to F_MAX). 100= 10s	100	10	10000	☒
175	RAMPTP_EN	Coast stop (immediate) or ramp to rest stop. 0 = coast stop 1 = ramp to rest	1	00	00	☒

4. Calculating Torque Limits. If the drive and the motor are not matched in HP ratings, or if there are multiple motors, the torque limits must be calculated.

Example Calculation:

VCI controller is rated at 20 HP.
Motor FLA (from nameplate) = 14 A.
Parameter 305 (P_V_MAX_I) = 400. (The maximum output of the controller is 40 amps).
Motor overcurrent limit = 150%, or $14 \times 1.5 = 21$ amps
In this case, the controller's output current (40 amps) can be greater than the motor's rated current (21 amps).
The maximum torque limits for parameters 263 (MAX_MOT_CL), and 264 (MAX_REG_CL) is 4096. You need to calculate a new number for the torque limits for parameters 263 (MAX_MOT_CL), and 264 (MAX_REG_CL) using the following equation:

$$\text{Max. Controller Output (Amps)} = \frac{4096}{x} = \frac{40}{21}$$

$x = 2150$

Enter 2150 into parameters 263 and 264 to limit the output of the controller to 21 amps.
For multiple motors: Use the sum of the full load motor amps of the motors.

5. Tuning

Note: It is recommended that this tuning procedure be performed with an unloaded motor. If the motor cannot be unloaded, Parameter 282 (U_MIN) might have to be increased significantly to boost the starting torque.
Note: The motor will have to be warm to perform this tuning procedure correctly. It could take 1-2 hours to warm the motor field properly. Perform Step a before continuing with the rest of the tuning procedure.
a. Run the motor, unloaded at 10 Hz. Perform the following steps:
1. Monitor the OUP AVPS using the display mode on the keypad
Note: You cannot change Parameter 282 (U_MIN) while the controller is running. You have to stop the controller, change U_MIN, and restart.

Appendix F - Pressure Switch Checklist

COLUMN WATER PRESSURE SWITCHES WIRING CHECK LIST			
FROM	TO	VIA	
PSL-750 C, WE, NC, NONE	JB801-01 TB1-1, -2, -3, -4	P270, W/R 532 RED, WHT, BLK, SHLD	
PSL-751 C, NC, NO, NONE	JB801-01 TB1-5, -6, -7, -8	P271, W/R 533 RED, WHT, BLK, SHLD	
PD15-750 C, NC, NO, NONE	JB801-01 TB1-9, -10, -11, -12	P272 W/R 534 RED, WHT, BLK, SHLD	
JB801-01 TB1-1, -2, -3, -4	JB801-02 TB1-1, -2, -3, -4	P269 W/R 531 1-BLK, WHT, RED, SHLD	
JB801-01 TB1-5, -6, -7, -8	JB801-02 TB1-13, -14, -15, -16	P269 W/R 531 2-BLK, WHT, RED, SHLD	
JB801-01 TB1-9, -10, -11, -12	JB801-02 TB1-1, -2, -3, -4	P269 W/R 531 3-BLK, WHT, RED, SHLD	
JB801-02 TB1-1, -2, -3, -4	JB101-100 TB4-9, -10, -11, -12	P210 W/R 530 1-BLK, WHT, RED, SHLD	
JB801-02 TB1-13, -14, -15, -16	JB101-100 TB4-13, -14, -15, -16	P210 W/R 530 4-BLK, WHT, RED, SHLD	
JB801-02 TB2-1, -2, -3, -4	JB101-100 TB4-17, -18, -19, -20	P210 W/R 530 7-BLK, WHT, RED, SHLD	
JB101-100 TB4-9, -10, -11, -12	JB156-01 TB3-13, -14, -15, -16	P206,261,301 W/R 504 10-BLK,WHT,RED,SHLD	
JB101-100 TB4-13, -14, -15, -16	JB156-01 TB3-17, -18, -19, -20	P206,261,301 W/R 504 11-BLK,WHT,RED,SHLD	
JB101-100 TB4-17, -18, -19, -20	JB156-01 TB3-21, -22, -23, -24	P206,261,301 W/R 504 12-BLK,WHT,RED,SHLD	
JB156-01 TB3-13, -14, -15, -16	CONTROL CONSOLE TB5-13, 14, 15, 16	J/P156-10 A,B,C,D BLK, RED, CLR, SHLD, P/J156-1 A,B,C,D BLK, WHT, RED, SHLD	
JB156-01 TB3-17, -18, -19, -20	CONTROL CONSOLE TB5-17, 18, 19, 20	J/P156-10 E,F,G,H BLK, RED, CLR, SHLD, P/J156-1 E,F,G,H BLK, WHT, RED, SHLD	
JB156-01 TB3-21, -22, -23, -24	CONTROL CONSOLE TB5-21, 22, 23, 24	J/P156-10 J,K,L,M BLK, RED, CLR, SHLD, P/J156-1 J,K,L,M BLK, WHT, RED, SHLD	
CONTROL CONSOLE TB5-13, -14, -15, -16	PS-1*, DS7-1, DS8-1, NONE	JMPR, BLK, RED, SHLD	
CONTROL CONSOLE TB5-17, -18, -19, -20	PS-1*, DS9-1, DS10-1, NONE	JMPR, BLK, RED, SHLD	
CONTROL CONSOLE TB5-21, -22, -23, -24	PS-1*, DS5-1, DS6-1, NONE	JMPR, BLK, RED, SHLD	
DS7-1, DS8-1	WT-156-01-B06, -B07	(RS-485 INTERFACE)	
DS9-1, DS10-1	WT-156-01-B08, -B09	(RS-485 INTERFACE)	
DS5-1, DS6-1	WT-156-01-B04, -B05	(RS-485 INTERFACE)	
WT-156-01 DATA, DATA*	PC-1 RS485 PORT TX/RX*, TX/RX-	TB3-2, -1	

REFERENCES H-2-78986 SHT 3, 78987 SHT 3, 78948 SHT 4, 10, 78983 SHT3, 4

PERFORMED BY W/A DATE(S) _____

NOT USED. 8.5.2 SAYS TO USE ONLY IF PROBLEMS ARE ENCOUNTERED.

Appendix G - VibraSwitch Checklist

page 1 of 2

PUMP #1 (P-702A) VIBRASWITCH WIRING CHECK LIST			
FROM	TO	VIA	✓
P1-VIB-1 UPPER NO, COM, NC	RTD JBOX TERMINALS 14, 15, 16	P334 W/R 561 BLK, CLR, RED	
P1-VIB-2 LOWER NO, COM, NC	RTD JBOX TERMINALS 32, 33, 34	P331 W/R 562 BLK, CLR, RED	
RTD JBOX TERMINALS 14, 15, 16	JB101-101 TB4- 1, 2, 3, 4	P333 P332 W/R 560 3-BLK,WHT,RED,SHLD	
RTD JBOX TERMINALS 32, 33, 34	JB101-101 TB4- 5, 6, 7, 8	P333 P332 W/R 560 4-BLK,WHT,RED,SHLD	
JB101-101 TB4- 1, 2, 3, 4	JB101-100 TB4- 1, 2, 3, 4	P215 W/R 528 1-BLK,WHT,RED,SHLD	
JB101-101 TB4- 5, 6, 7, 8	JB101-100 TB4- 5, 6, 7, 8	P215 W/R 528 2-BLK,WHT,RED,SHLD	
JB101-100 TB4- 1, 2, 3, 4	JB156-01 TB3- 5, 6, 7, 8	P256,251,301 W/R 504 2-BLK,WHT,RED,SHLD	
JB101-100 TB4- 5, 6, 7, 8	JB156-01 TB3- 9, 10, 11, 12	P256,251,301 W/R 504 3-BLK,WHT,RED,SHLD	
JB156-01 TB3- 5, 6, 7, 8	CONTROL CONSOLE TB9-17, 18, 19, 20	P/J156-10,-1;R,S,T,U BLK, CLR, RED, SHLD	
JB156-01 TB3- 9, 10, 11, 12	CONTROL CONSOLE TB9-21, 22, 23, 24	P/J156-10,-1;V,W,X,Y BLK, CLR, RED, SHLD	
TB9-17, 18	DS13-1, PS-1+ (24VDC)	(DS13-2 TO PS-1-)	
TB9-21, 22	DS14-1, PS-1+ (24VDC)	(DS14-2 TO PS-1-)	
DS13-1	WT-156-01-B0C		
DS14-1	WT-156-01-B0D		
WT-156-01 DATA, DATA*	PC-1 RS-485 PORT TX/RX+, TX/RX-	TB3-2, 1	

REFERENCES H-2-78948 SHT 7, 78975 SHT 3&4, 78981 SHT 3, 78983 SHT 1,3,4

PERFORMED BY N/A DATE(S) _____

NOT USED. 8.6.2 SAYS TO USE ONLY IF PROBLEMS
ARE ENCOUNTERED.

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Appendix G - VibraSwitch Checklist

page 2 of 2

PUMP #2 (P-701A) VIBRASWITCH WIRING CHECK LIST			
FROM	TO	VIA	✓
P2-VIB-1 UPPER NO, COM, NC	RTD JBOX TERMINALS 14, 15, 16	P330 W/R 566 BLK, CLR, RED	
P2-VIB-2 LOWER NO, COM, NC	RTD JBOX TERMINALS 32, 33, 34	P335 W/R 567 BLK, CLR, RED	
RTD JBOX TERMINALS 14, 15, 16	JB101-100 TB5- 21, 22, 23, 24	P329 P328 W/R 565 3-BLK,WHT,RED,SHLD	
RTD JBOX TERMINALS 32, 33, 34	JB101-100 TB5- 17, 18, 19, 20	P329 P328 W/R 565 4-BLK,WHT,RED,SHLD	
JB101-100 TB4- 21, 22, 23, 24	JB156-01 TB4- 21, 22, 23, 24	P256,251,301 W/R 504 9-BLK,WHT,RED,SHLD	
JB101-100 TB4- 17, 18, 19, 20	JB156-01 TB4- 17, 18, 19, 20	P256,251,301 W/R 504 8-BLK,WHT,RED,SHLD	
JB156-01 TB3- 21, 22, 23, 24	CONTROL CONSOLE TB4-17, 18, 19, 20	P/J156-10,-1;d,e,f,g BLK, CLR, RED, SHLD	
JB156-01 TB3- 17, 18, 19, 20	CONTROL CONSOLE TB4-21, 22, 23, 24	P/J156-10,-1;Z,a,b,c BLK, CLR, RED, SHLD	
TB4-17, 18	DS11-1, PS-1+ (24VDC)	(DS11-2 TO PS-1-)	
TB4-21, 22	DS12-1, PS-1+ (24VDC)	(DS12-2 TO PS-1-)	
DS11-1	WT-156-01-B0A		
DS12-1	WT-156-01-B0B		
WT-156-01 DATA, DATA*	PC-1 RS-485 PORT TX/RX+, TX/RX-	TB3-2, 1	

REFERENCES H-2-78948 SHT 7, 78975 SHT 3, 78981 SHT 3, 78983 SHT 1,3,4PERFORMED BY N/A DATE(S) _____

Appendix H - Control Console Checklist

RS-485 PUMP PADS TO PC-1 WIRING CHECK LIST			
FROM	TO	VIA	✓
TX/RX+, TX/RX-, COM JB100-101 TB2-12, 9, 7	JB100-100 TB2-15, 12, 10	P215 / W/R 525 RED, WHT, GRN	✓
TX/RX+, TX/RX-, COM, SHLD -- JB100-100 TB-15, 12, 10, 16	JB156-01 (156 BLDG) TB3-1, 2, 3, 4	P206, 261, 301 / WR504 1-RED, BLK, WHT, SHLD	✓
JB156-01 TB3-1, 2, 3, 4	CONTROL CONSOLE TB3-13, 14, 15, 16	P/J156-10 N,O,P,Q; P/J156-1 N,O,P,Q; BLK, RED, CLR, SHLD	✓
TB3-13, 14, 15, 16		JUMPERS	✓
TB3-1, 2, 3	PC RS485 PORT 1 TX/RX+, TX/RX-, COM	BLK, RED, SHLD TO PINS 1&4, 2&3, 5	✓

REFERENCES H-2-78975 SHT 3-4, H-2-78981 SHT 3, H-2-78983 SHT 3-4, H-2-78948 SHT 2, 3, AND 10, AND VENDOR DATA

PERFORMED BY

John Deiner

DATE(S)

1/7/97

Appendix I - Motor Bearing Temp Checklist

page 1 of 2

PUMP #1 (P-702A) MOTOR BEARING TEMPERATURE WIRING CHECK LIST			
FROM	TO	VIA	✓
LOWER BEARING RTD RED, BLK, WHT	RTD JBOX TERMINALS 10, 11, 12		✓
UPPER BEARING RTD RED, BLK, WHT	RTD JBOX TERMINALS 28, 29, 30		✓
RTD JBOX TERMINALS 10, 11, 12	JB101-101 WT-101-19 +SENSE/+I, -SENSE, -I	P333, P332, W/R 560 1-RED, 1-BLK, 1-WHT	✓
RTD JBOX TERMINALS 28, 29, 30	JB101-101 WT-101-20 +SENSE/+I, -SENSE, -I	P333, P332, W/R 560 2-RED, 2-BLK, 2-WHT	✓
WT-101-19 DATA, DATA*, GND	TB2-12, 9, 7 TXRX+, TXRX-, GND	RED, WHT, GRN	✓
WT-101-20 DATA, DATA*, GND	TB2-12, 9, 7 TXRX+, TXRX-, GND	RED, WHT, GRN	✓

REFERENCES H-2-78948 SHT 7, H-2-78975 SHT 4

PERFORMED BY John Dumer DATE(S) 1/7/97

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Appendix I - Motor Bearing Temp Checklist

page 2 of 2

PUMP #2 (P-701A) MOTOR BEARING TEMPERATURE WIRING CHECK LIST			
FROM	TO	VIA	✓
LOWER BEARING RTD RED, BLK, WHT	RTD JBOX TERMINALS 10, 11, 12		✓
UPPER BEARING RTD RED, BLK, WHT	RTD JBOX TERMINALS 28, 29, 30		✓
RTD JBOX TERMINALS 10, 11, 12	JB101-100 WT-101-17 +SENSE/+I, -SENSE, -I	P329, P328, W/R 565 1-RED, 1-BLK, 1-WHT	✓
RTD JBOX TERMINALS 28, 29, 30	JB101-100 WT-101-18 +SENSE/+I, -SENSE, -I	P329, P328, W/R 565 2-RED, 2-BLK, 2-WHT	✓
WT-101-17 DATA, DATA*, GND	TB2-15, 12, 10 TXRX+, TXRX-, GND	RED, WHT, GRN	✓
WT-101-18 DATA, DATA*, GND	TB2-15, 12, 10 TXRX+, TXRX-, GND	RED, WHT, GRN	✓

REFERENCES H-2-78948 SHT 7. H-2-78975 SHT 3

PERFORMED BY

John Deiner

DATE(S)

1/7/97

Appendix J - Strain Gage Checklist

page 1 of 2

PROBE 15E STRAIN GAUGE WIRING CHECK LIST			
FROM	TO	VIA	✓
WE-701A (-3 FT +60°) BLK, YEL, BRN	TB3-2, 3, 4	STRAIN GAUGE LEADS	
WE-702A (-20 FT +45°) BLK, YEL, BRN	TB3-9, 10, 11	STRAIN GAUGE LEADS	
WE-703A (-32 FT +30°) BLK, YEL, BRN	TB3-16, 17, 18	STRAIN GAUGE LEADS	
WE-704A (-3 FT -60°) BLK, YEL, BRN	TB2-2, 3, 4	STRAIN GAUGE LEADS	
WE-705A (-20 FT -45°) BLK, YEL, BRN	TB2-9, 10, 11	STRAIN GAUGE LEADS	
WE-706A (-32 FT -30°) BLK, YEL, BRN	TB2-16, 17, 18	STRAIN GAUGE LEADS	
TB3-2, 4, 5, 6	WT-101-1 (A) +IN, -EXC, +EXC, -IN	RED, ORN, BRN, WHT	
TB3-9, 11, 12, 13	WT-101-2 (A) +IN, -EXC, +EXC, -IN	RED, ORN, BRN, WHT	
TB3-16, 18, 19, 20	WT-101-3 (A) +IN, -EXC, +EXC, -IN	RED, ORN, BRN, WHT	
TB2-2, 4, 5, 6	WT-101-4 (A) +IN, -EXC, +EXC, -IN	RED, ORN, BRN, WHT	
TB2-9, 11, 12, 13	WT-101-5 (A) +IN, -EXC, +EXC, -IN	RED, ORN, BRN, WHT	
TB2-16, 18, 19, 20	WT-101-6 (A) +IN, -EXC, +EXC, -IN	RED, ORN, BRN, WHT	
WT-101-1 THRU 6 DATA, DATA*, +VS, GND	TB1-1, 4, 7, 8 TXRX+, TXRX-, +24, GND	YEL, GRN, BLU, BLK	
TB1-1, 8, 4, 8, 7, 8	JB101-101 TB2- 12, 13, 9, 10, 15, 16	W/R 526 RED/BLK, WHT/BLK, BLK/GRN	

REFERENCES H-2-78977 SHT 3, H-2-78975 SHT 4, H-2-78948 SHT 2, VENDOR DATA

PERFORMED BY _____ DATE(S) _____

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Appendix J - Strain Gage Checklist

page 2 of 2

PROBE 15F STRAIN GAUGE WIRING CHECK LIST			
FROM	TO	VIA	✓
WE-707A (-3 FT +60°) BLK, YEL, BRN	TB3-2, 3, 4	STRAIN GAUGE LEADS	
WE-708A (-20 FT +45°) BLK, YEL, BRN	TB3-9, 10, 11	STRAIN GAUGE LEADS	
WE-709A (-32 FT +30°) BLK, YEL, BRN	TB3-16, 17, 18	STRAIN GAUGE LEADS	
WE-710A (-3 FT -60°) BLK, YEL, BRN	TB2-2, 3, 4	STRAIN GAUGE LEADS	
WE-711A (-20 FT -45°) BLK, YEL, BRN	TB2-9, 10, 11	STRAIN GAUGE LEADS	
WE-712A (-32 FT -30°) BLK, YEL, BRN	TB2-16, 17, 18	STRAIN GAUGE LEADS	
TB3-2, 4, 5, 6	WT-101-1 (A) +IN, -EXC, +EXC, -IN	RED, ORN, BRN, WHT	
TB3-9, 11, 12, 13	WT-101-2 (A) +IN, -EXC, +EXC, -IN	RED, ORN, BRN, WHT	
TB3-16, 18, 19, 20	WT-101-3 (A) +IN, -EXC, +EXC, -IN	RED, ORN, BRN, WHT	
TB2-2, 4, 5, 6	WT-101-4 (A) +IN, -EXC, +EXC, -IN	RED, ORN, BRN, WHT	
TB2-9, 11, 12, 13	WT-101-5 (A) +IN, -EXC, +EXC, -IN	RED, ORN, BRN, WHT	
TB2-16, 18, 19, 20	WT-101-6 (A) +IN, -EXC, +EXC, -IN	RED, ORN, BRN, WHT	
WT-101-1 THRU 6 DATA, DATA*, +VS, GND	TB1-1, 4, 7, 8 TXRX+, TXRX-, +24, GND	YEL, GRN, BLU, BLK	
TB1-1, 8, 4, 8, 7, 8	JB101-101 TB2- 12, 13, 9, 10, 18, 19	W/R 529 RED/BLK, WHT/BLK, BLK/GRN	

REFERENCES H-2-78978 SHT 3, H-2-78975 SHT 4, H-2-78948 SHT 2, VENDOR DATA

PERFORMED BY _____ DATE(S) _____

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Appendix K - Sludge Mobilization Cart Checklist

page 1 of 2

SLUDGE MOBILIZATION GAMMA DATA WIRING CHECK LIST - CART #1 (#2)			
FROM	TO	VIA	✓
AMPLIFIER DEAD TIME	DST-001 ANALOG IN ADDRESS ()	COAX CABLE	
COUNT RATEMETER	DST-002 ANALOG IN ADDRESS ()	COAX CABLE	
MT-001 TBC-8,9,3 ADDRESS ()	TX/RX+, TX/RX-, COMM	RS-485 BUS	
DST-001 DATA, DATA*, +VS, GND	TX/RX+, TX/RX-, +VS, COMM	RS-485 BUS	
DST-002 DATA, DATA*, +VS, GND	TX/RX+, TX/RX-, +VS, COMM	RS-485 BUS	
TX/RX+, TX/RX-, +VS, COMM	TB2-1, 2, 3, 4	RS485 BUS	
TB2-1, 2, 3, 4	J2-A, B, C, D	JUMPERS	
J2-A, B, C, D	JB100-100 OR -101 J1-A, B, C, D	UMBILICAL CABLE	
JB100-100 OR -101 J1-A, B, C, D	TB2-15, 12, 17, 16		

REFERENCES H-2-79233 SHT 1-2, H-2-78944, H-2-78975 SHT 3-4, VENDOR DATA

PERFORMED BY _____ DATE(S) _____

Appendix L - Instrument Check List

INSTR. TYPE & IDENT.	NOMINAL INPUT	ACTUAL INPUT	NOMINAL RESPONSE	ACTUAL RESPONSE	✓
NEWPORT - DM2 PUMP ORIENT Pump 1	-5.00VDC 0.00VDC +5.00VDC		-90.0 0.0 +90.0		
NEWPORT - DM2 PUMP ORIENT Pump 2	-5.00VDC 0.00VDC +5.00VDC		-90.0 0.0 +90.0		
NEWPORT - DM4 PUMP 1 AMPS	0.00VDC 10.00VDC		0.0 365.0		
NEWPORT - DM5 PUMP 1 VOLTS	0.00VDC 10.00VDC		0.0 480.0		
NEWPORT - DM6 PUMP 1 FREQ.	0.00VDC 10.00VDC		0.0-60.0 OR 0.0-1180.0		
NEWPORT - DM10 PUMP 1 AMPS	0.00VDC 10.00VDC		0.0 365.0		
NEWPORT - DM11 PUMP 1 VOLTS	0.00VDC 10.00VDC		0.0 480.0		
NEWPORT - DM12 PUMP 1 FREQ.	0.00VDC 10.00VDC		0.0-60.0 OR 0.0-1180.0		
OMEGA 1412 WT-101-17 PMP 2 BOT BRG	100.00 OHM 138.50 OHM 146.06 OHM 149.82 OHM		0C (32F) 100C (212F) 120C (248F) 130C (266F)		
OMEGA 1412 WT-101-18 PMP 2 TOP BRG	100.00 OHM 138.50 OHM 146.06 OHM 149.82 OHM		0C (32F) 100C (212F) 120C (248F) 130C (266F)		
OMEGA 1412 WT-101-19 PMP 1 BOT BRG	100.00 OHM 138.50 OHM 146.06 OHM 149.82 OHM		0C (32F) 100C (212F) 120C (248F) 130C (266F)		
OMEGA 1412 WT-101-20 PMP 1 TOP BRG	100.00 OHM 138.50 OHM 146.06 OHM 149.82 OHM		0C (32F) 100C (212F) 120C (248F) 130C (266F)		
OMEGA 1142 WT-DST-001 CART 1 BUSY	0.3VDC 5.0VDC		0% 100% BUSY		

INSTR. TYPE & IDENT.	NOMINAL INPUT	ACTUAL INPUT	NOMINAL RESPONSE	ACTUAL RESPONSE	✓
OMEGA 1142 WT-DST-002 CART 1 COUNT	0.00VDC 10.00VDC		0 FULL SCALE		
RED LION LGD WT-MT-001 CART 1 FOOTAGE	RAISE & LOWER PROBE -- MEASURE POS.		SAME AS RED LION LGD & MEASURED		
OMEGA 1142 WT-DST-003 CART 2 BUSY	0.3VDC 5.0VDC		0% 100% BUSY		
OMEGA 1142 WT-DST-004 CART 2 COUNT	0.00VDC 10.00VDC		0 FULL SCALE		
RED LION LGD WT-MT-001 CART 2 FOOTAGE	RAISE & LOWER PROBE		SAME AS RED LION LGD DISPLAY		
STRAIN GAGES RISER 15E	SWITCH IN ≈350KΩ CAL RESISTOR		≈2.5mV, ≈500μe, ≈600lbf		
STRAIN GAGES RISER 15F	SWITCH IN ≈350KΩ CAL RESISTOR		≈2.5mV, ≈500μe, ≈600lbf		

REFERENCES _____

PERFORMED BY _____ DATE(S) _____

DISTRIBUTION SHEET

Page 1 of 1

To: Distribution

From: E. M. Nordquist

Date: 1/31/97

Project Title/Work Order:

Project W-151, Tank 101-AZ Waste Retrieval System
Checkout-Testing Report, HNF-SD-W151-TRP-003

EDT No.: 610579

ECN No.: N/A

Charge Code: D2D1A

Name	MSIN	With Attachment	EDT/ECN & Comment	EDT/ECN Only
E. F. Enloe	S2-56	X		
Central Files	A3-88	X		
Project Files	R1-29	X		