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ACCESSION NBR:9810150298 DOC.DATE: 98/10/09 NOTARIZED: NO DOCKET #
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50-389 St. Lucie Plant, Unit 2, Florida Power & Light Co. 05000389
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SUBJECT: Provides info to supplement relief request PR-12, per 980929
telcon with NRC.

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October 9, 1998

L-98-264
10 CFR 50.4
10 CFR 50.55a

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D. C. 20555

RE: St. Lucie Units 1 and 2
Docket Nos. 50-335 and 50-389
In-Service-Test Program
Relief Request PR-12 Supplement

Pursuant to 10 CFR 50.55a (a)(3), Florida Power and Light Company (FPL) provides the attached information to supplement Relief Request PR-12. The original request was submitted by FPL Letter L-98-243 dated September 21, 1998. This information is provided based on a telephone conversation between the NRC and FPL on September 29, 1998. The additional information is consistent with the guidelines contained in NRC Commission Proceedings, NUREG/CP-0152. The information is being provided to facilitate NRC review of Relief Request PR-12.

This Relief Request is needed to facilitate implementation of the Unit 1 Third Ten Year In-Service-Test Program. The new program implements the ASME Section XI 1989 edition, which requires a change in vibration monitoring from displacement measurement to velocity measurement. Vibration readings utilizing velocity measurement devices on pumps running on mini-recirculation lines typically result in higher vibration readings than during their design service. In the case of the St. Lucie Unit 1 Safety Injection Pumps, the vibration readings taken with the pumps running on mini-recirculation exceed the absolute ALERT level, thereby requiring additional surveillance testing. However, since pump run time using mini-recirculation line should be minimized, an alternative utilizing a higher ALERT vibration limit is proposed when the pumps are operated with mini-recirculation line and utilizing the ASME code required ALERT limits when the pump is run at full or substantial flow during outages.

Please contact us if there are any questions regarding this submittal.

Very truly yours,

J. A. Stall
Vice President
St. Lucie Plant

JAS/GRM

cc: Regional Administrator, Region II, USNRC
Senior Resident Inspector, USNRC, St. Lucie Plant

Attachment

9810150298 981009
PDR ADOCK 05000335
P PDR

an FPL Group company

A047 |

RELIEF REQUEST PR-12

ADDITIONAL INFORMATION JUSTIFYING THE BASIS FOR RELIEF

BACKGROUND

The following information is provided to supplement Relief Request PR-12 submitted by Florida Power & Light Company (FPL) under FPL letter L-98-243 dated September 21, 1998. This information is provided based on a conference call between the NRC and FPL on September 29, 1998. As requested, the additional information provided is consistent with the guidelines contained in NRC Commission Proceedings NUREG/CP-0152. The information is being provided to facilitate NRC review of the Relief Request PR-12.

This Relief Request is needed to facilitate implementation of the Unit 1 Third Ten Year IST Program. The new program implements the ASME Section XI 1989 edition, which requires a change in vibration monitoring from displacement measurement to velocity measurement. Vibration readings utilizing velocity measurement devices on pumps running on mini-recirculation lines typically result in higher vibration readings than during their design service. In the case of the St. Lucie Unit 1 Safety Injection Pumps, the vibration readings taken with the pumps running on mini-recirculation exceed the absolute ALERT level, thereby requiring additional surveillance testing. However, since pump run time using mini-recirculation lines should be minimized, an alternative utilizing higher ALERT vibration limits is proposed when the pumps are operated with mini-recirculation lines and FPL will utilize the ASME code required ALERT limits when the pump is run at full or substantial flow during outages.

COMPONENTS

Low Pressure Safety Injection Pumps 1A and 1B (8770-G-078, Sheet 130B)

SUPPORTING INFORMATION

As discussed in NUREG/CP-0152, *Code Absolute Vibration Requirements*, there are four key components that the staff considers in evaluating alternative requests: 1) vibration history, 2) consultation with pump manufacturer or vibration expert, 3) attempts to lower the vibration through modification, and 4) performance of spectral analysis of the pump-driver system.

Vibration History

These pumps are included in the plant "condition monitoring" program, therefore, several years of spectral analysis by the plant predictive maintenance group test results were available for review. From the spectral patterns it can be seen that, at minimum flow conditions, both pumps generate increased vibration levels. At low flow, vibration velocity levels at five and ten times running speed frequencies (5X/10X) are significantly increased due to elevated vane pass vibration

since the velocity vector is not striking the volute at an optimal angle. The increased vibration at the 2X frequency is a result of an abnormal pressure distribution in the volute that acts to load the impeller asymmetrically. Also contributing the overall vibration increase is hydraulic broadband "spectral floor" energy generated by shock energy due to increased turbulence and internal recirculation flow.

Note that an anomaly occurred on April 21, 1997, when relatively high vibration was experienced by the 1B LPSI pump at the 1X frequency in the horizontal direction. Based on a review of the data, it was determined that this resulted from a structural condition related to operation at elevated temperature. The most likely cause was postulated to be piping and support system stiffness and natural frequency changes resulting from elevated temperatures. Subsequent runs under similar conditions at non-elevated temperatures resulted in lower vibration.

Expert Opinion

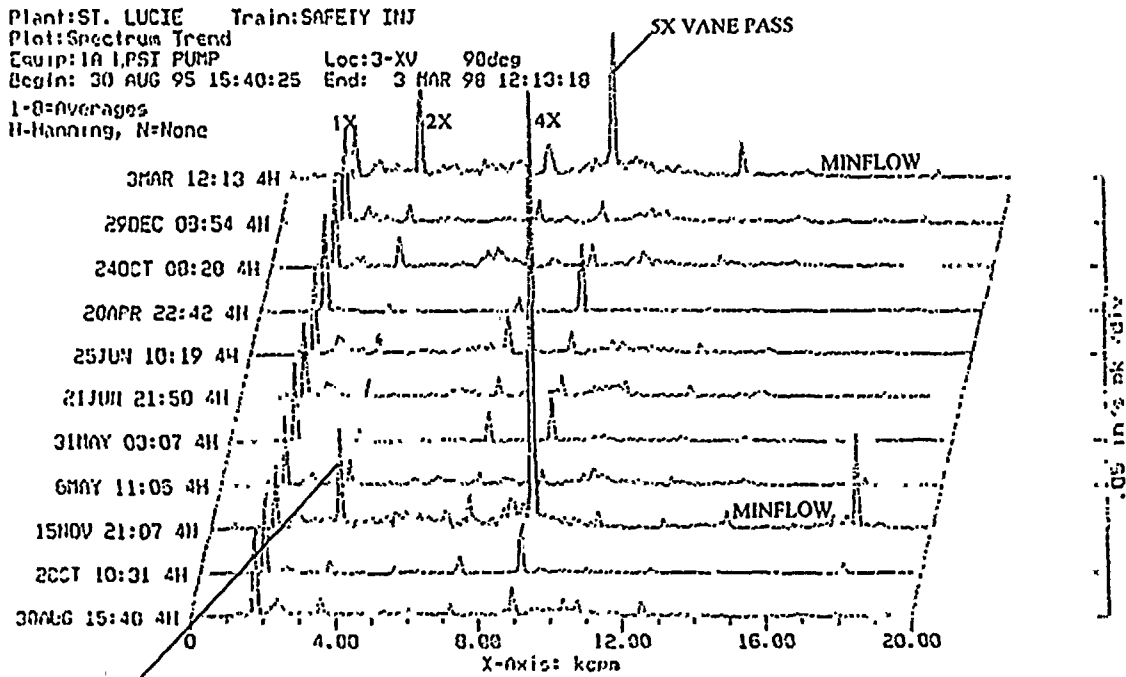
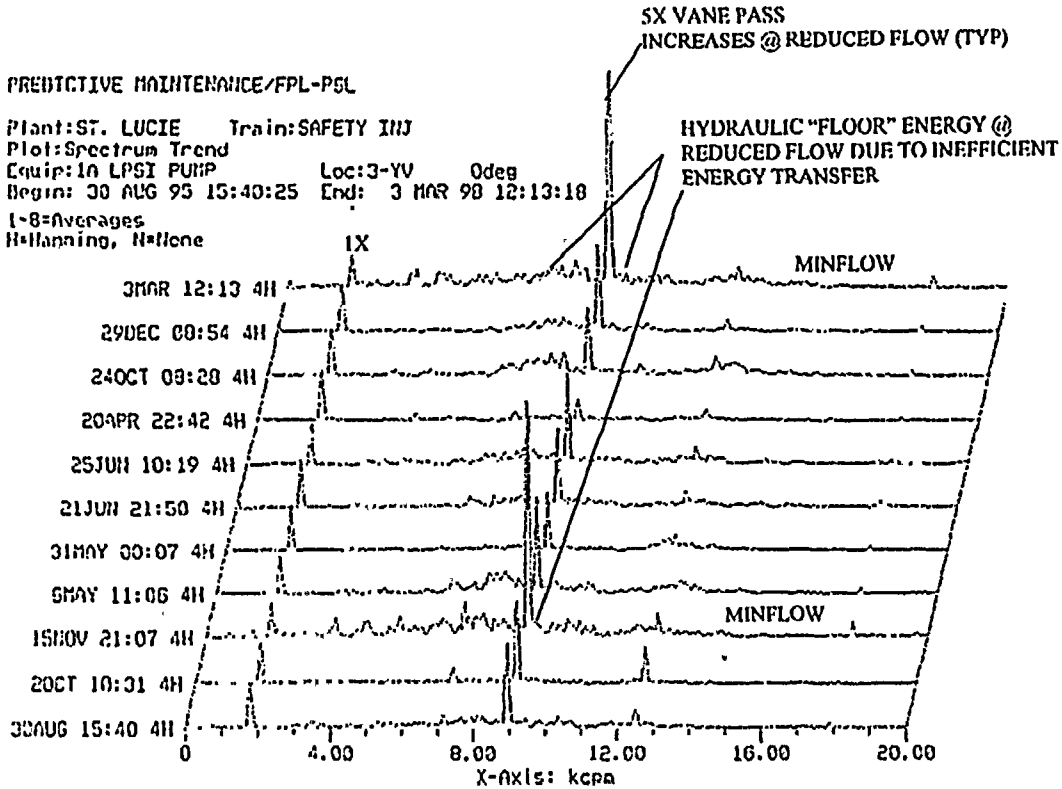
The spectral vibration data of these pumps was collected by plant predictive maintenance personnel experienced and trained in the performance monitoring of pumps and other rotating equipment. The spectral data along with historical pump displacement and velocity data obtained to comply with IST requirements has been reviewed and evaluated by our onsite equipment vibration specialist. In addition, operation of the pump in low flow conditions has been discussed with the original equipment manufacturer. The FPL predictive maintenance vibration specialist's conclusion based on the historical data, spectral analysis, and hands on data gathering is that there is no evidence of pump deterioration or mechanical anomalies detrimental to pump performance and that the LPSI pumps are operating satisfactorily.

Corrective Actions

As discussed above, the pump vibration history data has been reviewed to ensure that no maintenance related anomalies were evident that could be corrected to improve performance. The pump-piping configuration was also reviewed, however, changes to the pump/piping arrangement, including modification of pump internals and installation of a full flow test recirculation line, would be costly and generally impractical. Based on the data, the unacceptable levels of vibration experienced during low flow conditions are a result of flow noise and pump dynamics that are not a function of pump degradation. The elevated levels of vibration are not evident at design flows, and therefore do not detract from pump availability or reliability at design flows. Also, the LPSI pumps meet the ASME vibration criteria during outage conditions (substantial flow conditions). Accordingly, the need for substantial plant modification to install full flow recirculation lines for quarterly surveillance is considered impractical.

Spectral Analysis

The results derived from spectral analyses are provided.



2X INCREASED / 1X DECREASED @ MINFLOW - TYPICAL OF
 VOLUME PRESSURE DISTRIBUTION CAUSING ONE DIMENSIONAL
 LOADING (NOT AN ABNORMAL PHENOMENON)

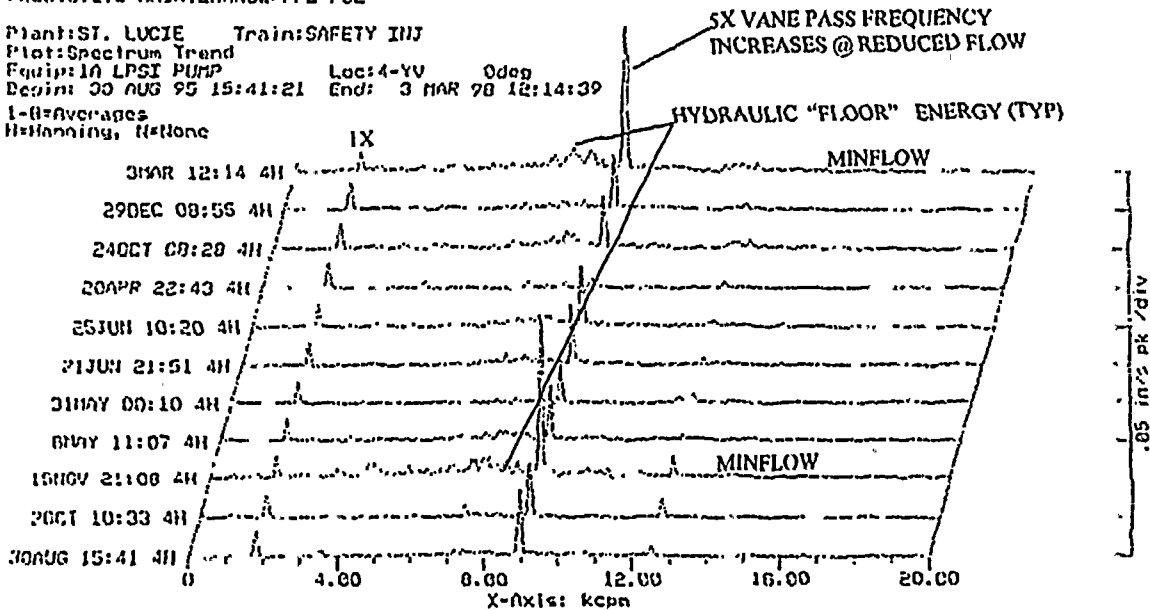
BEITLY, }
 NEVADA, } SS

NOTE: ALL MEASUREMENTS TAKEN AT SUBSTANTIAL FLOW (DESIGN OR SHUTDOWN COOLING FLOWRATES)
 EXCEPT WHERE NOTED.

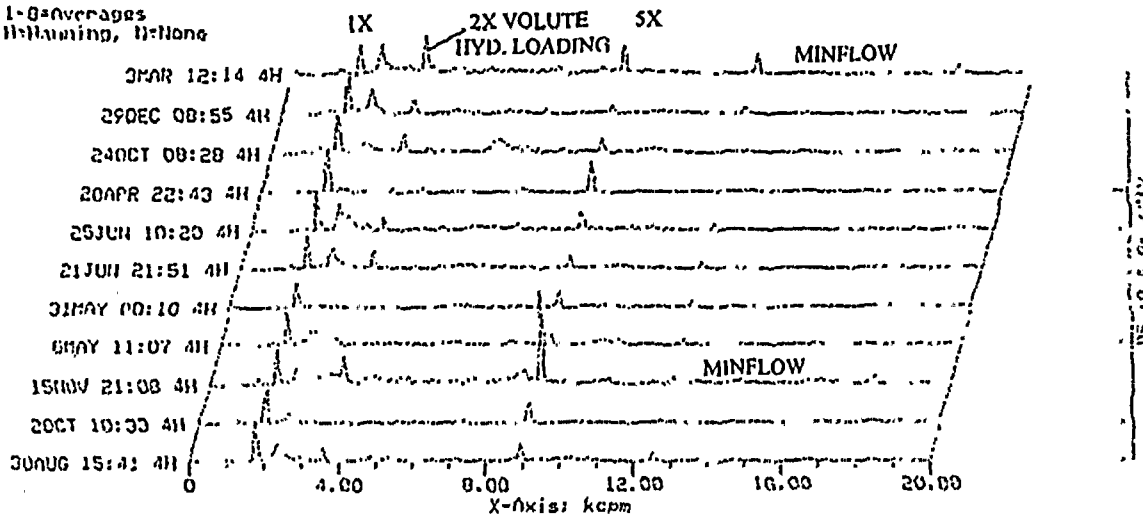
St. Lucie Units 1 and 2
 Docket Nos. 50-335 and 50-389
 L-98-264 Attachment Page 4

PREDICTIVE MAINTENANCE/FPL-PSL

Plant: ST. LUCIE Train: SAFETY INJ
 Plot: Spectrum Trend
 Equip: 1A LPSI PUMP Loc: 4-YV 0deg
 Begin: 30 AUG 95 15:41:21 End: 3 MAR 98 12:14:39
 I-B=Averages
 H=Hanning, N=None



Plant: ST. LUCIE Train: SAFETY INJ
 Plot: Spectrum Trend
 Equip: 1A LPSI PUMP Loc: 4-XV 90deg
 Begin: 30 AUG 95 15:41:21 End: 3 MAR 98 12:14:39
 I-B=Averages
 H=Hanning, N=None

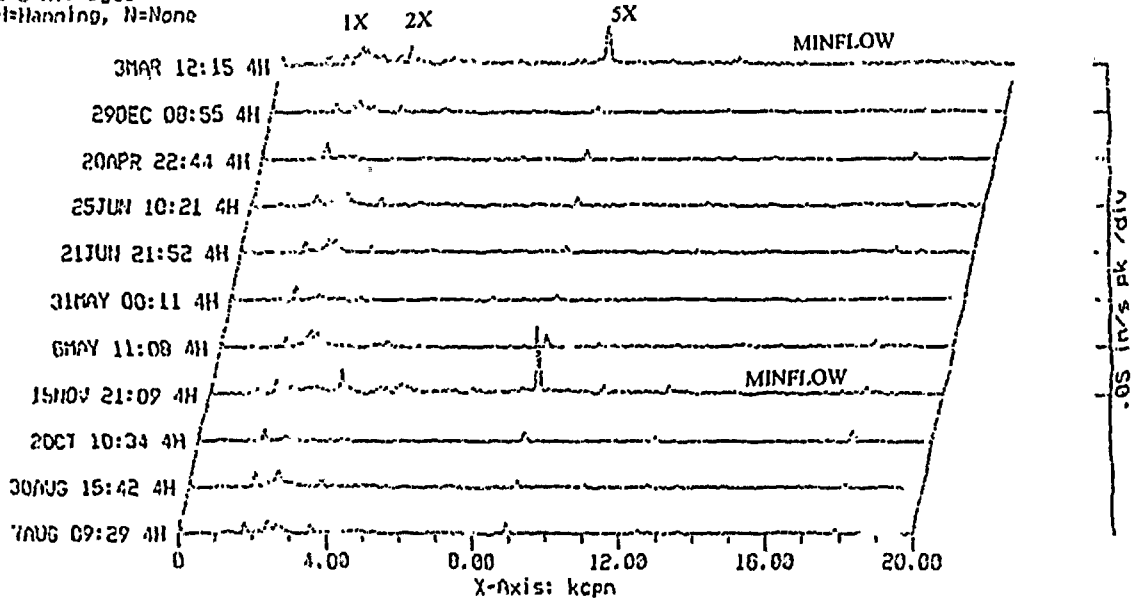


BENTLY,
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NOTE: ALL MEASUREMENTS TAKEN AT SUBSTANTIAL FLOW (DESIGN OR SHUTDOWN COOLING FLOWRATES)
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PREDICTIVE MAINTENANCE/FPL-PSL

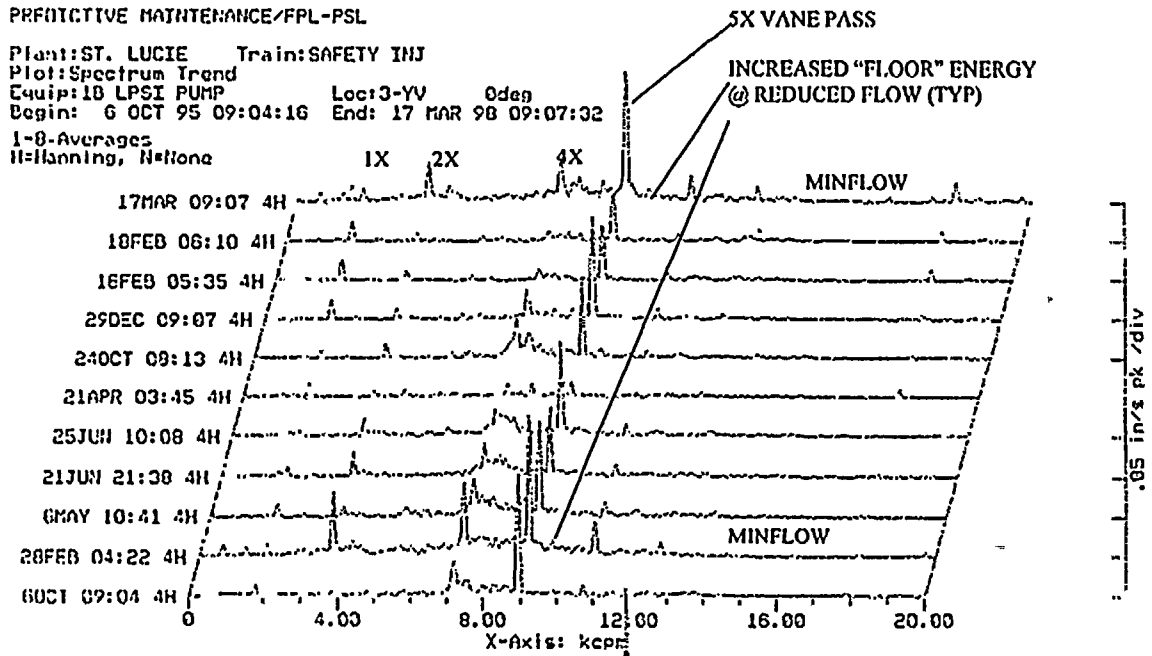
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 Plot: Spectrum Trend
 Equip: 1A LPSI PUMP Loc: 4-AV Axial
 Begin: 7 AUG 95 09:29:43 End: 3 MAR 98 12:15:51
 I=8-Averages
 H=Hanning, N=None



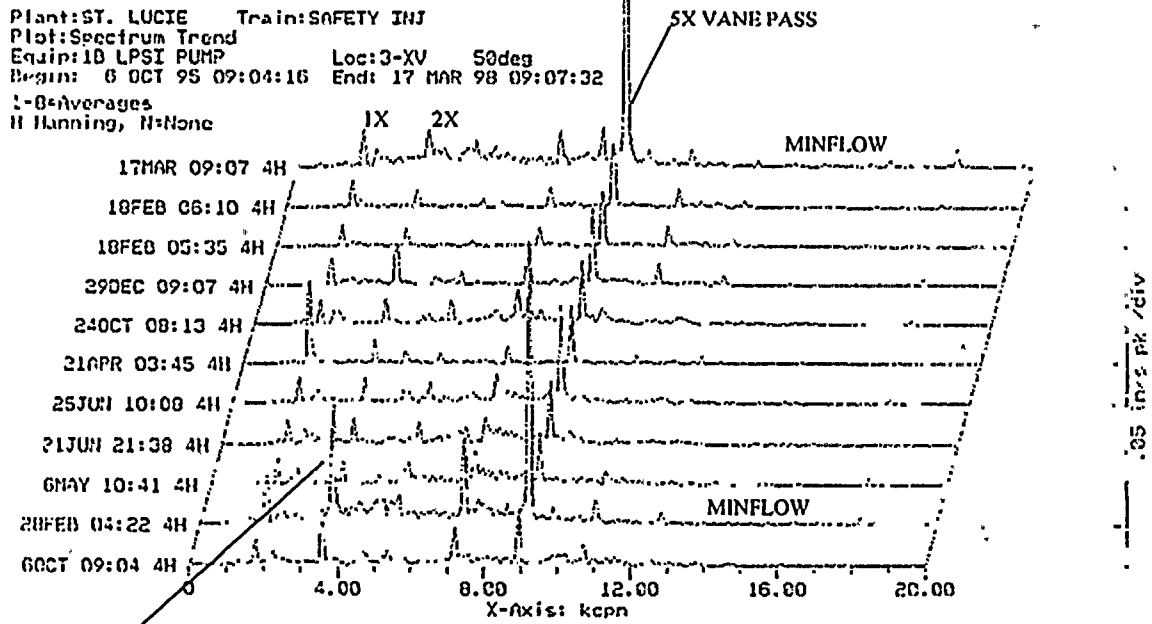
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 EXCEPT WHERE NOTED

PREVENTIVE MAINTENANCE/FPL-PSL

Plant: ST. LUCIE Train: SAFETY INJ
 Plot: Spectrum Trend
 Equip: 1B LPSI PUMP Loc: 3-YV 0deg
 Begin: 6 OCT 95 09:04:16 End: 17 MAR 98 09:07:32
 I-B=Averages
 H=Hanning, N=None



Plant: ST. LUCIE Train: SAFETY INJ
 Plot: Spectrum Trend
 Equip: 1B LPSI PUMP Loc: 3-XV 50deg
 Begin: 6 OCT 95 09:04:16 End: 17 MAR 98 09:07:32
 I-B=Averages
 H=Hanning, N=None

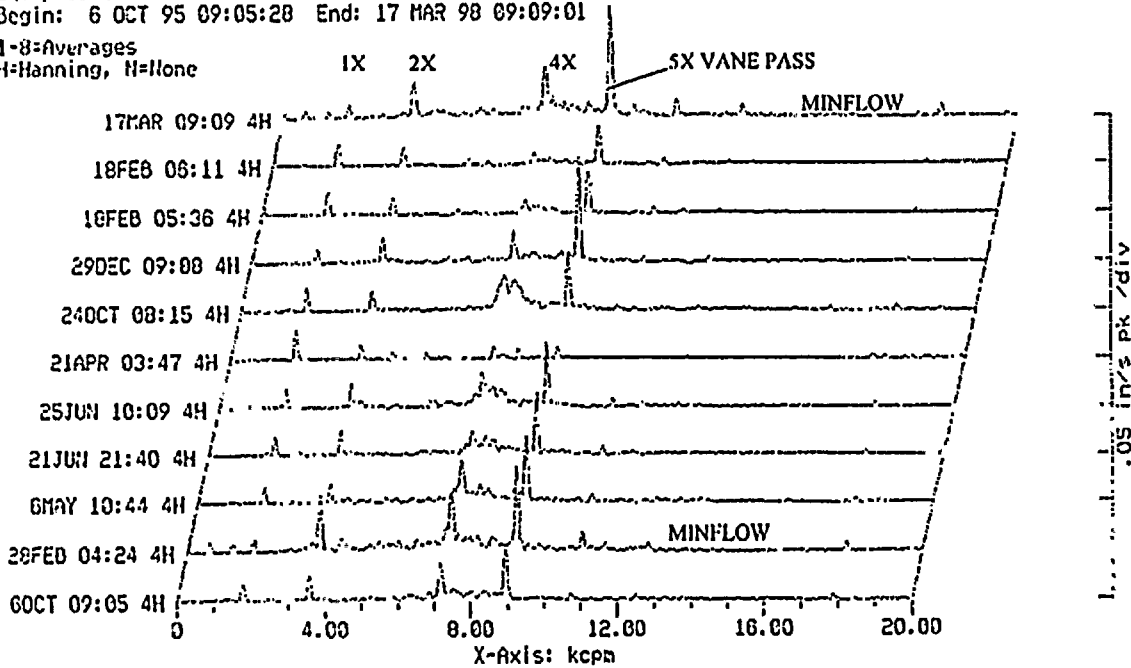


2X INCREASED @ REDUCED FLOW
 TYPICAL OF VOLUTE PRESSURE LOADING

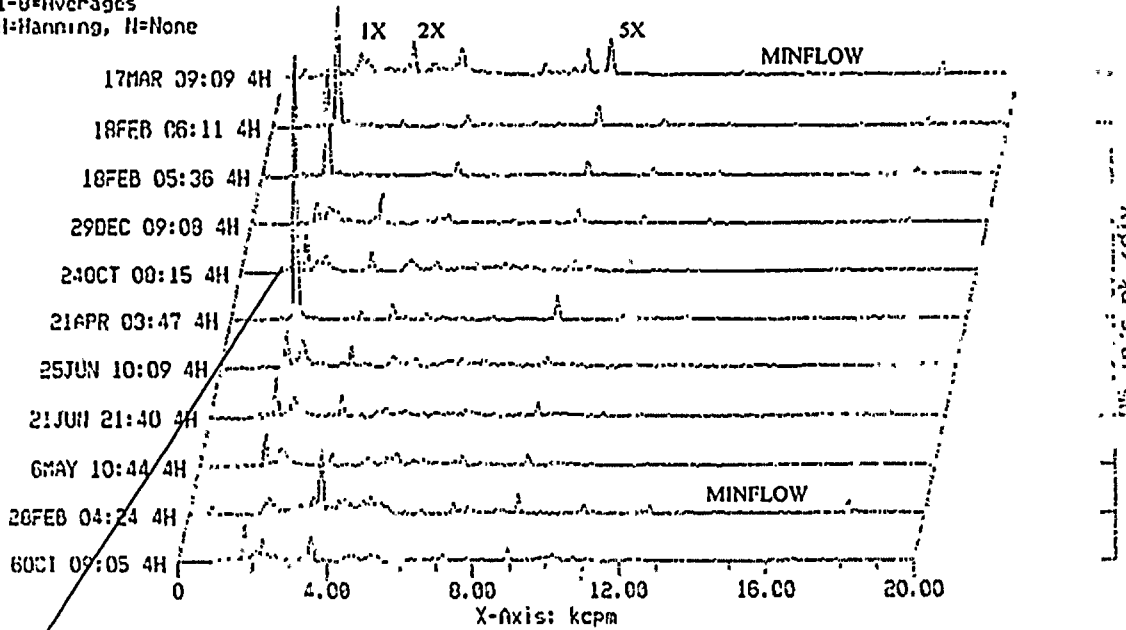
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 EXCEPT WHERE NOTED

PREDICTIVE MAINTENANCE/FPL-PSL

Plant: ST. LUCIE Train: SAFETY INJ
 Plot: Spectrum Trend
 Equip: 1B LPSI PUMP Loc: 4-YV 0deg
 Begin: 6 OCT 95 09:05:28 End: 17 MAR 98 09:09:01
 I=8=Averages H=Hanning, H=None



Plant: ST. LUCIE Train: SAFETY INJ
 Plot: Spectrum Trend
 Equip: 1B LPSI PUMP Loc: 4-XV 90deg
 Begin: 6 OCT 95 09:05:28 End: 17 MAR 98 09:09:01
 I=8=Averages H=Hanning, H=None

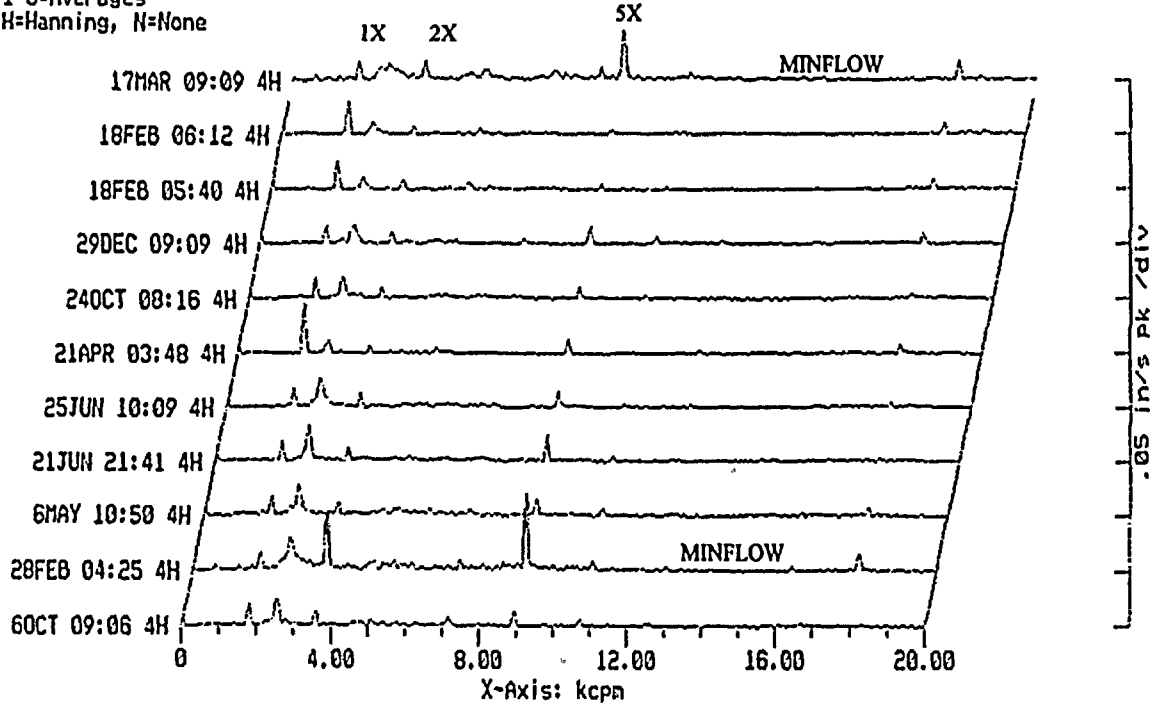


INCREASED HORIZONTAL IX DUE TO THERMAL
 SPRINGING OF PUMP CASING (PUMPING HOT WATER)

NOTE: ALL MEASUREMENTS TAKEN AT SUBSTANTIAL FLOW (DESIGN OR SHUTDOWN COOLING FLOWRATES)
 EXCEPT WHERE NOTED

PREDICTIVE MAINTENANCE/FPL-PSL

Plant:ST. LUCIE Train:SAFETY INJ
Plot:Spectrum Trend
Equip:1B LPSI PUMP Loc:4-AV Axial
Begin: 6 OCT 95 09:06:53 End: 17 MAR 98 09:09:40
1-8=Averages
H=Hanning, N=None



NOTE: ALL MEASUREMENTS TAKEN AT SUBSTANTIAL FLOW (DESIGN OR SHUTDOWN COOLING FLOWRATES)
EXCEPT WHERE NOTED



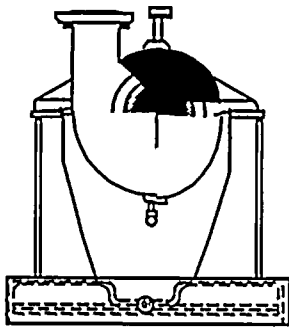
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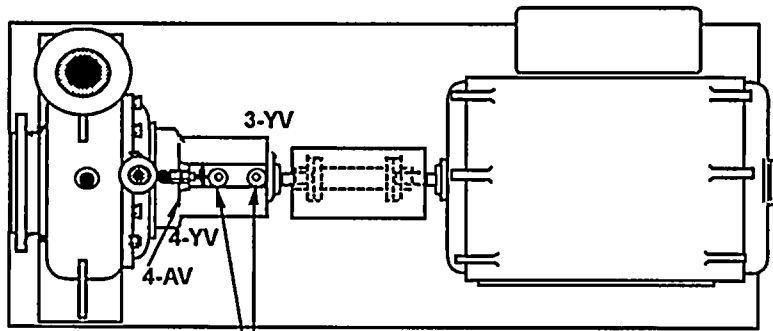
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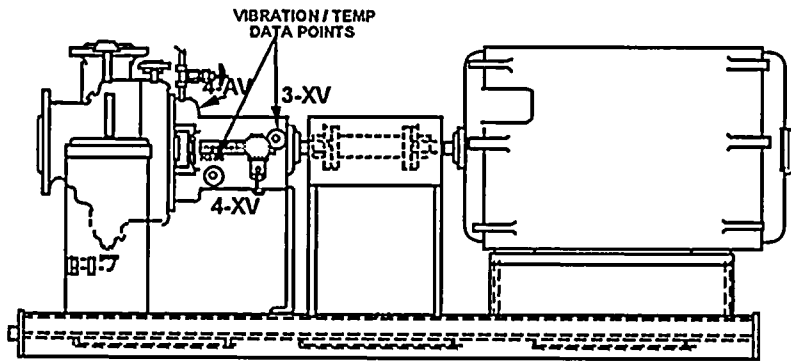
**UNIT 1
LOW PRESSURE
SAFETY
INJECTION
PUMP**



END VIEW



TOP VIEW



SIDE VIEW
LOOKING WEST