Docket Nos. 50-528/529/530

50.55(e) Report

ARIZONA PUBLIC SERVICE COMPANY

P. O. BOX 21666 · PHOENIX, ARIZONA 85036

February 18, 1982
ANPP-20213-GHD/BSK

U. S. Nuclear Regulatory Commission
Region V
Creekside Oaks Office Park
1450 Maria Lane - Suite 210
Walnut Creek, California 94596-5368

Attention: Mr. B. H. Faulkenberry, Chief
Reactor Construction and
Engineering Support Branch

Subject: Final Report - DER 81-25
A 50.55(e) Report Relating to Bingham-Willamette
Auxiliary Feedwater Pumps Could Not Be Rotated
By Hand For Maintenance During Storage
File: 82-019-026
D.4.33.2

Reference: (A) Telephone Conversation between T. Bishop and G. Duckworth on August 18, 1981

(B) ANPP-18945, dated September 18, 1981 (Interim Report)

(C) ANPP-19792, dated December 29, 1981 (Interim Report, Revision 1)

Dear Sir:

Attached, is our final written report of the deficiency referenced above, which has been determined to be Not Reportable under the requirements of 10CFR50.55(e).

Very truly yours,

E. E. Van Brunt, Jr.
APS Vice President
Nuclear Projects
ANPP Project Director

EEVBJr/GHD:skc

Attachments

cc: See Attached Page 2

IE27
S1/1
82-49

cc: Richard DeYoung, Director
Office of Inspection and Enforcement
U. S. Nuclear Regulatory Commission
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FINAL REPORT - DER 81-25

DEFICIENCY EVALUATION 50.55(e)

ARIZONA PUBLIC SERVICE COMPANY (APS)

PVNGS UNITS 1, 2 AND 3

I. Description of Deficiency

Eight (8) of a total of nine (9) Auxiliary Feedwater Pumps supplied and shipped by Bingham-Willamette were disassembled during storage because they could not be rotated by hand for maintenance. Storage and maintenance of this equipment was performed by Bechtel, as per Bingham-Willamette Instruction Manual (Log #M021-157-2), and included dry rotation of the pump shafts. The conditions noted included galling of the shaft, rubbing of impeller case rings/throttle bushing, and metal filings.

All eight (8) pumps were returned to the Bingham-Willamette factory in Portland, Oregon and upon inspection, the binding was found to be caused by galling of the stainless steel center stage piece and stainless steel shaft sleeve. The equipment Tag Numbers are 1- and 2-M-AFA-P01; 1-, 2- and 3-M-AFB-P01; and 1-, 2- and 3-M-AFN-P01. Pump Number 3-M-AFA-P01 had not yet been shipped.

II. Analysis of Safety Implications

Bingham-Willamette prepared and issued a new procedure for packing, shipping, and storage, which eliminated the dry rotation procedure by shipping the rotating element separate from the pump casing. Bingham-Willamette indicated that this action would resolve the condition and that the binding caused by the galling would not preclude the pumps from performing per design intent. Bechtel Engineering requested that a verification test be performed, particularly for shaft deflection during future storage and stand-by conditions, wherein the pump shafts could again be subjected to galling. Bingham-Willamette completed the requested test on December 18, 1981. Copies of the test procedure and test report are attached. The special test verified that these pumps are acceptable as supplied for the Auxiliary Feedwater System. This condition is, therefore, evaluated as not safety significant and not reportable, since if left undetected and uncorrected, it would not have impaired the safe functioning of the Auxiliary Feedwater System.

III. Corrective Action

Bechtel has verified that the test results demonstrate the pump design is satisfactory, and will implement the revised storage procedure for these pumps.

Bechtel Power Corporation

Interoffice Memorandum

To: Distribution

File No.: C1

Subject: Bingham-Willamette Auxiliary Feedwater Pump Metal to Metal Contact Problem

Date: October 8, 1981

From: A. J. Ortiz

Of: Engineering

At: Los Angeles Power Division

Ext. 3420

Copies to:
D. R. Bonano
H. C. Bream
W. L. Dornaus
H. W. Gilliland
J. W. Mowatt
L. R. Oquist
R. E. Ravetti
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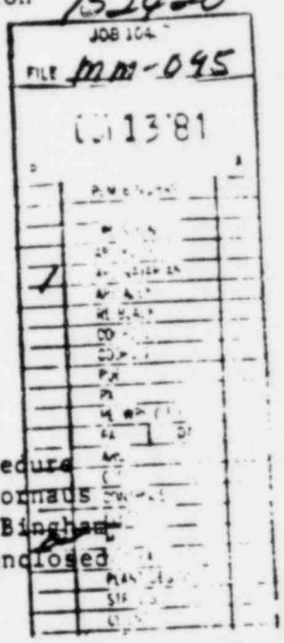
R. E. Weber



Enclosed is the Bingham-Willamette Pump Integrity Test Procedure for your information. The LAPD Mechanical Staff and Will Dornaus of SFPD have reviewed the procedure and have accepted it. Bingham-Willamette will proceed with the test on the basis of the enclosed procedure.

A. J. Ortiz

AJO:sp

Distribution

S. Agerbek
Z. Csukonyi
S. S. Dua
H. D. Farin
L. Jaw
J. R. Schuh
C. H. Shinbrot
R. R. Stiens

ATTN: Wm. VORNOUS -S.F.
A. ORTIZ -L.A.
ENG. MGR.

Bingham-Willamette Company
Bingham-Willamette Ltd.

E30.212
Rev. 0 10/7/81
Page 1 of 2

SIGNED Debbie Horton

SUBJECT: START/STOP INTEGRITY TEST PROCEDURE FOR SALES ORDER 1AB47/52

I. GENERAL

One pump of the above group will be set up in a closed loop with injection and receive a series of thirty (30) start/stops. The purpose of this test is to demonstrate the mechanical integrity of the pump - i.e., to demonstrate that the pump can be subjected to a series of start/stops without adverse effects such as severe rubbing or seizing of the rotating element. The test will be conducted in the following manner:

A. Prior to setting up in the test loop the pump will be disassembled, including the rotating element, for customer witness inspection of the pump internals. Upon completion of this inspection, the element will be reassembled and checked for balance. The pump will then be reassembled and set up in the test loop.

B. During the first start/run cycle three (3) performance points will be taken including approximate minimum flow, rated flow (1080 GPM) and an intermediate point between minimum flow and rated flow. In addition to performance, vibration measurements will also be taken at each of the above flows. After the above data has been acquired, the driver will be de-energized and the first start/stop will be concluded.

C. Additional start/stops will be performed in as rapid a sequence as possible to the limit of the test motor capabilities. Adequate running time will be allowed following each start to keep the test motor temperatures as low as possible. Data to be recorded during each successive start/stop cycle will be the start/stop cycle number, time and approximate flow rate.

D. During the final start/run cycle the performance and vibration test will be repeated as in B. above for comparison with the original data. Following this performance and vibration test, the pump will be shut down and the test concluded.

II. TEST CONDITIONS

A. Cold City of Portland tap water will be used for testing.

B. Suction head to the pump is not closely controlled and will vary with the flow. Adequate pressure is maintained for safe and smooth operation.

III. DRIVER

Pump will be tested with a calibrated BVC test motor. Test speed will be approximately 3585 RPM.

IV. INSTRUMENTATION

A. Capacity: Flow is measured with a differential mercury manometer or pressure gage and calibrated Venturi meters.

B. Head: Suction head is measured with a pressure gage, and discharge head is measured on a positive displacement type dead-weight tester.

C. Power: A calibrated polyphase wattmeter is used to read total power in to the motor. Based on efficiencies of the motor (and gear if included), brake horsepower supplied to the pump shaft is determined from this input power.

D. Speed: A General Radio Corp. Strobotac, set on line frequency, is used in conjunction with a stop watch to count slip of motor.

REVISION STATUS PAGE 1 2 REV. 0 0

ISSUED TO E30 Manuals

A. Ortiz - LA
Eng. Mgr.

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@ 10/7/81
2 of 2

Bingham-Willamette

E. Temperature: A thermocouple installed in the suction pipe in conjunction with a digital readout is used to monitor suction temperature.

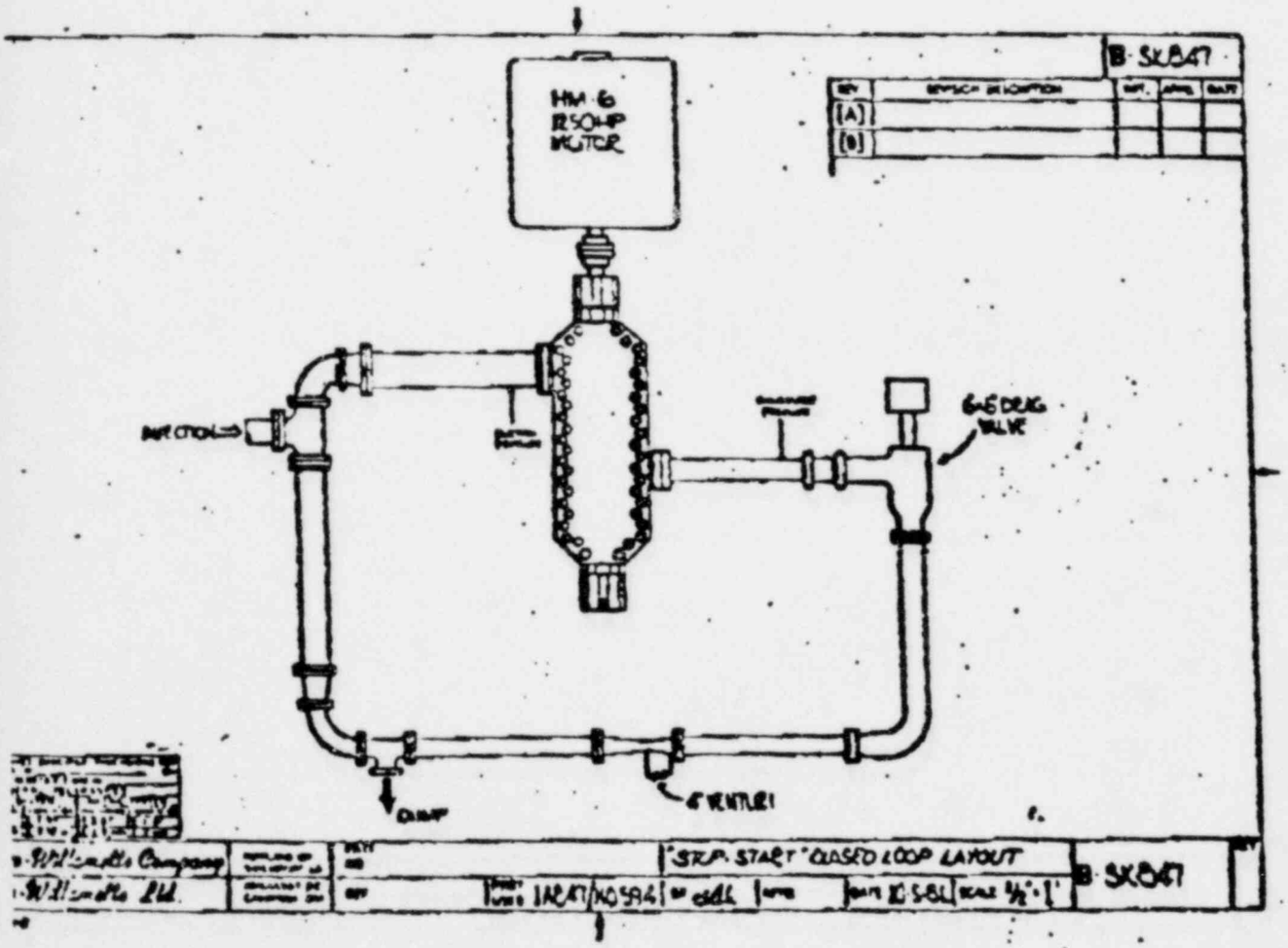
F. Vibration: Measured on the pump bearing housings with a portable IRD vibration instrument.

LOOP SCHEMATIC

Sketch B-SK-847 is included as a general schematic of the BWC test loop.

POST-TEST INSPECTION

Upon completion of testing the pump will be opened for BWC Engineering and Customer witness inspection, comparison with original condition, and disposition.



MIC

Bechtel Power Corporation

Interoffice Memorandum

157840

JOB 10407
FILE Amm-021
JAN 7 '82

To W. Bingham, Z. Csukonyi, H. Farin, C. Shinbrot

File No. C1

Subject Auxiliary Feedwater Pumps

Date January 5, 1982

From A. J. Ortiz

Of Engineering

At LAPD Ext. 3420

Copies to H. Bream, S.F. - w/attach.
W. Dornaus, S.F. - w/attach.
S. Agerbek - w/attach.
S. S. Dua - w/attach.
H. W. Gilliland - w/attach.
L. Jaw - w/attach.
L. R. Oquist - w/attach.
J. R. Schuh - w/attach.
R. E. Weber - w/attach.

There has been a question of possible generic problems related to design and material selection of auxiliary feedwater pumps supplied by Bingham-Willamette Company.

Palo Verde, Maanshan and Korea Nuclear Units all have pumps of the type in question.

A special test was outlined by Bechtel Engineering o answer these questions. Testing was performed at the expense of Bingham-Willamette. The test was completed on December 18, 1981.

It is the conclusion of mechanical engineering that the Bingham-Willamette pumps supplied for auxiliary feedwater service for the above mentioned projects are acceptable. There should be no further reasons to stop payments and manufacturing of pumps that have not previously been shipped.

A more complete report of the test is attached.

A. J. Ortiz

HWG:cs
Attachment

AUXILIARY FEEDWATER PUMP TEST
AT BINGHAM-WILLAMETTE COMPANY

For several months there have been meetings between Bechtel and Bingham-Willamette Company engineers to discuss the design of their pumps and the selection of materials for the shaft sleeve and center stage pieces for auxiliary feedwater pumps.

Special testing of an auxiliary feedwater pump for the Palo Verde project was performed by Bingham-Willamette Company to simulate field conditions. The pump used for this test was typical in design and materials for pumps purchased for Palo Verde Units 1, 2 and 3, Maanshan Units 1 and 2, KNU Units 5, 6, 7 and 8.

Testing was designed to simulate conditions of manual rotation of a dry pump during alignment of pump and driver. Also the pump was subjected to a series of thirty start-stop tests while pumping water. This was to simulate scheduled start-stop tests between full loading in an operating plant. Hydraulic performance tests were conducted at three operating points before and after the start-stop tests. When the tests were completed, the pump was disassembled and inspected.

The overall assessment was that the pump could operate indefinitely under the test conditions without a failure of parts. This verifies to Bechtel Engineering that there is no generic problem with this type of pump design and materials selected.

Inspection showed that there had been contact between the center shaft sleeve and one side of the two piece center stage piece. Contact resulted in several discolored areas on the shaft sleeve and one discolored area on the stage piece. Two small scratch marks were noted on the shaft sleeve and center stage piece.

A very detailed examination of the discolored areas and the scratches was done by Bechtel Engineering with participation by Bechtel Procurement and Inspection. The discolored areas on the shaft sleeve could not be felt and did not result in a measurable change in dimensions. This was also true for the center stage piece. Hand rubbing with a very fine abrasive cloth could not remove the discolored spots on either part. The surface became very smooth as the result of this rubbing but no other effect was noted.

The scratch marks appeared to be caused by solid particles in the water used for the pump test. These marks were slight and did not result in an increase in measurable dimensions. Rubbing with very fine abrasive cloth made the areas very smooth; but they were still visible.

There was no evidence of any transfer of metal between the shaft sleeve and the stage pieces.

Bingham-Willamette has agreed to issue additional instructions for clean-up of shaft bushings and center stage pieces that became damaged by impurities in the water during testing and start-up activities. These instructions will include criteria for determination of when these parts should be replaced.

Based on what was observed after this special test, there should be no requirement for additional parts to be shipped with the pumps to replace ones used in the test. As part of the owner's maintenance program, however, spare parts should be considered and required.

If it is required to inspect internal parts of these pumps during normal station operation, it will be necessary to remove the top half of the pump. This is typical of horizontally split pump casings. Frequency of inspection is usually determined by the pump user. Generally, a pump is not opened unless there are signs of distress, such as excessive vibration and noise or loss of hydraulic performance.

It is the conclusion of mechanical engineering that the Bingham-Willamette pumps supplied for auxiliary feedwater service for the above mentioned projects are acceptable. There should be no further reasons to stop payments and manufacturing of pumps that have not previously been shipped.