GRAND GULF NUCLEAR STATION
UNIT 1
STARTUP TEST REPORT

Test Number: 1C88-ST01 Test Condition: Preoperational through TC-6

Test Title: Special Test-Visual Steady-State Vibration Monitoring Program

Criteria

(X) Satisfied
( ) Level 1 Not Satisfied
( ) Level 2 Not Satisfied

Report Prepared By: _____ Date: 4-3-86
MP&L Test Supervisor/GE STD&A Engineer

Results Reviewed By: _____ Date: 4/29/86
MP&L Startup Test Group Leader

_____ Date: 6/13/86
MP&L Startup Supervisor

_____ Date: 4/13/86
GE Lead STD&A Engineer

Results Accepted By: _____ Date: 6-13-86
PSRC

VISUAL STEADY-STATE VIBRATION MONITORING PROGRAM
SPECIAL TEST PROCEDURE 1C88-ST01

1.0 PURPOSE

1.1 The objective of this procedure is to provide the means for formally documenting a visual pre-operational and operational vibration testing program. This program is concentrated on Non-NSSS safety related piping systems designated as Class 1, 2 or 3 under the ASME III Code and the supports and restraints for these systems.

2.2 The purpose of these tests was to visually confirm that these piping systems, restraints, components, and supports had been adequately designed to withstand flow induced dynamic loadings under the steady-state conditions anticipated during service. The testing was primarily conducted during system pre-operational testing to determine that the component vibrations were within acceptable limits. Additional testing on certain systems was conducted during the Power Ascension Test phase. This test, which consisted of visual walkdowns of the piping systems and vibration readings taken at selected points with a hand held vibragraph, was the first phase of pipe vibration testing. The second phase was conducted using remote displacement sensors and is described in test report 1C88-ST04.

2.0 CRITERIA

2.1 The measured operational steady-state piping vibrations shall be within the following limits:

1) 0.125 inch (peak to peak) for nuclear piping
2) 0.250 inch (peak to peak) for non-nuclear piping
3) less than the calculated displacement specified in Bechtel Specification 9645-M-275.0 for the locations given in that specification.

2.2 The measured dynamic effects vibration shall be within the following limits:

A. Dynamic movements measured during transient loading shall be within:

1) 0.125 inch (peak to peak) for nuclear piping
2) 0.250 inch (peak to peak) for non-nuclear piping
3) ±25 percent of the analytical value provided in the Bechtel Specification 9645-M-275.0

B. The total stress due to dynamic loading, plus all other combined stresses, shall not exceed ASME Section III or ANSI B31 allowable stresses as determined by Bechtel Project Engineering. (This request is conservatively met if the above displacement criteria are satisfied.)

NOTE: Table 2.1 contains a listing of preselected points for which specified criteria exists, along with the maximum displacements measured during this test.

TABLE 2.1
PRE-SELECTED POINTS WITH SPECIFIED CRITERIA

SENSOR NO.	EXPECTED (inches)	ACCEPTABLE (inches)	MAX. MEASURED (inches)
B33G02401VLY	.474	.664	<.001
2401VLL	.474	.664	<.001
E12G22501VVX	.224	.314	<.001
22502VVZ	.262	.367	<.001
22503VVY	.052	.073	<.001
22504VVZ	.008	.020	<.001
16301VVY	.060	.084	<.001
16302VVX	.032	.045	<.001
16401VVX	.758	1.061	<.001
1640ZVVZ	1.208	1.691	<.001
10101VVY	.216	.302	<.001
10102VVZ	.242	.339	<.001
15101VVY	.466	.652	<.001
15101VVZ	.466	.652	<.001
01201VLY	.012	.020	<.001
01201VLZ	.010	.020	.002*
01001VLX	.426	.596	.004
01001VLY	.010	.020	<.001
01001VVL	.141	.197	<.001
01001VVY	.058	.081	<.001
00701VVY	.018	.025	.009*
00801VVZ	.082	.115	.002*
E21G10701VVX	.548	.767	<.001
10702VVZ	.548	.767	<.001
10703VVZ	.174	.244	<.001
10301VVY	.600	.840	<.001
10302VVZ	.600	.840	<.001
00101VVZ	.016	.022	.006*
00102VVZ	.064	.090	.002*
E22G10101VVY	.204	.286	<.001
10102VVZ	.144	.202	<.001
11301VVX	.662	.927	<.001
11302VVY	.228	.319	<.001
11303VVY	.022	.031	<.001
10501VVY	.648	.907	<.001
10502VVX	.594	.832	<.001
00101VVY	.024	.034	.009*
00203VVY	.016	.022	.008*
E38G10301VVZ	.416	.582	Negligble
E51G00201VLX	.014	.020	.003
00202VLY	.030	.042	<.001
00101VLZ	.020	.028	<.001

TABLE 2.1
PRE-SELECTED POINTS WITH SPECIFIED CRITERIA

SENSOR NO.	EXPECTED (inches)	ACCEPTABLE (inches)	MAX. MEASURED (inches)
E61G00101VVZ	.098	.137	<.001
00102VVX	.146	.204	<.001
G41G01101VVZ	.016	.022	<.001
01102VVX	.004	.020	<.001
01102VVZ	.004	.020	<.001
N19G00101VLX	.536	.750	.005
00101VLY	.142	.199	.002
00201VLX	.052	.073	.006
00301VLX	.536	.750	.020
00301VLZ	.310	.434	.006
00401VLY	.156	.218	.002
00401VLZ	.460	.644	.004
P41G01001VVX	.004	.020	.002*
01001VVY	.004	.020	.006*

* Indicates maximum deflection occurred during pump start or stop transient.

3.0 PLANT CONDITIONS

3.1 FEEDWATER SYSTEM

3.1.1 Rated Feedwater Flow

Date: September 12, 1985
Core Thermal Power: 3786 MWt
Generator Output: 1195 MWe
A Reactor Feedpump Flow: 8.32 Mlb/hr
A Reactor Feedpump Suction Pressure: 472 Psig
A Reactor Feedpump Discharge Pressure: 1114 Psig
B Reactor Feedpump Flow: 8.35 Mlb/hr
B Reactor Feedpump Suction Pressure: 471 Psig
B Reactor Feedpump Discharge Pressure: 1115 Psig

3.2 RHR SYSTEM

3.2.1 Suppression Pool Cooling A

Date: August 28, 1981
RHR A Flow: 7600 GPM
RHR A Suction Pressure: 4.5 Psig
RHR A Discharge Pressure: 135 Psig

3.2.2 Suppression Pool Cooling B

Date: August 28, 1981
RHR B Flow: 7400 GPM
RHR B Suction Pressure: 4 Psig
RHR B Discharge Pressure: 140 Psig

3.2.3 Low Pressure Coolant Injection A

Date: August 28, 1981
RHR A Flow: 8000 GPM
RHR A Suction Pressure: 4.5 Psig
RHR A Discharge Pressure: 115 Psig

3.2.4 Low Pressure Coolant Injection B

Date: August 27, 1981
RHR B Flow: 7950 GPM
RHR B Suction Pressure: 3 Psig
RHR B Discharge Pressure: 110 Psig

3.2.5 Low Pressure Coolant Injection C

Date: August 28, 1981
RHR C Flow: 8050 GPM
RHR C Suction Pressure: 3 Psig
RHR C Discharge Pressure: 115 Psig

3.2.6 Shutdown Cooling A, Recirculation to Feedwater

Date: August 28, 1981
RHR A Flow: 7500 GPM
RHR A Suction Pressure: 40 Psig
RHR A Discharge Pressure: 180 Psig

3.2.7 Shutdown Cooling B, Recirculation to Feedwater

Date: September 1, 1981
RHR B Flow: 7400 GPM
RHR B Suction Pressure: 38 Psig
RHR B Discharge Pressure: 175 Psig

3.2.8 Shutdown Cooling A, Recirculation to LPCI Line

Date: August 28, 1981
RHR A Flow: 7500 GPM
RHR A Suction Pressure: 40 Psig
RHR A Discharge Pressure: 175 Psig

3.2.9 Shutdown Cooling B, Recirculation to LPCI Line

Date: August 28, 1981
RHR B Flow: 7500 GPM
RHR B Suction Pressure: 38 Psig
RHR B Discharge Pressure: 165 Psig

3.2.10 Test Return Line A

Date: September 9, 1981
RHR A Flow: 7500 GPM
RHR A Suction Pressure: 3 Psig
RHR A Discharge Pressure: 130 Psig

3.2.11 Test Return Line B

Date: September 9, 1981
RHR B Flow: 7450 GPM
RHR B Suction Pressure: 2 Psig
RHR B Discharge Pressure: 140 Psig

3.2.12 Test Return Line C

Date: September 8, 1981
RHR C Flow: 7550 GPM
RHR C Suction Pressure: 0 Psig
RHR C Discharge Pressure: 135 Psig

3.2.13 Minimum Flow Line A

Date: September 15, 1981
RHR A Flow: approximately 1000 GPM
RHR A Suction Pressure: 4 Psig
RHR A Discharge Pressure: 300 Psig

3.2.14 Minimum Flow Line B

Date: September 15, 1981
RHR B Flow: approximately 1000 GPM
RHR B Suction Pressure: 7.5 Psig
RHR B Discharge Pressure: 300 Psig

3.2.15 Minimum Flow Line C

Date: September 15, 1981
RHR C Flow: approximately 1000 GPM
RHR C Suction Pressure: 7 Psig
RHR C Discharge Pressure: 300 Psig

3.2.16 Spent Fuel Pool Cooling Assist A

Date: September 1, 1981
RHR A Flow: 7500 GPM
RHR A Suction Pressure: 49 Psig
RHR A Discharge Pressure: 170 Psig

3.2.17 Spent Fuel Pool Cooling Assist B

Date: September 3, 1981
RHR B Flow: 7600 GPM
RHR B Suction Pressure: 38 Psig
RHR B Discharge Pressure: 170 Psig

3.2.18 Modified Low Pressure Coolant Injection, Suction from Spent Fuel Pool

Date: August 31, 1981
RHR C Flow: 8400 GPM
RHR C Suction Pressure: 38 Psig
RHR C Discharge Pressure: 140 Psig

3.2.19 Head Spray

Date: September 11, 1982
RHR B Flow: 6100 GPM
Head Spray Flow: 900 GPM
RHR B Suction Pressure: 28 Psig
RHR B Discharge Pressure: 218 Psig

3.2.20 A Pump Start/Stop

Date: September 11, 1981
RHR A Flow: 7500 GPM
RHR A Suction Pressure: 4.5 Psig
RHR A Discharge Pressure: 135 Psig

3.2.21 B Pump Start/Stop

Date: September 11, 1981
RHR B Flow: 7450 GPM
RHR B Suction Pressure: 4.5 Psig
RHR B Discharge Pressure: 105 Psig

3.2.22 C Pump Start/Stop

Date: September 11, 1981
RHR C Flow: 7000 GPM
RHR C Suction Pressure: 0 Psig
RHR C Discharge Pressure: 150 Psig

3.3 HIGH PRESSURE CORE SPRAY SYSTEM

3.3.1 RPV Injection From Suppression Pool, Flow Orifice Resized (Third Run)

Date: May 15, 1981
HPCS Flow: 7700 GPM
HPCS Suction Pressure: 3.4 Psig
HPCS Discharge Pressure: 230 Psig

3.3.2 RPV Injection From Suppression Pool (First Run)

Date: May 10, 1981
HPCS Flow: 2600 GPM
HPCS Suction Pressure: 6 Psig
HPCS Discharge Pressure: 1175 Psig

3.3.3 RPV Injection From Suppression Pool (Second Run)

Date: May 12, 1981
HPCS Flow: 2900-7100 GPM
HPCS Suction Pressure: 7-4.8 Psig
HPCS Discharge Pressure: 450-1130 Psig

3.3.4 HPCS Test Return CST to CST

Date: May 13, 1981
HPCS Flow: 7500 GPM
HPCS Suction Pressure: 16.5 Psig
HPCS Discharge Pressure: 390 Psig

3.3.5 HPCS Test Return Suppression Pool to Suppression Pool

Date: May 13, 1981
HPCS Flow: 7800 GPM
HPCS Suction Pressure: 4.3 Psig
HPCS Discharge Pressure: 230 Psig

3.3.6 HPCS Minimum Flow to Suppression Pool

Date: May 13, 1981
HPCS Flow: Minimum Flow
HPCS Suction Pressure: 7.5 Psig
HPCS Discharge Pressure: 1370 Psig

3.4 LOW PRESSURE CORE SPRAY

3.4.1 LPCS Vessel Injection Runout

Date: May 10, 1981
LPCS Flow: 9050 GPM
LPCS Suction Pressure: 4 Psig
LPCS Discharge Pressure: 230 Psig

3.4.2 LPCS Vessel Injection Rated Flow

Date: May 10, 1981
LPCS Flow: 7200 GPM
LPCS Suction Pressure: 5 Psig
LPCS Discharge Pressure: 345 Psig

3.4.3 LPCS Test Return to Suppression Pool

Date: May 11, 1981
LPCS Flow: 7100 GPM
LPCS Suction Pressure: 5 Psig
LPCS Discharge Pressure: 345 Psig

3.4.4 LPCS Minimum Flow to Suppression Pool

Date: May 11, 1981
LPCS Flow: Minimum Flow

3.5 REACTOR CORE ISOLATION COOLING

3.5.1 RCIC Rated Flow, CST to CST

Date: November 5, 1983
RCIC Pump Flow: 800 GPM
RCIC Suction Pressure: 18 Psig
RCIC Discharge Pressure: 1090 Psig
RCIC Steam Inlet Pressure: 965 Psig

3.6 FUEL POOL COOLING AND CLEANUP

3.6.1 FPCCU Pump B to Containment Pools

Date: March 2, 1984
FPCCU Pump B Flow: 1000 GPM
FPCCU Pump B Discharge Pressure: 120 Psig

3.6.2 FPCUU Pump A to Containment Pools

Date: March 2, 1984
FPCCU Pump A Flow: 1000 GPM
FPCCU Pump A Discharge Pressure: 124 Psig

3.7 STANDBY LIQUID CONTROL SYSTEM

3.7.1 SLCS Storage Tank to Reactor Pressure Vessel - A Pump

Date: August 19, 1981
Pump A Discharge Pressure: <25 Psig

3.8 STANDBY SERVICE WATER SYSTEM

3.8.1 SSW Maximum Flow Through RHR Heat Exchangers

Date: April 15, 1982
SSW Discharge Pressure: 112 Psig
SSW Flow: 9600 GPM

3.8.2 SSW Flow Through Div. II Room Coolers

Date: June 20, 1983
SSW Discharge Pressure: 103 Psig

3.8.3 SSW Flow Through Div. I Room Coolers

Date: June 27, 1983
SSW Flow: 10,400 GPM
SSW Discharge Pressure: 107.0 Psig
RHR A Flow: 5200 GPM

3.8.4 SSW Flow Through Drywell Purge Compressor B Cooler

Date: July 2, 1983
SSW Local Differential Pressure: 46.7" H_2O

3.8.5 SSW Flow Through Drywell Purge Compressor A Cooler

Date: September 6, 1985
SSW Local Differential Pressure: 61" H_2O

3.9 COMBUSTIBLE GAS CONTROL

3.9.1 B Drywell Purge Compressor - Normal Operation

Date: July 2, 1983
CGC Local Differential Pressure: 46.7" H_2O

3.9.2 A Drywell Purge Compressor -Normal Operation

Date: September 6, 1985
CGC Local Differential Pressure: 61" H_2O

3.10 CONDENSATE SYSTEM

3.10.1 Flow Through Feedwater Minimum Flow Lines, All Condensate Pumps and Condensate Booster Pumps in Operation

Date: April 28, 1982
Condensate System Flow: 5.5 Mlb/hr

3.11 REACTOR WATER CLEANUP SYSTEM

3.11.1 Two Pumps in Pre-pump Mode, Maximum Flow Bypassing Heat Exchangers

Date: June 23, 1983
System Flow: 360 GPM
Pump Suction Pressure: A:0 Psig, B:0 Psig
Pump Discharge Pressure: A:250 Psig, B:200 Psig

3.12 JOCKEY PUMPS

3.12.1 HPCS Jockey Pump

Date: June 22, 1983
Pump Suction Pressure: 23.5 Psig

3.12.2 LPCS Jockey Pump

Date: June 22, 1983
Pump Suction Pressure: 7 Psig

3.12.3 RHR A Jockey Pump

Date: June 22, 1983

3.12.4 RHR C Jockey Pump

Date: June 22, 1983

3.13 FEEDWATER LEAKAGE CONTROL SYSTEM

3.13.1 Both Subsystems in service with the Reactor and Feedwater Shutdown

Date: December 6, 1985
Inboard Discharge Pressure: 13.2 Psig
Outboard Discharge Pressure: 9.5 Psig

3.14 MAIN STEAM ISOLATION VALVE LEAKAGE CONTROL SYSTEM

3.14.1 Dilution Air to Blowers

Date: June 22, 1983
Inboard Suction Pressure: 14" H_2O
Outboard Suction Pressure: 20" H_2O

4.0 RESULTS

The vibration data collected throughout this test were obtained in one of two ways. First, in conjunction with steady state system operation, detailed piping walkdowns were conducted in an effort to identify any modes of operation which resulted in high piping vibration characteristics and to record the piping vibration levels at selected locations on the piping. These selected locations were based on either preselected points specified by Bechtel Engineering on the associated system isometric drawings or points selected by the Test Engineers based on visual determinations of higher than average vibration or points where vibration levels would be of baseline interest (i.e. near elbows, tees, valves, flow restrictors, etc.). Vibration and velocity data was obtained using hand held Vibragraph.

It should be noted that the accuracy of the hand held meters was somewhat limited due to the low frequency roll off characteristics of the device. Vibrations of low frequency (<5Hz) are significantly attenuated (under-measured). Consequently, a large reliance was placed on the visual test inspections. Additionally, later testing under test 1C88-ST04 was performed with remote displacement devices (lanyard potentiometers and accelerometers) which were not subject to the low frequency limitations. The remote instruments were used at the preselected locations specified by Bechtel Engineering.

Additionally, during the inspections special attention was paid to connected small bore piping lines connected to the process piping.

The second method of test data collection was involved with pump start/stop events. In these cases, the dynamic vibrations were monitored with a full sized Vibragraph/Chart recorder setup. For these events, two points were selected for monitoring; one on the suction line, and one on the discharge line, in the vicinity of the pump itself.

Throughout the testing, only a few high vibration levels were noted, several of which were resolved by the addition of new rigid pipe supports. In other cases (particularly small bore lines) simple hanger adjustments were necessary to resolve the conditions.

The following Tables 4.1 through 4.12 contain the various displacement and velocity measurements obtained throughout the test. Refer to Section 5.0 for further discussions.

TABLE 4.1
FEEDWATER

LOCATION	ISOMETRIC DRAWING	DATA TYPE	Section 5.1.1								
			X	Y	Z	X	Y	Z	X	Y	Z
12"-CBD-2 at N1N21G001R02	M-1694 R2	Velocity (in/sec)	0.1	0.23	0.16						
		Displacement(mils)	1	4	1.3						
24" GBD-28 at N1N19G002H08	M-1695B R1	Velocity (in/sec)	0.14	0.18	0.18						
		Displacement(mils)	7.8	8	3						
14" FBD-2 at N1N19G003H21	M-1695C R1	Velocity (in/sec)	0.72	0.9	0.22						
		Displacement(mils)	17	3.6	7.8						
14"-FBD-2 at 1 foot above N19-F046A	M-1695C R1	Velocity (in/sec)	0.15	0.21	0.20						
		Displacement(mils)	3.8	2.8	13						
Cond. Booster Pump A Discharge on Tee at El.123'-9"	M-1695C R1	Velocity (in/sec)	0.27	N/A	0.19						
		Displacement(mils)	6.8	N/A	4.8						
Cond.Demin Bypass Return Line 4' above 1N19-F043 on horizontal line	M-1695C R1	Velocity (in/sec)	0.24	0.48	N/A						
		Displacement(mils)	7.2	3.8	N/A						
24"-FBD-24 on horizontal line above 1N19-F029B	M-1695E R1	Velocity (in/sec)	0.27	0.22	0.31						
		Displacement(mils)	4.5	2.0	3.6						
24"-FBD-24 just below 1N19-F029A on verticial line	M-1695E-R1	Velocity (in/sec)	0.20	0.12	0.11						
		Displacement(mils)	4.2	1.7	2.2						

TABLE 4.2
RHR A

LOCATION	ISOMETRIC DRAWING	DATA TYPE	Section 5.2.1			Section 5.2.3			Section 5.2.6		
			X	Y	Z	X	Y	Z	X	Y	Z
18"GBB-18 at E12G01201VLY/		Velocity (in/sec)	N/A	0.12	0.076	N/A	0.058	0.072	N/A	0.05	0.04
1202VLZ	M-1661 R2	Displacement(mils)	N/A	0.36	0.22	N/A	0.34	0.14	N/A	0.20	0.30
		Velocity (in/sec)	0.072	0.07	0.10	0.056	0.043	0.068	0.07	0.05	0.06
18" GBB-18 at 1E12-F029A	M-1661-R2	Displacement(mils)	0.54	2.40	2.20	0.24	0.84	0.79	0.30	0.80	0.70
		Velocity (in/sec)	0.09	N/A	0.11				0.06	N/A	0.07
18" GBB-18 at Elev. 129'	M-1661-R2	Displacement(mils)	2.30	N/A	1.60				0.90	N/A	0.80
		Velocity (in/sec)	0.04	0.06	0.036				0.03	0.03	0.04
18" GBB-18 at E12G01201DLX	M-1661-R2	Displacement(mils)	0.50	1.40	0.60				0.30	0.40	0.35
18"GBB-19 above Q1E12G009-		Velocity (in/sec)	0.03	0.026	0.022				0.02	0.04	0.02
H01	M-1663-R1	Displacement(mils)	1.40	0.48	0.56				0.30	0.50	0.25
		Velocity (in/sec)	0.11	0.11	0.074						
18" GBB-20 at Q1E12G009H01	M-1664-R1	Displacement(mils)	3.10	2.90	2.20						
		Velocity (in/sec)	0.12	0.09	0.10	0.024	0.034	0.032			
18" GBB-20 at 1E12-F048A	M-1664-R1	Displacement(mils)	3.20	2.90	3.20	0.48	0.72	0.46			
		Velocity (in/sec)	0.24	0.29	N/A	0.042	0.05	N/A	0.15	0.20	N/A
18" GBB-20 at E12G01303DLY	M-1664-R1	Displacement(mils)	4.30	3.40	N/A	1.10	0.86	N/A	2.00	1.50	N/A
		Velocity (in/sec)	0.20	0.28	0.30	0.042	0.052	0.048	0.18	0.18	0.13
18" GBB-20 at E12G01301DLX	M-1664-R1	Displacement(mils)	2.00	3.40	2.80	0.84	0.72	1.40	1.50	1.50	1.10
		Velocity (in/sec)	0.90	0.65	0.65						
18" GBB-82 at 1E12 F024A	M-1664-R1	Displacement(mils)	5.80	7.00	8.50						
18"GBB-20 b/t intersection		Velocity (in/sec)				0.04	0.034	0.023			
with 4"GBB-50 and elbow	M-1664-R1	Displacement(mils)				0.66	0.38	0.42			
below E12F027A											
		Velocity (in/sec)				0.05	0.03	0.01			
18" GBB-20 at Q1E12G015R03	M-1666-R1	Displacement(mils)				0.80	0.40	1.00			
		Velocity (in/sec)				0.03	0.045	N/A			
14" GBB-20 at Q1E12G015R02	M-1666-R1	Displacement(mils)				0.40	0.50	N/A			
		Velocity (in/sec)				0.015	0.054	0.028			
14" GBB-20 at E12G01501DLY	M-1661-R1	Displacement(mils)				0.18	0.52	0.26			
		Velocity (in/sec)							0.07	0.06	0.04
18" GBB-20 at Q1E12G013R05	M-1664-R1	Displacement(mils)							0.70	1.10	0.40
		Velocity (in/sec)							0.40	0.40	N/A
12" DBB-72 at 1E12-F050A	M-1664-R1	Displacement(mils)							1.50	1.50	N/A
		Velocity (in/sec)							0.25	0.25	0.20
12" DBB-72 at E12G02101DLZ	M-1693-R0	Displacement(mils)							1.00	0.60	0.40

TABLE 4.2
RHR A

LOCATION	ISOMETRIC DRAWING	DATA TYPE	Section 5.2.8			Section 5.2.10					
			X	Y	Z	X	Y	Z	X	Y	Z
20" DBA-64 at intersection with the recirc suctionline	M-1661 R2	Velocity (in/sec)	0.016	N/A	N/A						
		Displacement(mils)	0.40	N/A	N/A						
20" GBB-31 at Tee with 18" GBB-32	M-1661-R2	Velocity (in/sec)	0.026	0.022	0.013						
		Displacement(mils)	0.27	0.34	0.10						
18" GBB-31 at E12G01204DLZ	M-1661-R2	Velocity (in/sec)	0.036	0.026	0.034						
		Displacement(mils)	0.56	0.40	0.32						
18" GBB-31 downstream of elbow below 1E12-F006A	M-1661-R2	Velocity (in/sec)	0.15	0.044	N/A						
		Displacement(mils)	1.40	0.32	N/A						
24" GBB-30 at intersection with 18" GBB-81		Velocity (in/sec)	0.056	0.062	0.044	0.046	0.072	0.072			
		Displacement(mils)	0.49	0.26	0.40	0.40	0.34	0.40			
24" GBB-30 b/t elbow upstream and intersection with 18" GBB-33	M-1661-R2	Velocity (in/sec)	0.062	0.064	N/A	0.11	0.10	0.064			
		Displacement(mils)	0.86	0.62	N/A	2.20	0.72	0.80			
24" GBB-30 at E12G01203DLY	M-1661-R2	Velocity (in/sec)	0.10	0.059	0.048	N/A	0.068	0.064			
		Displacement(mils)	0.90	0.15	0.26	N/A	0.60	0.40			

TABLE 4.2
RHR A

LOCATION	ISOMETRIC DRAWING	DATA TYPE	Section 5.2.10			Section 5.2.13			Section 5.2.16		
			X	Y	Z	X	Y	Z	X	Y	Z
18" GBB-18 at E12G01201VLY/		Velocity (in/sec)	N/A	0.09	0.09	N/A	0.16	0.15	N/A	0.092	0.074
1202VLZ	M-1661-R2	Displacement(mils)	N/A	0.25	0.22	N/A	0.50	0.45	N/A	0.22	0.14
		Velocity (in/sec)	0.10	0.10	0.15				0.13	0.074	0.11
18" GBB-18 at E12-F029A	M-1661-R2	Displacement(mils)	0.50	1.40	2.50				0.32	0.96	0.94
		Velocity (in/sec)	0.48	0.50	0.60	0.90	1.50	0.80			
4" HBB-120 at Q1E12G012R07	M-1661-R2	Displacement(mils)	2.70	4.20	12.00	9.00	13.00	16.00			
		Velocity (in/sec)	0.18	0.21	0.22						
18" GBB-20 at 1E12-F048 A	M-1664-R1	Displacement(mils)	1.00	1.20	0.90						
		Velocity (in/sec)	0.28	0.30	N/A				0.31	0.35	N/A
18" GBB-20 at E12G01303DLY	M-1664-R1	Displacement(mils)	1.30	2.00	N/A				1.30	2.20	N/A
		Velocity (in/sec)	0.20	0.33	0.22				0.17	0.28	0.24
18" GBB-20 at E12G01301DLX	M-1664-R1	Displacement(mils)	1.80	2.40	2.50				1.30	1.40	1.60
		Velocity (in/sec)	1.50	0.60	0.70	0.70	0.45	1.00			
18" HBB-82 at Q1E12G013C01	M-1664-R1	Displacement(mils)	5.40	4.50	5.80	8.00	6.00	21.00			
4" HBB-120 at Elbow b/t		Velocity (in/sec)	3.60	3.00	1.40						
HBB-156 and Q1E12G012H04	M-1661-R2	Displacement(mils)	60.00	22.00	15.00						
		Velocity (in/sec)							0.032	0.034	0.026
18" GBB-30 after 1E12-F066A	M-1661-R2	Displacement(mils)							0.32	0.38	0.28
		Velocity (in/sec)							0.054	0.058	0.04
24" GBB-30 at E12G01203DLY	M-1661-R2	Displacement(mils)							0.16	0.60	0.24
18" GBB-19 above		Velocity (in sec)							0.038	0.032	0.038
Q1E12G009H01	M-1663-R1	Displacement(mils)							0.38	0.36	0.46

TABLE 4.2
RHR A

LOCATION	ISOMETRIC DRAWING	DATA TYPE	Section 5.2.16			Section 5.2.20 (start)			Section 5.2.20 (stop)		
			X	Y	Z	X	Y	Z	X	Y	Z
18" GBB-18 at elev. 129	M-1661-R2	Velocity (in/sec)	0.15	N/A	0.15						
		Displacement(mils)	1.30	N/A	0.80						
18" GBB-20 at Q1E12G013R05	M-1664-R1	Velocity (in/sec)	0.43	0.21	0.44						
		Displacement(mils)	1.30	1.90	1.40						
14" GBB-288 at 1E12-F099A	M-1664-R1	Velocity (in/sec)	0.14	0.10	N/A						
		Displacement(mils)	1.40	0.80	N/A						
18" GBB-18 at E12G01201DLX	M-1661-R2	Velocity (in/sec)	0.058	0.074	0.058						
		Displacement(mils)	0.46	0.88	0.52						
24" GBB-30 at E12G01203DLY	M-1661-R2	Velocity (in/sec)				N/A	N/A	N/A	N/A	N/A	N/A
		Displacement(mils)				N/A	1.20	N/A	N/A	1.90	N/A
18" GBB-18 at E12G01202VLZ	M-1661-R2	Velocity (in/sec)				N/A	N/A	N/A	N/A	N/A	N/A
		Displacement(mils)				N/A	N/A	1.90	N/A	N/A	1.60

TABLE 4.2
RHR-B

LOCATION	ISOMETRIC DRAWING	DATA TYPE	Section 5.2.2			Section 5.2.4			Section 5.2.7		
			X	Y	Z	X	Y	Z	X	Y	Z
		Velocity (in/sec)	0.06	0.09	0.07	0.07	0.08	0.05	0.034	0.082	0.064
18" GBB-74 at E12G01001VLY	M-1662-R1	Displacement(mils)	0.20	0.20	0.20	0.15	0.14	0.15	0.18	0.28	0.58
		Velocity (in/sec)	0.10	0.15	0.11	0.05	0.065	0.05	0.095	0.10	0.14
18" GBB-74 at E12G01005DLX	M-1662-R1	Displacement(mils)	0.80	1.40	1.50	0.45	0.70	0.60	0.61	1.20	2.20
		Velocity (in/sec)	0.21	N/A	0.14				0.16	N/A	0.18
18" GBB-74 at E12G01001VLX	M-1662-R1	Displacement(mils)	3.60	N/A	2.10				2.30	N/A	2.60
		Velocity (in/sec)	0.09	0.19	0.095				0.056	0.16	0.06
18" GBB-74 at E12G01002DLY	M-1662-R1	Displacement(mils)	1.50	6.10	1.60				1.30	8.20	1.30
		Velocity (in/sec)	0.066	0.09	0.07				0.046	0.014	0.026
18" GBB-78 at E12G00901DLY	M-1663-R1	Displacement(mils)	2.00	1.20	1.70				1.90	0.34	0.64
		Velocity (in/sec)	0.19	0.10	0.13				0.20	0.033	0.052
18" GBB-78 at E12G00902DLY	M-1663-R1	Displacement(mils)	9.40	1.60	8.00				10.00	0.80	2.00
18" GBB-81 below 18x20 re-		Velocity (in/sec)	0.31	N/A	0.32				0.07	N/A	0.17
ducer at HX B002B outlet	M-1665-R1	Displacement(mils)	2.40	N/A	1.30				0.70	N/A	0.92
		Velocity (in/sec)	0.35	0.29	0.25	0.04	0.025	0.05	0.094	0.088	0.095
18" GBB-81 at E12G01401DLX	M-1665-R1	Displacement(mils)	3.00	1.50	2.20	0.80	0.50	1.00	0.88	0.52	1.00
		Velocity (in/sec)	0.28	0.25	0.41	0.04	0.05	0.05	0.19	0.25	0.21
18" GBB-81 at Q1E12G014H03	M-1665-R1	Displacement(mils)	1.80	3.30	4.60	0.70	1.00	0.80	1.50	1.90	2.10
18" GBB-81 b/t 1E12-FE-N014		Velocity (in/sec)	0.42	0.32	0.28	N/A	0.04	0.05	0.13	0.25	0.28
B and Q1E12G014H02	M-1665-R1	Displacement(mils)	3.30	3.20	4.80	N/A	0.70	1.00	1.50	1.70	1.60
		Velocity (in/sec)	N/A	0.48	0.60						
18" HBB-76 at 1E12F024B	M-1665-R1	Displacement(mils)	N/A	5.00	9.00						
18" HBB-76 at midpoint on		Velocity (in/sec)	0.90	N/A	0.95						
vertical run just prior to	M-1665-R1	Displacement(mils)	10.00	N/A	8.60						
containment											
18" GBB-81 at intersection		Velocity (in/sec)				0.05	0.03	0.03	0.35	0.36	0.32
with 12" DBB-68	M-1665-R1	Displacement(mils)				1.40	1.00	0.60	1.20	1.30	1.30
18" GBB-81 at midpoint on		Velocity (in/sec)				0.03	0.03	0.04			
vertical run below 1E12-	M-1665-R1	Displacement(mils)				0.60	0.70	1.20			
F027B											
18" GBB-81 at intersection		Velocity (in/sec)				0.03	0.03	0.17			
with 14" DBA-28	M-1666-R1	Displacement(mils)				0.50	0.50	0.15			
		Velocity (in/sec)				0.60	0.01	0.04			
14" DBA-28 at Q1E12G015H08	M-1666-R1	Displacement(mils)				0.80	0.10	1.00			
		Velocity (in/sec)				0.10	0.07	0.06			
14" DBA-28 at E12G01506DLZ	M-1666-R1	Displacement(mils)				1.40	1.40	1.00			

TABLE 4.2
RHR B

LOCATION	ISOMETRIC DRAWING	DATA TYPE	Section 5.2.2			Section 5.2.4			Section 5.2.7		
			X	Y	Z	X	Y	Z	X	Y	Z
14" DBA-28 at E12G01505DLY	M-1666-R1	Velocity (in/sec)				0.06	0.20	0.04			
		Displacement(mils)				1.40	6.00	0.80			
12" DBB-68 at F050B	M-1665-R1	Velocity (in/sec)							0.31	0.45	N/A
		Displacement(mils)							1.20	1.30	N/A
12" DBB-68 b/t Q1E12G014-H04 and Penet. AP-232	M-1665-R1	Velocity (in/sec)							0.36	0.38	0.34
		Displacement(mils)							0.78	0.12	1.10
12" DBB-68 at Q1E12G021R03	M-1693-R0	Velocity (in/sec)							0.31	0.21	0.46
		Displacement(mils)							0.58	0.64	0.64

TABLE 4.2
RHR B

LOCATION	ISOMETRIC DRAWING	DATA TYPE	Section 5.2.9			Section 5.2.11			Section 5.2.14		
			X	Y	Z	X	Y	Z	X	Y	Z
20" DBA-64 at intersection with recirculation pipe	M-1661-R2	Velocity (in/sec)	0.005	N/A	N/A						
		Displacement(mils)	0.10	N/A	N/A						
20" GBB-31 at Tee with 18" GBB-32	M-1661-R2	Velocity (in/sec)	0.01	0.01	0.005						
		Displacement(mils)	0.14	0.15	0.05						
18" GBB-32 at E1201001DLZ	M-1662-R1	Velocity (in/sec)	0.02	0.03	0.03						
		Displacement(mils)	0.10	0.20	0.30						
18" GBB-32 downstream of elbow below 1E12-F006B	M-1662-R1	Velocity (in/sec)	0.04	0.04	N/A						
		Displacement(mils)	0.60	0.40	N/A						
24" GBB-73 at E12G01001-VVY/VVL	M-1662-R1	Velocity (in/sec)	0.04	0.04	0.02	0.046	0.036	0.02			
		Displacement(mils)	0.44	0.24	0.70	0.46	0.30	0.15			
24" GBB-73 at elbow just upstream of intersection with 18" GBB-107	M-1662-R1	Velocity (in/sec)	0.04	0.05	0.04	0.08	0.076	0.04			
		Displacement(mils)	0.30	0.40	0.30	0.66	0.70	0.46			
24" GBB-73 at Q1E12G010R01	M-1662-R1	Velocity (in/sec)	0.03	0.06	0.04	0.04	0.076	0.056			
		Displacement(mils)	0.10	0.60	0.14	0.10	0.70	0.12			
18" GBB-107 at 1E12-F066B	M-1662-R1	Velocity (in/sec)				0.037	0.03	0.025			
		Displacement(mils)				0.30	0.25	0.40			
18" GBB-74 at E12G01001VLY	M-1662-R1	Velocity (in/sec)				0.06	0.10	0.10	N/A	0.17	0.25
		Displacement(mils)				0.18	0.23	0.20	N/A	0.30	0.60
4" HBB-113 at Q1E12G010H08	M-1662-R1	Velocity (in/sec)				0.30	0.32	0.30	0.80	0.80	0.90
		Displacement(mils)				2.50	1.50	3.60	15.00	8.00	22.00
18" HBB-76 at midspan on vertical run just upstream of the Containment Pene.	M-1665-R1	Velocity (in/sec)				1.10	1.00	1.00	1.00	1.80	0.90
		Displacement(mils)				5.00	6.20	3.50	15.00	34.00	17.00

TABLE 4.2
RHR B

LOCATION	ISOMETRIC DRAWING	DATA TYPE	Section 5.2.11			Section 5.2.14			Section 5.2.17		
			X	Y	Z	X	Y	Z	X	Y	Z
		Velocity (in/sec)	0.10	0.11	0.15				0.15	0.18	0.10
18" GBB-74 at E12G01005DLZ	M-1662-R1	Displacement(mils)	0.70	1.0	2.00				1.20	0.71	1.20
		Velocity (in/sec)	0.11	0.11	0.15				0.52	0.52	0.48
18" GBB-17 at E12G01401DLX	M-1665-R1	Displacement(mils)	1.2	0.70	1.0				4.20	3.30	2.60
		Velocity (in/sec)	0.20	0.30	0.36				0.30	0.27	0.25
18" GBB-81 at Q1E12G014H03	M-1665-R1	Displacement(mils)	1.30	1.70	2.50				1.00	1.20	2.00
18" GBB-81 between FEN014B		Velocity (in/sec)	0.17	0.27	0.28				0.12	0.18	0.15
and Q1E12G014H02	M-1665-R1	Displacement(mils)	1.50	1.80	2.00				0.60	1.20	1.30
		Velocity (in/sec)	N/A	0.50	0.50						
18" HBB-76 at F024B	M-1665-R1	Displacement(mils)	N/A	4.50	3.00						
		Velocity (in/sec)				3.40	3.00	0.90			
4" HBB-113 at Q1E12G010H09	M-1662-R1	Displacement(mils)				85.00	60.00	20.00			
		Velocity (in/sec)							0.04	0.034	0.082
18" GBB-107 at 1E12-F066B	M-1662-R1	Displacement(mils)							0.22	0.46	0.40
		Velocity (in/sec)							0.20	N/A	0.16
18" GBB-74 at E12G01001VLX	M-1662-R1	Displacement(mils)							2.30	N/A	1.40
		Velocity (in/sec)							0.09	0.074	0.08
18" GBB-74 at E12G01002DLY	M-1662-R1	Displacement(mils)							4.00	1.00	1.00
		Velocity (in/sec)							0.11	0.09	0.07
18" GBB-78 at E12G00902DLY	M-1663-R1	Displacement(mils)							1.40	3.50	1.20
		Velocity (in/sec)							0.13	0.12	0.10
18" GBB-96 at 1E12-F099B	M-1665-R1	Displacement(mils)							1.40	0.80	1.00

TABLE 4.2
RHR B

LOCATION	ISOMETRIC DRAWING	DATA TYPE	Section 5.2.17			Section 5.2.21 (Start)			Section 5.2.21 (Stop)		
			X	Y	Z	X	Y	Z	X	Y	Z
18" GBB-81 just downstream of the 20x18 reducer	M-1665-R1	Velocity (in/sec)	0.51	N/A	0.50						
		Displacement(mils)	2.90	N/A	2.50						
24" GBB-73 at Q1E12G010R01	M-1662-R1	Velocity (in/sec)	0.054	0.12	0.052	N/A	N/A	N/A	N/A	N/A	N/A
		Displacement(mils)	0.54	1.20	0.38	N/A	1.40	N/A	N/A	1.40	N/A
18" GBB-74 at E12G01001VLY	M-1662-R1	Velocity (in/sec)	0.042	0.092	0.062	N/A	N/A	N/A	N/A	N/A	N/A
		Displacement(mils)	0.11	0.18	0.18	N/A	N/A	3.00	N/A	N/A	0.80

TABLE 4.2
RHR-B

LOCATION	ISOMETRIC DRAWING	DATA TYPE	Section 5.2.19								
			X	Y	Z	X	Y	Z	X	Y	Z
6" GBB-84 at elbow upstream of flow element FE-N012	M-1665-R1	Velocity (in/sec)	0.40	0.48	0.50						
		Displacement(mils)	1.10	6.60	7.20						
6" DBA-30 b/t test connections F061 and F342	M-1674-R3	Velocity (in/sec)	0.08	N/A	0.09						
		Displacement(mils)	0.90	N/A	0.90						
6" DBA-30 at Q1E51G001R10	M-1674-R3	Velocity (in/sec)	0.11	0.12	0.09						
		Displacement(mils)	0.64	0.82	0.94						
6" DBA-30 at Q1E51G001R12	M-1674-R3	Velocity (in/sec)	0.15	0.12	0.16						
		Displacement(mils)	1.20	1.00	1.10						
6" DBA-30 elbow upstream of Q1E51G001R15	M-1674-R3	Velocity (in/sec)	0.13	0.12	0.30						
		Displacement(mils)	1.10	1.20	0.45						
6" DBA-30 at Q1E51G001R18	M-1674-R3	Velocity (in/sec)	0.16	0.11	0.20						
		Displacement(mils)	1.40	1.90	0.70						

TABLE 4.2
RHR C

LOCATION	ISOMETRIC DRAWING	DATA TYPE	Section 5.2.5			Section 5.2.12			Section 5.2.15		
			X	Y	Z	X	Y	Z	X	Y	Z
12" GBB-58 at intersection with 4"GBB-101	M-1669-R1	Velocity (in/sec)	0.06	0.02	0.02						
		Displacement(mils)	1.00	0.30	0.10						
12" DBA-38 at E12G01601DLX	M-1670-R1	Velocity (in/sec)	0.04	0.05	0.16						
		Displacement(mils)	0.50	0.70	8.00						
12"DBA-38 at Q1E12G016H03	M-1670-R1	Velocity (in/sec)	0.04	0.03	0.10						
		Displacement(mils)	1.30	0.40	3.00						
12" DBA-38 at E12G01602DLY	M-1670-R1	Velocity (in/sec)	0.05	0.08	0.03						
		Displacement(mils)	1.00	2.00	0.50						
18" GBB-58 at midpoint between Q1E12G007C02 and Q1E12G007C01	M-1669-R1	Velocity (in/sec)	N/A	0.10	0.06	N/A	0.35	0.35			
		Displacement(mils)	N/A	2.00	0.80	N/A	2.00	1.50			
18" GBB-58 at 1E12-F029C	M-1669-R1	Velocity (in/sec)	0.15	0.15	0.07	0.10	0.15	0.08			
		Displacement(mils)	3.50	4.50	1.30	2.50	4.00	1.00			
18" GBB-58 at E12G00701VVY	M-1669-R1	Velocity (in/sec)	N/A	0.08	0.08	0.20	0.13	0.15	0.54	0.25	0.34
		Displacement(mils)	N/A	0.30	0.60	0.60	0.40	0.50	1.70	4.20	3.00
18" HBB-75 at RO-D003C	M-1669-R1	Velocity (in/sec)				0.50	0.70	0.07	0.17	0.21	0.25
		Displacement(mils)				2.00	1.10	0.40	4.50	8.00	1.00
4" GBB-72 at 1E12-F064C	M-1669-R1	Velocity (in/sec)				0.15	0.15	0.20	0.70	0.35	0.80
		Displacement(mils)				1.00	0.50	0.90	6.00	2.50	6.00
4" GBB-64 at 1E12-F022	M-1669-R1	Velocity (in/sec)							0.40	0.50	0.40
		Displacement(mils)							2.80	4.60	2.00
24" GBB-62 at 1E12-F004C	M-1668-R1	Velocity (in/sec)				0.025	0.02	0.03			
		Displacement(mils)				0.40	1.00	0.20			

TABLE 4.2
RHR C

LOCATION	ISOMETRIC DRAWING	DATA TYPE	Section 5.2.12			Section 5.2.18					
			X	Y	Z	X	Y	Z	X	Y	Z
24" GBB-62 intersection with 18" HBC-222	M-1668-R1	Velocity (in/sec)	0.045	0.02	0.03	0.07	0.08	0.25			
		Displacement(mils)	0.25	0.40	0.30	0.80	1.80	0.60			
24" GBB-62 at E12G00801VVZ	M-1668-R1	Velocity (in/sec)	N/A	0.04	0.04	N/A	0.35	0.35			
		Displacement(mils)	N/A	0.25	0.25	N/A	0.50	0.50			
18" HBC-222 b/t Q1G41G007-R04 and Penetration HP54A	M-1668-R1	Velocity (in/sec)	N/A	0.09	0.12						
		Displacement(mils)	N/A	2.00	4.50						
18" HBC-222 at Q1G41G007H01	M-1668-R1	Velocity (in/sec)	N/A	0.06	0.15						
		Displacement(mils)	N/A	1.40	3.50						

TABLE 4.2
RHR C

LOCATION	ISOMETRIC DRAWING	DATA TYPE	Section 5.2.22 (start)			Section 5.2.22 (stop)					
			X	Y	Z	X	Y	Z	X	Y	Z
24" GBB-62 at E12G00801VVZ	M-1668-R1	Velocity (in/sec)	N/A	N/A	N/A	N/A	N/A	N/A			
		Displacement(mils)	N/A	N/A	2.40	N/A	N/A	1.50			
18" GBB-58 at E12G00701VVY	M-1669-R1	Velocity (in/sec)	N/A	N/A	N/A	N/A	N/A	N/A			
		Displacement(mils)	N/A	8.00	N/A	N/A	8.50	N/A			

TABLE 4.3
HPCS

LOCATION	ISOMETRIC DRAWING	DATA TYPE	Section 5.3.1			Section 5.3.2			Section 5.3.3 (40%)		
			X	Y	Z	X	Y	Z	X	Y	Z
14" DBA-5 at elbow above valve 1E22-F205	M-1657-R0	Velocity (in/sec)	0.17	0.14	0.13				0.80	0.48	0.75
		Displacement(mils)	0.55	1.50	0.30				7.50	6.00	2.50
14" DBA-5 at E22G00302DLY	M-1657-R0	Velocity (in/sec)	0.24	0.13	0.14				0.60	0.58	0.35
		Displacement(mils)	3.00	1.50	2.00				7.00	2.80	4.00
14" DBA-5 at approximately 6' from elbows	M-1657-R0	Velocity (in/sec)	0.14	0.20	N/A				0.52	0.52	N/A
		Displacement(mils)	2.80	2.50	N/A				6.00	3.00	N/A
14" DBA-5 above elbow at 138' 9¼" Elevation	M-1657-R0	Velocity (in/sec)	0.27	N/A	0.25				0.65	N/A	0.68
		Displacement(mils)	5.00	N/A	4.80				7.00	N/A	7.00
16" DBB-8 at tee with 4" DBB-20	M-1660-R0	Velocity (in/sec)	0.16	0.12	0.10						
		Displacement(mils)	4.00	2.40	3.00						
16" DBB-8 at 1E22-R0-D002	M-1660-R0	Velocity (in/sec)	0.20	0.08	0.10						
		Displacement(mils)	3.20	0.89	2.20						
16" DBB-8 at 1E22-FE-N007	M-1660-R0	Velocity (in/sec)	0.22	0.12	0.15						
		Displacement(mils)	2.90	1.60	4.60						
16" DBB-8 at elbow upstream of Q1E22G001C06	M-1660-R0	Velocity (in/sec)	0.22	0.14	N/A						
		Displacement(mils)	5.20	3.20	N/A						
16" DBB-8 at approximately 3' below tee with 4" DBB-14	M-1660-R0	Velocity (in/sec)	0.24	N/A	0.16						
		Displacement(mils)	4.80	N/A	4.30						
16" DBB-8 just above elbow next to Q1E22G001C07	M-1660-R0	Velocity (in/sec)	0.22	N/A	0.12	0.60	N/A	0.90			
		Displacement(mils)	1.40	N/A	2.20	4.00	N/A	6.00			
16" DBB-8 at E22G00101VVY	M-1660-R0	Velocity (in/sec)	0.10	0.12	N/A	0.50	0.50	0.20			
		Displacement(mils)	5.40	1.50	N/A	4.00	4.00	0.50			
12"DBB-16 at 1E22-F023C	M-1660-R0	Velocity (in/sec)									
		Displacement(mils)									
4" DBB-11-at 1E22-R0-D001	M-1660-R0	Velocity (in/sec)									
		Displacement(mils)									
10" DBB-18 at elbow up-stream of 1E22-F010C	M-1660-R0	Velocity (in/sec)									
		Displacement(mils)									
14" HBB-32 approximately midpoint between the elbows	M-1660-R0	Velocity (in/sec)									
		Displacement(mils)									
24" HBB-21 at Q1E22G001R09	M-1660-R0	Velocity (in/sec)									
		Displacement(mils)									
24" HBB-19 at E22G00203VVY	M-1672-R0	Velocity (in/sec)				0.18	0.18	0.10			
		Displacement(mils)				0.15	0.30	0.20			

TABLE 4.3
HPCS

LOCATION	ISOMETRIC DRAWING	DATA TYPE	Section 5.3.1			Section 5.3.2			Section 5.5.5 (40%)		
			X	Y	Z	X	Y	Z	X	Y	Z
24" HBB-19 at E22G00203DLX	M-1672-R0	Velocity (in/sec)				0.13	0.10	0.07			
		Displacement(mils)				0.30	0.40	0.18			
18" HBB-19 at E22G00202DLY	M-1672-R0	Velocity (in/sec)				0.08	0.10	N/A			
		Displacement(mils)				0.24	0.50	N/A			
18" HBB-19 at E22G00201DLY	M-1672-R0	Velocity (in/sec)				0.14	0.14	0.12			
		Displacement(mils)				0.30	0.40	0.40			
18" HBB-19 at 1E22-F001	M-1672-R0	Velocity (in/sec)									
		Displacement(mils)									

TABLE 4.3
HPCS

LOCATION	ISOMETRIC DRAWING	DATA TYPE	Section 5.3.3 (80%) X	Y	Z	Section 5.3.3 (100%) X	Y	Z	Section 5.3.4 X	Y	Z
14" DBA-5 at elbow above valve 1E22-F205	M-1657-R0	Velocity (in/sec)	0.70	0.50	0.50	0.52	0.55	0.58			
		Displacement(mils)	1.80	2.00	1.00	1.20	2.50	1.50			
14" DBA-5 at E22G00302DLY	M-1657-R0	Velocity (in/sec)	0.90	1.10	0.82	0.32	0.32	0.45			
		Displacement(mils)	7.00	6.00	7.00	3.00	1.80	3.50			
14" DBA-5 at approximately 6' from elbows	M-1657-R0	Velocity (in/sec)	1.10	1.20	N/A	0.50	0.30	N/A			
		Displacement(mils)	10.00	8.00	N/A	6.00	2.80	N/A			
14" DBA-5 above elbow at 138' 9¼" Elevation	M-1657-R0	Velocity (in/sec)	1.30	N/A	1.40	0.40	N/A	0.40			
		Displacement(mils)	15.00	N/A	15.00	6.50	N/A	9.00			
16" DBB-8 at tee with 4" DBB-20	M-1660-R0	Velocity (in/sec)				0.16	0.18	0.12			
		Displacement(mils)				4.40	2.20	2.20			
16" DBB-8 at 1E22-R0-D002	M-1660-R0	Velocity (in/sec)				0.11	0.09	0.15			
		Displacement(mils)				3.40	1.00	2.00			
16" DBB-8 at 1E22-FE-N007	M-1660-R0	Velocity (in/sec)				0.14	0.13	0.15	0.26	0.26	0.28
		Displacement(mils)				4.80	2.50	3.20	6.00	5.20	5.80
16" DBB-8 at elbow upstream of Q1E22G001C06	M-1660-R0	Velocity (in/sec)				0.16	0.18	N/A			
		Displacement(mils)				4.30	3.40	N/A			
16" DBB-8 at approximately 3' below tee with 4" DBB-14	M-1660-R0	Velocity (in/sec)				0.18	0.14	N/A			
		Displacement(mils)				4.00	4.40	N/A			
16" DBB-8 just above elbow next to Q1E22G001C07	M-1660-R0	Velocity (in/sec)				0.12	0.11	N/A			
		Displacement(mils)				0.80	3.20	N/A			
16" DBB-8 at E22G00101VVY	M-1660-R0	Velocity (in/sec)	0.16	0.20	N/A	0.08	0.09	N/A			
		Displacement(mils)	1.10	1.10	N/A	0.80	1.00	N/A			
12" DBB-16 at 1E22-F023C	M-1660-R0	Velocity (in/sec)				0.17	0.10	0.08			
		Displacement(mils)				2.60	1.80	1.20			
4" DBB-11 at 1E22-R0-D001	M-1660-R0	Velocity (in/sec)				0.10	0.12	0.12			
		Displacement(mils)				1.20	1.80	1.00			
10" DBB-18 at elbow upstream of 1E22-F010C	M-1660-R0	Velocity (in/sec)				0.20	0.08	0.10	0.80	1.20	0.80
		Displacement(mils)				1.80	1.20	2.00	10.00	25.00	6.00
14" HBB-32 approximately midpoint between the elbows	M-1660-R0	Velocity (in/sec)				0.14	N/A	0.12			
		Displacement(mils)				0.80	N/A	1.10			
24" HBB-21 at Q1E22G001R09	M-1660-R0	Velocity (in/sec)				0.08	0.08	0.18			
		Displacement(mils)				0.60	1.80	0.60			
24" HBB-19 at E22G00203VVY	M-1672-R0	Velocity (in/sec)	0.12	0.16	N/A	0.06	0.062	N/A	0.10	0.10	N/A
		Displacement(mils)	0.32	0.20	N/A	0.19	0.12	N/A	0.30	0.28	N/A

TABLE 4.3
HPCS

LOCATION	ISOMETRIC DRAWING	DATA TYPE	Section 5.3.3 (80%) X	Y	Z	Section 5.3.3 (100%) X	Y	Z	Section 5.3.4 X	Y	Z
		Velocity (in/sec)	0.10	0.10	0.08	0.062	0.05	0.032	0.08	0.08	0.044
24" HBB-19 at E22G00203DLX	M-1672-R0	Displacement(mils)	0.44	0.30	0.16	0.32	0.22	0.10	0.58	0.68	0.18
		Velocity (in/sec)	0.062	0.08	N/A	0.04	0.05	N/A	0.054	0.07	N/A
18" HBB-19 at E22G00202DLY	M-1672-R0	Displacement(mils)	0.16	0.58	N/A	4.00	0.36	N/A	0.20	0.80	N/A
		Velocity (in/sec)	0.08	0.11	0.06	0.05	0.05	0.04	0.09	0.08	0.048
18" HBB-19 at E22G00201DLY	M-1672-R0	Displacement(mils)	0.20	0.51	0.65	0.20	0.33	0.41	0.30	0.90	0.80
		Velocity (in/sec)				0.03	0.03	0.01	0.068	0.05	0.06
18" HBB-19 at 1E22-F001	M-1672-R0	Displacement(mils)				0.49	0.37	0.30	1.00	1.50	1.30

TABLE 4.3
HPCS

LOCATION	ISOMETRIC DRAWING	DATA TYPE	Section 5.3.5			Section 5.3.6					
			X	Y	Z	X	Y	Z	X	Y	Z
12"DBB-16 at 1E22-F023C	M-1660-R0	Velocity (in/sec)	0.22	0.20	0.22	0.60	0.60	0.50			
		Displacement(mils)	4.00	0.90	2.40	10.00	4.00	5.00			
4" DBB-11 at 1E22-R0-D001	M-1660-R0	Velocity (in/sec)				1.60	0.90	0.50			
		Displacement(mils)				25.00	16.00	4.00			
10" DBB-18 at elbow upstream of 1E22-F010C	M-1660-R0	Velocity (in/sec)									
		Displacement(mils)									
14" HBB-32 approximately midpoint between the elbows	M-1660-R0	Velocity (in/sec)	0.24	N/A	0.32	1.80	N/A	2.00			
		Displacement(mils)	1.80	N/A	2.40	21.00	N/A	22.00			
24" HBB-21 at Q1E22G001R09	M-1660-R0	Velocity (in/sec)	0.18	0.13	0.21						
		Displacement(mils)	1.20	1.40	0.80						

TABLE 4.3

HPCS PUMP START/STOP

Location	16" DBB-8 at E22G00101VVY	24" HBB-19 at E22G00203VVY
	X Displacement	X Displacement
Isometric Drawing	M-1660 R0	M-1672 R0
TEST	(mils)	(mils)
1. 3.3.2		
Start	1.00	8.00
2. 3.3.3		
Start	0.50	2.10
Stop	0.30	1.50
Start	1.00	2.90
Stop	1.90	3.40
3. RPV Injection from CST (6-1-81)		
Start	9.00	1.20
Stop	0.50	2.00
4. RPV Injection from Suppression Pool (6-1-81)		
Start	0.5	2.00
Stop	N/A	0.50

TABLE 4.4
LPCS

LOCATION	ISOMETRIC DRAWING	DATA TYPE	Section 5.4.1			Section 5.4.2			Section 5.4.3		
			X	Y	Z	X	Y	Z	X	Y	Z
14" DBA-1 at E21G00202DLZ	M-1655-R0	Velocity (in/sec)	0.12	0.18	0.16	0.28	0.30	0.25			
		Displacement(mils)	1.50	2.50	2.20	2.50	2.50	2.20			
14" DBA-1 at Q1E21G002R02	M-1655-R0	Velocity (in/sec)				0.40	0.32	0.44			
		Displacement(mils)				3.50	3.50	2.50			
14" DBA-1 approximately 10' downstream of Q1E21G002C01	M-1655-R0	Velocity (in/sec)				0.54	0.48	N/A			
		Displacement(mils)				7.50	2.00	N/A			
14" DBA-1 at Q1E21G002R03	M-1655-R0	Velocity (in/sec)				0.36	0.46	0.48			
		Displacement(mils)				5.00	1.60	7.00			
14" DBA-1 approximately 5' above the grating at 135'4"	M-1655-R0	Velocity (in/sec)				0.75	N/A	0.64			
		Displacement(mils)				4.00	N/A	4.00			
16" GBB-7 approximately 2' above 1E21-R0-D002	M-1656-R0	Velocity (in/sec)				0.50	N/A	0.48			
		Displacement(mils)				6.80	N/A	3.20			
16" GBB-7 at tee with 14" GBB-14	M-1656-R0	Velocity (in/sec)				0.32	0.34	0.38			
		Displacement(mils)				2.80	3.00	3.20			
16" GBB-7 at 1E21-FE-N002	M-1656-R0	Velocity (in/sec)				0.30	0.30	0.30			
		Displacement(mils)				4.80	6.20	8.00			
16" GBB-7 at E21G00102DLX	M-1656-R0	Velocity (in/sec)	0.12	0.18	0.30	0.34	0.28	0.18			
		Displacement(mils)	2.00	2.40	10.00	4.80	2.20	2.00			
16" GBB-7 at E21G00101DLZ	M-1656-R0	Velocity (in/sec)	0.12	0.12	0.11	0.22	0.16	0.10			
		Displacement(mils)	2.80	0.70	2.20	2.40	0.70	1.20			
16" GBB-7 at E21G00101VVZ	M-1656-R0	Velocity (in/sec)	0.10	0.071	0.056	0.12	0.10	0.08			
		Displacement(mils)	0.42	0.18	0.14	0.50	0.22	0.18			
24" HBB-8 at E21G00102VVZ	M-1656-R0	Velocity (in/sec)	0.050	0.055	N/A	0.06	0.10	N/A			
		Displacement(mils)	0.10	0.20	N/A	0.28	0.40	N/A			
24" HBB-8 approximately 2' upstream of tee with 18" HBB-14	M-1656-R0	Velocity (in/sec)				0.06	0.06	0.11	0.50	0.60	0.68
		Displacement(mils)				0.70	1.10	3.40	2.00	4.00	3.00
24" HBB-8 at elbow downstream of 1E21-F001A	M-1656-R0	Velocity (in/sec)				N/A	0.08	N/A			
		Displacement(mils)				N/A	2.20	N/A			
Test Return Line downstream of 1E21-F012A	M-1656-R0	Velocity (in/sec)							N/A	N/A	N/A
		Displacement(mils)							22.00	18.00	N/A

TABLE 4.4

LPCS PUMP START/STOP

Location	16" GBB-7 E21G00101VVZ Z Displacement	24" HBB-8 E21G00102VVZ Z Displacement	24" HBB approximately 6" Off pump/pipe flange Z Displacement
Isometric Drawing	M-1656 R0	M-1656 R0	M-1656 R0
Test #			
1. RPV Injection from spent fuel pool (9-1-81)			
Start	4.00		0.70
Stop	2.00		0.60
2. RPV Injection (5-10-81)			
Start	6.00	2.00	

TABLE 4.5
RCIC

			Section 5.5.1								
LOCATION	ISOMETRIC DRAWING	DATA TYPE	X	Y	Z	X	Y	Z	X	Y	Z
Elbow upstream of F011 on 6" HBB-57 Elevation 102'	HL-1336B-R6	Velocity (in/sec)	N/A	N/A	0.30						
		Displacement(mils)	2.00	2.50	3.00						
2'3" west of the RCIC pump suction flange on 6" HBB-40 at E51G00201VLX Elevation 96'	HL-1336B-R6	Velocity (in/sec)	0.70	N/A	0.20						
		Displacement(mils)	3.30	0.70	0.80						
18" from RCIC Pump Discharge Flange on 6" DBB-44 at E51G00101VLZ Elevation 100'	HL-1346A-R12	Velocity (in/sec)	0.10	0.08	0.10						
		Displacement(mils)	0.20	0.05	0.30						
Elbow downstream of F204 on 6" DBB-44, Elevation 102'	HL-1346A-R12	Velocity (in/sec)	0.09	0.70	0.75						
		Displacement(mils)	1.20	3.00	0.65						
At Q1E51G001H02 on 6" DBB-44 Elevation 102'	HL-1346A-R12	Velocity (in/sec)	0.08	0.40	0.18						
		Displacement(mils)	0.80	0.80	1.50						
Downstream of F022A on 4" DBB-51 Elevation 97'	HL-1346A-R12	Velocity (in/sec)	0.07	0.15	0.10						
		Displacement(mils)	1.00	3.50	2.00						

TABLE 4.6
FPCCU

LOCATION	ISOMETRIC DRAWING	DATA TYPE	Section 5.6.1			Section 5.6.2					
			X	Y	Z	X	Y	Z	X	Y	Z
8" HBC-15, Elbow after F009B	M-1676-R2	Velocity (in/sec)	0.08	0.08	0.09						
		Displacement(mils)	0.20	0.40	0.90						
8" HBC-15, Elbow after F009A	M-1676-R2	Velocity (in/sec)	0.05	0.04	0.05	0.10	0.10	0.05			
		Displacement(mils)	0.20	0.30	0.60	0.30	1.00	0.50			
8" HBC-15 at G41G01101VVZ	M-1676-R2	Velocity (in/sec)	N/A	0.10	0.09						
		Displacement(mils)	N/A	0.10	0.40						
8" HBC-15 at YS D003A	M-1676-R2	Velocity (in/sec)	0.02	0.02	0.03	0.07	0.06	0.07			
		Displacement(mils)	0.10	0.20	0.20	0.20	1.40	0.70			
8" HBC-19 at G41G01102VVZ	M-1676-R2	Velocity (in/sec)	0.10	N/A	0.11						
		Displacement(mils)	0.20	N/A	0.20						
8" HBC-19 at F010A	M-1676-R2	Velocity (in/sec)	0.02	0.02	0.03	0.08	0.20	0.18			
		Displacement(mils)	0.20	0.70	0.30	0.60	3.00	2.50			
8" HBC-19 at elbow after F011B	M-1676-R2	Velocity (in/sec)	0.07	0.07	0.07	0.06	0.07	0.07			
		Displacement(mils)	0.70	0.80	0.90	0.70	1.40	0.70			
8" HBC-19 at elbow after F011A	M-1676-R2	Velocity (in/sec)	0.08	0.05	0.04	0.14	0.09	0.08			
		Displacement(mils)	0.90	0.60	0.40	2.30	1.30	1.30			
8" HBC-25 elbow after F013A	HL-1351E-R7	Velocity (in/sec)	0.15	0.06	0.06	0.21	0.08	0.08			
		Displacement(mils)	2.50	0.30	0.40	3.00	0.50	0.80			
10" HBC-25 after tee with 8" HBC-25 at elbow	HL-1351E-R7	Velocity (in/sec)	0.10	0.10	0.10	0.11	0.16	0.15			
		Displacement(mils)	0.70	0.40	0.80	0.90	0.40	0.70			
8" HBC-19 at F010B	M-1676-R2	Velocity (in/sec)	0.10	0.25	0.18						
		Displacement(mils)	0.95	3.90	3.50						

TABLE 4.6

FPCUU PUMP B START/STOP

Location	8" HBC-15 first elbow after F009B Z Displacement	8" HBC-19 at F010B Y Displacement
Isometric Drawing	M-1676 R2	M-1676 R2
Test #		
3.6.1		
Start	4.80	12.00
Stop	1.80	3.00

TABLE 4.7
SLCS

LOCATION	ISOMETRIC DRAWING	DATA TYPE	Section 5.7.1								
			X	Y	Z	X	Y	Z	X	Y	Z
1½" DCB-33 between F033A and F003A	M-1684 RO	Velocity (in/sec)	0.40	0.88	0.80						
		Displacement(mils)	0.70	4.80	6.00						
1½" DCB-3 after F004A at Q1C41G113C02	M-1688 RO	Velocity (in/sec)	2.50	N/A	1.00						
		Displacement(mils)	20.00	N/A	8.20						
1½" DCB-3 at Q1C41G113R02	M-1688 RO	Velocity (in/sec)	0.90	1.00	N/A						
		Displacement(mils)	5.50	6.00	N/A						
1½" DCB-3 between Q1C41G11-3C03 and Q1C41G113R02	M-1688 RO	Velocity (in/sec)	0.50	0.40	N/A						
		Displacement(mils)	3.00	3.00	N/A						
1½" DCB-3 at Q1C41G113R03	M-1688 RO	Velocity (in/sec)	0.25	0.48	0.35						
		Displacement(mils)	2.00	0.70	2.00						
1½" DCB-3 between Q1C41G113 R03 and 1C41-R006	M-1688 RO	Velocity (in/sec)	0.20	N/A	0.20						
		Displacement(mils)	2.40	N/A	1.60						

TABLE 4.7

SBLCS PUMP A START/STOP

Location	DCB-33 at 5½" beyond pump discharge Y Displacement	1½" DCA-2 at 3'9" South of Q1C41G114C02 Y Displacement
Isometric Drawing	M-1684 R0	FSK-H-1082-014-C R4
Test #		
1. 3.7.1		
Start	2.50	
Stop	1.30	
2. Test tank to Test tank (6-27-83)		
Start		<1.00
Stop		0.35

TABLE 4.8
SSW

LOCATION	ISOMETRIC DRAWING	DATA TYPE	Section 5.8.1								
			X	Y	Z	X	Y	Z	X	Y	Z
24" HBC-79 at P41G01001VVX	M-1677 R1	Velocity (in/sec)	0.005	0.004	N/A						
		Displacement(mils)	0.15	0.22	N/A						
4" HBC-173 above QSP41G01-R03	M-1677-R1	Velocity (in/sec)	0.02	0.025	0.018						
		Displacement(mils)	0.60	0.60	0.70						
20" HBC-171 before F002A	M-1677 R1	Velocity (in/sec)	N/A	0.04	0.05						
		Displacement(mils)	N/A	0.50	0.40						
6" HBD-171 after F015A-A	M-1677 R1	Velocity (in/sec)	0.003	0.07	0.10						
		Displacement(mils)	0.20	1.30	3.00						
24" HBC-79 after F001A-A	M-1677 R1	Velocity (in/sec)	0.20	0.18	N/A						
		Displacement(mils)	0.30	0.40	N/A						

TABLE 4.8

SSW PUMP A START/STOP

Location	24" HBC-79 at P41G01001VVX X Displacement	24" HBC-79 at P41G01001VVX Y Displacement
Isometric Drawing	M-1677 R1	M-1677 R1
Test #		
A Pump		
Start	2.00	1.40
Stop	1.30	6.30

TABLE 4.9
CGC SYSTEM

LOCATION	ISOMETRIC DRAWING	DATA TYPE	Section 5.9.1 X	Section 5.9.1 Y	Section 5.9.1 Z	Section 5.9.2 X	Section 5.9.2 Y	Section 5.9.2 Z	X	Y	Z
E61G00102VVX on 10" HBB-135	M-1671 R3	Velocity (in/sec)	0.02	0.02	N/A	V/N	V/N	N/A			
		Displacement(mils)	0.15	0.10	N/A	0.24	V/N	N/A			
F002B on 10" HBB-135	M-1671 R3	Velocity (in/sec)	0.008	0.01	0.01	0.013	0.008	0.012			
		Displacement(mils)	0.07	0.10	0.20	0.18	0.10	0.26			
Screen D009B on 10" HBB-136	M-1671 R3	Velocity (in/sec)	0.01	0.015	0.02	V/N	V/N	V/N			
		Displacement(mils)	0.15	0.15	0.30	V/N	V/N	V/N			
After cooler B001A on 12" HBB-135	M-1671 R3	Velocity (in/sec)	V/N	V/N	V/N	0.02	N/A	0.06			
		Displacement(mils)	V/N	V/N	V/N	V/N	N/A	V/N			
E61G00101VVZ on 10" HBB-135	M-1671 R3	Velocity (in/sec)	V/N	V/N	V/N	N/A	0.02	0.01			
		Displacement(mils)	V/N	V/N	V/N	N/A	0.10	0.11			
Between 10" HBB-135 and F001A on 10" HBB-136	M-1671 R3	Velocity (in/sec)	V/N	V/N	V/N	0.021	N/A	0.02			
		Displacement(mils)	V/N	V/N	V/N	0.16	N/A	0.15			
Between 10" HBB-135 and F001B on 10" HBB-136	M-1671 R3	Velocity (in/sec)	0.015	0.02	0.015	V/N	V/N	V/N			
		Displacement(mils)	0.20	0.25	0.25	V/N	V/N	V/N			
Between aftercooler B001B & 12"x4" red. on 12 HBB-135	M-1671 R3	Velocity (in/sec)				0.01	0.01	0.03			
		Displacement(mils)				0.12	0.11	0.90			
A suction flange on 6" HBB-185	M-1671 R3	Velocity (in/sec)	0.08	0.12	0.045	0.07	0.13	N/A			
		Displacement(mils)	0.30	0.45	0.20	0.25	0.30	N/A			

NOTE: V/N denotes vibration negligible

TABLE 4.9

CGC SYSTEM
DRYWELL PURGE COMPRESSORS START/STOP

Location	On F001B on 10" HBB-136		On aftercooler on 10" HBB-135	
	X Displacement	Y Displacement	X Displacement	Y Displacement
Isometric Drawing	M-1671 R3		M-1671 R3	
Test #				
1. B Compressor Start/Stop (7-2-83)				
Start	<1	<1		
Stop	<1	<1		
2. A Compressor Start/Stop (9-6-85)				
Start			<1	<1
Stop			<1	<1

TABLE 4.10
CONDENSATE

LOCATION	ISOMETRIC DRAWING	DATA TYPE	Section 5.10.1								
			X	Y	Z	X	Y	Z	X	Y	Z
24" GBD-21 Condensate Pump Discharge Header BetweenB&C	M-1695A RO	Velocity (in/sec)	N/A	0.20	0.20						
		Displacement(mils)	N/A	3.50	4.00						
30" HBD-147 at N19G00101DLZ	M-1695A RO	Velocity (in/sec)	0.02	0.05	0.02						
		Displacement(mils)	0.40	1.00	0.40						
18" GBD-19 at N19G00101VLX	M-1695A RO	Velocity (in/sec)	0.25	0.08	N/A						
		Displacement(mils)	5.00	1.50	N/A						
24" GBD-21 Condensate Pump Discharge prior to Cleanup System	M-1695A RO	Velocity (in/sec)	0.15	N/A	0.15						
		Displacement(mils)	2.50	N/A	3.00						
24" GBD-28 Condensate Booster Pump Suction after Cleanup System	M-1695B RO	Velocity (in/sec)	0.19	0.15	0.18						
		Displacement(mils)	8.00	2.50	12.00						
14" GBD-17 at N19G00201VLX	M-1695B RO	Velocity (in/sec)	0.10	0.24	0.10						
		Displacement(mils)	6.00	0.80	2.10						
14" GBD-17 at N19G002H14	M-1695B RO	Velocity (in/sec)	0.46	0.04	0.51						
		Displacement(mils)	0.60	0.50	2.50						
24" GBD-28 at N19G002H08	M-1695B RO	Velocity (in/sec)	0.23	0.22	0.21						
		Displacement(mils)	1300*	11.00	3.60						
24" GBD-28 at the Condensate Booster Pump Inlet Header	M-1695B RO	Velocity (in/sec)	0.40	0.20	0.30						
		Displacement(mils)	6.00	1.50	2500*						
16" GBD-29 at N19G002H21	M-1695B RO	Velocity (in/sec)	3.20	N/A	2.30						
		Displacement(mils)	2500*	N/A	8.00*						
14" FBD-1 at the Condensate Booster Pump Bypass	M-1695C RO	Velocity (in/sec)	0.25	0.60	0.50						
		Displacement(mils)	8.00	4.00	6.00						
14" FBD-2 at N19G00301VLX/VLZ	M-1695C RO	Velocity (in/sec)	3.50	0.45	0.30						
		Displacement(mils)	2000*	3.00	6.00*						
24" FBD-1 at the Condensate Booster Pump Discharge Header	M-1695C RO	Velocity (in/sec)	0.15	0.25	0.25						
		Displacement(mils)	6.00	0.80	5.00						
24" FBD-1 at the Feedwater C Heater Inlet	M-1695C RO	Velocity (in/sec)	0.15	0.12	0.12						
		Displacement(mils)	10.00	3.00	5.00						
20" FBD-21 at N19G00401VLZ/VLY	M-1695D RO	Velocity (in/sec)	0.15	0.08	0.12						
		Displacement(mils)	8.00	2.00	4.00						
16" FBD-15 at the FW Heater A String Inlet	M-1695D RO	Velocity (in/sec)	0.30	N/A	0.28						
		Displacement(mils)	4.60	N/A	3.50						
16" FBD-19 at N19G004H01	M-1695D RO	Velocity (in/sec)	N/A	0.06	N/A						
		Displacement(mils)	N/A	1.50	N/A						

TABLE 4.10
CONDENSATE

LOCATION	ISOMETRIC DRAWING	DATA TYPE	Section 5.10.1								
			X	Y	Z	X	Y	Z	X	Y	Z
12" FBD-13 at Feedwater Heater Minimum Flow	M-1695E RO	Velocity (in/sec)	N/A	0.18	0.30						
		Displacement(mils)	N/A	5.00	1300*						
12" FBD-13 at N19G005H03	M-1695E RO	Velocity (in/sec)	0.20	0.06	0.17						
		Displacement(mils)	8.00	3.00	2.80						
24" FBD-21 at N19G005H01	M-1695E RO	Velocity (in/sec)	0.18	0.19	0.12						
		Displacement(mils)	6.40	3.60	5.60						
30" FBD-23 at N21G005H01	M-1695E RO	Velocity (in/sec)	0.09	0.07	0.08						
		Displacement(mils)	4.00*	1.30	2.50						
24" FBD-24 at N21G005H02	M-1695E RO	Velocity (in/sec)	0.22	N/A	0.20						
		Displacement(mils)	9.00	N/A	7.00						
24" FBD-24 at N21G005H04	M-1695E RO	Velocity (in/sec)	0.17	0.11	0.14						
		Displacement(mils)	4.20	3.00	4.00						
24" FBB-24 at N21G005MLX	M-1695E RO	Velocity (in/sec)	0.14	0.06	0.13						
		Displacement(mils)	4.00	1.10	4.00						

NOTE: *Large low frequency oscillations

TABLE 4.10

CONDENSATE BOOSTER PUMPS START/STOP

Location	16" GBD-29 at N1N19G002H01 Z Displacement	12" FBD-2 at N1N19G003H18 X Displacement	16" GBD-29 at N1N19G002H04 X Displacement	12" FBD-2 at N1N19G003H18 Z Displacement	16" GBD-29 at 1N19G002H05 Z Displacement	12" FBD-2 at 1N19G003H16 X Displacement
Isometric Drawing	M-1695B-RO	M-1695C-RO	M-1695B-RO	M-1695C-RO	M-1695B-RO	M-1695C-RO
Test						
1. A Booster Pump Start/Stop (4-9-82)						
Start	6.00	15.00				
Stop	13.50	8.50				
2. B Booster Pump Start/Stop (4-19-82)						
Start			1.50	10.50		
Stop			2.10	2.10		
3. C Booster Pump Start/Stop (4-19-82)						
Start					7.00	7.00
Stop					9.00	7.50

TABLE 4.11
RWCU SYSTEM

LOCATION	ISOMETRIC DRAWING	DATA TYPE	Section 5.11.1 X	Y	Z	X	Y	Z	X	Y	Z
At tee of 2" DCA-24 and 4"		Velocity (in/sec)	0.012	0.015	0.005						
DCA-1	M-1696A-R1	Displacement(mils)	0.20	0.15	0.40						
At tee of 1" DCA-86 and 4"		Velocity (in/sec)	0.004	0.005	0.004						
DCA-11	M-1696A-R1	Displacement(mils)	0.04	0.08	0.07						
5' after Q1G33G002H16 on 4"		Velocity (in/sec)	0.03	0.03	N/A						
DCA-1	M-1696A-R1	Displacement(mils)	0.30	0.40	N/A						
B33G02401VLL/VLY on 4"		Velocity (in/sec)	0.02	0.015	0.02						
DCA-10	M-1696A-R1	Displacement(mils)	0.15	0.30	0.20						
Next elbow (3'4") after		Velocity (in/sec)	0.02	0.015	N/A						
Q1G33G002H14 on 6" DCA-9	M-1696A-R1	Displacement(mils)	0.50	0.15	N/A						
At tee of 2" DBZ-19 and 4"		Velocity (in/sec)	0.013	0.04	0.075						
DBZ-1	M-1696A-R1	Displacement(mils)	0.30	0.30	0.40						
		Velocity (in/sec)	0.024	0.017	0.027						
At F005B on 4" DBZ-1	M-1696A-R1	Displacement(mils)	0.13	0.10	0.07						
		Velocity (in/sec)	0.02	0.02	0.036						
At tee of F005A on 4" DBZ-1	M-1696A-R1	Displacement(mils)	0.20	0.10	0.08						
1' north of F012A on 4"		Velocity (in/sec)	0.08	0.06	0.09						
DBZ-2	M-1696A-R1	Displacement(mils)	0.80	0.30	1.50						
At elbow after (1')		Velocity (in/sec)	0.05	0.015	0.03						
1G33G01101DLZ on 6" DBA-89	M-1696B-R1	Displacement(mils)	1.00	0.20	0.50						
2' after Q1G33G011H01 on 6"		Velocity (in/sec)	0.04	N/A	0.01						
DBA-89	M-1696B-R1	Displacement(mils)	0.90	N/A	0.20						
At Data Point 768 on 6"		Velocity (in/sec)	0.02	N/A	0.04						
DBA-89	M-1696B-R1	Displacement(mils)	0.30	N/A	0.80						
1' after F250 on 6" DBA-89		Velocity (in/sec)	0.02	0.02	0.02						
(Y on valve body)	M-1696B-R1	Displacement(mils)	0.30	0.30	0.40						

TABLE 4.12
JOCKEY PUMPS

LOCATION	ISOMETRIC DRAWING	DATA TYPE	Section 5.12.1			Section 5.12.2			Section 5.12.3		
			X	Y	Z	X	Y	Z	X	Y	Z
E22G10101VVY/10102VVZ on 1½" HBB-28	M-1644A-R1	Velocity (in/sec)	N/A	0.05	0.10						
		Displacement(mils)	N/A	0.15	0.30						
E22G11301VVX on 1" DBB-15	M-1644B-R1	Velocity (in/sec)	0.05	0.05	N/A						
		Displacement(mils)	0.70	0.15	N/A						
E22G11303VVY on 1" HBB-27	M-1644B-R1	Velocity (in/sec)	0.15	0.07	N/A						
		Displacement(mils)	0.60	0.12	N/A						
E22G10501VVY on 1" DBB-15	M-1644C-R1	Velocity (in/sec)	0.03	0.03	N/A						
		Displacement(mils)	0.50	0.20	N/A						
E21G10703VVZ on 1½" HBB-12	M-1645A-R1	Velocity (in/sec)				0.04	0.07	0.05			
		Displacement(mils)				0.10	0.10	0.10			
E21G10701VVX/10702VVZ on 1½" HBB-12	M-1645A R1	Velocity (in/sec)				0.05	N/A	0.03			
		Displacement(mils)				0.15	N/A	0.70			
E21G10301VVY/302VVZ on 1" HBB-11	M-1645B-R1	Velocity (in/sec)				N/A	0.04	0.03			
		Displacement(mils)				N/A	0.17	0.13			
Elevation 96' on 1½" HBB-12	M-1645A-R1	Velocity (in/sec)				0.05	N/A	0.04			
		Displacement(mils)				0.15	N/A	0.15			
E12G22501VVX on 1½" GBB-56	M-1646A-R1	Velocity (in/sec)							0.02	N/A	0.02
		Displacement(mils)							0.30	N/A	0.20
E12G22503VVY/22504VVZ on 1½" GBB-56	M-1646A-R1	Velocity (in/sec)							N/A	0.05	0.04
		Displacement(mils)							N/A	0.40	0.40
E12G16301VVY/16302VVX on 1½" GBB-35	M-1646B-R1	Velocity (in/sec)							0.06	0.05	N/A
		Displacement(mils)							0.20	0.10	N/A

TABLE 4.12
JOCKEY PUMPS

LOCATION	ISOMETRIC DRAWING	DATA TYPE	Section 5.12.3			Section 5.12.4					
			X	Y	Z	X	Y	Z	X	Y	Z
E12G16401VVX/16402VVZ on 1½" GBB-35	M-1646C-R1	Velocity (in/sec)	0.03	N/A	0.03						
		Displacement(mils)	0.20	N/A	0.30						
E12G10101VVY/10102VVZ on 1½" GBB-66	M-1647A-R1	Velocity (in/sec)				0.04	0.04	N/A			
		Displacement(mils)				0.20	0.10	N/A			
E12G15101VVY/VVZ on 1½" GBB-67	M-1647B-R1	Velocity (in/sec)				N/A	0.02	0.015			
		Displacement(mils)				N/A	0.20	0.20			

5.0 DISCUSSION

5.1 FEEDWATER SYSTEM

5.1.1 Rated Feedwater Flow

This test was run with the reactor at full power due to the inability to obtain full feedwater flow during preoperational testing. All radiologically accessible feedwater piping was inspected and found to be acceptable. There were several loose small bore lines discovered on the Condensate piping which exhibited minor vibration. These lines were located on 24" GBD-28, reference M-1695B. All data can be found on Table 4.1.

5.2 RHR SYSTEM

5.2.1 Suppression Pool Cooling A

In addition to the points inspected, small bore piping and instrument lines were inspected visually for vibrations and found to be acceptable. All data can be found on Table 4.2.

5.2.2 Suppression Pool Cooling B

See 5.2.1

5.2.3 Low Pressure Coolant Injection A

See 5.2.1

5.2.4 Low Pressure Coolant Injection B

See 5.2.1

5.2.5 Low Pressure Coolant Injection C

See 5.2.1

5.2.6 Shutdown Cooling A, Recirculation to Feedwater

See 5.2.1

5.2.7 Shutdown Cooling B, Recirculation to Feedwater

See 5.2.1

5.2.8 Shutdown Cooling A, Recirculation to LPCI Line

See 5.2.1

5.2.9 Shutdown Cooling B, Recirculation to LPCI Line

See 5.2.1

5.2.10 Test Return Line A

In addition to the points inspected, small bore piping and instrument lines were inspected visually for vibrations and found to be acceptable. The test connection piping (with valves E12F322 and F348) was found vibrating with 34 mil displacement at the end near the line cap and 24 mil displacement below valve E12F348. The minimum flow line, 4" GBB-37, was vibrating with a displacement of 10 to 30 mils at spring hanger Q1E12G012H04 and a velocity of 0.8 to 2.00 in/sec. All data can be found on Table 4.2.

5.2.11 Test Return Line B

In addition to the points inspected, small bore piping and instrument lines were inspected visually for vibrations and found to be acceptable. While all lines were acceptable, line 1"HBB 184-1"HBD-1095 - 1"HBB184 had a high frequency vibration (approximately 2.5 in/sec) with a displacement of approximately 20 mils. All data can be found on Table 4.2.

5.2.12 Test Return Line C

See 5.2.1

5.2.13 Test Return A, Minimum Flow Line

In addition to the points inspected, small bore piping and instrument lines were inspected visually for vibrations and found to be acceptable. Noticeable vibration was also observed at the elbow on 4" HBB-120. All data can be found on Table 4.2.

5.2.14 Test Return B, Minimum Flow Line

In addition to the points inspected, small bore piping and instrument lines were visually inspected for vibrations and found to be acceptable. However, the 4" HBB-113 line was judged to be vibrating excessively. Maximum vibration was at the elbow near hanger Q1E12G010H09. Field report E12-0060 was written to document this problem. The resolution involved the redesign at the piping supports in the vicinity of the minimum flow line. All vibration data can be found on Table 4.2.

5.2.15 Test Return C, Minimum Flow Line

See 5.2.1

5.2.16 Spent Fuel Pool Cooling Assist A

See 5.2.1

5.2.17 Spent Fuel Pool Cooling Assist B

In addition to the points inspected, small bore piping and instrument lines were visually inspected for vibrations and found to be acceptable. A drain line, 1" GBB-94 was observed vibrating on the order of 1/8". All data can be found on Table 4.2

5.2.18 Modified Low Pressure Coolant Injection C, Suction from Spent Fuel Pool

See 5.2.1

5.2.19 Head Spray

See 5.2.1

5.2.20 A Pump Start/Stop

See 5.2.1

5.2.21 B Pump Start/Stop

See 5.2.1

5.2.22 C Pump Start/Stop

See 5.2.1

5.3 HIGH PRESSURE CORE SPRAY SYSTEM

5.3.1 RPV Injection From Suppression Pool Orifice Resized

This test of HPCS only examined the pump discharge piping. It was deemed acceptable. All data can be found on Table 4.3.

5.3.2 RPV Injection From Suppression Pool

This test of HPCS was prematurely terminated with the discovery of a broken test connection line. The HPCS pump start vibration levels were acceptable. The remaining points were measured during subsequent testing. All data can be found on Table 4.3.

5.3.3 RPV Injection From Suppression Pool

Following repair of the test connection 3/4" DBB-4 (supports for which were redesigned to provide added rigidity) the visual observation of vibrations was judged acceptable. The pump start and stop data was also acceptable. All data can be found on Table 4.3.

5.3.4 HPCS Test Return CST to CST

All the HPCS piping was inspected and found acceptable. The discharge line relief valve was vibrating at between 50 and 80 mils in the horizontal direction. All data can be found on Table 4.3.

5.3.5 HPCS Test Return Suppression Pool to Suppression Pool

In addition to the points inspected, small bore piping and instrument lines were visually inspected for vibration and found acceptable. All data can be found on Table 4.3.

5.3.6 HPCS Minimum Flow to Suppression Pool

Visual inspection of piping, including small bore and instrumentation lines, was deemed acceptable. Vibration of lines ½ HBD-1429 for both F304 and F303 was noted by inspection. Magnitude was estimated at approximately 1/16". The 3/4" HBB-24 small bore vents and drain line located on the Suppression Pool Suction Line was also checked and found acceptable. All data can be found on Table 4.3.

5.4 LOW PRESSURE CORE SPRAY

5.4.1 LPCS Vessel Injection Runnout

In addition to the points inspected, small bore piping and instrument lines were inspected visually for vibrations and found to be acceptable. All data can be found on Table 4.4.

5.4.2 LPCS Vessel Injection Rated Flow

See 5.4.1

5.4.3 LPCS Test Return to Suppression Pool

See 5.4.1

5.4.4 LPCS Minimum Flow to Suppression Pool

See 5.4.1

5.5 REACTOR CORE ISOLATION COOLING

5.5.1 RCIC Rated Flow CST to CST

In addition to the points inspected, all small bore piping and instrument lines were visually inspected for vibration. All lines were found acceptable. All data can be found on Table 4.5.

5.6 FUEL POOL COOLING AND CLEANUP

5.6.1 FPCCU Pump B to Containment Pools

In addition to the points inspected, all small bore piping and instrument lines were visually inspected for vibration. All lines were found acceptable. All data can be found on Table 4.6.

5.6.2 FPCCU Pump A to Containment Pools

See 5.6.1

5.7 STANDBY LIQUID CONTROL SYSTEM

5.7.1 SLCS Storage Tank to Reactor Pressure Vessel - A Pump

In addition to the points inspected all small bore unsupported piping and instrument lines were visually inspected for vibration. All lines were found acceptable. All data can be found on Table 4.7.

5.8 STANDBY SERVICE WATER SYSTEM

5.8.1 SSW Maximum Flow Through RHR Heat Exchangers

In addition to the recorded inspected points, all small bore piping and instrumentation lines were visually inspected for vibration. Their vibration levels were acceptable. The complete data for this section can be found on Table 4.8.

5.8.2 SSW Flow Through DIV. II Room Coolers

The inspection for this data set included checking all ESF Switchgear Room Coolers with their associated fans running (except for DIV. I West 139'

elevation - breaker was tagged out). The RHR A, B, & C, LPCS and HPCS room coolers were also inspected with their fans running. The RHR B&C Pump seal coolers were also inspected while SSW flow was provided to them. All observed vibration levels were negligible.

5.8.3 SSW Flow Through DIV. I Room Coolers

The inspection for this data set included checking the SSW A piping to RCIC and the ESF DIV. I West 139' elevation switchgear room coolers. The SSW piping to the RHR A pump seal cooler was also inspected. All observed vibration levels were negligible.

5.8.4 SSW Flow Through Drywell Purge Compressor B Cooler

The inspection for this test condition involved inspecting the SSW B piping to the B Drywell Purge Compressor during operation of the system. All vibration levels observed were satisfactory.

5.8.5 SSW Flow Through Drywell Purge Compressor A Cooler

See 5.8.4

5.9 COMBUSTIBLE GAS CONTROL

5.9.1 B Drywell Purge Compressor - Normal Operation

In addition to the inspection points found on Table 4.9, SSW small bore piping to the aftercooler was inspected. All points inspected were satisfactorily accepted. The small bore piping was found to be adequately supported.

5.9.2 A Drywell Purge Compressor - Normal Operation

See 5.9.1

5.10 CONDENSATE SYSTEM

5.10.1 Flow Through Feedwater Minimum Flow Lines, All Condensate Pumps and Condensate Booster Pumps in Operation

The Condensate System was visually inspected during this test with data taken as shown on Table 4.10. In addition, Condensate System small bore piping was visually inspected during the test and found to be exhibiting acceptable vibration levels. Various locations were exhibiting low-frequency oscillations as noted in Table 4.10.

5.11 REACTOR WATER CLEANUP SYSTEM

5.11.1 Two Pumps In Pre-pump Mode, Maximum Flow Bypassing Heat Exchangers

The RWCU System was visually inspected with measurements taken at the locations documented on Table 4.11. In addition, RWCU Piping in the drywell, heat exchanger rooms, pump rooms and the Steam Tunnel was visually inspected for small bore piping and instrumentation lines. All inspections denoted satisfactory levels of vibrations.

5.12 JOCKEY PUMPS

5.12.1 HPCS Jockey Pump

In addition to the points inspected, small bore piping and instrument lines were visually inspected for vibration and found acceptable. All applicable data can be found on Table 4.12.

5.12.2 LPCS Jockey Pump

See 5.12.1

5.12.3 RHR A Jockey Pump

See 5.12.1

5.12.4 RHR C Jockey Pump

See 5.12.1

5.13 FEEDWATER LEAKAGE CONTROL SYSTEM

5.13.1 Both Subsystems in Service With the Reactor and Feedwater Shutdown

This test section involved a walkdown from the RHR jockey pumps to the Feedwater lines. Piping included in the walkdown can be found on M-1685 and small bore drawings FSK-S-1077A-056, 062, FSK-S-1085A-068, 069, 070, 071, 021, FSK-S-1112-002, 005, 010, FSK-S-1085B-050, 048, 049, 022. Due to the small size of the line, particularly at the specified location E38G10301VVZ, and the extremely low levels of vibration and contamination possibilities, no instrument readings were taken with the hand held meter. All inspected FWLCS piping was found installed properly and had no abnormal vibration.

5.14 MAIN STEAM ISOLATION VALVE LEAKAGE CONTROL SYSTEM

5.14.1 Dilution Air to Blowers

The inboard and outboard subsystem were visually inspected during system operation. All observed vibration levels were negligible.