

Sifre, Wayne

From: Farnholtz, Thomas
Sent: Tuesday, May 02, 2017 11:44 AM
To: Sifre, Wayne; Sifre, Wayne; Sifre, Wayne; Sifre, Wayne
Subject: FW: PlantIQ CNR - 2MSIBP02**PUMPXX (Vibration Monitoring)

Wayne –

The second email.

Thank you.

Tom.

From: Miller, Geoffrey
Sent: Tuesday, May 02, 2017 8:24 AM
To: Farnholtz, Thomas <Thomas.Farnholtz@nrc.gov>
Subject: FW: PlantIQ CNR - 2MSIBP02**PUMPXX (Vibration Monitoring)

Tom,

This may be helpful in the review of the Palo Verde HPSI pump data – it references the applicable Code sections.

Thank you,

Geoff

From: Krause Browner, Holly A
Sent: Thursday, April 13, 2017 11:39 PM
To: Arnold, Elias; Brutcher, Mark A; Bolf, Boris B; McLain, Michael W; Gaber III, Frank C
Cc: Radspinner, Mark A; King, David K; Glover, John J; Johnson, Bryan M; Graham, Kevin T; Amoroso, Arthur J; Thiele, Carl B; Gaffney, Timothy J; Schrecker, Kenneth D; Jackson, Keith L; Lopez, Steven A
Subject: RE: PlantIQ CNR - 2MSIBP02**PUMPXX (Vibration Monitoring)

All,

A couple of clarifications of information for 2MSIBP02 pump testing.

- This pump is classified as an ASME OM Code Group B which is defined as “pumps in standby systems that are not operated routinely except for testing.” This required the pump have a Group B test Quarterly and a Comprehensive Test every 2 years per ASME OM Table ISTB-3400-1 Inservice Test Frequency.
- The Group B test is a test that requires Differential Pressure and Flow measurements. It does not record vibration measurements (73ST-9SI10). The Group B test is required to be performed at +/- 20% of pump design flow, however, Palo Verde has Pump Relief Request PRR-04 to allow testing quarterly at mini-flow instead.
- Comprehensive Test is performed at full flow conditions per 73ST-9XI33 and measures Differential Pressure, Flow and Vibration.

- Continued use of the pump at the changed value of 0.421 IPS is not supported. Per the Code requirements, establishing new reference value at this value would require the Alert Range to be > 0.3250 to ≤ 0.7000 IPS and the 0.421 reference value would still be in the Alert Range. See below for details of the sections of the Code and the requirements.
- Required action here is to correct the condition and perform the required Comprehensive Test 73ST-9X133** as the retest to meet the requirements of ASME OM Code ISTB-3310 (see below). Performance of 73ST-9S110 is not acceptable as it is a Group B Test that is performed at mini-flow conditions and does not measure vibration. Also, note that due to the extensive work (WM 4317565 seal and WM 3362862 Head gasket replacement) on this pump in 2R20, the pump curve per Appendix G is also required in accordance with ISTB-3100 and ISTB-5110 Preservice Testing .

ASME OM Code ISTB-6200 Corrective Action has two sections that describe allowable actions

(a) *Alert Range.* If the measured test parameter values fall within the alert range of Table ISTB-5100-1, Table ISTB-5200-1, Table ISTB-5300-1, or Table ISTB-5300-2, as applicable, the frequency of testing specified in ISTB-3400 shall be doubled until the cause of the deviation is determined and the condition is corrected.

(c) *New Reference Values.* In cases where the pump's test parameters are within either the alert or required action ranges of Table ISTB-5100-1, Table ISTB-5200-1, Table ISTB-5300-1, or Table ISTB-5300-2, as applicable, and the pump's continued use at the changed values is supported by an analysis, a new set of reference values may be established. This analysis shall include verification of the pump's operational readiness. The analysis shall include both a pump level and a system level evaluation of operational readiness, the cause of the change in pump performance, and an evaluation of all trends indicated by available data. The results of this analysis shall be documented in the record of tests (See ISTB-9000).

The HPSI B Pump 2MSIBP02 is a Horizontal Centrifugal 8-Stage pump which must comply with ASME OM Code Table ISTB-5100-1 Centrifugal Pump Test Acceptance Criteria.

TABLE ISTB-5100-1 CENTRIFUGAL PUMP TEST ACCEPTANCE CRITERIA

Test Type	Pump Speed	Test Parameter	Acceptable Range	Alert Range	Required Action Range	
					Low	High
Group A Test [Notes (1), (2)]	N/A	Q	0.90 to $1.10Q_r$	None	$<0.90Q_r$	$>1.10Q_r$
	N/A	ΔP	0.90 to $1.10\Delta P_r$	None	$<0.90\Delta P_r$	$>1.10\Delta P_r$
	<600 rpm	V_d or V_v	$\leq 2.5V_r$	$>2.5V_r$ to $6V_r$ or >10.5 to 22 mils (266.7 to $558.8 \mu\text{m}$)	None	$>6V_r$ or >22 mils ($558.8 \mu\text{m}$)
	≥ 600 rpm	V_v or V_d	$\leq 2.5V_r$	$>2.5V_r$ to $6V_r$ or >0.325 to 0.7 in./sec (0.8 to 1.7 cm/sec)	None	$>6V_r$ or >0.7 in./se (1.7 cm/se)

This Criteria requires that when the calculated lower Alert Range criteria 2.5 times the Vibration Reference (V_r) Value exceeds 0.325 in/sec (IPS), the lower Alert Range criteria must be truncated to 0.325 IPS. Likewise, for when the

calculated upper Alert Range criteria 6 times Vr exceeds 0.7 IPS the upper Alert Range criteria must be truncated to 0.7 IPS.

Given the 0.421 IPS vibration value obtained, if calculating the Alert Range criteria using this as the new reference value (Vr) the Alert Range would be > 1.0525 IPS to <=/ 2.5260 IPS. Both the calculated upper and lower Alert Range value exceed the values specified in the Code and **the new Alert Range would be truncated to > 0.3250 IPS to </= 0.7000 IPS.** This would not be appropriate to have a vibration reference value that would automatically be in the Alert Range.

ASME OM Code ISTB-3310 Effect of Pump Replacement, Repair, and Maintenance on Reference Values requires a Comprehensive Test. 73ST-9SI10 is not a Comprehensive Test.

ISTB-3310 Effect of Pump Replacement, Repair, and Maintenance on Reference Values. When a reference value or set of values may have been affected by repair, replacement, or routine servicing of a pump, a new reference value or set of values shall be determined in accordance with ISTB-3300, or the previous value reconfirmed by a comprehensive or Group A test run before declaring the pump operable. The Owner shall determine whether the requirements of ISTB-3100, to reestablish reference values, apply. Deviations between the previous and new set of reference values shall be evaluated, and verification that the new values represent acceptable pump operation shall be placed in the record of tests (see ISTB-9000).

From: Arnold, Elias

Sent: Thursday, April 13, 2017 2:55 PM

To: Brutcher, Mark A; Bolf, Boris B; McLain, Michael W; Gaber III, Frank C

Cc: Radspinner, Mark A; King, David K; Glover, John J; Johnson, Bryan M; Krause Browner, Holly A; Graham, Kevin T; Amoroso, Arthur J

Subject: RE: PlantIQ CNR - 2MSIBP02**PUMPXX (Vibration Monitoring)

With respect to IST, ASME OM code provides two possible resolutions when a pump tests in the alert range:

- 1) Place the pump on increased-frequency testing until the cause of the deviation is determined and the condition corrected.
- 2) Establish new reference values. This requires an analysis to verify the pump's operational readiness. The analysis must include pump and system-level evaluations, the cause of the change in performance, and an evaluation of all trend indicated by available data.

Option 1 would require us to test the HPSI pump at full-flow conditions approximately halfway through an operating cycle, unless we can resolve the issue now, perhaps by implementing CMWO 4755588 (described below) and re-running and passing the test.

Option 2 allows us to accept the higher vibration level by completing a thorough analysis of the pump, the system and related data. However, this may only provide temporary relief given that the vibrations have been trending upwards.

-Eli



ELI ARNOLD

Engineer, Palo Verde Nuclear Generating Station
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From: Brutcher, Mark A
Sent: Thursday, April 13, 2017 2:09 PM
To: Bolf, Boris B; McLain, Michael W; Gaber III, Frank C
Cc: Radspinner, Mark A; King, David K; Glover, John J; Johnson, Bryan M; Krause Browner, Holly A; Graham, Kevin T; Amoroso, Arthur J; Arnold, Elias
Subject: FW: PlantIQ CNR - 2MSIBP02**PUMPXX (Vibration Monitoring)

To All,

Full-Flow vibration readings were taken today for the U2 B HPSI pump (2MSIBP02) in support of STWO 4730947. Overall vibration readings at the pump Inboard Horizontal Bearing location (PCH) were measured on the order of 0.421 Inches per Second (IPS). This value exceeds the current ASME IST "Alert" Level Acceptance Criteria of 0.325 IPS (73ST-9XI33). The primary excitation force for the observed vibration levels occurs at one-times (1X) the pump operating speed at approximately 59.38 Hz. PdM has been monitoring an increasing trend with the vibration levels on 2MSIBP02 for some time (03/14/16). See the attached files for additional information regarding the current vibration levels and historical vibration trends.

Thank You

Mark Brutcher
Vibration Analyst Cat. IV, ISO/ANSI Compliant
Predictive Maintenance Engineering
Palo Verde Nuclear Generating Station
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Tonopah, AZ. 85354
M.S. 7152
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From: Brutcher, Mark A
Sent: Thursday, March 16, 2017 2:20 PM
To: Bolf, Boris B; McLain, Michael W; Gaber III, Frank C
Cc: Radspinner, Mark A; King, David K; Glover, John J; Johnson, Bryan M
Subject: PlantIQ CNR - 2MSIBP02**PUMPXX (Vibration Monitoring)

To All,

Minimum-Flow vibration levels for 2MSIBP02 have continued to trend up at the Pump Inboard Horizontal location (PCH). The mini-flow overall vibration levels are currently running on the order of 0.357 Inches per Second (IPS). This pump historically has had higher vibration levels under Full-Flow operating conditions when

compared to a Minimum-Flow line up. As such, there is a potential for the pump to exceed the current ASME IST "Alert" Level Acceptance Criteria (0.325 IPS) during its next scheduled Full-Flow Surveillance Test (2R20).

PV Operating Experience (OE) has shown that the HPSI pumps have a history of elevated vibration levels due to binding in the pump outboard support pedestals. CMWO 4755588 has been generated to clean and lubricate the pump outboard bearing support pedestals for the pump per Appendix G of 31MT-9SI02. This work has been scheduled for 6/15/17.

The PV HPSI pumps suffer from a horizontal structural resonance coincident with the running speed of the Pump at pump support pedestals. Various static impact tests and running resonance test have been conducted to validate this fact. Three pump (3B, 1A and 2A) have had a modification implemented (DMWO 2605551) to stiffen the pump support pedestals. These modifications were successful in reducing the operating vibration levels for the affected HPSI pumps.

Please see the attached CNR link and associated files for additional information and vibration data trends. Let me know if you have any questions, comments or need additional information.

Equip ID: 2MSIBP02**PUMPXX

Description: TRAIN B HPSI PUMP

Technology: Vibration Monitoring

Status: Alert

Click on this link to view the CNR: http://iks/plantig/tech_exams/tech_exam.aspx?teid=881007

Thank You

Mark Brutcher

Vibration Analyst Cat. IV, ISO/ANSI Compliant

Predictive Maintenance Engineering

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Hearing Identifier: WCS_CISF_Saf_Public
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Subject: FW: PlantIQ CNR - 2MSIBP02**PUMPXX (Vibration Monitoring)
Sent Date: 5/2/2017 11:44:02 AM
Received Date: 5/2/2017 11:44:05 AM
From: Farnholtz, Thomas

Created By: Thomas.Farnholtz@nrc.gov

Recipients:

"Sifre, Wayne" <WCS-CISFSafHrgPEm.Resource@nrc.gov>
Tracking Status: None
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image001.png	24556	
image006.png	23970	
image007.png	7892	

Options

Priority: Standard
Return Notification: No
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Sensitivity: Normal
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(a) *Alert Range.* If the measured test parameter values fall within the alert range of Table ISTB-5100-1, Table ISTB-5200-1, Table ISTB-5300-1, or Table ISTB-5300-2, as applicable, the frequency of testing specified in ISTB-3400 shall be doubled until the cause of the deviation is determined and the condition is corrected.

(c) *New Reference Values.* In cases where the pump's test parameters are within either the alert or required action ranges of Table ISTB-5100-1, Table ISTB-5200-1, Table ISTB-5300-1, or Table ISTB-5300-2, as applicable, and the pump's continued use at the changed values is supported by an analysis, a new set of reference values may be established. This analysis shall include verification of the pump's operational readiness. The analysis shall include both a pump level and a system level evaluation of operational readiness, the cause of the change in pump performance, and an evaluation of

all trends indicated by available data. The results of this analysis shall be documented in the record of tests (See ISTB-9000).



TABLE ISTB-5100-1 CENTRIFUGAL PUMP TEST ACCEPTANCE CRITERIA

Test Type	Pump Speed	Test Parameter	Acceptable Range	Alert Range	Required Action Range	
					Low	High
Group A Test [Notes (1), (2)]	N/A	Q	0.90 to $1.10Q_r$	None	$<0.90Q_r$	$>1.10Q_r$
	N/A	ΔP	0.90 to $1.10\Delta P_r$	None	$<0.90\Delta P_r$	$>1.10\Delta P_r$
	<600 rpm	V_d or V_v	$\leq 2.5V_r$	$>2.5V_r$ to $6V_r$ or >10.5 to 22 mils (266.7 to $558.8 \mu\text{m}$)	None	$>6V_r$ or >22 mils ($558.8 \mu\text{m}$)
	≥ 600 rpm	V_v or V_d	$\leq 2.5V_r$	$>2.5V_r$ to $6V_r$ or >0.325 to 0.7 in./sec (0.8 to 1.7 cm/sec)	None	$>6V_r$ or >0.7 in./sec (1.7 cm/sec)

ISTB-3310 Effect of Pump Replacement, Repair, and Maintenance on Reference Values. When a reference value or set of values may have been affected by repair, replacement, or routine servicing of a pump, a new reference value or set of values shall be determined in accordance with ISTB-3300, or the previous value reconfirmed by a comprehensive or Group A test run before declaring the pump operable. The Owner shall determine whether the requirements of ISTB-3100, to reestablish reference values, apply. Deviations between the previous and

new set of reference values shall be evaluated, and verification that the new values represent acceptable pump operation shall be placed in the record of tests (see ISTB-9000).