

PACIFIC GAS & ELECTRIC COMPANY
MECHANICAL & NUCLEAR ENGINEERING
DIABLO CANYON UNIT 1
WALKDOWN OF PIPING DURING INITIAL HEATUP

Procedure P-36
Revision 2

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1.0 Purpose

The purpose of this procedure is to verify that the following points are complied with during the initial RCS heatup:

- a) Those piping systems subject to significant thermal expansion and/or thermal anchor motion during heatup respond in accordance with calculated deflections.
- b) The piping systems meet the acceptance criteria described in section 4.0.
- c) Adequate piping clearances are maintained.

2.0 Scope

2.1 Hot deflection measurement for the piping systems listed in Section 2.2 will be conducted only for that piping identified on the pipe stress analysis isometric drawings listed in Appendix A.

2.2 The piping systems within the scope of the walkdown are:

2.2.1 Main Feedwater inside Containment

2.2.2 Main Steam

2.2.2.1 Main Steam Leads inside Containment

2.2.2.2 Main Steam Leads from Containment Penetrations to the High Pressure Turbine, including Relief Valve Headers and the Cross Tie Header, will be visually inspected at all plateaus.

2.2.2.3 Safety related portions of Steam Generator Blowdown



2.2.3 Reactor Coolant System

2.2.3.1 RTD piping

2.2.3.2 Pressurizer piping

2.2.4 Chemical and Volume Control System

2.2.4.1 Charging from the Regenerative Heat Exchanger to the Reactor Coolant System will be visually inspected at the 250°F, 340°F, and 450°F plateaus and will be measured at the 547°F plateau.

2.2.4.2 Letdown from the Reactor Coolant System to the Regenerative Heat Exchanger

2.2.4.3 Letdown from the Regenerative Heat Exchanger to the Letdown Heat Exchanger will be visually inspected at the 250°F, 340°F, and 450°F plateaus and will be measured at the 547°F plateau.

2.2.4.4 Seal Water Injection, Leakoff, and Bypass piping from the Reactor Coolant Pumps out to the first anchor

2.2.5 Safety Injection System piping attached to the Reactor Coolant System out to the first anchor or when used as a part of the Residual Heat Removal System

2.2.6 All Residual Heat Removal piping used for heatup

2.2.7 Component Cooling Water piping attached to the Reactor Coolant Pumps out to the first anchor



2.2.8 Diesel Engine Exhaust Piping

2.3 For convenience in performing the walkdown the analyses are grouped into the walkdown packages listed in Appendix B.

2.4 The P&ID's containing the scope piping are listed in Appendix C.

3.0 Responsibility

3.1 Engineering is responsible for the following activities:

3.1.1 Providing the pipe stress isometric and sets of thermal displacements at heatup hold temperatures corresponding to the latest revision of the analysis.

3.1.2 Assisting General Construction as required during the walkdown.

3.1.3 Resolving any problems between calculated movements and actual movements.

3.1.4 Final review and acceptance of each Heatup Walkdown Package and all associated Heatup Walkdown Problem Reports.

2

3.2 The Stress Walkdown Team Leader is responsible for interfacing with Startup Team, meeting the requirements of this procedure, assuring that all measurements are taken, and that problems, if any, are resolved prior to leaving a temperature plateau.



4.0 Acceptance Criteria

- 4.1 Piping systems, as described in Section 2.0 involved in this test that are subject to visual inspection will be deemed acceptable for thermal expansion if the following criteria are satisfied.
- 4.1.1 The piping system and related or attached components should not be restrained against thermal expansion during the test except by design intent.
- 4.1.2 If the piping system is supported by spring hangers, these should not become extended or compressed beyond their working range during the thermal expansion of the piping.
- 4.1.3 If the piping system is restrained by snubbers, these will not become extended or compressed to the limits of their total travel, or bound-up due to the swing angle during the thermal expansion of the piping.
- 4.1.4 Measured deflections will be reviewed against the calculated deflections and should fall within the shaded acceptable range of the graph in Appendix D.
- 4.2 It is not the intent of this procedure, nor is it required, to verify during this test the movements predicted by the analysis for every point in the system. Instead the above objectives will be accomplished by monitoring pre-selected, strategically located snubbers, spring supports and rupture restraints and/or by visual observation of piping clearances. These pre-selected points are as noted on the pipe stress analysis isometrics (see Appendix A).
- 4.3 All exceptions to the acceptance criteria shall be documented and reconciled by Engineering (Refer to section 5.3.4).



5.0 Procedure

- 5.1 Prior to the beginning of Heatup the walkdown packages will be assembled and the following efforts completed:
 - 5.1.1 Data points will be chosen that can be used to monitor the overall behavior of the piping system.
 - 5.1.2 Directions of displacement to be measured at each data point will be determined and marked on the stress analysis isometric.
 - 5.1.3 Expected displacement at the data points will be calculated in the localized directions to be measured. These displacements will be recorded (to the nearest 0.1") on Attachment C under "Calculated Deflections".
 - 5.1.4 The "Cold Positions" will be measured (to the nearest 0.1"), recorded on Attachment 3, and signed off on Attachment 1.
- 5.2 Prior to walkdown activities at a given temperature, the system's temperature will be held constant for a minimum of 60 minutes. This will allow thermal transients to decay, ensuring that the piping system is at steady state temperature.
- 5.3 The following work will be completed at each of the temperature plateaus defined in Appendix E:
 - 5.3.1 The "Hot Positions" will be measured (to the nearest 0.1"), recorded on Attachment 3, and signed off on Attachment 1.



5.3.2 In the course of recording data for Section 5.3.1, the entire piping system shall be observed for compliance with the criteria listed in Section 4.1.

5.3.3 The "Measured Deflection" will be determined and compared with the "Calculated Deflections".

5.3.4 A Heatup Walkdown Problem Report (Attachment 2) will be used to document any cases where measured deflections do not satisfy the acceptance criteria and/or where interferences occur. The problem resolution section will be completed by a Walkdown Team Member. | 2

5.3.5 The Walkdown Team Leader will notify the G.C. Startup Team of the completion of walkdown activities at each temperature plateau.

5.4 At the completion of Walkdown activities the Walkdown Team Leader will indicate final Engineering Acceptance by signing the Heatup Walkdown Cover Sheet, as well as each associated Heatup Walkdown Problem Report in the designated space. Upon final acceptance, the Walkdown Team Leader shall transfer completed Walkdown Packages to Project Engineering File 146.154. | 2

6.0 Walkdown Package

The walkdown package shall be assembled and completed as follows:

6.1 The Heatup Walkdown Cover Sheet, Attachment 1, will be completed to indicate the piping system description and analysis numbers (see Appendix B), the completion of the walkdown for each test temperature, and final acceptance by Engineering.



- 6.2 The stress analysis isometrics will be included.
- 6.3 The Heatup Walkdown Piping Deflection Sheet(s) (Attachment 3) will be completed. The Calculated Deflections and Cold Positions will be entered prior to heatup (Section 5.1). Hot Positions will be entered during heatup (Section 5.3), and Measured Deflections will be calculated from the cold and hot position data.
- 6.4 One copy of each Heatup Walkdown Problem Report will remain as part of the package.
- 6.5 Applicable computer runs and hand calculations made prior to and during heatup will be included in the package. This information will be listed in calculation MP-1065.

7.0 Documentation

- 7.1 All Walkdown Packages will be filed under file number 146.154.
- 7.2 Because the calculations performed to generate the anticipated thermal movements are not "design" calculations, an approving signature is not required.

8.0 Equipment

The engineering personnel performing this walkdown shall be provided with or have access (as required) to the following:

- a) scales
- b) binoculars
- c) safety belts
- d) flashlight
- e) required forms
- f) gloves
- g) pyrometers



9.0 References

9.1 Startup Test Procedure No. 40.0.

9.2 Operating Procedure No. L-1

10.0 Appendices

10.1 Appendix A - List of Pipe Stress Analysis Isometrics to be included
in the Heatup Walkdown

10.2 Appendix B - List of Walkdown Packages

10.3 Appendix C - List of Scope Piping P&IDs

10.4 Appendix D - Piping Displacement Acceptance Chart

10.5 Appendix E - Test Temperatures

11.0 Attachments

11.1 Attachment 1 - Heatup Walkdown Cover Sheet

11.2 Attachment 2 - Heatup Walkdown Problem Report

11.3 Attachment 3 - Heatup Piping Deflections



List of Pipe Stress Analysis Isometrics to be
Included in the Heatup Walkdown

<u>Iso. No.</u>	<u>Title</u>
1. 1-100	Steam Generator 4 Blowdown Inside Containment
2. 1-101	Steam Generator 1 Blowdown Inside Containment
3. 1-102	Steam Generator 1 Blowdown Inside Containment
4. 1-103	Steam Generator 2 Blowdown Inside Containment
5. 1-104	Steam Generator 4 Blowdown Inside Containment
6. 1-105	Steam Generator 1 Blowdown Inside Containment
7. 1-106	Steam Generator 1 Outlet Inside Containment
8. 1-107	Steam Generator 2 Blowdown Inside Containment
9. 1-110	Steam Generator 3 Blowdown Inside Containment
10. 1-111	Steam Generator 1 Blowdown Outside Containment
11. 1-112	Steam Generator 2 Blowdown Outside Containment
12. 1-113	Steam Generator 3 Blowdown Outside Containment
13. 1-114	Steam Generator 4 Blowdown Outside Containment
14. 1-119	Steam Generator 2 Outlet Inside Containment
15. 1-120	Steam Generator 3 Outlet Inside Containment
16. 1-121	Steam Generator 4 Outlet Inside Containment
17. 2-100	Steam Generator 2 Feedwater Supply Inside Containment
18. 2-101	Steam Generator 3 Feedwater Supply Inside Containment
19. 2-102	Steam Generator 1 Feedwater Supply Inside Containment
20. 2-103	Steam Generator 4 Feedwater Supply Inside Containment
21. 3-101	Loop 1 Pressurizer Spray
22. 3-102	Loop 1 Pressurizer Spray
23. 3-104	Loops 1 and 2 Pressurizer Spray
24. 4A-101	Reactor Coolant Pump 2 Thermal Barrier Component Cooling Water Return
25. 4A-110	Reactor Coolant Pumps 3 and 4 Thermal Barrier Component Cooling Water Return
26. 4A-111	Reactor Coolant Pump 1 Thermal Barrier Component Cooling Water Return
27. 4A-113	Reactor Coolant Pump 3 Motor Upper Bearing Cooler Component Cooling Water Return



List of Pipe Stress Analysis Isometrics to be
Included in the Heatup Walkdown

<u>Iso. No.</u>	<u>Title</u>
28. 4A-114	Reactor Coolant Pump 4 Component Cooling Water Supply
29. 4A-115	Reactor Coolant Pump 2 Component Cooling Water Supply
30. 4A-116	Reactor Coolant Pump 1 Component Cooling Water Supply
31. 4A-117	Reactor Coolant Pump 1 Motor Upper Bearing Cooler Component Cooling Water Return
32. 4A-119	Reactor Coolant Pump 2 Motor Upper Bearing Cooler Component Cooling Water Return
33. 4A-123	Reactor Coolant Pump 4 Motor Upper Bearing Cooler Component Cooling Water Return
34. 4A-125	Reactor Coolant Pump 3 Component Cooling Water Supply
35. 6-100	Residual Heat Removal Pump 1 Injection to Loops 1 and 2 Cold Legs
36. 7-100	Loop 4 Hot Leg RTD
37. 7-101	Loop 3 RTD
38. 7-102	Loop 4 RTD
39. 7-103	Loop 1 RTD
40. 7-104	Loop 2 RTD
41. 8-103	Residual Heat Removal Pumps Suction and Discharge
42. 8-110	Residual Heat Removal Heat Exchanger 2 Outlet
43. 8-112	Residual Heat Removal Pump 1 Suction and Discharge
44. 8-121	Residual Heat Removal Pump 2 Suction and Discharge
45. 8-304	Reactor Coolant Pump 4 Seal Water Injection
46. 8-306	Reactor Coolant Pump 2 Seal Water Injection
47. 8-308	Reactor Coolant Pump 3 Seal Water Bypass
48. 8-311	Reactor Coolant Pump 1 Seal Water Leakoff
49. 8-312	Reactor Coolant Pump 2 Seal Water Leakoff
50. 8-313	Reactor Coolant Pump 3 Seal Water Leakoff
51. 8-314	Reactor Coolant Pump 4 Seal Water Leakoff
52. 8-319	Reactor Coolant Pump 3 Seal Water Injection
53. 8-320	Reactor Coolant Pump 1 Seal Water Injection



List of Pipe Stress Analysis Isometrics to be
Included in the Heatup Walkdown

<u>Iso. No.</u>	<u>Title</u>
54. 8-327	Reactor Coolant Pump 2 Seal Water Bypass
55. 8-328	Reactor Coolant Pump 4 Seal Water Bypass
56. 8-329	Reactor Coolant Pump 1 Seal Water Bypass
57. 9-104	Regenerative Heat Exchanger Outlet
58. 9-105	Charging to Loop 3
59. 9-106	Charging to Loop 4 Cold Leg
60. 9-107	Charging to Loop 3 Cold Leg
61. 9-108	Letdown to Regenerative Heat Exchanger
62. 9-109	Letdown from Loop 2
63. 9-110	Letdown from Loop 2
64. 9-111	Letdown from Loop 2 Crossover Leg
65. 9-113	Regenerative Heat Exchanger Outlet
66. 9-300	Boron Injection to Loops 1 and 4 Cold Legs
67. 9-301	Boron Injection to Loop 2 Cold Leg
68. 9-302	Boron Injection to Loop 3 Cold Leg
69. 10-301	Letdown from Regenerative Heat Exchanger Outside Containment
70. 14-101	Diesel Engine 1 Exhaust
71. 14-102	Diesel Engine 2 Exhaust
72. 14-103	Diesel Engine 3 Exhaust
73. ACC1/RHR1	Accumulator 1 and Residual Heat Removal to Loop 1 Cold Leg
74. ACC2/RHR2	Accumulator 2 and Residual Heat Removal to Loop 2 Cold Leg
75. ACC3/RHR3	Accumulator 3 and Residual Heat Removal to Loop 3 Cold Leg
76. ACC4/RHR4	Accumulator 4 and Residual Heat Removal to Loop 4 Cold Leg
77. PSARV	Pressurizer Safety and Relief Valves
78. RHRHL4	Residual Heat Removal Suction from and Safety Injection to Loop 4 Hot Leg
79. SI12	Safety Injection and Residual Heat Removal to Loops 1 and 2 Hot Legs
80. SI3	Safety Injection to Loop 3 Hot Leg
81. SURGE	Pressurizer Surge



List of Walkdown Packages

<u>Walkdown Package</u>	<u>Analyses</u>	<u>Description</u>
1	2-102	Steam Generator 1 Feedwater Supply Inside Containment
2	2-100	Steam Generator 2 Feedwater Supply Inside Containment
3	2-101	Steam Generator 3 Feedwater Supply Inside Containment
4	2-103	Steam Generator 4 Feedwater Supply Inside Containment
5	1-106	Steam Generator 1 Outlet
6	1-119	Steam Generator 2 Outlet
7	1-120	Steam Generator 3 Outlet
8	1-121	Steam Generator 4 Outlet
9	1-101, 1-102, 1-105	Steam Generator 1 Blowdown Inside Containment
10	1-103, 1-107	Steam Generator 2 Blowdown Inside Containment
11	1-110	Steam Generator 3 Blowdown Inside Containment
12	1-100, 1-104	Steam Generator 4 Blowdown Inside Containment
13	1-111	Steam Generator 1 Blowdown Outside Containment
14	1-112	Steam Generator 2 Blowdown Outside Containment
15	1-113	Steam Generator 3 Blowdown Outside Containment
16	1-114	Steam Generator 4 Blowdown Outside Containment
17	7-103	Loop 1 RTD



List of Walkdown Packages

<u>Walkdown Package</u>	<u>Analyses</u>	<u>Description</u>
18	7-104	Loop 2 RTD
19	7-101	Loop 3 RTD
20	7-100, 7-102	Loop 4 RTD
21	SURGE	Pressurizer Surge
22	PSARV	Pressurizer Safety and Relief
23	3-101, 3-102, 3-104	Pressurizer Spray
24	9-104, 9-105, 9-106, 9-107	Charging from Regenerative Heat Exchanger to Reactor Coolant System
25	9-108, 9-109, 9-110, 9-111	Letdown from Reactor Coolant System to Regenerative Heat Exchanger
26	9-113	Letdown from Regenerative Heat Exchanger Inside Containment
27	10-301	Letdown from Regenerative Heat Exchanger Outside Containment
28	8-311, 8-320, 8-329	Reactor Coolant Pump 1 Seal Water Injection, Bypass and Leakoff
29	8-306, 8-312, 8-327	Reactor Coolant Pump 2 Seal Water Injection, Bypass and Leakoff
30	8-308, 8-313, 8-319	Reactor Coolant Pump 3 Seal Water Injection, Bypass and Leakoff
31	8-304, 8-314, 8-328	Reactor Coolant Pump 4 Seal Water Injection, Bypass and Leakoff
32	6-100, ACC1/RHR1, ACC2/RHR2	Residual Heat Removal Pump 1 and Accumulator Injection to Loops 1 and 2 Cold Legs
33	ACC3/RHR3, ACC4/RHR4	Residual Heat Removal Pump 2 and Accumulator Injection to Loops 3 and 4 Cold Legs



List of Walkdown Packages

<u>Walkdown Package</u>	<u>Analyses</u>	<u>Description</u>
34	9-300	Boron Injection to Loops 1 and 4 Cold Legs
35	9-301	Boron Injection to Loop 2 Cold Leg
36	9-302	Boron Injection to Loop 3 Cold Leg
37	SI12	Residual Heat Removal Pumps and Safety Injection to Loops 1 and 2 Hot Legs
38	SI3	Safety Injection to Loop 3 Hot Leg
39	RHRHL4	Residual Heat Removal Suction from and Safety Injection to Loop 4 Hot Leg
40	8-103, 8-110, 8-112 8-121	Residual Heat Removal Outside Containment
41	4A-111, 4A-116, 4A-117	Component Cooling Water Supply and Return to Reactor Coolant Pump 1
42	4A-101, 4A-115, 4A-119	Component Cooling Water Supply and Return to Reactor Coolant Pump 2
43	4A-110, 4A-113, 4A-125	Component Cooling Water Supply and Return to Reactor Coolant Pumps 3 and 4 (partial)
44	4A-114, 4A-123	Component Cooling Water Supply and Return to Reactor Coolant Pump 4 (partial)
45	14-101	Diesel Engine 1 Exhaust
46	14-102	Diesel Engine 2 Exhaust
47	14-103	Diesel Engine 3 Exhaust

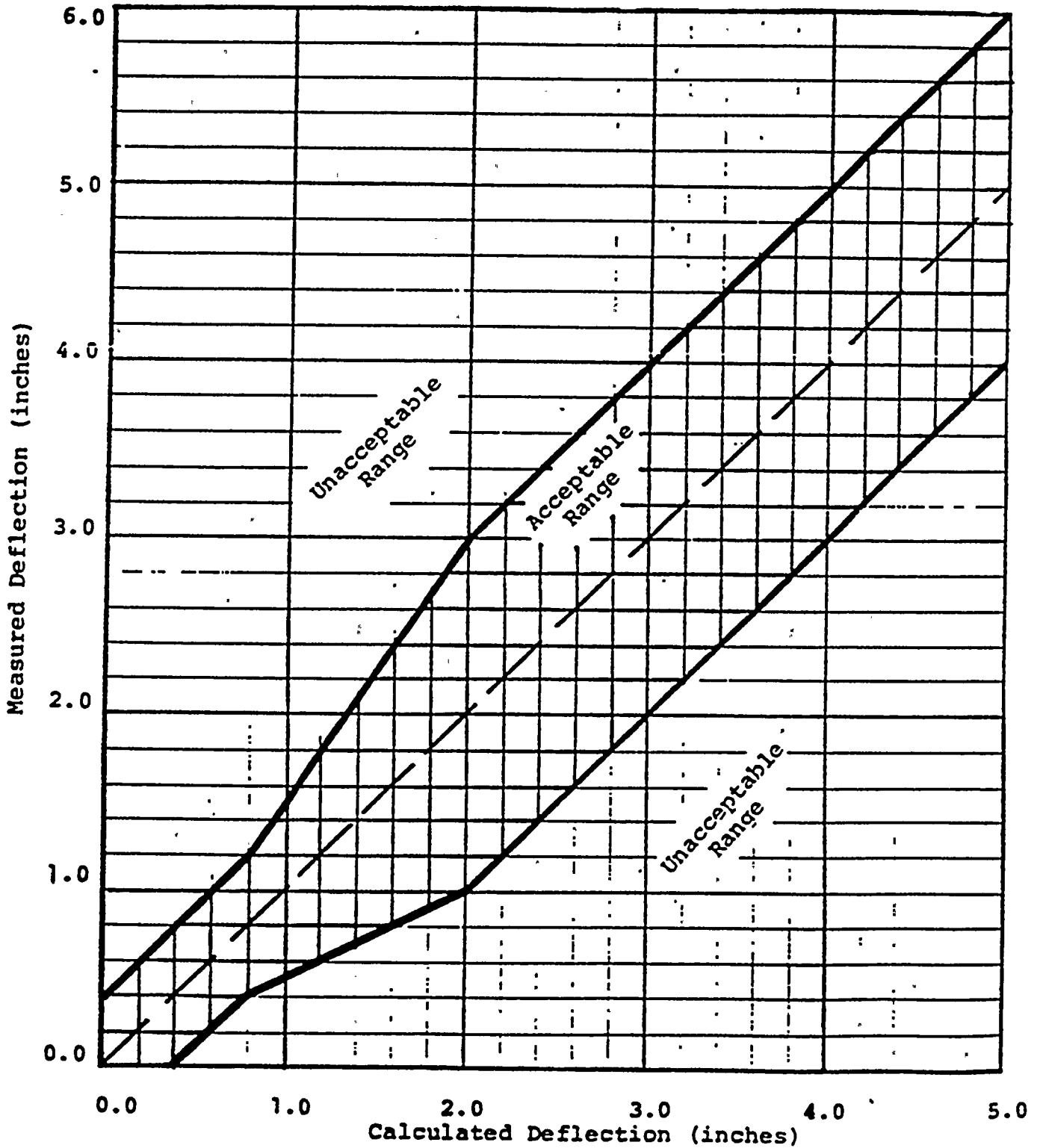


List of Scope Piping P&IDs

- | | | | |
|----|--------|----------------|----------------------------------|
| 1. | 102003 | Sht 4 | Feedwater |
| 2. | 102004 | Shts 3,5 and 7 | Main Steam |
| 3. | 102007 | Shts 3 and 4 | Reactor Coolant System |
| 4. | 102008 | Shts 3 and 4 | Chemical & Volume Control System |
| 5. | 102009 | Shts 3,4 and 5 | Safety Injection System |
| 6. | 102010 | Sht 3 | Residual Heat Removal System |
| 7. | 102014 | Sht 7 | Component Cooling Water System |
| 8. | 102021 | Sht 5 | Diesel Engine-Generator Systems |



ACCEPTANCE CRITERIA CHART





E. TEST TEMPERATURES

E.1 The following scope piping systems will be tested during the reactor coolant system temperature plateau. See section 2.2 for a complete description of the individual piping systems.

Feedwater
Main Steam
Reactor Coolant System
Chemical and Volume Control Systems
Safety Injection System
Residual Heat Removal System
Component Cooling Water System

E.2 Testing of the piping systems described in section E.1 will be conducted at the reactor coolant system nominal temperature plateaus of 250°F, 340°F, 450°F, and 547°F.

E.3 Refer to the Piping Deflections sheets in Attachment 3 for a description of the actual test conditions for a specific walkdown package.

E.4 The Diesel-Engine Generator system will be tested during normal operation of the diesels.



Heatup Walkdown Cover Sheet

Heatup Walkdown Package Number: _____

Piping System Description: _____

Analysis Numbers: _____

Cold Position Measurement - By:

_____ Date

_____ Date

Heatup Walkdown - By:

Problem
Report Numbers

250°F _____ Date _____

_____ Date _____

340°F _____ Date _____

_____ Date _____

450°F _____ Date _____

_____ Date _____

547°F _____ Date _____

_____ Date _____

Engineering Acceptance

_____ Date



Heatup Walkdown Problem Report

Heatup Walkdown Package Number: _____ Problem No.: _____

Piping System Description: _____

Analysis Number of Piping Where Problem is Located: _____
(list only one)

Describe Problem: _____

Temperature: _____

By: _____ Date _____
_____ Date _____

Resolution: _____

By: _____ Date _____

Engineering Acceptance
By: _____ Date _____



Heatup Walkdown Piping Deflections

Heatup Walkdown Package Number: _____

Description of Test Condition: _____

Test Temp. (°F)	Data Point	Direction of Deflection	Cold Position (in)	Hot Position (in)	Measured Deflection (in)	Calculated Deflection (in)	Remarks
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ATTACHMENT 5-16

