



PETER KIEWIT SONS' CO. • CONTRACTORS  
MECHANICAL-ELECTRICAL DISTRICT

WASHINGTON PUBLIC POWER SUPPLY SYSTEM  
NUCLEAR PROJECT NOS. 3 & 5

PRESSURE TEST PROCEDURE FOR PIPING AND COMPONENTS

ORIGINAL  
DATE:

6/21/79

PROC. NO.

PKS-EP-6

REV. NO.	DATE	DESCRIPTION	PKS Q.A.	PKS PROJ. MGR.	WPPSS EBASCO Q.A.	WPPSS EBASCO CM
6	3/12/82	GENERAL REVISIONS	<i>fw</i>	<i>lin</i>		
7	8/2/82	INCORPORATE WPPSS/EBASCO COMMENTS FROM TRANS. T-251/226-717, STP-35T-76, AND EBASCO LETTER EB 251/226-82-459.	<i>fw</i>	<i>[signature]</i>		
8	10/12/ 82	INCORPORATE WPPSS/EBASCO COMMENTS FROM TRANS. T-251/226-989 GENERAL REVISION	<i>fw</i>	<i>[signature]</i>		
9	12/15/ 82	INCORPORATED WPPSS/EBASCO COMMENTS FROM TRANSMITTAL T-251/226-1053 para. 4.1B, 5.5, 6.6, C.7D, 6.7E and 6.8.	<i>fw</i>	<i>[signature]</i>		

PETER KIEWIT SONS' CO.  
CONTRACT 251/226

TRANSMITTED BY

DATE

12-16-82

PREPARED BY	DATE	EBASCO SERVICES, INC.	DATE
D. MASSIE/J. WYNNE	6/21/79	ENGINEER	
PETER KIEWIT SONS' CO. APPROVAL			
QUALITY ASSURANCE <i>Forrest M. Wisner</i>	DATE 3/15/82	QUALITY ASSURANCE	DATE
PROJECT MANAGER <i>Gordon Nordlund</i>	DATE 3/15/82	CONSTRUCTION MANAGER	DATE

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PDR ADDCK 05000508  
PDR



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0	6/21/79	ORIGINAL ISSUE	<i>DWP</i>	<i>[Signature]</i>		
1	4/29/80	GENERAL REVISION	<i>DWP</i>	<i>YN</i>		
2	2/13/81	INCORPORATE WPPSS/EBASCO COMMENTS ON TRANS. NO. T-251/226-48, A2B9, AS AGREED BY R. GERDES & D. PAULSON (PKS) AND J. KLEIN & M. FARNER (EBASCO) ON 2/13/81.	<i>DWP</i>	<i>YN</i>		
X	X		X	X		
3	2/16/91	INCORPORATE WPPSS/EBASCO COMMENTS ON TRANS. No. T-251/226-198, A2B6.	<i>DWP</i>	<i>AM</i>		
4	4/20/81	REVISED PARA. 2.0, 3.3, 3.4, 4.1E, 4.1F, 4.1H, 5.1, 5.8. ADD NEW 2.1L AND RENUMBERED ACCORDINGLY. ADD FIGURE 2.	<i>DWP</i>	<i>YN</i>		
5	1/27/82	INCORPORATE WPPSS/EBASCO COMMENTS PER TRANSMITTAL NO. T-251/226-262, A2B7, LETTER EB251/226-709, PKS PQA AUDIT NO. 81-27 AND GENERAL REVISIONS	<i>[Signature]</i>	<i>YN</i>		

PREPARED BY D. MASSIE/J. WYNNE	DATE 6/21/79	EBASCO SERVICES, INC. ENGINEER	DATE
PETER KIEWIT SONS' CO. APPROVAL			
QUALITY ASSURANCE <i>[Signature]</i> D. W. PAULSON, JR.	DATE 6/21/79	QUALITY ASSURANCE TRANSMITTAL T-251/226-1140	DATE
PROJECT MANAGER <i>[Signature]</i> GORDON WERLUND	DATE 6/21/79	CONSTRUCTION MANAGER SET 108	DATE

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## 1.0 SCOPE

This procedure outlines PKS engineering prerequisites and basic requirements for the development of specific hydrostatic and pneumatic tests for WPPSS Quality Class I (ASME III), Fire Protection and Waste Management Quality Class systems. At the discretion of Project Management this procedure or portions thereof may be implemented for hydrostatic and pneumatic testing of WPPSS Quality Class II and G systems.

## 2.0 REFERENCES

- 2.1 Contract Specifications 3240-251/226 -
- 2.2 ASME Section III, Division 1
- 2.3 National Fire Protection Code, NFPA 13, 14 and 24
- 2.4 ANSI B31.1, Power Piping
- 2.5 National Plumbing Code
- 2.6 PKS Project QA Manual
- 2.7 PKS-QP-6 (Calibration)
- 2.8 PKS-QP-7 (Inspection & Examination)
- 2.9 PKS-QP-9 (Control of Nonconformances)
- 2.10 PKS-QP-10 (Quality Assurance Records)
- 2.11 PKS-QP-11 (Audits)
- 2.12 PKS-QP-12 (Surveillance)
- 2.13 PKS-EP-2 (PKS Drawing Format and Document Identification)

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### 3.0 RESPONSIBILITIES

Whenever a reference is made herein to a Department of Title, it shall mean the Department Head or his designee.

3.1 The Engineering Manager shall prescribe the technical information required for the preparation of pressure test packages in accordance with the Contract Specifications and applicable code. The Engineering Manager shall be responsible for the administrative control of the pressure test documents.

3.2 The Superintendent shall be responsible for testing activities and compliance with Contract Specifications, applicable code and procedure requirements.

3.3 Project QA Manager shall conduct required verifications, inspections, and examinations and survey and audit of all the necessary phases of testing. Furthermore, the Project QA Manager shall maintain Quality Assurance Records and be responsible for the calibration and control of tools and measuring and testing equipment.

### ✓ 4.0 PLANNING

4.1 PKS Engineering shall develop the details of a pressure test based upon the following:

- A. Reference to the P. & I. D. or Flow Diagram to define pressure boundaries.
- B. Listing of line numbers included (Reference Figure 4):
- C. Listing of isometric drawings to be included in the test.

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4.0 PLANNING (continued)

4.1 (continued)

- D. Listing of major equipment within test boundaries.
- E. Listing of in-line valves showing positions and specialties within test boundaries (Figure 3).
- F. Reference check of the Piping Line List and the Flow Diagrams or P. & I. D. drawings for compatibility and test pressures.
- G. Review vendor data on equipment and specials to ascertain their pressure limits and compatibility to design test pressure as designated.
- H. Develop the mechanics of the test set up, either in narrative or drawing format. This will include such information as over-pressure protection (relief valve set at no more than 6% over test pressure, etc.), as may be deemed necessary for the test.
- I. Determine additional required vent and drain valves.
- J. List the test medium to be utilized for the test. Specify water quality in accordance with Contract requirements, or type of gas to be utilized for pneumatic test.
- K. Determine and list drain down and restoration action, as well as unique considerations such as inhibitors, purges, etc., as applicable.
- L. Reference all individual tests to the total system to assure complete coverage and accountability.

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4.0 PLANNING (continued)

4.1 (continued)

- M. For the prevention of brittle fracture, the Test Package will address the stabilization of the hydrostatic test medium and pipe system temperature, as applicable, prior to pressurization.
- N. Specify the pressure including any adjustment for head differential.
- O. Pressure gauge location in accordance with applicable code.
- P. Valve packing shall be in accordance with Contract Specification.
- Q. Any special considerations necessary to preclude unusual stress to the pipe hanger/support system, as applicable.

4.2 PKS Engineering shall compile the technical information package format including a cover sheet (Figure 2). Each package shall be uniquely identified by system and test number in accordance with PKS-EP-2.

4.3 PQA shall review WPPSS Quality Class I (ASME III), Fire Protection and Waste Management Quality Classes (RQC), test packages prior to testing for compliance with Contract and applicable codes. During this review, PQA shall verify the status of the associated fabrication/installation records (i.e. work releases) to assure required construction work activities, verifications, inspections and examinations are complete. PQA shall prepare an Inspection/Examination Data Report (I/EDR) as described in PKS-QP-7 for required verifications, inspections and examinations to be performed during testing. Moreover, PQA will afford the Authorized Nuclear Inspector an opportunity to review the test package.

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#### 4.0 PLANNING (continued)

4.4 The pressure test package and a letter of notification will be transmitted to the Engineer for concurrence at least three weeks prior to conducting system or major subsystem tests.

#### 5.0 PREREQUISITES

5.1 Test pressure shall be in accordance with the applicable piping code, or as stipulated by the Engineer.

- A. ASME III - The pressure, for both Hydrostatic or Pneumatic test, shall be not less than 1.25 times the system design pressure and no greater than 1.325 times the system design pressure unless otherwise directed by the Engineer. The test pressure shall not exceed the maximum test pressure of any component in the system.
- B. Waste Management Quality Class (RQC) - Tested in accordance with applicable ASME or ASNI codes. The test pressure shall be a minimum of 75 psig.
- C. ANSI B31.1 - ANSI B31.1 piping systems which are inaccessible for inspection during initial system operation or with both operating conditions above 200° F. and 275 psig shall be hydro/pneumatic tested. All other B31.1 piping shall be tested by the owner in accordance with initial service leak test requirements. The pressure for Hydrostatic testing shall be not less than 1.5 times the system design pressure, but shall not exceed the maximum allowable test pressure of any non-isolated component such as vessels, pumps or valves in the system. The pressure for Pneumatic testing shall

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5.0 PREREQUISITES (continued)

5.1 (continued)

C. (continued)

be not less than 1.2, nor more than 1.5 times the design pressure of the piping system and shall not exceed the maximum allowable test pressure of any non-isolated component such as vessels, pumps or valves in the system. ANSI B31.1 lines open to the atmosphere, such as vents or drains down stream of the last shutoff valve, need not be tested.

D. NFPA - The Hydrostatic Test Pressure shall be at not less than 200 psig or not less than 50 psig in excess of the normal pressure when the normal pressure is in excess of 150 psig.

E. Plumbing and Drainage - Test shall be in accordance with applicable section of National Plumbing Code.

5.2 Only indicating gauges shall be used in pressure testing. If the indicating gauge is not readily visible to the operator controlling the pressure, an additional gauge shall be provided and located where it will be visible to the operator for the duration of the test.

Additional gauges may be used when deemed necessary by PKS.

A. Indicating pressure gauges used in testing shall have dials graduated over a range of about double the intended maximum test pressure, but in no case shall the range be less than 1-1/2 or more than 4 times the test pressure. For Non-ASME III tests this is a rule of thumb which may be deviated from on a case by case basis.

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## 5.0 PREREQUISITES (continued)

### 5.2 (continued)

- B. Test gauges shall be calibrated and controlled in accordance with PKS-QP-6. These test gauge(s) shall be calibrated before each test or series of tests. A series of tests is that group of tests, using the same pressure test gauge or gauges, which is conducted within a period not exceeding two weeks.

### 5.3 Pneumatic test may be used in lieu of Hydrostatic testing when:

- A. Components, appurtenances, or systems are so designed or supported that they cannot be safely filled with water.
- B. Components, appurtenances or systems which are not readily dried, are to be used in services where traces of the testing medium cannot be tolerated.

5.4 A Pneumatic test at a pressure not to exceed 15 psig may be applied preliminary to either Hydrostatic or Pneumatic test, as a means of locating major leaks.

5.5 All mechanical and welded joints, not previously tested, shall be left uninsulated and exposed for examination during the test except for ANSI B31.1 systems, where, when agreed to by Owner and PKS, complete systems or portions thereof subject to test may be insulated prior to the test period provided an extended holding time pressurization of the system is performed to check for possible leakage through the insulation barrier.

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5.0 PREREQUISITES (continued)

- 5.6 Components designed for vapor or gas may be provided with additional temporary supports, if necessary, to support the weight of the test liquid.
- 5.7 Expansion joints shall be provided with temporary restraints, as required for the additional pressure load under test, or they shall be isolated from the test.
- 5.8 Equipment or instrumentation that is not subject to pressure test shall be either disconnected from the system or isolated by a blank or similar means. When isolation is by a shutoff mechanism, such as a valve, which may leak or be opened, ensure that equipment is properly vented.
- 5.9 All permanent plant safety and relief valves shall be isolated from the test, blinded off or gagged per vendor or Engineer instructions. In no case will it be permissible to change the spring setting on the valve.

6.0 PRESSURE TEST PERFORMANCE

- 6.1 Air shall be purged from the system through high point vents (where available) and by slowly filling with the test medium. If the installation of additional high point vents is required for purging air from the system to be tested, contact the Engineer for resolution.

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6.0 PRESSURE TEST PERFORMANCE (continued)

- 6.2 The test pressure shall not be applied until the test system and the test medium liquid are approximately at the same temperature. Allow approximately 10 to 15 minutes after filling for the temperature to stabilize.
- 6.3 For Hydrostatic tests, gradually apply the pressure in increments of approximately  $1/3$  the test pressure and hold for approximately two (2) minutes between increments until test pressure is reached. For Pneumatic tests, the pressure shall be gradually increased to not more than one-half the test pressure and held for approximately two (2) minutes, after which the pressure shall be increased in steps of approximately  $1/10$  of the test pressure and held for approximately two (2) minutes between increments until required test pressure is reached.
- 6.4 If a pressure test is to be maintained for an extended period of time and the test medium in the system is subject to thermal expansion, precautions shall be taken to avoid excessive pressure.
- 6.5 The test pressure shall be maintained for a minimum of ten (10) minutes prior to conducting the examination for leakage and shall be in accordance with the following, as applicable, by code and contract specification.

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6.0 PRESSURE TEST PERFORMANCE (continued)

6.5 (continued)

- A. ANSI B31.1 - Examination for leakage of all joints and connections shall be made at test pressure.
- B. ASME III - Following the application of the test pressure for a minimum of ten (10) minutes, examination for leakage shall be made of all joints, connections and of all regions of high stress such as regions around openings and thickness transition sections. This examination shall be made at a pressure equal to the greater of the design pressure or three-fourths (3/4) of the test pressure, and held until the examination is completed. If it becomes necessary to test individual pumps and valves, examination of those items shall be at test pressure.
- C. WASTE MANAGEMENT QUALITY CLASS (RQC) - Piping system test pressure should be held for a minimum of 30 minutes with no leakage indicated.
- D. NFPA - Hydrostatic test pressure shall be maintained for a minimum of two (2) hours. Examination of joints shall be made during this holding time.

6.6 No visible leakage of tested items shall be the basis for acceptance. If a leak should occur during testing, material repair, after reducing pressure to 0 psig, shall be in accordance with code requirements, Contract Specifications, and approved Repair Procedure or Work Instruction, as may be applicable. Repaired areas shall be

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6.0 PRESSURE TEST PERFORMANCE (continued)

6.6 (continued)

retested unless otherwise approved by the Engineer. Leakage of temporary gaskets and seals, installed for the purpose of conducting the test and which will be replaced later, may be permitted unless the leakage exceeds the capacity to maintain system test pressure for the required amount of time. Other leaks, such as from permanent seals, seats, and gasketed joints in components, may be permitted when specifically allowed by the Design Specification or applicable code. For Pneumatic tests, examination for leakage shall be made of all joints and connections using an Engineer approved soap bubble solution or equivalent (leak-tec, snoop, etc.) Following the Pneumatic tests the leak test solution shall be removed with demineralized water.

6.7 Pressure tests shall be witnessed by the following:

- A. PQA (WPPSS Quality Class I (ASME III), Fire Protection and Waste Management Quality Classes). PQA may witness WPPSS Quality Class II and G.
- B. PKS superintendent responsible for the test.
- C. Owner/Engineer representative, unless waived prior to test.  
Owner/Engineer representative will be notified in writing a minimum of twenty-four (24) hours prior to any WPPSS Quality Class I, Fire Protection and Waste Management Quality Class test. Verbal

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6.0 PRESSURE TEST PERFORMANCE (continued)

6.7 (continued)

C. (continued)

-- notification, a minimum of twenty-four (24) hours in advance, is acceptable for WPPSS Quality Class II and G.

D. PKS Authorized Nuclear Inspector (for ASME Section III, Division 1, only), unless waived prior to test in accordance with requirements.

E. Engineer's Authorized Nuclear Inspector (for ASME Section III, Division 1, only), unless waived prior to test in accordance with requirements.

6.8 PKS shall inspect all joints, welded or mechanical connection.

Engineer written direction is required before PKS commences any work on welds made by others (i.e., grinding, cleaning, etc.) to facilitate examination, or repairs of welds.

6.9 WPPSS Quality Class I (ASME III), Fire Protection and Waste Management Quality Class pressure tests shall be documented by PQA on the Hydro/Pneumatic Test Record (Figure 1). For WPPSS Quality Class II and G, the superintendent shall document test on the Hydro/Pneumatic Test Record.

6.10 The Owner/Engineer shall be notified if a system is overpressurized during testing.

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#### 6.0 PRESSURE TEST PERFORMANCE (continued)

- 6.11 When field conditions require a modification to a pressure test, the superintendent will note the change on the pressure test package and obtain the approvals of PKS Engineering and PQA.

#### 7.0 QUALITY ASSURANCE

- 7.1 For WPPSS Quality Class I (ASME III), Fire Protection and Waste Management Quality Classes, verification, inspection and examination shall be performed to assure pressure testing adheres to Contract, Code and Procedure Requirements. The Inspection/Examination Data Report, prepared in accordance with PKS-QP-7 reflects the extent of PQA involvement with each test.
- 7.2 For WPPSS Quality Class II and G, PQA may perform random verification, inspection and/or examination.
- 7.3 PQA shall conduct periodic surveillance and audit to assure compliance with the Codes, Contract and Procedure requirements. PQA surveillance and audit shall be documented and administratively controlled as described in PKS-QP-12 and PKS-QP-11, respectively.
- 7.4 Tools, measuring and test equipment that are used for determining the acceptability of an item or process shall be controlled in accordance with PKS-QP-6.

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7.0 QUALITY ASSURANCE (continued)

7.5 Nonconforming or indeterminate items identified during the testing of WPPSS Quality Class I, Fire Protection and Waste Management

-- Quality Classes, shall be controlled and dispositioned in accordance with PKS-QP-9.

7.6 For WPPSS Quality Class I, Fire Protection and Waste Management Quality Classes, PQA shall compile and maintain records as described by PKS-QP-10.

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(FIGURE 1)



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LEAKAGE TESTS INCORPORATED  
ENR - 1/1

HYDRO / PNEUMATIC TEST RECORD

CONTRACT NO. \_\_\_\_\_ TEST NO. \_\_\_\_\_

UNIT NO. \_\_\_\_\_ SAV SYSTEM NO. \_\_\_\_\_

1. SYSTEM NAME \_\_\_\_\_

2. DESCRIPTION OF SYSTEM / COMPONENT: \_\_\_\_\_

3. REFERENCES DRAWINGS \_\_\_\_\_ 4. ATTACHED DRAWINGS, MARKED UP TO SHOW  
SCHEMATIC: \_\_\_\_\_

5. TEST WATER SPECIFICATION CLASS \_\_\_\_\_

6. TEST CONDUCTED TO PROCEDURE: \_\_\_\_\_

MATERIAL	CARBON STEEL	CHROME	STAINLESS STEEL
COPPER	CAST IRON	BARREN LINED STEEL	PVC
ALUMINUM	INSTRUMENT TUBING	OTHER	

7. CODE CLASS \_\_\_\_\_

8. METHOD USED FOR TEST HYDROSTATIC PNEUMATIC VACUUM

VACUUM USED \_\_\_\_\_ VACUUM TEMPERATURE \_\_\_\_\_

9. REQUIRED TEST PRESSURE \_\_\_\_\_ ATMO. TEMPERATURE \_\_\_\_\_

10. PERIOD OF TIME PRESSURE HELD \_\_\_\_\_

11. TIME STARTED TEST \_\_\_\_\_ 12. GAUGE PRESSURE \_\_\_\_\_

13. TIME COMPLETED TEST \_\_\_\_\_ 14. GAUGE PRESSURE \_\_\_\_\_

15. DATE TEST CONDUCTED \_\_\_\_\_

16. TEST GAUGE NO. \_\_\_\_\_ 17. CALIBRATION DUE DATE \_\_\_\_\_

18. TEST GAUGE NO. \_\_\_\_\_ 19. CALIBRATION DUE DATE \_\_\_\_\_

20. TEST ACCEPTED YES \_\_\_\_\_ NO \_\_\_\_\_ IF NO WHY \_\_\_\_\_

21. REMARKS \_\_\_\_\_

CONTRACTOR OR OWNER \_\_\_\_\_ DATE \_\_\_\_\_ CONTRACTOR

HYDRO ENGR. \_\_\_\_\_ DATE \_\_\_\_\_ HYDRO ENGR.

CONSTRUCTION \_\_\_\_\_ DATE \_\_\_\_\_ OWNER/ENGR.

HYDRO ENGR. \_\_\_\_\_ DATE \_\_\_\_\_ FITNESS \_\_\_\_\_

CONSTRUCTION \_\_\_\_\_ DATE \_\_\_\_\_

HYDRO ENGR. \_\_\_\_\_ DATE \_\_\_\_\_

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FIGURE 2



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TEST

PACKAGE

NO. \_\_\_\_\_

~~PRESSURE TEST IN~~

ACCORDANCE WITH PKS-EP-6

REVISION \_\_\_\_\_

ATTACHMENTS:

PREPARED BY: \_\_\_\_\_ / \_\_\_\_\_ Engineer  
Date

REVIEWED BY: \_\_\_\_\_ / \_\_\_\_\_ Engineering  
Date

REVIEWED BY: \_\_\_\_\_ / \_\_\_\_\_ J.A.  
Date

REVIEWED BY: \_\_\_\_\_ / \_\_\_\_\_ A.N.I.  
Date

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FIGURE 3



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775/1500 2750, 28.

202 143

VALUE LINE OF CASE LIST

### CONTRACTOR

[illegible]

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FIGURE 4



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GRAIN CR LINE NC.

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