Omaha Public Power District
444 South 16th Street Mall
Omaha, Nebraska 68102-2247
402/636-2000

August 3, 1994
LIC-94-0159

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Mail Station PI-137
Washington, D.C. 20555

REFERENCES:
1. Docket No. 50-285
2. Letter from OPPD (W. G.Gates) to NRC (Document Control Desk), dated November 13, 1992 (LIC-92-320)
3. ASME/ANSI Operation and Maintenance of Nuclear Power Plants, 1987 Edition, 1988 Addenda, Part 6, Table 3
4. USNRC Generic Letter 89-04, April 3, 1989
5. USNRC NUREG-1482 (Draft), Guidelines for Inservice Testing at Nuclear Power Plants, November 1993
6. "Progress in Pumps," Richard F. Neerken, The Ralph M. Parsons Co., *Chemical Engineering*, September 14, 1987

Gentlemen:

SUBJECT: Request for Relief from Vibration Limits for Quarterly Minimum Recirculation ISI Surveillance Tests of Low Pressure Safety Injection (LPSI) and Containment Spray (CS) Pumps

Pursuant to 10 CFR 50.55a(a)(3), Omaha Public Power District (OPPD) requests relief from certain requirements of the ASME Section XI Code for inservice testing at Fort Calhoun Station (FCS). Specifically, OPPD is requesting relief from and proposing alternatives to vibration limits contained in ASME/ANSI Operation and Maintenance (OM) of Nuclear Power Plants (Reference 3) for the Alert and Required Action ranges of the LPSI and CS Pumps Quarterly ISI Surveillance Tests. This relief request is being submitted because compliance with Code acceptance criteria for vibration would result in an undue hardship to FCS (i.e., re-design of the systems) without a commensurate increase in the level of quality or safety.

The Code of record at FCS for the Third Ten-Year Inservice Test (IST) Interval is the 1989 Edition of ASME Section XI which incorporates, by reference, OM Part 6 for safety related pumps (Reference 3). Both 10 CFR 50.55a(f)(5)(iv) and draft NUREG-1482 (Reference 5) specify that the licensee list the Code requirements found to be impractical for the new interval such that "the basis for this determination...be demonstrated to the satisfaction of the Commission not later than 12 months" from the start of the interval. The Third Ten-Year Interval for the FCS IST Program commenced September 26, 1993; thus, the 12 month period ends September 26, 1994.

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The FCS ISI Program Plan (Reference 2) requires the LPSI and CS pumps be tested quarterly in accordance with OM Part 6 using the minimum recirculation flow path to the Safety Injection and Refueling Water Tank (SIRWT), and during cold shutdowns using the full flow path to the Reactor Coolant System in accordance with Position 9 of Reference 4. The testing includes measurement of vibration and discharge pressure parameters.

In OM Part 6, Table 3, the vibration limits presently listed are 0.325 inches per second (ips) for the Alert range and 0.7 ips for the Required Action range. Due to several inherent design factors such as temperature and reduced flow (as discussed in the enclosure to this letter), the LPSI and CS pumps during minimum recirculation testing have never been able to meet the vibration limits presently required. In general, however, these pumps have met the vibration displacement criteria contained in previous editions of the FCS ISI Program Plan and the Code. During the full flow tests performed at cold shutdown frequency (last performed during the 1993 Refueling Outage), the LPSI and CS pumps met the previous and current FCS ISI Program Plan and OM Part 6 vibration acceptance criteria.

On July 15, 1994, OPPD completed an engineering evaluation of the present condition of the LPSI and CS pumps. This evaluation confirmed that these pumps are operable, but that due to their design, the vibration levels during minimum recirculation testing exceed the current Code requirements. OPPD therefore proposes alternative limits for the Alert and Required Action ranges of 0.8 ips and 1.1 ips, respectively. It should be emphasized that the proposed vibration limits will *only* apply to the LPSI and Containment Spray pumps during quarterly (minimum recirculation) testing. The full flow cold shutdown vibration limits will continue to be as currently stated in OM Part 6. Detailed discussion and justification for relief are enclosed.

OPPD requests expedited NRC approval of relief prior to the expiration of the authorized extension date of September 26, 1994. If full approval cannot be provided by this date, OPPD requests interim approval of this relief request.

If you should have any questions, please contact me.

Sincerely,

W. G. Gates

W. G. Gates
Vice President

WGG/tcm

Enclosure

c: LeBoeuf, Lamb, Greene & MacRae (w/o attachments)
L. J. Callan, NRC Regional Administrator, Region IV (w/o attachments)
R. P. Mullikin, NRC Senior Resident Inspector (w/o attachments)
S. D. Bloom, NRC Project Manager

Omaha Public Power District (OPPD)
Fort Calhoun Station (FCS) Unit No. 1

Request for Relief from Vibration Limits for Quarterly (Minimum Recirculation) ISI Surveillance Tests of Low Pressure Safety Injection (LPSI) and Containment Spray (CS) Pumps.

Discussion and Justification

Background

10 CFR 50.55a directs nuclear power plant operators to comply with Section XI of the ASME Boiler and Pressure Vessel Code. Section XI IWA-2432 (Program B) establishes four 10-year intervals that reference the current edition of the Code at the beginning of each 10-year interval. The first 10-year interval for Fort Calhoun Station (FCS) started on the official commercial operation date of the plant, September 26, 1973. In addition to the 10 CFR requirements, FCS Technical Specification 3.3(1)(a) requires compliance with the applicable edition of ASME Section XI for components that are designated ASME Code Class 1, 2, or 3.

From September 26, 1983 to September 25, 1993, the applicable Code for FCS was the 1980 edition, including the 1980 Winter addenda of ASME Section XI. Since September 26, 1993, the applicable Code for FCS has been the 1989 edition of ASME Section XI. The FCS ISI Program Plan refers to this edition of the Code, which incorporates ASME/ANSI Operation and Maintenance (OM) of Nuclear Power Plants, 1987 Edition, 1988 Addenda. One significant change is the preference (in OM Part 6, Table 3) to measure vibration as broadband unfiltered peak velocity rather than peak-to-peak displacement for pumps with operating speeds of greater than 600 rpm. Another change is the absolute peak velocity acceptance criteria limits of >0.325 inches per second (ips) for Alert and >0.7 ips for Required Action.

For FCS, the two LPSI pumps, SI-1A/B, and the three CS pumps, SI-3A/B/C, are identical Ingersoll-Rand Model 6UCL single stage pumps designed and built in the late 1960s. They are directly coupled to General Electric Custom 8000 horizontal 300 hp 2 pole (full load rpm = 3560) induction motors. The three CS pump motors are powered from individual 480v buses, while the two LPSI pump motors are powered from 4160v buses. It is believed that only six additional Model 6UCL pumps are installed and in use in the commercial nuclear industry, three at Palisades and three at Connecticut Yankee. This means that extensive historical operating data for these pumps are limited.

These double-suction pumps were originally designed to supply approximately 2400 gpm of borated water at about 400 ft of head to the LPSI/CS systems. Minimum recirculation orifices were supplied with each pump to allow 150-200 gpm of recirculation flow in dead-head situations (e.g., when initially started with the discharge safety injection valves closed) while diverting the least amount of water away from the reactor core during design accident conditions. The minimum recirculation path at FCS is a non-instrumented flow line to the Safety Injection and Refueling Water Tank (SIRWT).

DISCUSSION

Because the design of any pump involves the tradeoff of many characteristics, emphasis is usually placed on exceeding the specific pump requirements, with desirable but optional characteristics given less weight. Since the intended design basis applications of the Model 6UCL pumps involve minimal operation at low flow rates, no significant design accommodations were incorporated to enhance low flow operation, such as minimizing vibration.

On July 15, 1994, OPPD completed an engineering evaluation of the present condition of the LPSI and CS pumps. Plotting the last 15 years of peak-to-peak displacement and 5 years of peak velocity vibration measurements shows no adverse trend in LPSI/CS pump performance at FCS. Since May 1990, the LPSI/CS pumps have been tested with minimum recirculation flow a total of 91 times. If the 1989 Code vibration limits were applied during the minimum recirculation testing, the LPSI/CS pumps would have been in the Alert range 79 times and would have been declared inoperable 12 times; i.e, not once during these tests were the new Code's acceptance criteria met.

Because of the inability to comply with the 1989 Code limits, OPPD proposes alternative limits for the Alert and Required Action ranges of >0.8 ips and >1.1 ips, respectively, during minimum recirculation testing. These alternative limits are considered acceptable based on previous pump testing history, the lack of significant observed pump degradation, and the continued ability to comply with the Code criteria during full flow testing.

Analysis of the specific design features of the Model 6UCL pump leads to the conclusion the pump design is a leading cause of the relatively high overall vibration measured during minimum recirculation inservice testing. Normally, a properly designed and operated pumping system will run smoothest and have the longest service life when it is operated at the pump's best efficiency point (BEP). For the Model 6UCL pumps, the BEP is about 80% between 2400 and 2800 gpm. When the pump is run at minimum flow conditions (~150 gpm), the pump efficiency falls to about 10% and the vibration displacements increase by approximately a factor of four.

A baseline pump performance test, FCS procedure SP-SI/CS-4, was conducted in April 1990. The results of this test (see Attachment 1, pages 1-1 through 1-10) clearly show pump vibration decreased as flow was increased. A comparison of displacement and velocity measurements recorded during quarterly minimum flow versus during cold shutdown full flow testing confirms this characteristic of vibration versus flow.

Following initial installation of the LPSI/CS pumps and prior to initial plant startup, concern over the high pump vibration levels measured and the lack of free rotation caused the LPSI/CS pumps to be returned to the factory for machining to increase impeller clearances. Annually the LPSI/CS pump couplings are separated, inspected, greased, and recoupled. Alignment is checked and in-service testing is performed. On one occasion, post-maintenance testing for SI-1A indicated an alignment problem (abnormally high vibration in mils) with the coupling that was promptly corrected. During January 1989, quarterly pump testing indicated abnormally high vibration displacement for SI-3A. The pump was opened for inspection and the cause was determined to be foreign material that had caused spalling on the wear ring.

After the spalling was blended out, post-maintenance testing indicated that the pump had returned to "normal" vibration levels. Outside of these activities, very little repair work has been performed on these pumps. They have operated for over 20 years with consistently high vibration levels during quarterly minimum recirculation in-service testing.

The LPSI/CS pumps are borderline "high energy" pumps (as defined by API-610 Sixth Edition) and are susceptible to blade passing frequency vibrations and low-frequency vibration at reduced flow rates.

Another factor contributing to low flow vibration is low flow cavitation. Although considerable analysis has been performed to verify these pumps meet their net positive suction head (NPSH) requirements under all anticipated conditions, this does not ensure that the pumps will be able to operate smoothly under low flow conditions at the NPSH available. When these pumps were constructed, NPSH requirements were based upon an industry-wide standard of 3% head decay. The 3% head decay ensured the pumps would be able to satisfy their design requirements if the NPSH available (NPSHA) was greater than the NPSH required (NPSHR), but it did not ensure the pumps would operate smoothly.

As noted in Reference 6, generic research and testing during the 1970s and 1980s indicates that long periods of cavitation-free operation at low flows in "high energy" pumps require three or four times the traditional NPSH values as determined from the 3% head decay suppression test.

> From Reference 6, p. 80: "Concurrent with this research and development, the phenomenon of low-flow cavitation was observed, especially in larger pumps, or in pumps with high suction-specific-speed (10,000 to 12,000, and above, in U.S. units -- see Table I)."
>
> From Reference 6, Table I, the suction-specific-speed equation is:

$$N_{ss} = \frac{rpm\ \sqrt{flow(gpm)}}{NPSHR(ft)^{3/4}}$$

> Note: For double suction pumps, use one-half of total flow when calculating suction specific speed. Always use flow at pump's best efficiency point, with maximum diameter impeller.

The suction-specific-speed for the FCS LPSI and CS pumps is found by entering the following actual pump values into the above equation:

rpm = 3560
flow = 2400/2 = 1200 gpm
NPSHR = 18 ft. @ 2400 gpm

N_{ss} = 14,112

Reference 6, Figure 2 (shown as Figure 2 of this enclosure) compares, for a pump similar to a Model 6UCL, the traditional 3% head decay NPSHR curve and a NPSHR curve that suppresses incipient cavitation. Study of the SI-1A vibration spectra for different operating conditions indicates that approximately one half of the vibrational energy during quarterly in-service testing is caused by low-flow cavitation. Compare the SI-1A vibration spectra for minimum recirculation flow conditions (Attachment 1, pages 1-51 and 1-60, ~150 gpm, NPSHA ≈ 62 ft), shutdown cooling-cold conditions (Attachment 1, page 1-78, ~1500 gpm, 61 ft ≤ NPSHA ≤ 95 ft), and shutdown cooling-hot conditions (Attachment 1, page 1-69, ~1500 gpm, NPSHA ≈ 450 ft). The shutdown cooling hot and cold conditions noted are intended to be comparative, denoting the greater amounts of NPSHA with higher temperature supply water.

Note that the vibrational spectral lines ("grass") in the 40 to 300 Hz region (heard as pinging noises during the testing) that are present in the minimum recirculation and the shutdown cooling-cold spectra do not appear, except for the running speed harmonics, under shutdown cooling-hot conditions. The absence of this vibrational energy under high NPSHA conditions is the result of full suppression of incipient cavitation. The majority of the spectral energy measured during minimum recirculation and shutdown cooling-cold operation is non-synchronous, but during shutdown cooling-hot operation most of the energy is synchronous. Other temperature/pressure related effects resulting in changes to the pump nozzle loads (e.g., less "cold spring") and pump alignment may be responsible for the reduction of the running speed harmonics during hot shutdown cooling conditions.

EVALUATION

At just under 300 Hz there is a 5x line (see Attachment 1, pages 1-48 through 1-86). This line is the pump vane rate and will always be present. When the pump is cavitating (quarterly testing), the amplitude of this line is greater than 0.1 ips (Attachment 1, pages 1-52, 1-56; inboard vertical). With adequate NPSH to suppress cavitation (shutdown cooling-hot testing), the amplitude drops to less than 0.03 ips (Attachment 1, pages 1-70 & 1-74; inboard vertical). Cavitation in the pump will always accentuate the vane rate. The first harmonic of the vane rate (just under 600 Hz) is prominent in the vertical direction (inboard and outboard). The highest vane rates occur vertically inboard, followed by vertically outboard, then horizontally inboard and finally horizontally outboard. This is to be expected, since the pump has a large overhung impeller with vertical suction and discharge. As the pump pushes water up the discharge pipe, the shaft acts like a teeter-totter rocking on the outboard bearing, creating large vertical vane rate velocities at the inboard bearing. There is less force acting in the horizontal direction, thus making the outboard horizontal the smoothest position. Because of this rocking, the inboard bearings are subjected to the harshest service conditions.

A significant 2x line (Attachment 1, pages 1-52 through 1-86; near 120 Hz) suggests an alignment problem. A number of historic Maintenance Work Orders were identified that measured coupling alignment. Although these used the less accurate dial indicator method, the readings were within the Ingersoll-Rand Technical Manual tolerance of three mils vertical offset.

Four of the pumps have had their present condition measured using an OPTALIGN® laser/prism system. The laser measurements confirm the alignments are within the vendor manual recommendation. The coupling is designed to accommodate up to five mils of misalignment without accelerated wear.

Based on the piping load calculations, the pumps have significant nozzle loads due to a designed cold spring. Since the pumps are aligned cold and tested at the same temperature, this cold spring does not cause an alignment problem. The excessive nozzle loads may, however, cause some distortion of the pump case which could affect impeller clearances and contribute to flow noise. This distortion may also contribute to the amplitude of the 5x line and may further explain the reduction in the 5x line under shutdown cooling-hot conditions. As with the 5x line, the 2x line is more prominent on the inboard bearing and virtually nonexistent at the outboard horizontal position (Attachment 1, pages 1-52 and 1-55).

A series of lines at 1x, 2x, 3x, 4x, etc. suggests some mechanical looseness inherent in the pump design. The series is typical of a bearing with linear looseness in its cap, or it could indicate the bearing housing is not rigid. The only identified measurement of pump end play is for SI-1B, performed July 6, 1973. Five mils of end play were recorded, which meets the manufacturer's specifications. The overhung rotor design and possible lack of rigidity in the bearing housing represent a source of mechanical looseness that cannot be overcome without extensive analysis of the pump design and modifications that are very sensitive to the pump's critical speed. These factors are not considered an operability concern relative to the design basis function of the LPSI/CS pumps. Parallel misalignment could also be a contributing factor to this series.

OPPD personnel have carefully reviewed Surveillance Test results, Preventative Maintenance, Corrective Maintenance, a special pump performance baseline test, work practices, and pump vibration information received from the Safety Injection System Engineer at Palisades Nuclear Plant, which has the same pump configuration as FCS. Following are the salient points of this evaluation:

1. The LPSI/CS pump mini-recirculation flow vibration trends have held relatively constant at an elevated level since plant construction (Attachment 1, pages 1-31 through 1-45).

2. The LPSI/CS pumps exhibit similar vibration spectra and overall vibration displacements/energies when operated under similar conditions (Attachment 1).

3. The LPSI/CS vibration displacements are reduced by a factor of three or four when operated at the higher flow rates. Since vibrational energy is directly related to the square root of peak vibration velocities integrated over the pump's vibration spectra, the pump vibrational energies associated with minimum flow operation are significantly greater than the increase in either pump vibration displacement or velocity indicates (Attachment 1).

4. The LPSI/CS pump vibration spectral peaks at the running speed harmonics are not excessive nor abnormal. After 20 years of operation, the original bearings are not showing signs of degradation. There are four specific

bearing defect frequencies which will appear for a time near the end of each bearing's useful life. If the bearing remains in service, the amplitude of these defect frequencies will diminish, but the amplitude of the 1x line will increase. A review of the spectral data concludes that the bearings have not yet reached the stage where defect frequencies appear. Vibration is higher at the inboard bearing and lower at the outboard bearing (Attachment 1).

5. Oil analysis does not show any indication of bearing damage (Attachment 3).

6. The couplings have been disassembled and inspected annually (recently this was changed to biennially). No indication of coupling damage has been identified.

7. The LPSI/CS pumps operate at about the same vibration levels in mini-recirculation as the three identical pumps installed at Palisades (Attachment 2).

CONCLUSION

OPPD concludes that the dominant contribution to the vibration of the LPSI/CS pumps during minimum recirculation quarterly testing is incipient cavitation caused by operating a high energy pump under low flow conditions with insufficient NPSHA. This may be aggravated by excessive nozzle loads that distort the pump casing, affecting impeller clearances. Under high NPSHA conditions and/or normal design flow rates, the spectral lines associated with incipient cavitation effects disappear, and the overall pump vibration velocities fall within the Code acceptable range.

Because of the inability to comply with the 1989 Code limits, OPPD proposes alternative limits for the Alert and Required Action ranges of >0.8 ips and >1.1 ips, respectively, during minimum recirculation testing of the LPSI/CS pumps. These alternative limits are considered acceptable based on previous pump testing history, the lack of significant observed pump degradation, and the continued ability to comply with the Code criteria during full flow testing.

No significant reduction in the minimum recirculation vibration levels of these pumps can be achieved without major redesign of the pumps and/or system piping. Past testing demonstrates that the pumps are performing acceptably, i.e., they are able to perform their design function and show no adverse trend. Therefore, this relief request is being submitted because compliance with the Code vibration acceptance criteria would result in hardship or unusual difficulty without a compensating increase in the level of quality or safety.

Relief Request Basis Summary:

Components: Low Pressure Safety Injection Pumps SI-1A, SI-1B
Containment Spray Pumps SI-3A, SI-3B, SI-3C

Class: 2

Test Requirements: All deviations from the reference values shall be compared with the limits given in O&M Part 6, and corrective action taken as specified in Paragraph 6.1.

Low Pressure Safety Injection Pumps

Basis for Exception from O&M Part 6, Subsection 5.2 and Table 3a:

An analysis of previous quarterly pump tests while operating with minimum recirculation flow found that the low pressure pumps consistently exceed the >0.325 ips Alert Range Limit when they were known to be operating acceptably. Based on analysis of the pump design and on discussions with the pump vendor, pump experts, and another utility with identical pumps, OPPD has concluded that these pumps were not designed to meet this vibration criterion when operating with only minimum recirculation flow.

Alternate Testing:

During full flow testing of the pumps, the requirements of O&M Part 6, Subsection 5.2 and Table 3a will be fully implemented. During quarterly pump testing while on minimum recirculation flow, the >0.325 ips Alert Range Limit and the >0.70 ips Required Action Limit will be replaced with an Alert Range Limit of >0.80 ips and the Required Action Limit of >1.1 ips.

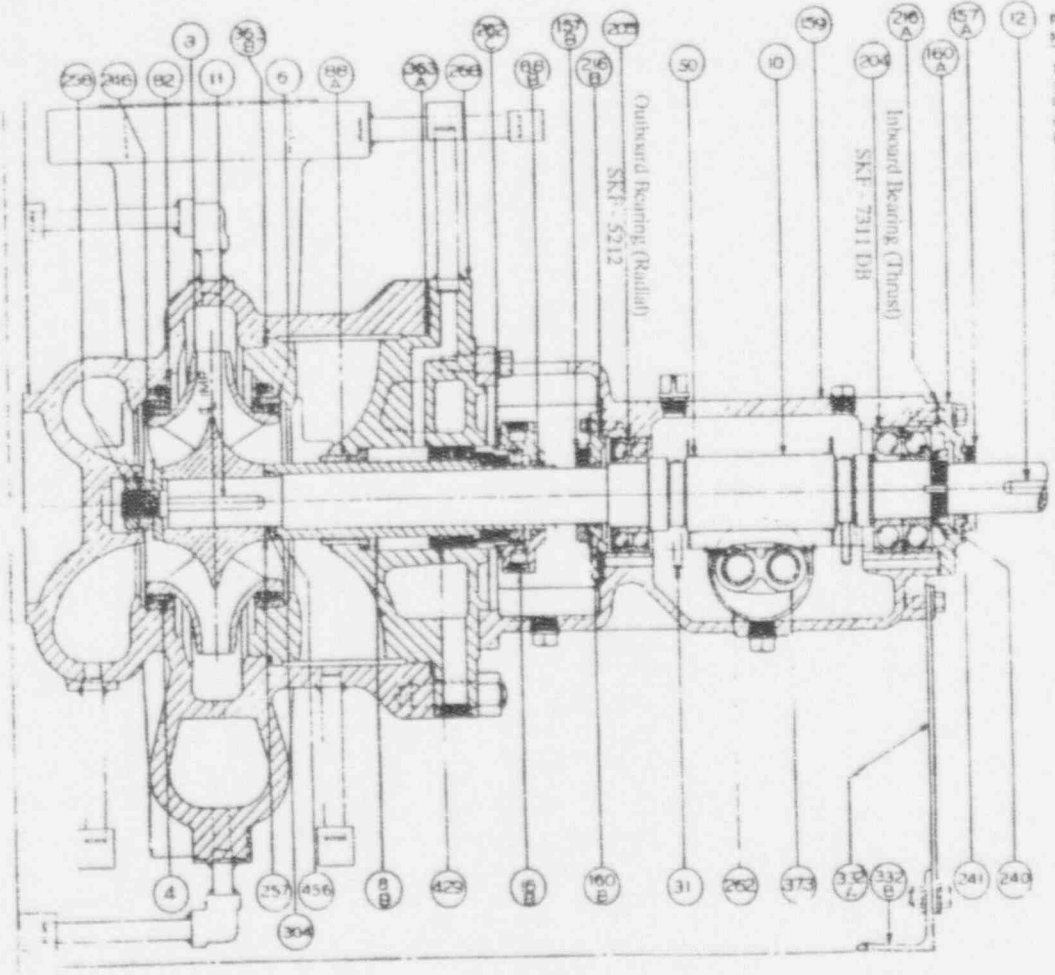
Containment Spray Pumps

Basis for Exception from O&M Part 6, Subsection 5.2 and Table 3a:

An analysis of previous quarterly pump tests while operating with minimum recirculation flow found that the containment spray pumps consistently exceed the >0.325 ips Alert Range Limit when they were known to be operating acceptably. Based on analysis of the pump design and on discussions with the pump vendor, pump experts, and another utility with identical pumps, OPPD has concluded that these pumps were not designed to meet this vibration criterion when operating with only minimum recirculation flow.

Alternate Testing:

During full flow testing of the pumps, the requirements of O&M Part 6, Subsection 5.2 and Table 3a will be fully implemented. During quarterly pump testing while on minimum recirculation flow, the >0.325 ips Alert Range Limit and the >0.70 ips Required Action Limit will be replaced with an Alert Range Limit of >0.80 ips and the Required Action Limit of >1.1 ips.



PART NO.	NAME OF PART	IR MATL SPEC.
1	CASING	730 (MOD. ASTM A351CF8)
3	IMPELLER	730 (MOD. ASTM A351CF8)
4	[illegible]	[illegible] ASTM A351CF8
6	WEARING RING	400 (ASTM A276TP304)
8B	SHAFT SLEEVE	400 (ASTM A276TP304)
10	SHAFT	379 (ASTM A276TP316)
11	IMPELLER KEY	266 (AISI 1020)
12	COUPLING KEY	304 S.S.
16B	GLAND	116 (ASTM B 145 ALLOY 4A
31	OIL RING	STEEL
50	OIL THROWER	304 S.S.
82	LOCKING SCREW	379 (ASTM A276TP316)
88A	STUFFING BOX BUSHING	CARBON
88B	THROTTLE BUSHING	165 (ASTM B143 ALLOY 2A
157A	FLINGER-INBOARD	165 (ASTM B143 ALLOY 2A
157B	FLINGER-OUTBOARD	C.I.
159	BEARING HOUSING	C.I.
160A	BEARING END COVER-INBOARD	C.I.
160B	BEARING END COVER-OUTBOARD	STEEL
204	BALL BEARING-THRUST	STEEL
250	BALL BEARING-RADIAL	HYDROIL
215A	GASKET-BRG. END COVER-INBOARD	HYDROIL
216B	GASKET-BRG. END COVER-OUTBOARD	STEEL
240	LOCK NUT-THRUST BEARING	STEEL
241	LOCK WASHER-THRUST BEARING	379 (ASTM A276TP316)
243	WASHER	379 (ASTM A276TP316)
257	SHIMS	379 (ASTM A276TP316)
257	JAM NUT	HYDROIL
262	GASKET-COOLER TO BEARING HOUSING	ASBESTOS
262C	GASKET-GLAND EXT.	730 (MOD. ASTM A351CF8
266	SUCTION END BRACKET	20
304	PACKING RING-SHAFT SLEEVE	STEEL
332A	SUPPORT PLATE	STEEL
332B	PUMP FOOT	304 S.S.
363A	GASKET-CASING TO SUCT. END BRKT.	304 S.S.
363B	GASKET-CASING TO SUCT. END BRKT.	C.I.
373	COOLING CARTRIDGE	DURAMETALLIC
429	MECHANICAL SEAL	EP-6018
456	"O"RING SHAFT SLEEVE	

C.E.I. CONTRACT NUMBER 23866
C.E.I. PURCHASE ORDER 9900104
C.E.I. CUSTOMER: OMAHA PUBLIC POWER DIST.
FORT CALHOUN STATION UNIT 1
6UCL - CONTAINMENT SPRAY PUMPS

CERTIFIED WHEN SIGNED

DATE

INGERSOLL RAND CO.

U-LINE PUMP

001-32201-1

Figure 1 - SI-1A/B, SI-3A/B/C

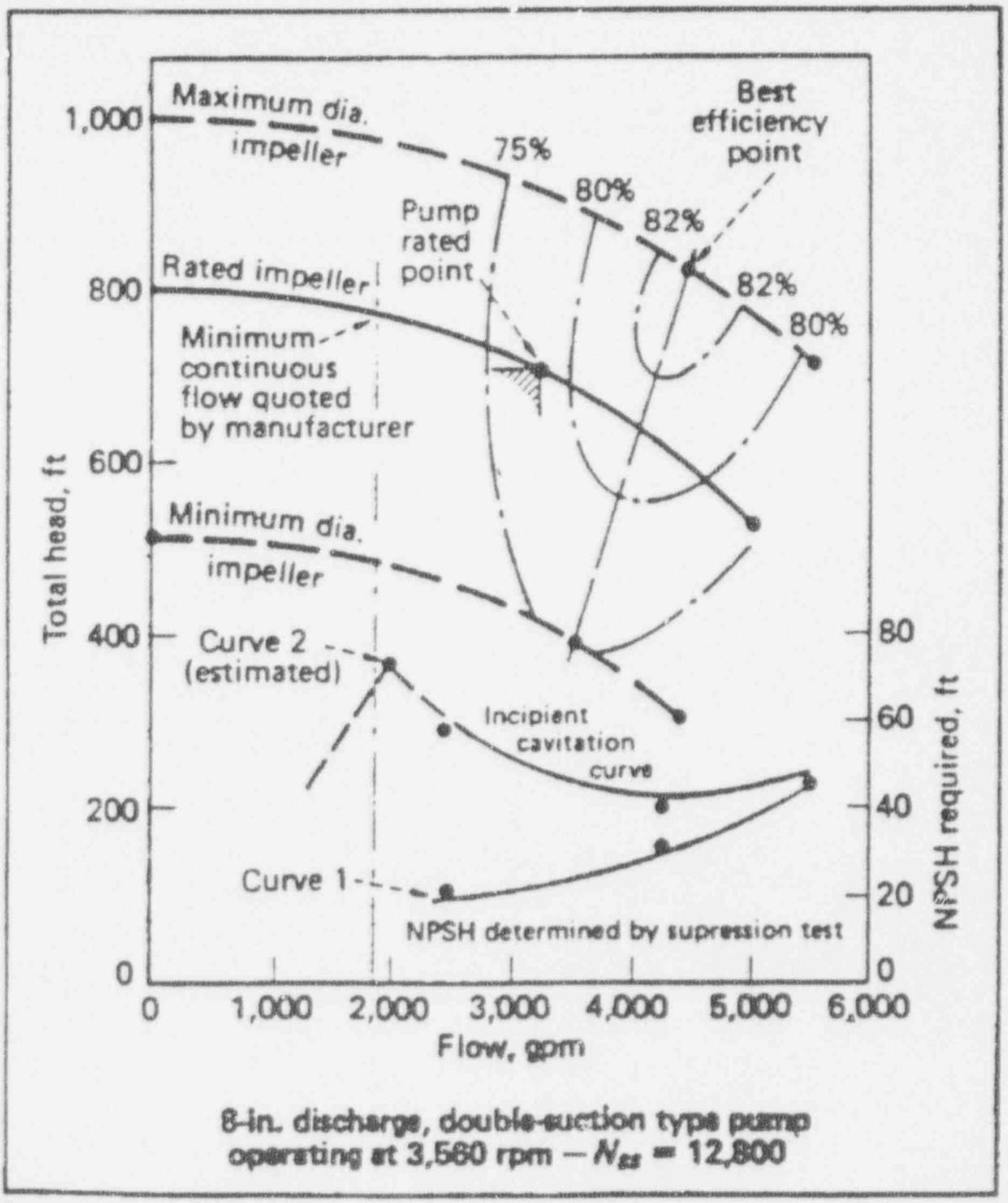


Figure 2 — Head needed to avoid cavitation, via the suppression test (for 3% head decay), and incipient cavitation

Figure 2 - NPSHR Curve 1 vs NPSHR Curve 2

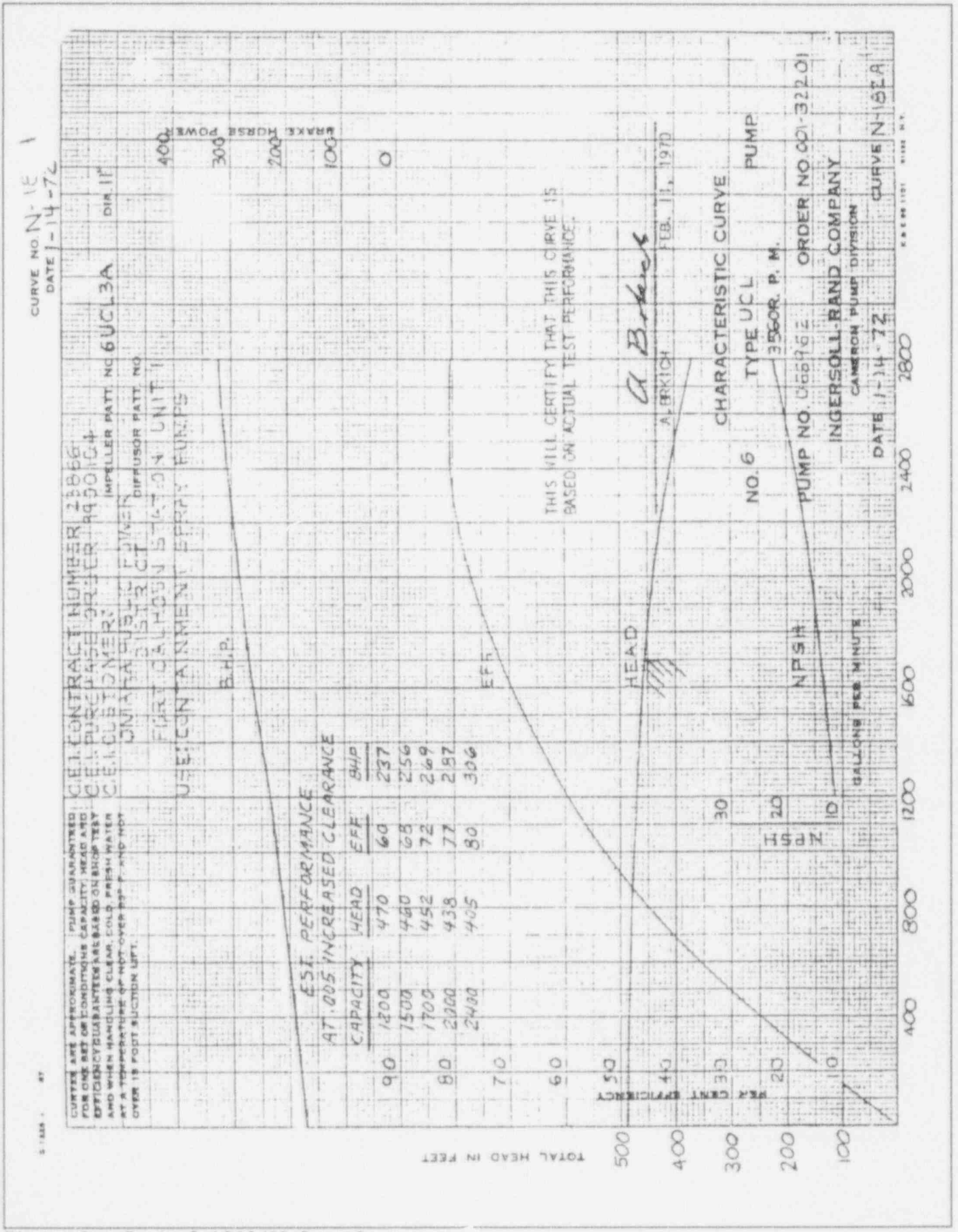


Figure 3 - Typical LPSI/CS Pump Curve

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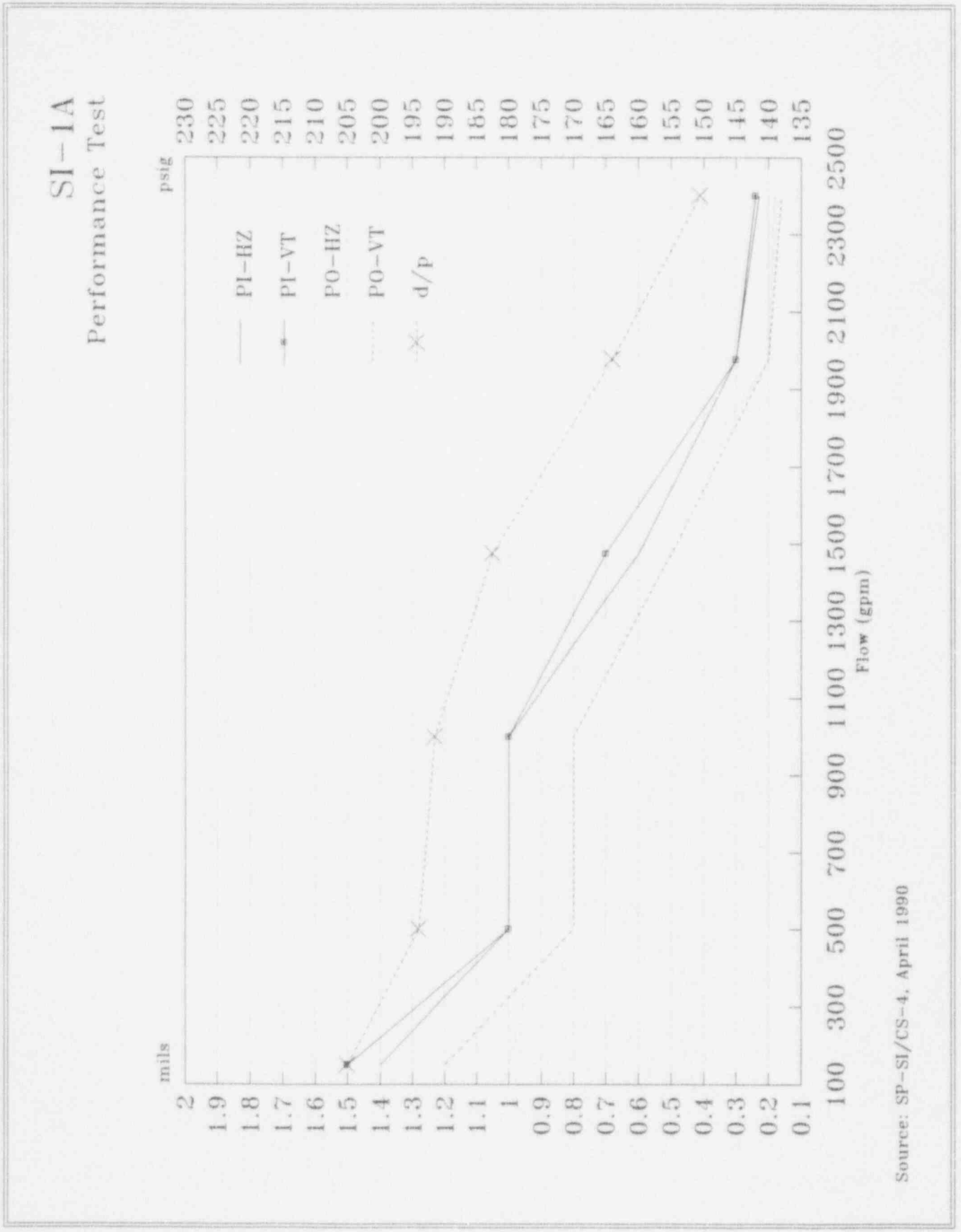
ENCLOSURE

ATTACHMENT 1

Legend

PI-HZ	Pump Inboard Bearing, Horizontal Direction
PI-VT	Pump Inboard Bearing, Vertical Direction
PO-HZ	Pump Outboard Bearing, Horizontal Direction
PO-VT	Pump Outboard Bearing, Vertical Direction
d/p	Differential Pressure

ATTACHMENT 1

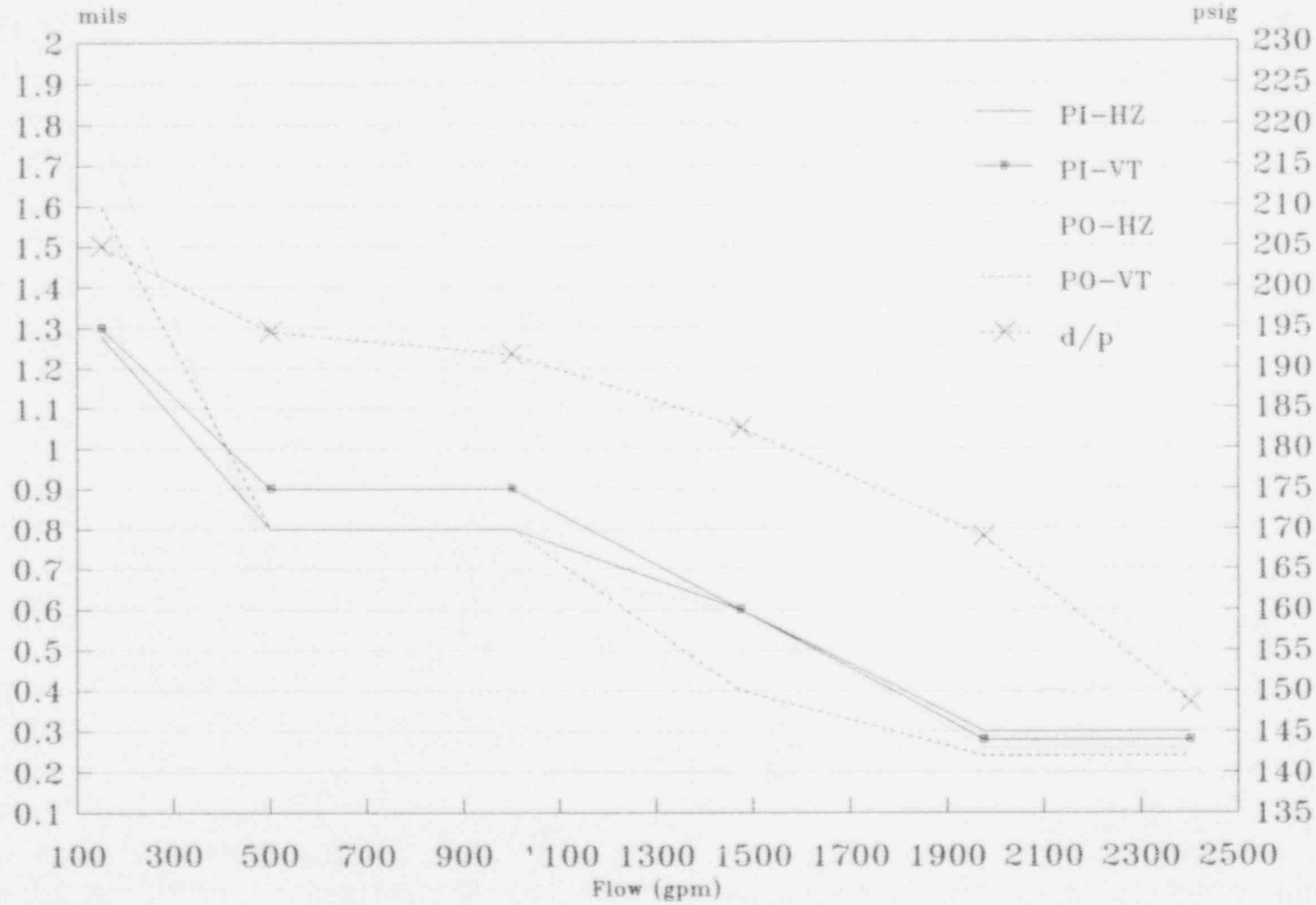


Source: SP-SI/CS-4, April 1990

SI-1A Vibration (mils)
SP-SI/CS-4

Flow	PI-HZ	PI-VT	PO-HZ	PO-VT	d/p
150	1.4	1.5	1.0	1.2	205.0
500	1.0	1.0	0.9	0.8	194.0
1000	1.0	1.0	0.9	0.8	191.5
1475	0.6	0.7	0.6	0.5	182.5
1975	0.3	0.3	0.2	0.2	164.0
2400	0.23	0.24	0.18	0.16	150.5

SI-1B
Performance Test

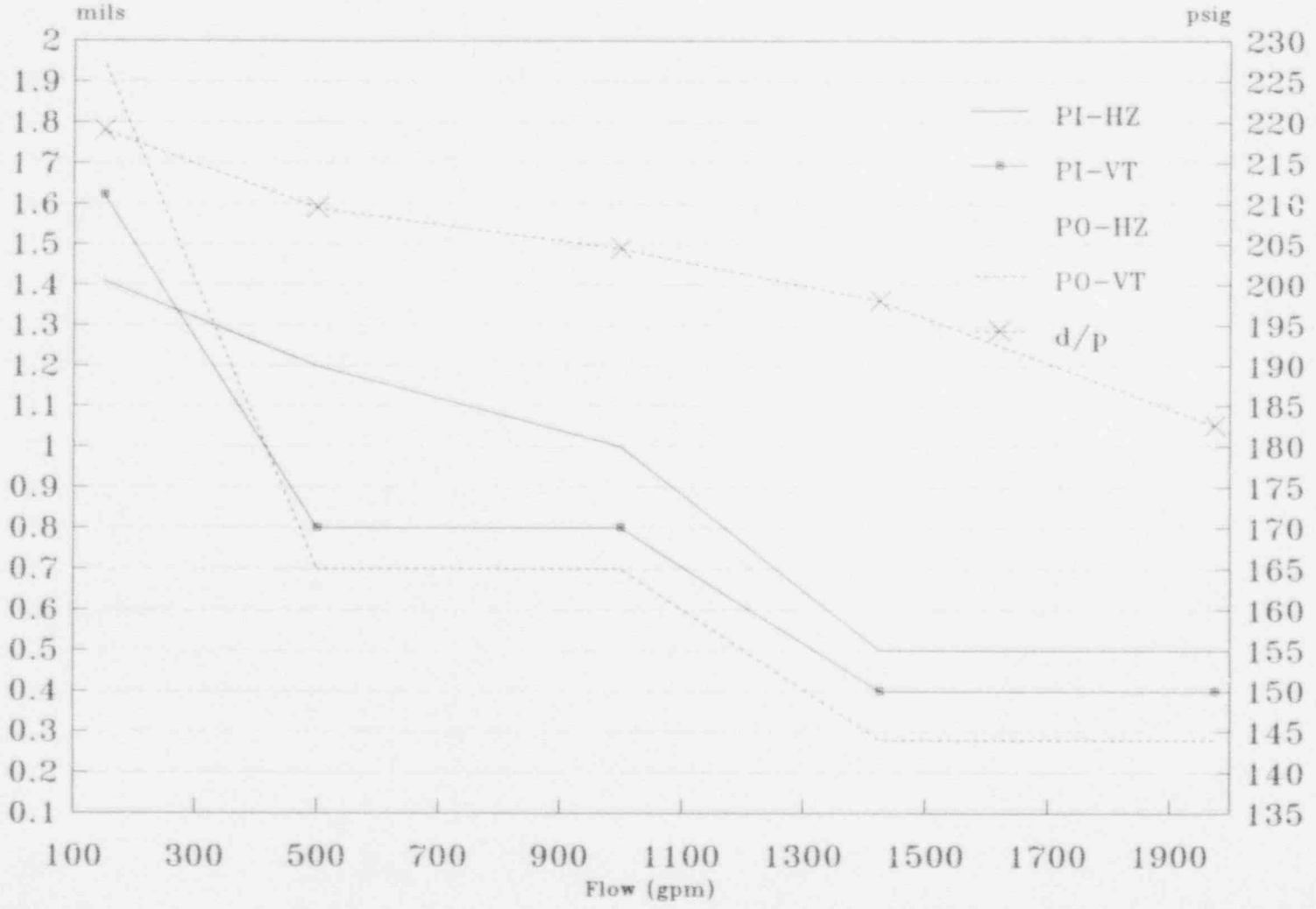


Source: SP-SI/CS-4, April 1990

SI-1B Vibration (mils)
SP-SI/CS-4

Flow	PI-HZ	PI-VT	PO-HZ	PO-VT	d/p
150	1.28	1.3	1.8	1.6	205
500	0.8	0.9	0.7	0.8	194.5
1000	0.8	0.9	0.7	0.8	191.75
1475	0.6	0.6	0.6	0.4	182.5
1975	0.3	0.28	0.26	0.24	169.0
2400	0.3	0.28	0.26	0.24	148.5

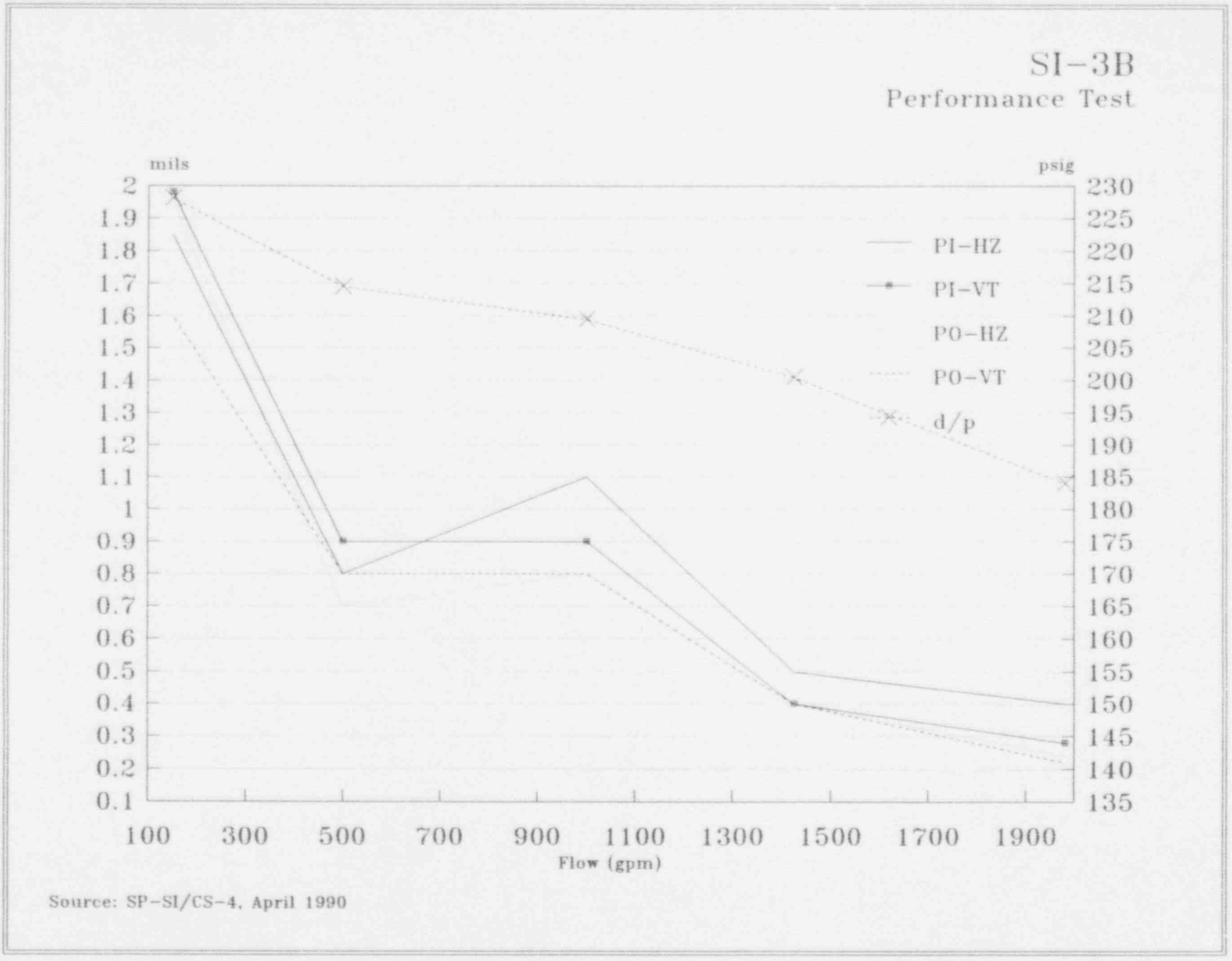
SI-3A
Performance Test



Source: SP-SI/CS-4, April 1990

SI-3A Vibration (mils)
SP-SI/CS-4

Flow	PI-HZ	PI-VT	PO-HZ	PO-VT	d/p
150	1.41	1.62	1.40	1.95	219
500	1.20	0.8	1.2	0.7	209.5
1000	1.0	0.8	1.0	0.7	204.5
1425	0.5	0.4	0.4	0.28	198.0
1975	0.5	0.4	0.4	0.28	182.5

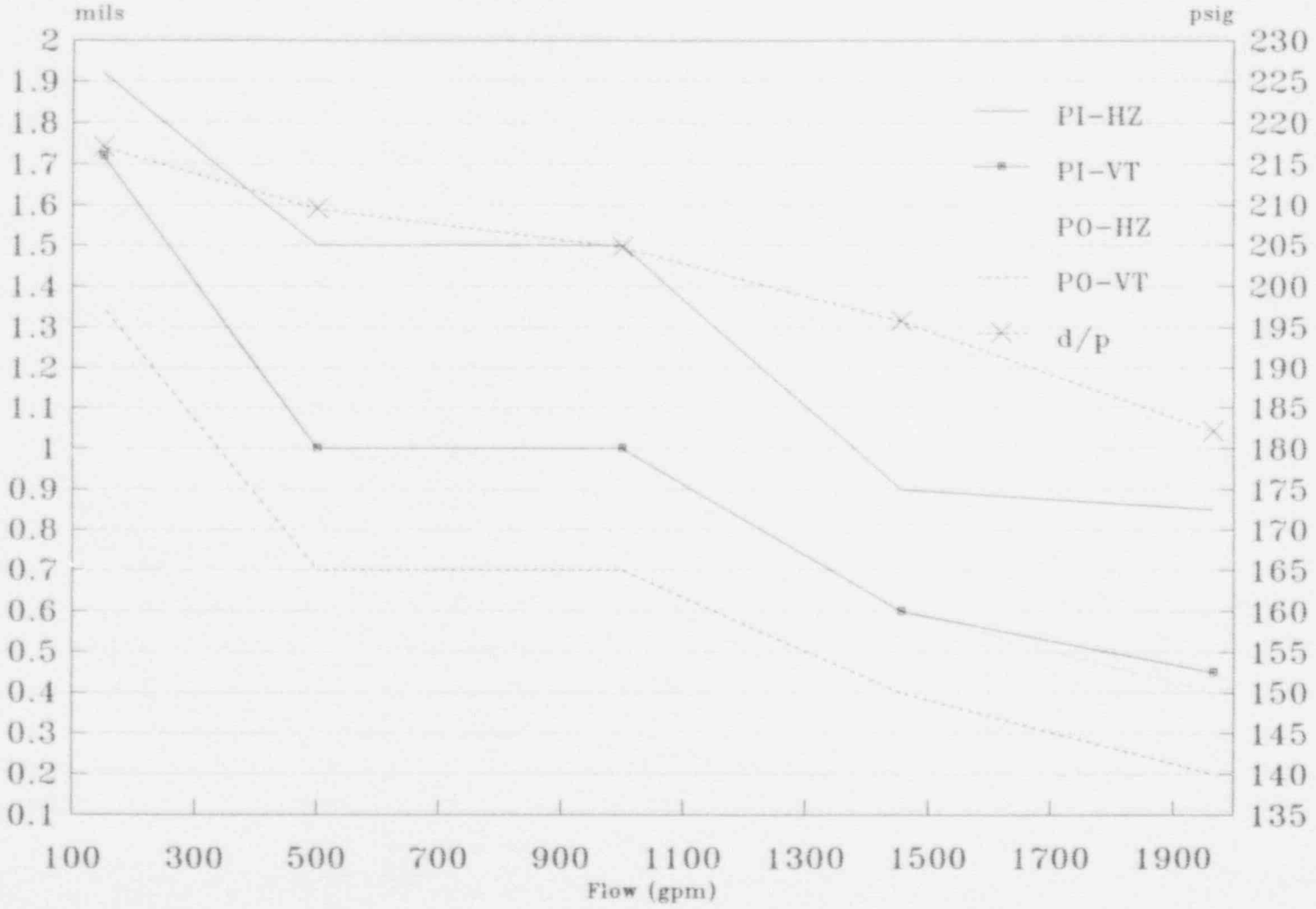


Source: SP-SI/CS-4, April 1990

SI-3B Vibration (mils)
SP-SI/CS-4

Flow	PI-HZ	PI-VT	PO-HZ	PO-VT	d/p
150	1.85	1.98	1.95	1.60	228
500	0.8	0.9	0.7	0.8	214.5
1000	1.1	0.9	0.8	0.8	209.5
1425	0.5	0.4	0.4	0.4	200.5
1980	0.4	0.28	0.24	0.22	184.0

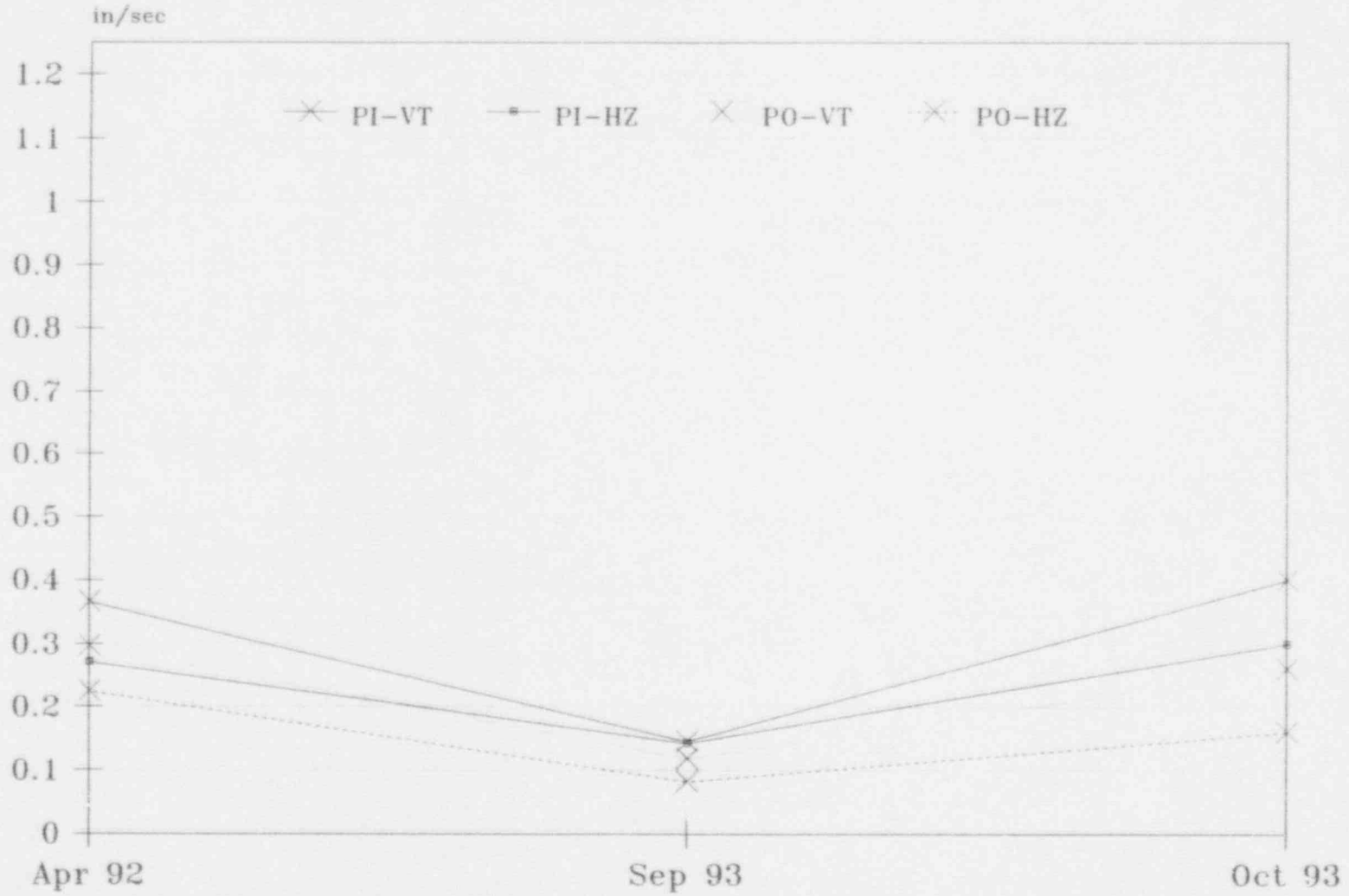
SI-3C
Performance Test



Source: SP-SI/CS-4, April 1990

SI-30 Vibration (mils)
SP-SI/CS-4

Flow	PI-HZ	PI-VT	PO-HZ	PO-VT	d/p
150	1.92	1.72	1.70	1.35	217
500	1.5	1.0	1.0	0.7	209.5
1000	1.5	1.0	1.0	0.7	204.75
1455	0.9	0.6	0.6	0.4	195.75
1965	0.85	0.45	0.4	0.2	182.0


SI-1A Vibration
Full Flow Tests
in/sec
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
PI-VT
PI-HZ
PO-VT
PO-HZ
Apr 92
Sep 93
Oct 93

SI-1A Vibration (in/sec)
Full Flow Tests

Date	PI-VT	PI-HZ	PO-VT	PO-HZ	Axial (1)
04/13/92	0.365	0.271	0.296	0.224	0.133
09/27/93	0.145	0.143	0.118	0.082	
10/01/93	0.40	0.30	0.26	0.16	0.13

(1) Axial measurements are not taken on the thrust bearing housing due to inaccessibility. The reading is taken axially to the pump shaft at an accessible location.

SI-1B Vibration
Full Flow Tests

SI-1B Vibration (in/sec)
Full Flow Tests

Date	PI-VT	PI-HZ	PO-VT	PO-HZ	Axial (1)
10/01/93	0.35	0.23	0.29	0.17	0.11

(1) Axial measurements are not taken on the thrust bearing housing due to inaccessibility. The reading is taken axially to the pump shaft at an accessible location.

SI-3A Vibration
Full Flow Tests

SI-3A Vibration (in/sec)
Full Flow Tests

Date	PI-VT	PI-HZ	PO-VT	PO-HZ	Axial (1)
10/09/93	0.305	0.256	0.189	0.153	0.209

(1) Axial measurements are not taken on the thrust bearing housing due to inaccessibility. The reading is taken axially to the pump shaft at an accessible location.

SI-3B Vibration
Full Flow Tests

SI-3B Vibration (in/sec)
Full Flow Tests

Date	PI-VT	PI-HZ	PO-VT	PO-HZ	Axial (1)
10/09/93	0.279	0.270	0.221	0.181	0.187

(1) Axial measurements are not taken on the thrust bearing housing due to inaccessibility. The reading is taken axially to the pump shaft at an accessible location.

SI-3C Vibration

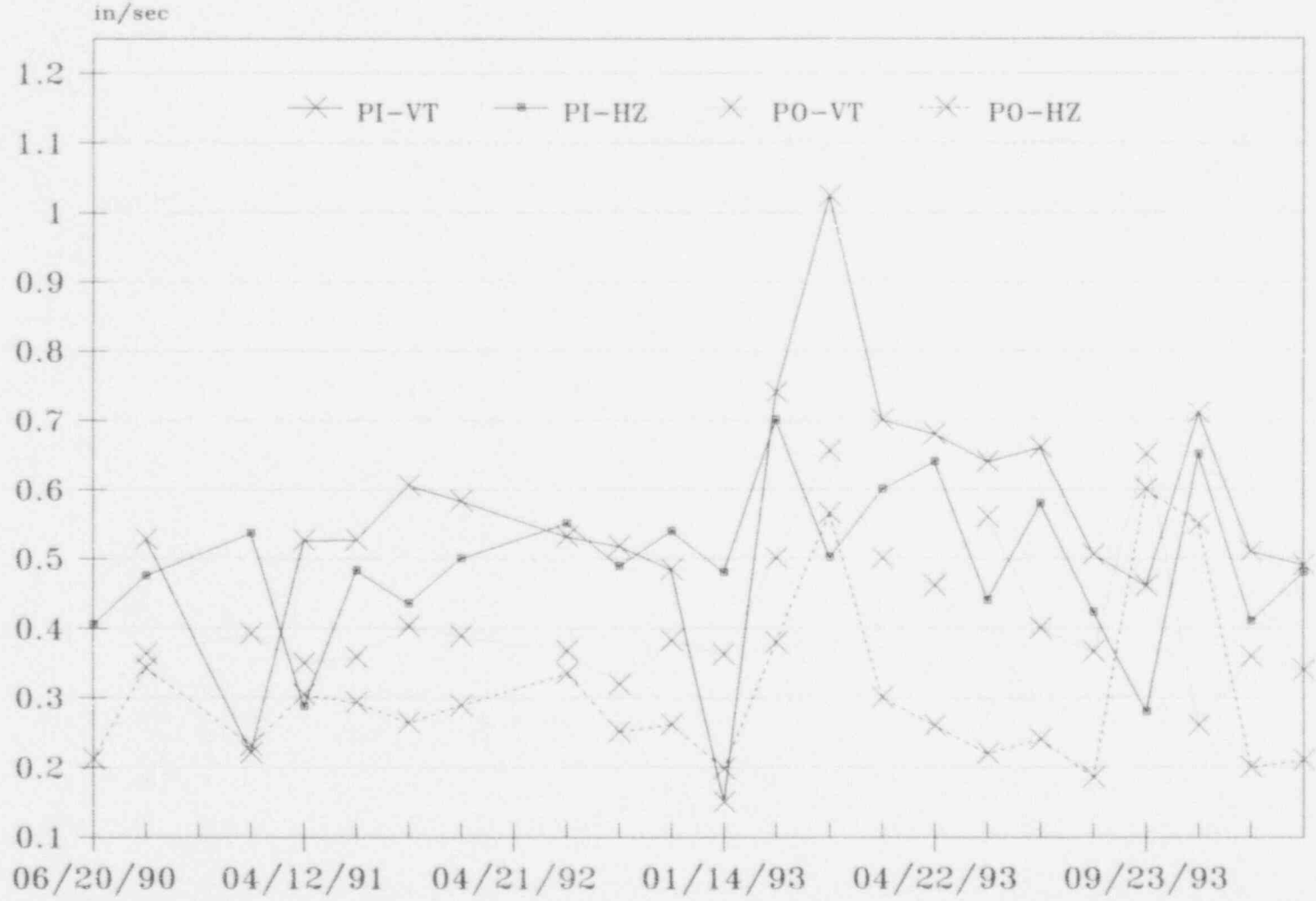
Full Flow Tests

SI-3C Vibration (in/sec)
Full Flow Tests

Date	PI-VT	PI-HZ	PO-VT	PO-HZ	Axial (1)
10/09/93	0.238	0.253	0.194	0.187	0.179

(1) Axial measurements are not taken on the thrust bearing housing due to inaccessibility. The reading is taken axially to the pump shaft at an accessible location.

SI-1A Vibration
Partial Flow Tests

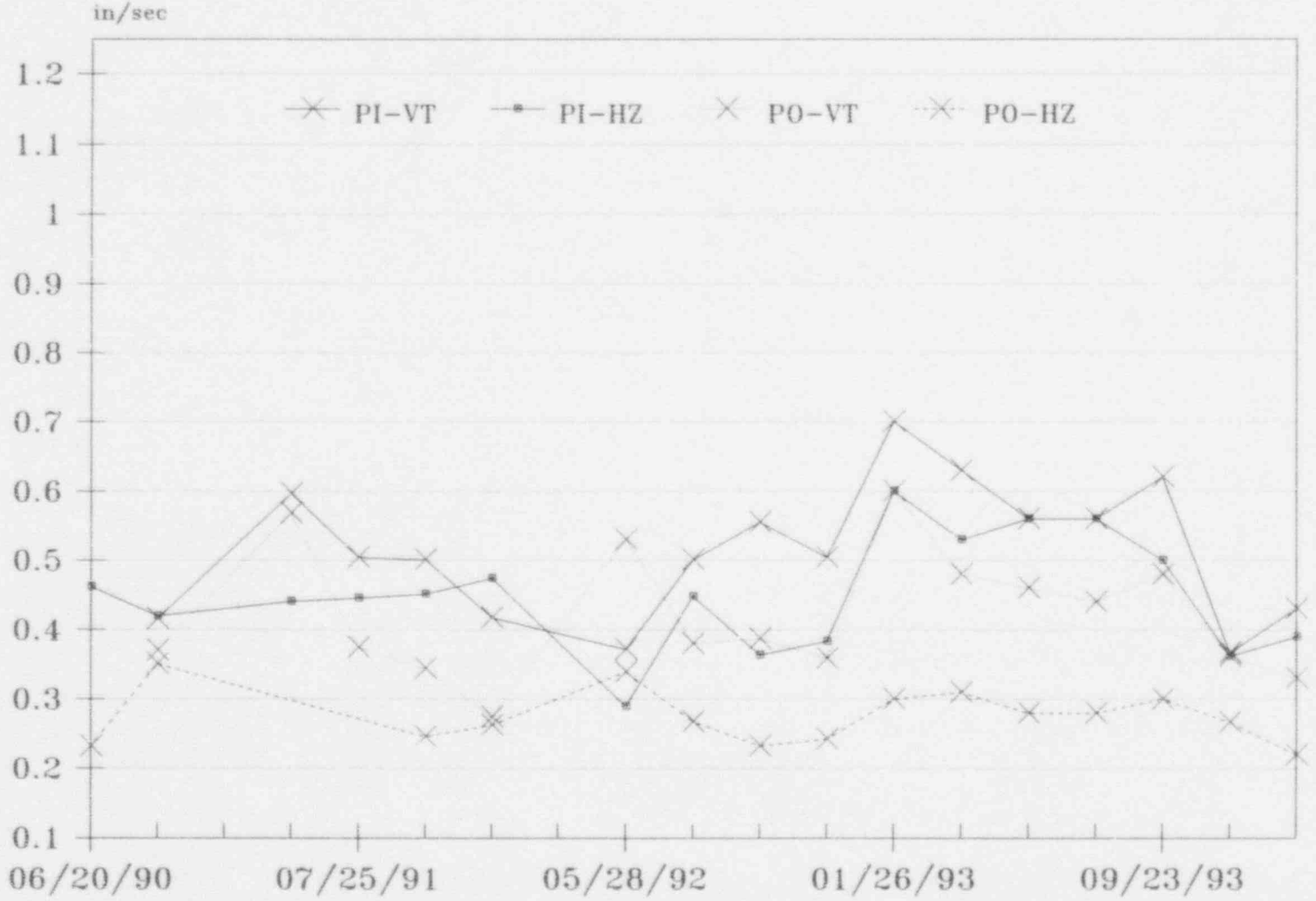


SI-1A Vibration (in/sec)
Partial Flow Tests

Date	PI-VT	PI-HZ	PO-VT	PO-HZ	Axial (1)
06/20/90		0.405		0.212	
10/18/90	0.528	0.475	0.364	0.343	
03/13/91	0.221	0.537	0.392	0.231	
04/12/91	0.526	0.287	0.350	0.304	
07/25/91	0.527	0.482	0.359	0.293	
10/10/91	0.606	0.435	0.403	0.264	
01/17/92	0.583	0.500	0.389	0.289	
05/28/92	0.532	0.551	0.368	0.335	
08/10/92	0.518	0.489	0.319	0.251	
10/22/92	0.484	0.540	0.382	0.261	
01/14/93	0.150	0.480	0.363	0.198	
01/14/93	0.74	0.70	0.50	0.38	0.24
01/26/93	1.023	0.502	0.655	0.565	
01/26/93	0.70	0.60	0.50	0.30	0.30
04/22/93	0.68	0.64	0.46	0.26	0.28
07/14/93	0.64	0.44	0.56	0.22	0.28
07/14/93	0.66	0.58	0.40	0.24	0.32
09/14/93	0.506	0.423	0.367	0.186	
09/23/93	0.46	0.28	0.65	0.60	0.26
12/17/93	0.71	0.65	0.26	0.55	0.28
03/09/94	0.518	0.415	0.367	0.202	0.252
03/24/94	0.49	0.48	0.34	0.21	0.25
06/30/94	0.549	0.452	0.393	0.279	0.226

(1) Axial measurements are not taken on the thrust bearing housing due to inaccessibility. The reading is taken axially to the pump shaft at an accessible location.

SI-1B Vibration
Partial Flow Tests

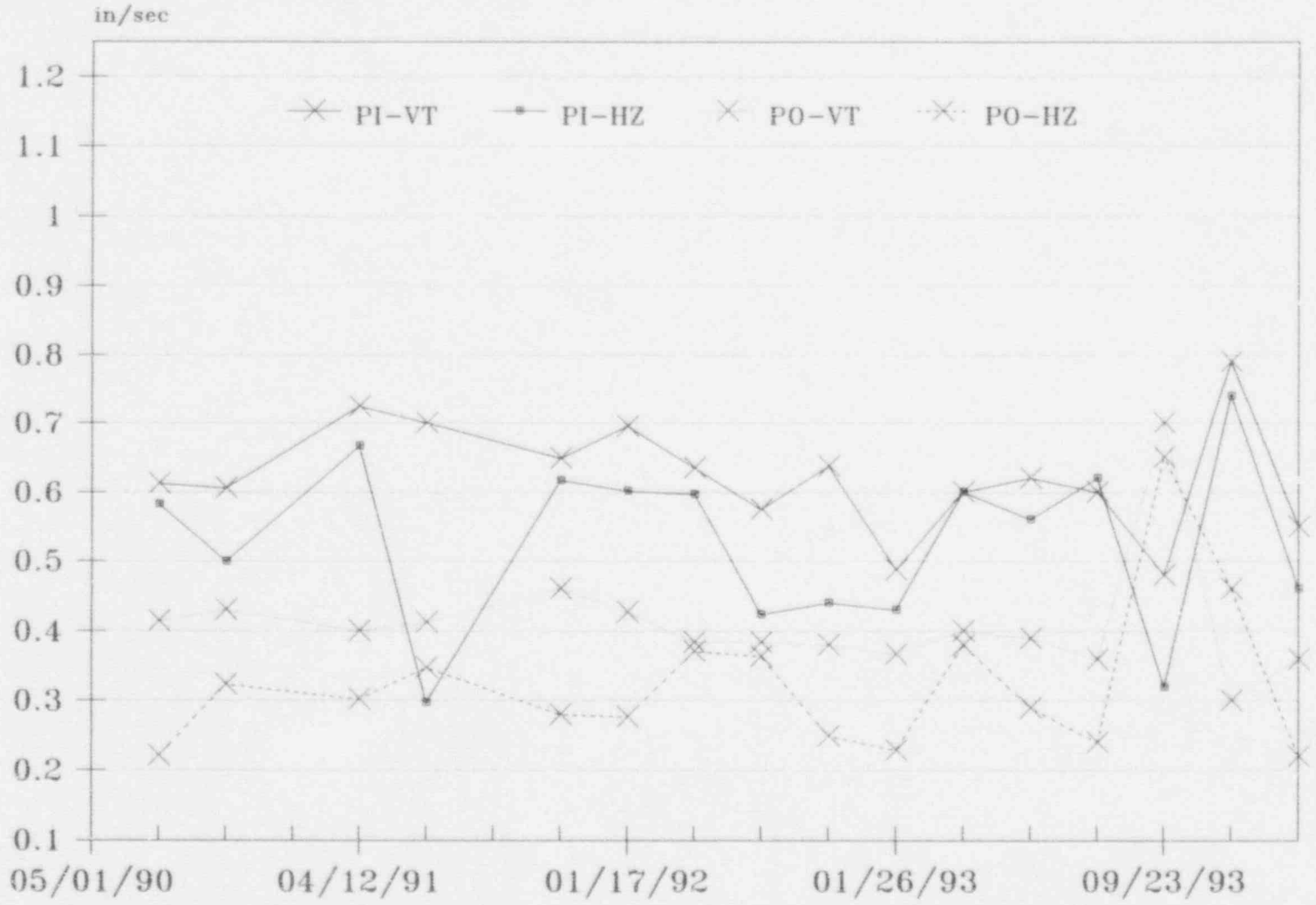


SI-1B Vibration (in/sec)
Partial Flow Tests

Date	PI-VT	PI-HZ	PO-VT	PO-HZ	Axial (1)
06/20/90		0.462		0.232	
10/18/90	0.416	0.420	0.370	0.351	
04/12/91	0.597	0.441	0.568		
07/25/91	0.504	0.446	0.374		
10/09/91	0.501	0.451	0.344	0.246	
01/17/92	0.417	0.474	0.274	0.263	
05/28/92	0.372	0.290	0.530	0.339	
08/10/92	0.501	0.448	0.380	0.268	
10/22/92	0.555	0.364	0.387	0.233	
01/26/93	0.504	0.383	0.359	0.243	
01/26/93	0.70	0.60	0.60	0.30	0.30
04/22/93	0.63	0.53	0.48	0.31	0.24
07/14/93	0.56	0.56	0.46	0.28	0.40
07/14/93	0.56	0.56	0.44	0.28	0.38
09/23/93	0.62	0.50	0.48	0.30	0.25
12/16/93	0.367	0.362	0.362	0.267	0.493
03/24/94	0.43	0.39	0.33	0.22	0.25
07/01/94	0.452	0.416	0.349	0.268	0.222

(1) Axial measurements are not taken on the thrust bearing housing due to inaccessibility. The reading is taken axially to the pump shaft at an accessible location.

SI-3A Vibration
Partial Flow Tests

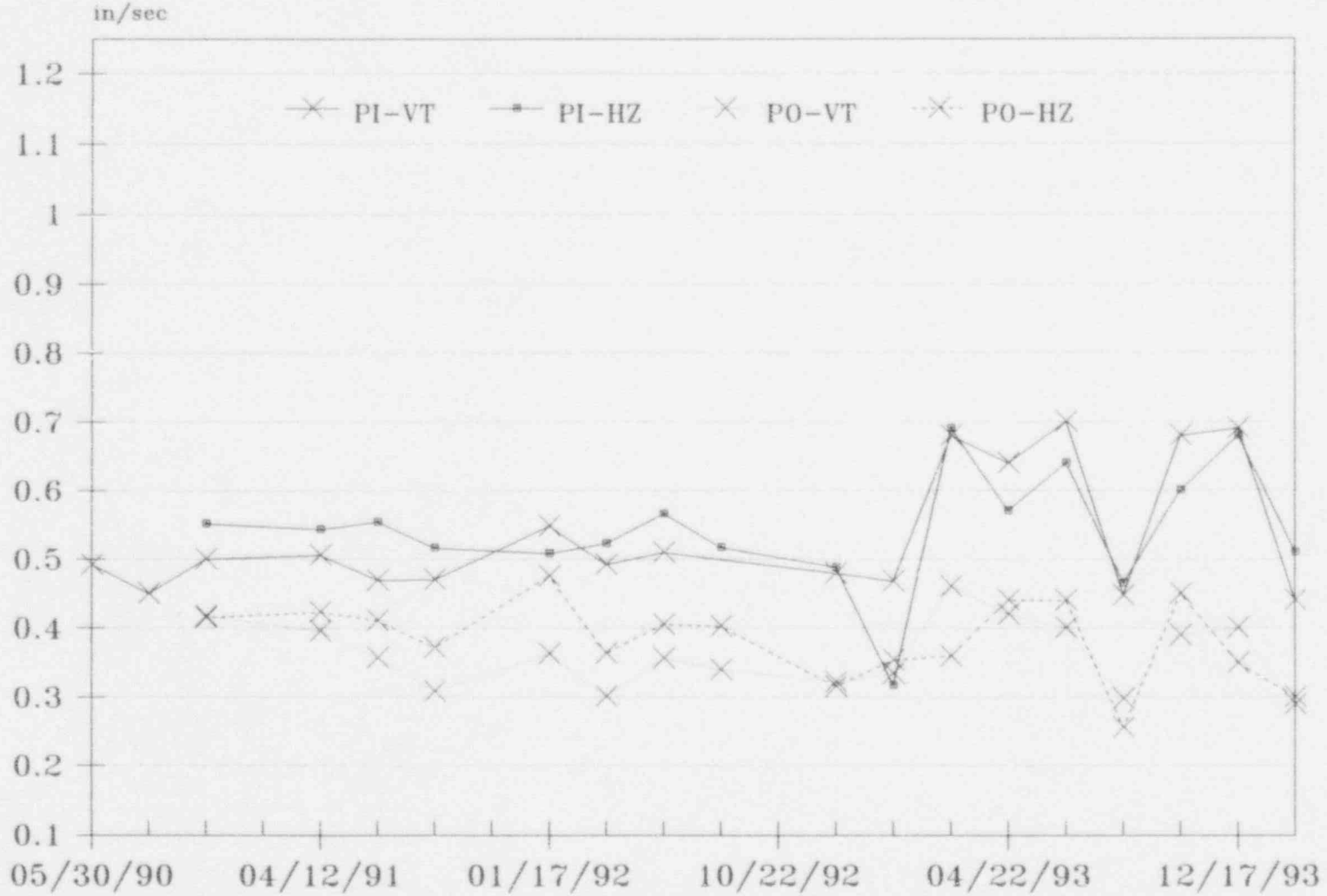


SI-3A Vibration (in/sec)
Partial Flow Tests

Date	PI-VT	PI-HZ	PO-VT	PO-HZ	Axial (1)
06/20/90	0.612	0.582	0.414	0.221	
10/18/90	0.606	0.499	0.430	0.323	
04/12/91	0.724	0.667	0.400	0.302	
06/25/91	0.700	0.297	0.412	0.347	
10/10/91	0.649	0.617	0.460	0.280	
01/17/92	0.695	0.602	0.427	0.277	
05/28/92	0.635	0.597	0.384	0.371	
08/10/92	0.575	0.424	0.384	0.364	
10/22/92	0.637	0.440	0.380	0.249	
01/26/93	0.487	0.430	0.367	0.229	
01/26/93	0.60	0.60	0.40	0.38	0.27
04/22/93	0.62	0.56	0.39	0.29	0.64
07/14/93	0.60	0.62	0.36	0.24	0.22
09/23/93	0.48	0.32	0.70	0.65	0.25
12/17/93	0.79	0.74	0.30	0.46	0.25
03/24/94	0.55	0.46	0.36	0.22	0.35
06/30/94	0.520	0.471	0.394	0.323	0.194

(1) Axial measurements are not taken on the thrust bearing housing due to inaccessibility. The reading is taken axially to the pump shaft at an accessible location.

SI-3B Vibration
Partial Flow Tests

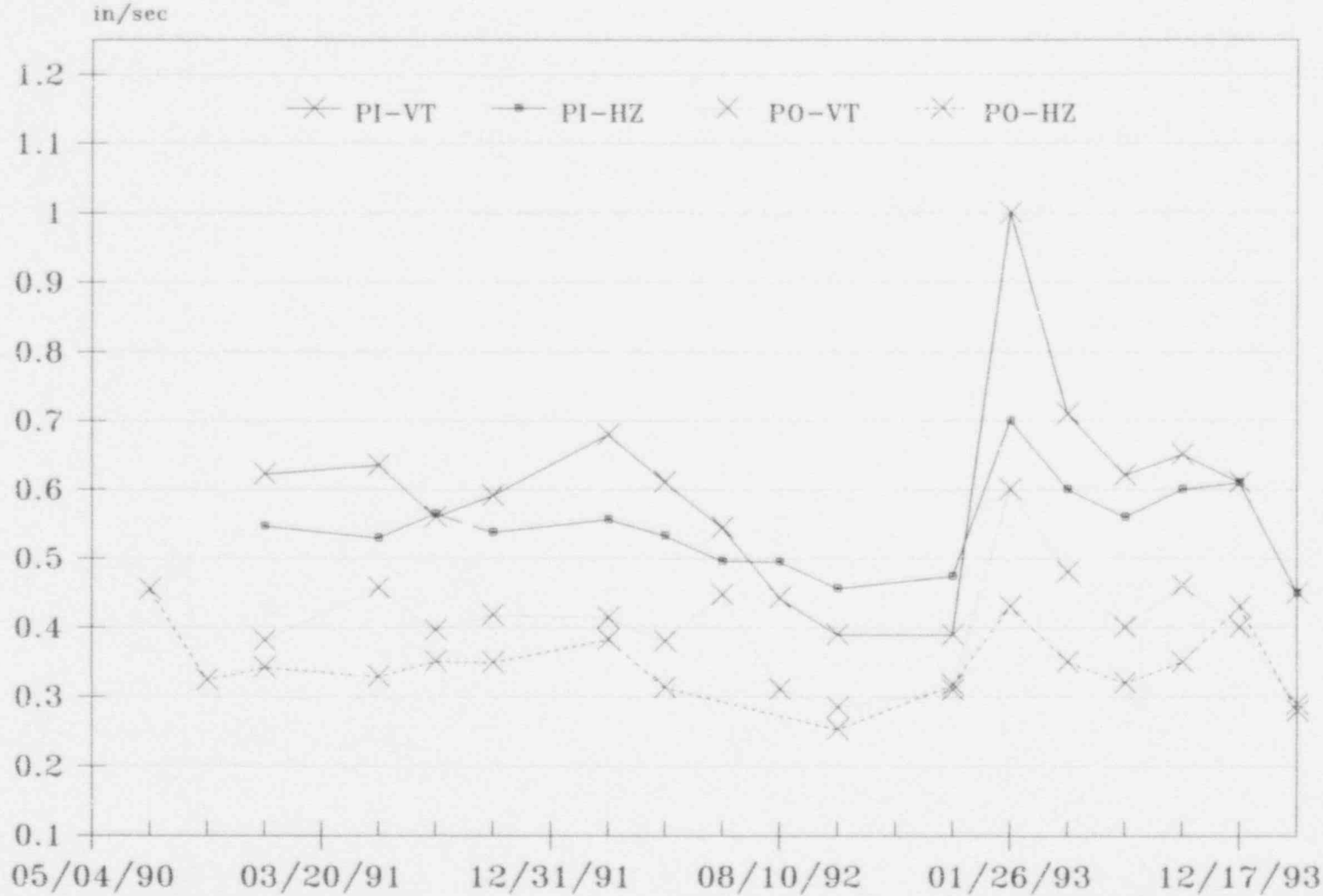


SI-3B Vibration (in/sec)
Partial Flow Tests

Date	PI-VT	PI-HZ	PO-VT	PO-HZ	Axial (1)
05/30/90	0.492				
06/20/90	0.450				
10/19/90	0.500	0.551	0.417	0.415	
04/12/91	0.506	0.543	0.395	0.423	
07/25/91	0.469	0.554	0.357	0.411	
10/09/91	0.470	0.516	0.308	0.372	
01/17/92	0.548	0.508	0.363	0.475	
04/22/92	0.492	0.523	0.301	0.364	
05/28/92	0.510	0.566	0.356	0.405	
08/10/92		0.517	0.340	0.403	
10/22/92	0.479	0.488	0.322	0.316	
01/26/93	0.468	0.317	0.334	0.354	
01/26/93	0.68	0.69	0.46	0.36	0.31
04/22/93	0.64	0.57	0.42	0.44	0.24
07/15/93	0.70	0.64	0.40	0.44	0.34
09/10/93	0.447	0.465	0.298	0.256	
09/23/93	0.68	0.60	0.39	0.45	0.24
12/17/93	0.69	0.68	0.40	0.35	0.34
03/24/94	0.44	0.51	0.29	0.30	0.38
07/01/94	0.454	0.512	0.351	0.512	0.208

(1) Axial measurements are not taken on the thrust bearing housing due to inaccessibility. The reading is taken axially to the pump shaft at an accessible location.

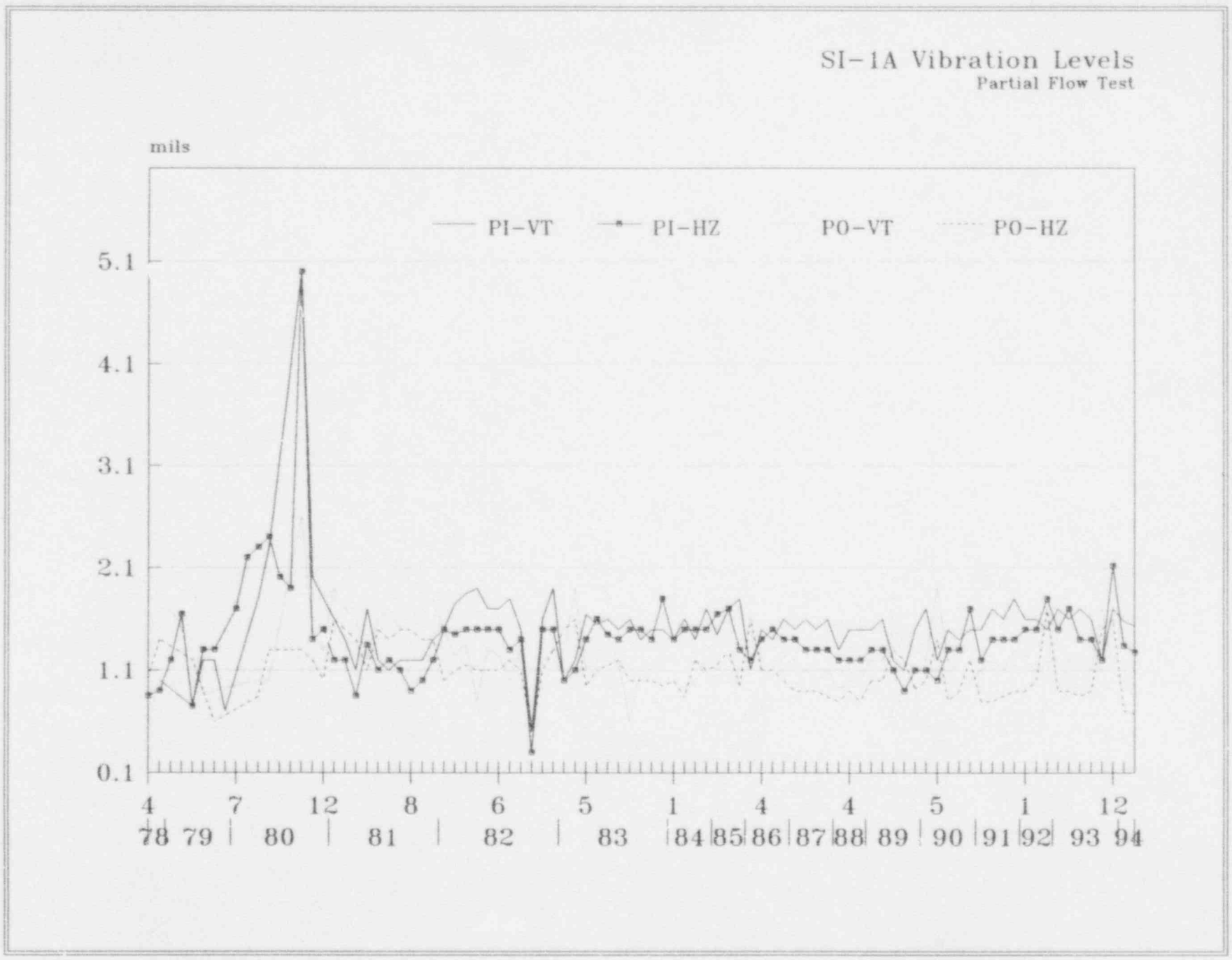
SI-3C Vibration
Partial Flow Tests



SI-3C Vibration (in/sec)
Partial Flow Tests

Date	PI-VT	PI-HZ	PO-VT	PO-HZ	Axial (1)
10/19/90				0.455	
03/04/91				0.324	
03/05/91	0.622	0.547	0.381	0.342	
04/12/91	0.635	0.530	0.457	0.329	
07/25/91	0.560	0.565	0.396	0.351	
10/09/91	0.591	0.538	0.418	0.349	
12/31/91	0.680	0.557	0.414	0.382	
01/17/92	0.611	0.533	0.380	0.313	
05/28/92	0.545	0.496	0.447		
08/10/92	0.442	0.495	0.311		
10/22/92	0.390	0.456	0.285	0.253	
01/26/93	0.390	0.474	0.310	0.317	
01/26/93	1.00	0.70	0.60	0.43	0.41
04/22/93	0.71	0.60	0.48	0.35	0.36
07/15/93	0.62	0.56	0.40	0.32	0.38
09/23/93	0.65	0.60	0.46	0.35	0.30
12/17/93	0.61	0.61	0.40	0.43	0.99
03/24/94	0.45	0.45	0.29	0.28	0.35
07/01/94	0.445	0.484	0.318	0.390	0.241

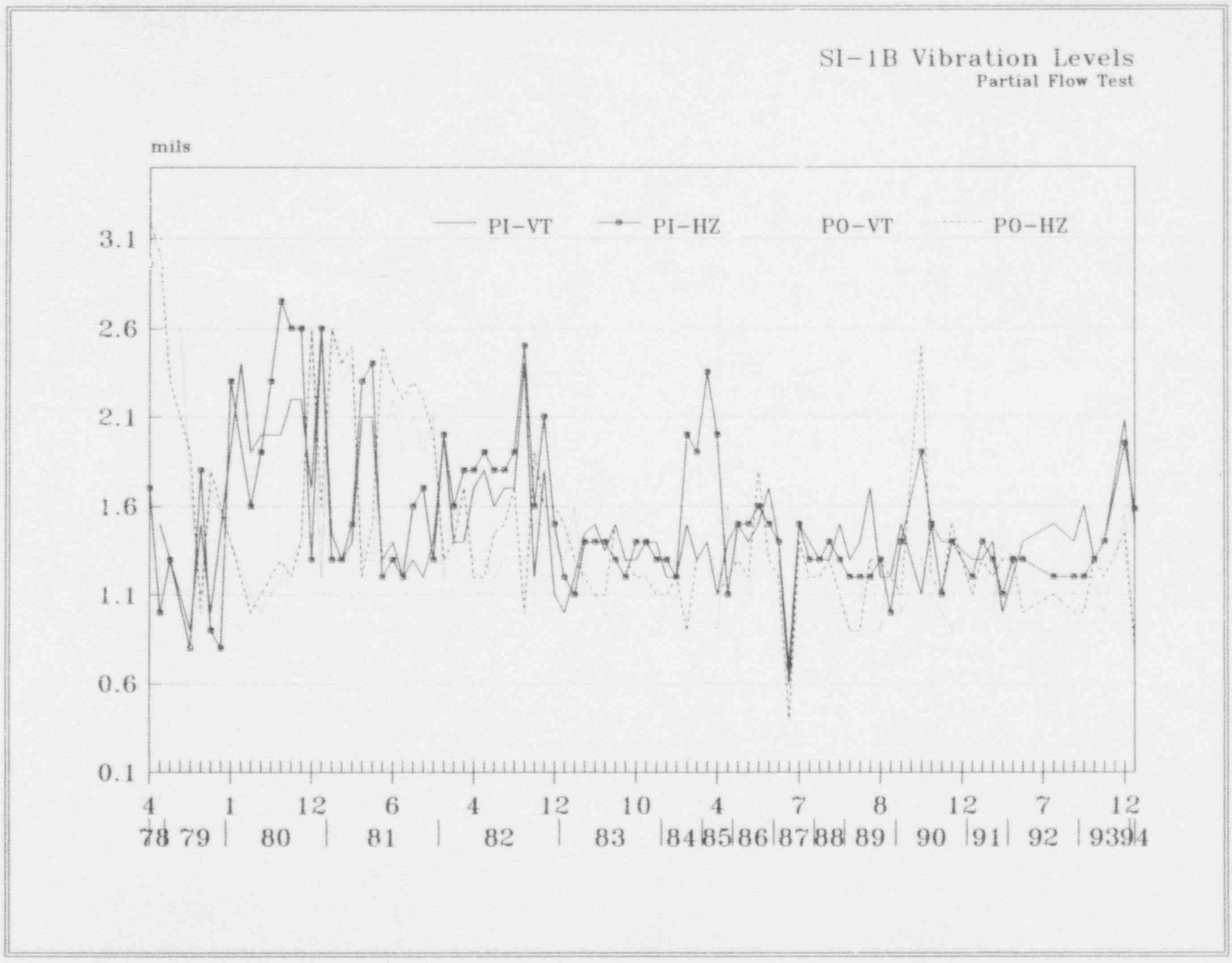
(1) Axial measurements are not taken on the thrust bearing housing due to inaccessibility. The reading is taken axially to the pump shaft at an accessible location.


SI-1A Vibration Levels
Partial Flow Test
mils
PI-VT
PI-HZ
PO-VT
PO-HZ
5.1
4.1
3.1
2.1
1.1
0.1
4 7 12 8 6 5 1 4 4 5 1 12
78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94

SI-1A Vibration Levels (Mils)
Partial Flow Test

Date	PI-VT	PI-HZ	PO-VT	PO-HZ
04/78	0.00	0.85	0.00	1.03
07/78	1.00	0.90	1.50	1.40
01/79	0.00	1.20	1.70	0.00
04/79	0.00	1.65	0.00	0.00
07/79	0.75	0.75	1.30	1.20
10/79	1.20	1.30	0.85	0.90
11/79	1.20	1.30	0.90	0.60
12/79	0.70	0.00	0.00	0.00
07/80	0.00	1.70	0.00	0.00
06/80	0.00	2.20	0.00	0.00
07/80	1.80	2.30	1.00	0.84
08/80	2.30	2.40	1.00	1.30
09/80	0.00	2.01	0.00	0.00
10/80	0.00	1.90	0.00	0.00
11/80	5.00	5.00	2.60	1.30
11/80	2.00	1.40	1.50	1.20
12/80	1.80	1.50	1.30	1.00
01/81	1.60	1.20	1.90	1.60
02/81	1.40	1.20	1.70	1.50
03/81	1.10	0.85	1.60	1.40
04/81	1.70	1.35	1.20	1.10
05/81	1.20	1.10	1.60	1.50
06/81	1.10	1.20	1.70	1.40
07/81	1.20	1.10	1.50	1.50
08/81	1.20	0.90	1.60	1.50
09/81	1.20	1.00	1.70	1.40
12/81	1.40	1.20	1.80	1.40
01/82	1.50	1.50	1.50	1.00
02/82	1.75	1.45	1.25	1.10
03/82	1.85	1.50	1.35	1.15
04/82	1.90	1.50	0.80	1.10
05/82	1.70	1.50	1.30	1.10
06/82	1.70	1.50	1.25	1.10
07/82	1.80	1.30	1.00	1.20
08/82	1.50	1.40	1.30	1.10
09/82	0.50	0.30	0.60	0.50
10/82	1.60	1.50	1.20	1.10
11/82	1.90	1.50	1.30	1.30
03/83	1.00	1.00	1.30	1.50
04/83	1.20	1.10	1.90	1.60
05/83	1.65	1.40	1.10	0.95
06/83	1.55	1.60	1.20	1.10
07/83	1.60	1.45	1.20	1.15
08/83	1.50	1.40	1.20	1.20
09/83	1.60	1.50	0.60	1.00
10/83	1.40	1.50	1.10	1.00
11/83	1.50	1.40	1.10	1.00
12/83	1.50	1.80	1.10	0.95
01/84	1.40	1.40	1.10	1.00
02/84	1.60	1.50	1.10	0.84
07/84	1.40	1.50	0.95	1.20
10/84	1.70	1.50	1.20	1.10
01/85	1.45	1.65	1.10	1.15
04/85	1.70	1.70	1.20	1.30
07/85	1.80	1.30	1.40	0.95
01/86	1.10	1.20	1.50	1.60
04/86	1.50	1.40	1.20	1.10
07/86	1.40	1.50	1.10	1.10
10/86	1.60	1.40	1.30	1.00
01/87	1.50	1.40	1.20	0.90

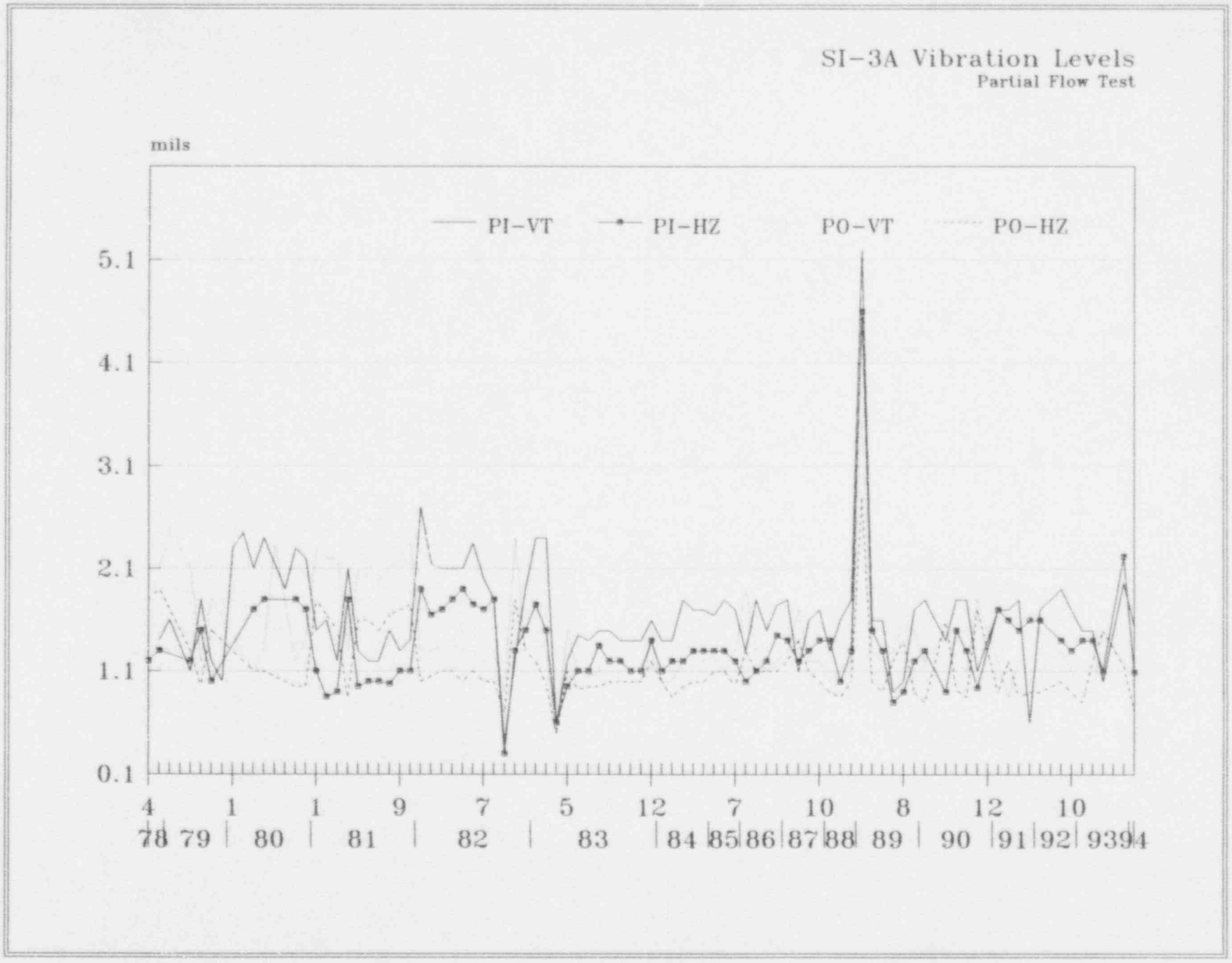
06/87	1.60	1.30	1.10	0.90
07/87	1.50	1.30	1.00	0.90
10/87	1.60	1.30	1.10	0.84
01/88	1.30	1.20	0.90	0.80
04/88	1.50	1.20	1.00	0.90
07/88	1.50	1.20	1.00	0.80
01/89	1.50	1.30	1.20	1.00
02/89	1.60	1.30	1.20	1.00
05/89	1.20	1.10	1.50	1.30
08/89	1.10	0.90	1.40	1.20
11/89	1.50	1.10	1.30	0.92
02/90	1.70	1.10	1.20	1.00
05/90	1.20	1.00	1.90	1.40
06/90	1.50	1.30	1.20	0.80
07/90	1.40	1.30	1.10	0.90
10/90	1.50	1.70	0.99	1.20
01/91	1.50	1.20	1.10	0.80
04/91	1.70	1.40	1.20	0.80
07/91	1.60	1.40	1.10	0.85
10/91	1.80	1.40	1.30	0.90
01/92	1.60	1.50	1.20	0.90
08/92	1.60	1.50	1.10	1.00
10/92	1.50	1.80	1.20	1.70
01/93	1.70	1.50	1.20	0.90
01/93	1.60	1.70	1.20	0.90
04/93	1.70	1.40	1.20	0.85
07/93	1.60	1.40	1.10	0.90
09/93	1.20	1.20	1.70	1.50
12/93	1.70	2.12	1.09	1.60
03/94	1.58	1.34	1.00	0.71
03/94	1.54	1.28	0.95	0.68


SI-1B Vibration Levels
Partial Flow Test
mils
PI-VT
PI-HZ
PO-VT
PO-HZ
3.1
2.6
2.1
1.6
1.1
0.6
0.1
4 1 12 6 4 12 10 4 7 8 12 7 12
78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94

SI-1B Vibration Levels (Mils)
Partial Flow Tests

Date	PI-VT	PI-HZ	PO-VT	PO-HZ
04/78		1.70		3.20
07/78	1.50	1.00	2.40	3.00
01/79		1.30	0.00	2.30
04/79			2.60	
07/79	0.90	0.80	1.70	1.90
10/79	1.50	1.80	1.10	1.00
11/79	1.00	0.90	1.70	1.80
12/79		0.80		
01/80		2.30		
06/80	2.40			
07/80	1.90	1.60	1.10	1.00
08/80	2.00	1.90	1.00	1.10
09/80		2.30		
10/80	2.00	2.75	1.20	1.30
11/80	2.20	2.60	1.30	1.20
12/80	2.20	2.60	1.40	1.40
12/80	1.70	1.30	2.60	2.60
12/80	2.60	2.60	1.20	1.60
01/81	1.45	1.30	2.60	2.60
02/81	1.30	1.30	2.30	2.40
03/81	1.40	1.50	2.40	2.50
04/81	2.10	2.30	1.30	1.20
05/81	2.10	2.40	1.30	1.50
05/81	1.30	1.20	2.00	2.50
06/81	1.40	1.30	2.20	2.30
07/81	1.20	1.20	1.90	2.20
08/81	1.30	1.60	2.10	2.30
09/81	1.20	1.70	1.90	2.20
12/81	1.40	1.30	2.10	2.00
01/82	2.00	2.00	1.20	1.30
02/82	1.40	1.60	1.60	1.40
03/82	1.40	1.80	1.45	1.70
04/82	1.70	1.80	1.30	1.20
05/82	1.80	1.90	1.30	1.20
06/82	1.60	1.80	1.20	1.45
07/82	1.70	1.80	1.30	1.50
08/82	1.70	1.90	1.20	1.70
09/82	2.40	2.50	1.30	1.00
10/82	1.20	1.60	1.50	1.90
11/82	1.80	2.10	1.50	1.60
12/82	1.10	1.50	1.40	1.60
03/83	1.00	1.20	1.30	1.50
04/83	1.20	1.10	1.60	1.30
05/83	1.45	1.40	1.10	1.20
06/83	1.50	1.40	1.10	1.10
07/83	1.35	1.40	1.00	1.10
08/83	1.50	1.30	1.00	1.50
09/83	1.30	1.20	1.00	1.30
10/83	1.30	1.40	1.00	1.20
11/83	1.40	1.40	1.10	1.20
12/83	1.40	1.30	0.95	1.10
01/84	1.20	1.30	1.00	1.10
02/84	1.20	1.20	1.10	1.20
07/84	1.50	2.00	1.10	0.90
10/84	1.30	1.90	1.10	1.30
01/85	1.40	2.35	1.10	1.40
04/85	1.10	2.00	0.90	1.10
07/85	1.40	1.10	1.60	1.20
01/86	1.50	1.50	1.20	1.30
04/86	1.40	1.50	1.10	1.20

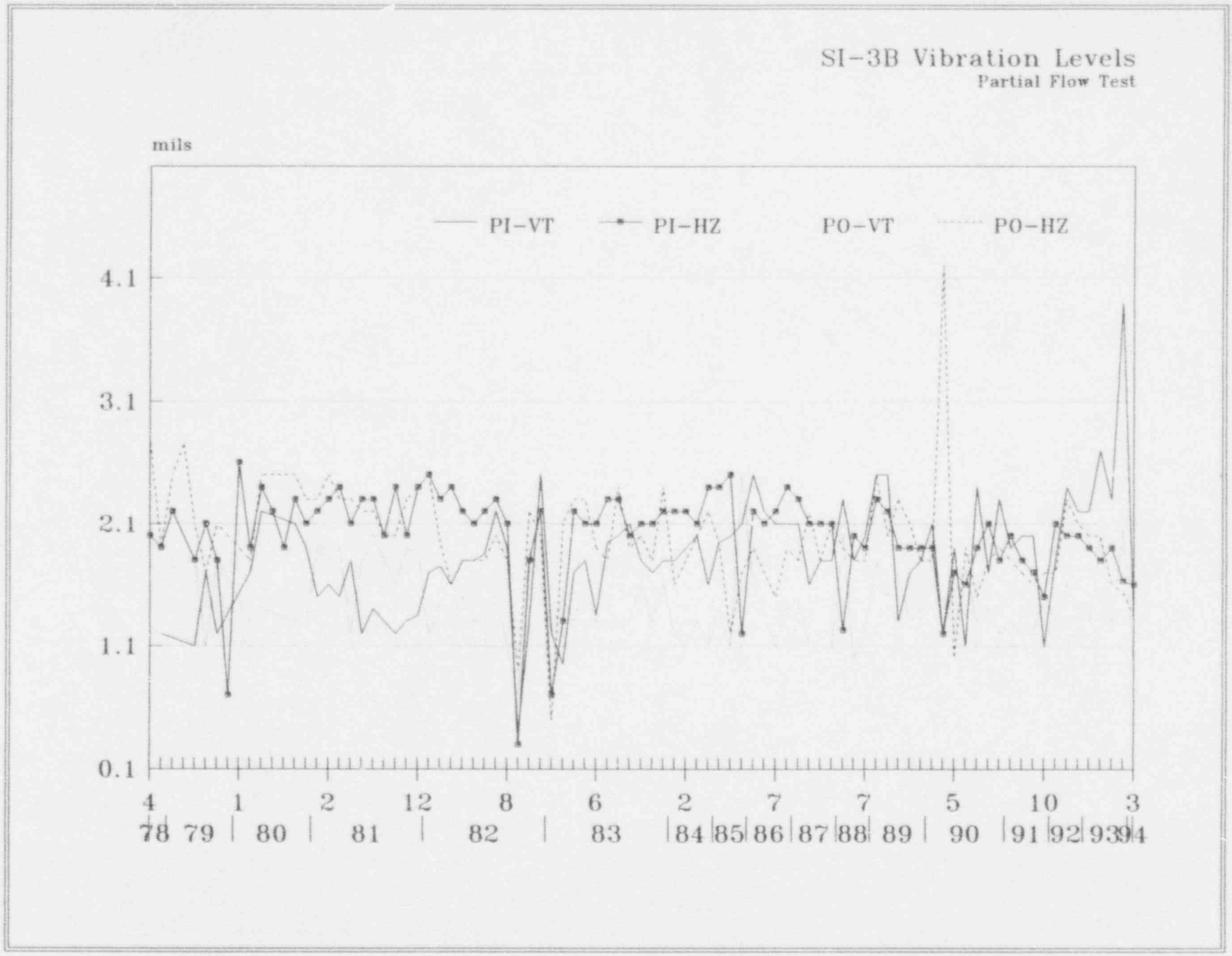
07/86	1.50	1.60	1.40	1.80
10/86	1.70	1.50	1.40	1.30
01/87	1.40	1.40	1.30	1.20
06/87	0.60	0.70	0.60	0.40
07/87	1.50	1.50	1.10	1.40
10/87	1.40	1.30	1.20	1.20
01/88	1.30	1.30	1.00	1.20
04/88	1.30	1.40	1.00	1.30
07/88	1.50	1.30	1.00	1.10
01/89	1.30	1.20	1.00	0.90
02/89	1.40	1.20	1.10	0.90
05/89	1.70	1.20	1.30	1.30
08/89	1.20	1.30	0.90	1.30
11/89	1.20	1.00	1.40	1.20
02/90	1.50	1.40	1.00	1.10
05/90	1.10	1.90	1.30	2.50
06/90	1.50	1.50	1.10	1.20
07/90	1.40	1.10	1.00	1.10
10/90	1.40	1.40	0.90	1.50
01/91	1.30	1.20	1.10	1.10
04/91	1.30	1.40	1.10	1.30
07/91	1.40	1.30	1.00	1.20
10/91	1.00	1.10	1.40	1.30
01/92	1.20	1.30	1.30	1.30
01/92	1.40	1.30	1.30	1.00
08/92	1.50	1.20	1.20	1.10
10/92	1.40	1.20	1.10	1.00
01/93	1.60	1.20	1.20	1.00
07/93	1.30	1.30	1.20	1.30
09/93	1.40	1.40	1.00	1.20
12/93	2.08	1.95	1.55	1.45
03/94	1.49	1.58	0.86	0.80


SI-3A Vibration Levels
Partial Flow Test
mils
PI-VT
PI-HZ
PO-VT
PO-HZ
5.1
4.1
3.1
2.1
1.1
0.1
4 1 1 9 7 5 12 7 10 8 12 10
78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94

SI-3A Vibration Levels (Mils)
Partial Flow Tests

Date	PI-VT	PI-HZ	PO-VT	PO-HZ
04/78		1.20		1.80
07/78	1.40	1.30	2.10	1.90
01/79	1.60		2.50	
04/79			2.30	
07/79	1.10	1.20	2.10	1.30
10/79	1.80	1.50	1.20	0.95
11/79	1.20	1.00	1.80	1.50
12/79	1.00			
01/80	2.30			
06/80	2.45			
07/80	2.10	1.70	1.10	1.10
08/80	2.40	1.80	1.30	1.10
09/80			2.35	
10/80	1.90			
11/80	2.30	1.80	1.20	0.95
12/80	2.20	1.70	1.40	0.95
01/81	1.50	1.10	2.30	1.80
02/81	1.60	0.85	2.20	1.65
03/81	1.20	0.90	2.20	1.50
04/81	2.10	1.80	1.30	0.85
05/81	1.30	0.95	2.10	1.60
06/81	1.20	1.00	2.00	1.60
07/81	1.20	1.00	2.00	1.50
08/81	1.50	0.98	2.10	1.65
09/81	1.30	1.10	2.20	1.70
12/81	1.40	1.10	2.35	1.75
01/82	2.70	1.90	1.30	1.00
02/82	2.15	1.65	1.30	1.05
03/82	2.10	1.70	1.35	1.10
04/82	2.10	1.80	1.40	1.10
05/82	2.10	1.90	1.30	1.00
06/82	2.35	1.75	1.30	1.10
07/82	2.00	1.70	1.20	1.00
08/82	1.80	1.80	1.30	1.00
09/82	0.40	0.30	0.90	0.70
10/82	1.20	1.30	2.40	1.80
11/82	1.90	1.50	1.30	1.30
03/83	2.40	1.75	1.40	1.20
04/83	2.40	1.50	1.30	0.98
05/83	0.60	0.60	0.50	0.50
05/83	1.20	0.95	1.50	1.10
06/83	1.45	1.10	1.10	0.92
07/83	1.40	1.10	1.05	0.95
07/83	1.50	1.35	1.10	0.95
08/83	1.50	1.20	1.00	1.00
09/83	1.40	1.20	0.90	1.00
10/83	1.40	1.10	1.00	1.00
11/83	1.40	1.10	1.00	1.00
12/83	1.60	1.40	1.40	1.20
01/84	1.40	1.10	1.00	1.00
02/84	1.40	1.20	1.00	0.85
07/84	1.80	1.20	1.20	0.95
07/84	1.70	1.30	1.30	1.00
10/84	1.70	1.30	1.20	1.00
01/85	1.65	1.30	1.25	1.10
04/85	1.80	1.30	1.10	1.10
07/85	1.70	1.20	1.30	0.95
01/86	1.30	1.00	1.90	1.30
04/86	1.80	1.10	1.30	1.10
07/86	1.50	1.20	1.10	1.10

10/86	1.75	1.45	1.20	1.10
01/87	1.80	1.40	1.30	1.20
06/87	1.10	1.20	1.70	1.40
07/87	1.60	1.30	1.20	1.10
10/87	1.70	1.40	1.20	1.00
01/88	1.30	1.40	1.00	0.90
04/88	1.60	1.00	1.10	0.85
07/88	1.80	1.30	1.20	1.00
01/89	5.20	4.60	3.60	2.80
01/89	1.60	1.50	1.30	1.00
02/89	1.60	1.30	1.20	0.90
05/89	0.90	0.80	1.30	1.20
08/89	1.00	0.90	1.60	1.40
11/89	1.70	1.20	1.50	0.90
02/90	1.80	1.30	1.20	0.80
05/90	1.40	0.90	1.50	1.60
06/90	1.80	1.50	1.20	0.92
07/90	1.80	1.30	1.10	0.85
10/90	1.10	0.94	1.80	1.70
01/91	1.70	1.70	1.20	0.90
04/91	1.70	1.60	0.85	1.20
07/91	1.80	1.50	1.20	0.85
10/91	0.60	1.60	1.10	0.90
01/92	1.70	1.60	1.10	0.90
08/92	1.90	1.40	1.30	1.00
10/92	1.70	1.30	1.10	0.90
01/93	1.50	1.40	0.90	0.80
07/93	1.50	1.40	0.90	1.20
09/93	1.00	1.10	1.50	1.50
12/93	1.96	2.22	1.18	1.15
03/94	1.55	1.09	0.95	0.71

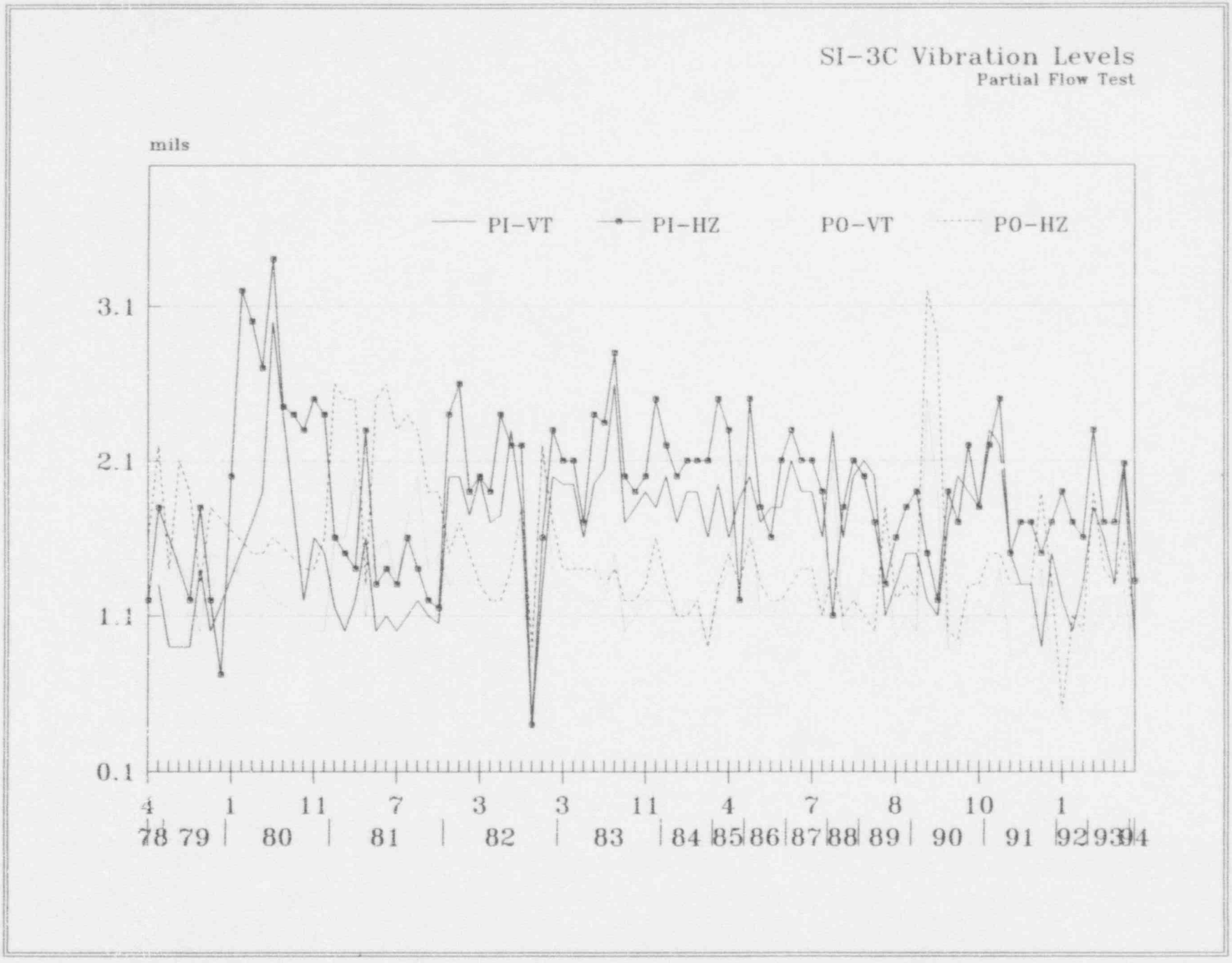

SI-3B Vibration Levels
Partial Flow Test
mils
PI-VT
PI-HZ
PO-VT
PO-HZ
4.1
3.1
2.1
1.1
0.1
4 1 2 12 8 6 2 7 7 5 10 3
78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94

9h-1

SI-3B Vibration Levels (Mils)
Partial Flow Tests

Date	PI-VT	PI-HZ	PO-VT	PO-HZ
04/78		2.00		2.80
07/78	1.20	1.90	1.70	1.90
01/79		2.20		2.50
04/79				2.75
07/79	1.10	1.80	1.80	2.10
10/79	1.70	2.10	1.10	1.70
11/79	1.20	1.80	1.80	2.10
12/79		0.70		
01/80		2.60		
07/80	1.70	1.90	1.30	1.80
08/80	2.20	2.40	1.40	2.50
09/80		2.20		
10/80		1.90		
11/80	2.10	2.30	1.30	2.50
12/80	1.90	2.10	1.30	2.30
01/81	1.50	2.20	1.90	2.30
02/81	1.60	2.30	1.80	2.50
03/81	1.50	2.40	1.90	2.30
04/81	1.80	2.10	1.20	2.30
05/81	1.20	2.30	1.80	2.20
06/81	1.40	2.30	2.00	2.20
07/81	1.30	2.00	1.80	2.00
08/81	1.20	2.40	1.60	2.00
09/81	1.30	2.00	1.90	2.30
12/81	1.35	2.40	1.85	2.40
01/82	1.70	2.50	1.20	2.50
02/82	1.75	2.30	1.45	1.95
03/82	1.60	2.40	1.30	1.60
04/82	1.80	2.20	1.50	1.80
05/82	1.80	2.10	1.30	1.80
06/82	1.85	2.20	1.30	1.80
07/82	2.20	2.30	1.50	2.00
08/82	1.90	2.10	1.10	1.80
09/82	0.40	0.30	0.70	0.90
10/82	1.30	1.80	1.90	2.20
11/82	2.50	2.20	1.60	2.00
03/83	1.20	0.70	1.20	0.50
03/83	0.95	1.30	1.50	2.10
04/83	1.70	2.20	1.30	2.30
05/83	1.80	2.10	1.60	2.30
06/83	1.35	2.10	1.30	1.90
07/83	1.95	2.30	1.30	1.80
08/83	2.00	2.30	1.30	2.40
09/83	2.10	2.00	1.30	1.90
10/83	1.80	2.10	1.60	2.00
11/83	1.70	2.10	1.30	1.80
12/83	1.80	2.20	1.60	2.40
01/84	1.80	2.20	1.20	1.60
02/84	1.90	2.20	1.10	1.80
07/84	2.00	2.10	1.30	2.00
10/84	1.60	2.40	1.10	2.20
01/85	1.95	2.40	1.40	1.95
04/85	2.00	2.50	1.10	1.20
07/85	2.10	1.20	2.50	1.70
01/86	2.50	2.20	1.60	1.90
04/86	2.20	2.10	1.40	1.70
07/86	2.10	2.20	1.10	1.50
10/86	2.10	2.40	1.40	1.90
01/87	2.10	2.30	1.50	1.80
06/87	1.60	2.10	1.10	2.20

07/87	1.80	2.10	1.10	1.80
10/87	1.80	2.10	1.10	2.10
01/88	2.30	1.23	2.00	1.90
04/88	1.80	2.00	1.00	1.80
07/88	2.00	1.90	1.20	1.80
07/88	2.50	2.30	1.80	2.50
02/89	2.50	2.20	1.50	2.00
05/89	1.30	1.90	1.70	2.30
08/89	1.70	1.90	1.30	2.10
11/89	1.80	1.90	1.40	1.80
02/90	2.10	1.90	1.40	1.80
05/90	1.20	1.20	1.50	4.20
05/90	1.90	1.70	1.20	1.00
06/90	1.10	1.60	1.70	1.90
07/90	2.40	1.90	1.30	1.50
09/90	1.70	2.10	1.40	1.80
10/90	2.30	1.80	1.20	1.90
01/91	1.90	2.00	1.30	1.80
04/91	2.00	1.80	1.20	1.70
07/91	2.00	1.70	1.20	1.60
10/91	1.10	1.50	1.50	1.70
01/92	1.80	2.10	1.30	1.70
08/92	2.40	2.00	1.60	2.30
10/92	2.20	2.00	1.40	2.10
01/93	2.20	1.90	1.30	2.00
07/93	2.70	1.80	2.00	2.00
09/93	2.30	1.90	1.30	1.60
12/93	3.90	1.63	2.04	1.54
03/94	1.33	1.60	0.95	1.34


SI-3C Vibration Levels
Partial Flow Test
mils
PI-VT
PI-HZ
PO-VT
PO-HZ
3.1
2.1
1.1
0.1
4
1
11
7
3
3
11
4
7
8
10
1
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94

SI-3C Vibration Levels (Mils)
Partial Flow Tests

Date	PI-VT	PI-HZ	PO-VT	PO-HZ
04/78		1.20		1.60
07/78	1.30	1.80	1.70	2.20
01/79	0.90			1.40
04/79				2.10
07/79	0.90	1.20	1.30	1.90
10/79	1.40	1.80	1.00	1.30
11/79	1.00	1.20	1.50	1.80
12/79		0.72		
01/80		2.00		
06/80		3.20		
07/80	1.70	3.00	1.30	1.50
08/80	1.90	2.70	1.30	1.50
08/80	3.00	3.40	1.20	1.60
09/80		2.45		
10/80		2.40		
11/80	1.20	2.30	1.10	1.40
11/80	1.60	2.50	1.00	1.40
12/80	1.50	2.40	1.00	1.60
01/81	1.15	1.60	1.60	2.60
02/81	1.00	1.50	1.60	2.50
03/81	1.20	1.40	2.00	2.50
04/81	1.60	2.30	1.10	1.30
05/81	1.00	1.30	1.50	2.50
06/81	1.10	1.40	1.60	2.60
07/81	1.00	1.30	1.30	2.30
08/81	1.10	1.60	1.70	2.40
09/81	1.20	1.40	2.00	2.30
11/81	1.10	1.20	1.40	1.90
12/81	1.05	1.15	1.50	1.90
01/82	2.00	2.40	1.30	1.50
02/82	2.00	2.60	1.40	1.70
03/82	1.75	1.90	1.30	1.50
03/82	2.00	2.00	1.20	1.30
05/82	1.70	1.90	1.20	1.20
06/82	1.75	2.40	1.30	1.20
07/82	2.30	2.20	1.30	1.40
08/82	1.80	2.20	1.30	1.80
09/82	0.38	0.40	0.80	0.90
10/82	1.30	1.60	2.20	2.20
11/82	2.00	2.30	1.40	1.70
03/83	1.95	2.10	1.20	1.40
04/83	1.95	2.10	1.30	1.40
05/83	1.60	1.70	1.20	1.40
06/83	1.95	2.40	1.20	1.40
07/83	2.05	2.35	1.20	1.30
08/83	2.60	2.80	1.50	1.40
09/83	1.70	2.00	1.00	1.20
10/83	1.80	1.90	1.10	1.20
11/83	1.90	2.00	1.20	1.30
12/83	1.80	2.50	1.20	1.60
01/84	2.00	2.20	1.20	1.30
02/84	1.70	2.00	1.10	1.10
07/84	1.90	2.10	1.20	1.10
07/84	1.90	2.10	1.20	1.20
10/84	1.60	2.10	0.90	0.90
01/85	1.95	2.50	1.25	1.30
04/85	1.60	2.30	1.40	1.50
07/85	1.85	1.20	2.10	1.30
01/86	2.00	2.50	1.80	1.60
04/86	1.70	1.80	1.10	1.30

07/86	1.80	1.60	1.10	1.20
10/86	1.80	2.10	1.20	1.20
01/87	2.10	2.30	1.20	1.30
06/87	1.90	2.10	1.30	1.40
07/87	1.90	2.10	1.30	1.40
10/87	1.60	1.90	1.10	1.10
01/88	2.30	1.10	2.10	1.40
04/88	1.60	1.80	1.00	1.10
07/88	2.00	2.10	1.10	1.20
01/89	2.10	2.00	1.40	1.10
02/89	2.00	1.70	1.30	1.00
05/89	1.10	1.30	1.50	1.80
08/89	1.30	1.60	0.95	1.20
11/89	1.50	1.80	1.10	1.30
02/90	1.50	1.90	1.00	1.20
03/90	1.20	1.50	2.50	3.20
05/90	1.10	1.20	1.90	2.90
06/90	1.70	1.90	0.90	1.00
07/90	2.00	1.70	0.85	0.95
09/90	1.90	2.20	1.10	1.30
10/90	1.80	1.80	1.20	1.30
01/91	2.30	2.20	1.10	1.50
03/91	2.20	2.50	1.40	1.50
03/91	1.50	1.50	0.85	1.30
04/91	1.30	1.70	0.84	1.30
07/91	1.30	1.70	0.95	1.30
10/91	0.90	1.50	1.40	1.90
12/91	1.50	1.70	0.80	1.30
01/92	1.20	1.90	0.80	0.50
08/92	1.00	1.70	0.76	1.10
10/92	1.30	1.60	0.80	1.00
01/93	1.80	2.30	1.00	1.90
07/93	1.60	1.70	1.20	1.40
09/93	1.30	1.70	1.00	1.30
12/93	2.06	2.08	1.27	1.57
03/94	0.94	1.32	0.71	1.02

LPSI and CS Pumps
Ingersoll-Rand Model 6UCL
June 24, 1994

Sync Speed (rpm)	3600
Design Flow (gpm)	2500
Driver (LPSI)	300 HP 4160 VAC
Driver (CS)	300 HP 480 VAC
Vanes	5
Running Speed (rpm)	3577
Flow (gpm)	1500 (supplying shutdown cooling)

	FTF	Bd	BSF	BPFO	BPFI	NB
Radial Bearing (SKF-5212, Outboard)	.42	.625	2.60	4.15	5.84	10
Thrust Bearing (SKF-7311DB, Inboard)	.40	.812	2.04	4.84	7.14	12

Ball Defect	1 x BSF
Cage Defect	1 x FTF
Outer Race Defect	1 x BPFO
Inner Race Defect	1 x BPFI

ELEMENT	HARMONIC	MULTIPLE	CRITICAL FREQUENCY (CPM)	CRITICAL FREQUENCY (HZ)
Thrust Bearing FTF	1.0	.400	1431.	23.847
Radial Bearing FTF	1.0	.420	1502.	25.039
Shaft	1.0	1.000	3577.	59.617
Shaft	2.0	2.000	7154.	119.233
Thrust Bearing BSF	1.0	2.040	7297.	121.618
Radial Bearing BSF	1.0	2.600	9300.	155.003
Shaft	3.0	3.000	10731.	178.850
Shaft	4.0	4.000	14308.	238.467
Radial Bearing BPFO	1.0	4.150	14845.	247.409
Thrust Bearing BPFO	1.0	4.840	17313.	288.545
Vane rate	1.0	5.000	17885.	298.083
Radial Bearing BPFI	1.0	5.840	20890.	348.161
Thrust Bearing BPFI	1.0	7.140	25540.	425.663

LPSI and CS Pumps
Ingersoll-Rand Model 6UCL
June 24, 1994

Sync Speed (rpm)	3600
Design Flow (gpm)	2500
Driver (LPSI)	300 HP 4160 VAC
Driver (CS)	300 HP 480 VAC
Vanes	5
Running Speed (rpm)	3583
Flow (gpm)	c. 150 (minimum recirculation lineup)

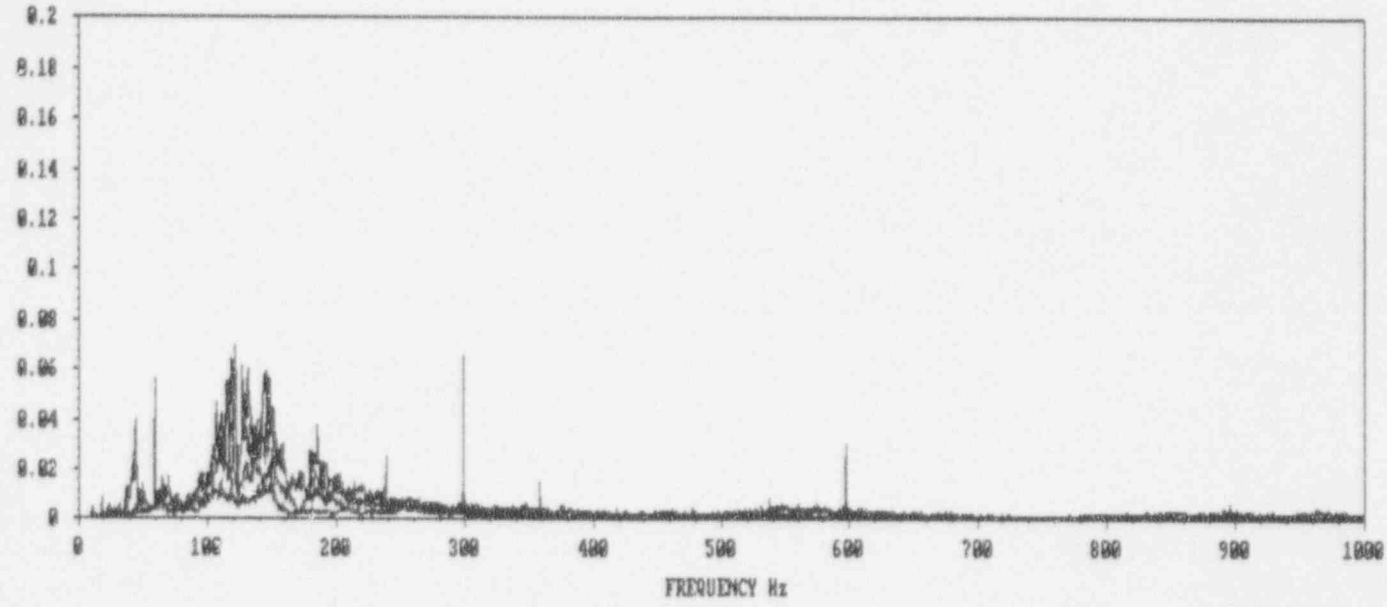
	FTF	Bd	BSF	BPFO	BPFI	NB
Radial Bearing (SKF-5212, Outboard)	.42	.625	2.60	4.15	5.84	10
Thrust Bearing (SKF-7311DB, Inboard)	.40	.812	2.04	4.84	7.14	12

Ball Defect	1 x BSF
Cage Defect	1 x FTF
Outer Race Defect	1 x BPFO
Inner Race Defect	1 x BPFI

ELEMENT	HARMONIC	MULTIPLE	CRITICAL FREQUENCY (CPM)	CRITICAL FREQUENCY (HZ)
Thrust Bearing FTF	1.0	.400	1433.	23.887
Radial Bearing FTF	1.0	.420	1505.	25.081
Shaft	1.0	1.000	3583.	59.717
Shaft	2.0	2.000	7166.	119.433
Thrust Bearing BSF	1.0	2.040	7309.	121.822
Radial Bearing BSF	1.0	2.600	9316.	155.263
Shaft	3.0	3.000	10749.	179.150
Shaft	4.0	4.000	14332.	238.867
Radial Bearing BPFO	1.0	4.150	14869.	247.824
Thrust Bearing BPFO	1.0	4.840	17342.	289.029
Vane rate	1.0	5.000	17915.	298.583
Radial Bearing BPFI	1.0	5.840	20925.	348.745
Thrust Bearing BPFI	1.0	7.140	25583.	426.377

OVERLAY SPECTRAL PLOT

FREQ: 0.31



(A) SET: SI-1B COLD DESC: SI-1B COLD PUMP
ID: SI-1B IB VERT. DESC: PUMP INBOARD VERTICAL
DATE: 23-SEP-93 10:58:23 FULL SCALE: 1 IPS
FREQ. RNG: 0 - 1000 Hz FFT LINES: 3200 RPM: 3584

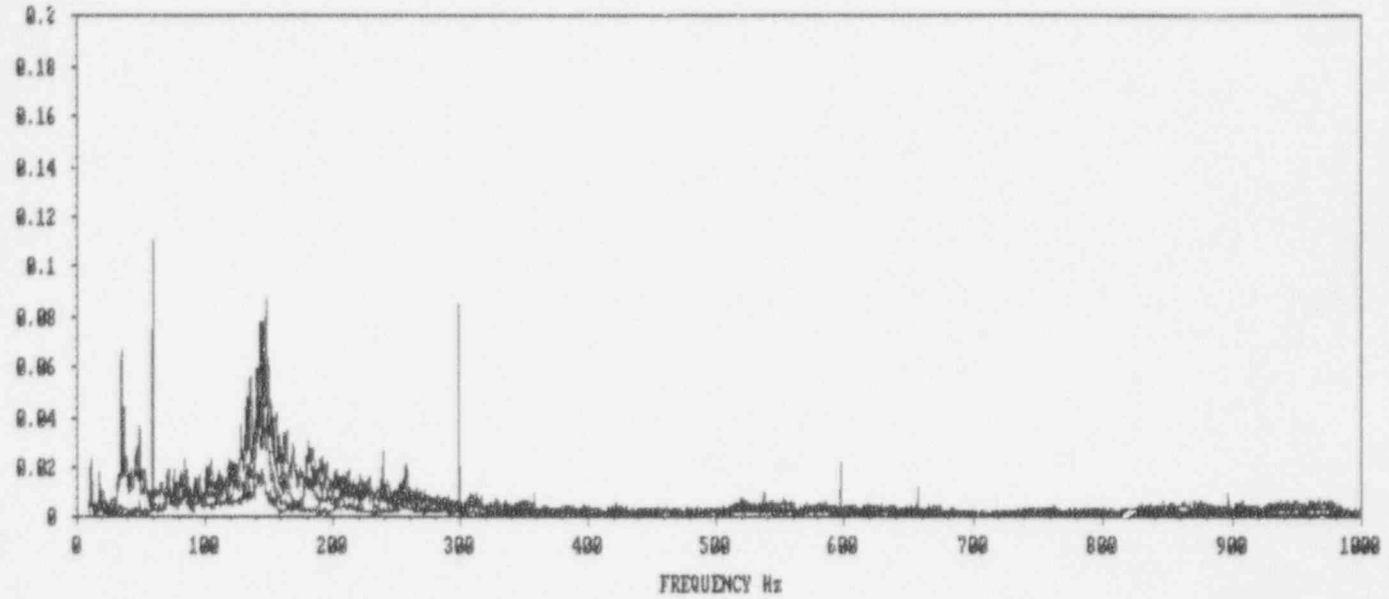
(B) SET: SI-1B COLD DESC: SI-1B COLD PUMP
ID: SI-1B IB HORZ. DESC: PUMP INBOARD HORIZONTAL
DATE: 23-SEP-93 10:53:31 FULL SCALE: 1 IPS
FREQ. RNG: 0 - 1000 Hz FFT LINES: 3200 RPM: 3583

(C) SET: SI-1B COLD DESC: SI-1B COLD PUMP
ID: SI-1B OB VERT. DESC: PUMP OUTBOARD VERTICAL
DATE: 23-SEP-93 11:14:06 FULL SCALE: 1 IPS
FREQ. RNG: 0 - 1000 Hz FFT LINES: 3200 RPM: 3583

*** (D) SET: SI-1B COLD DESC: SI-1B COLD PUMP
ID: SI-1B OB HORZ. DESC: PUMP OUTBOARD HORIZONTAL
DATE: 23-SEP-93 11:03:30 FULL SCALE: 1 IPS
FREQ. RNG: 0 - 1000 Hz FFT LINES: 3200 RPM: 3583

OVERLAY SPECTRAL PLOT

FREQ: 0.31



(A) SET: SI-3B COLD DESC: SI-3B COLD PUMP
ID: SI-3B IB VERT. DESC: PUMP INBOARD VERT.
DATE: 23-SEP-93 13:07:14 FULL SCALE: 1 IPS
FREQ. RNG: 0 - 1000 Hz FFT LINES: 3200 RPM: 3585

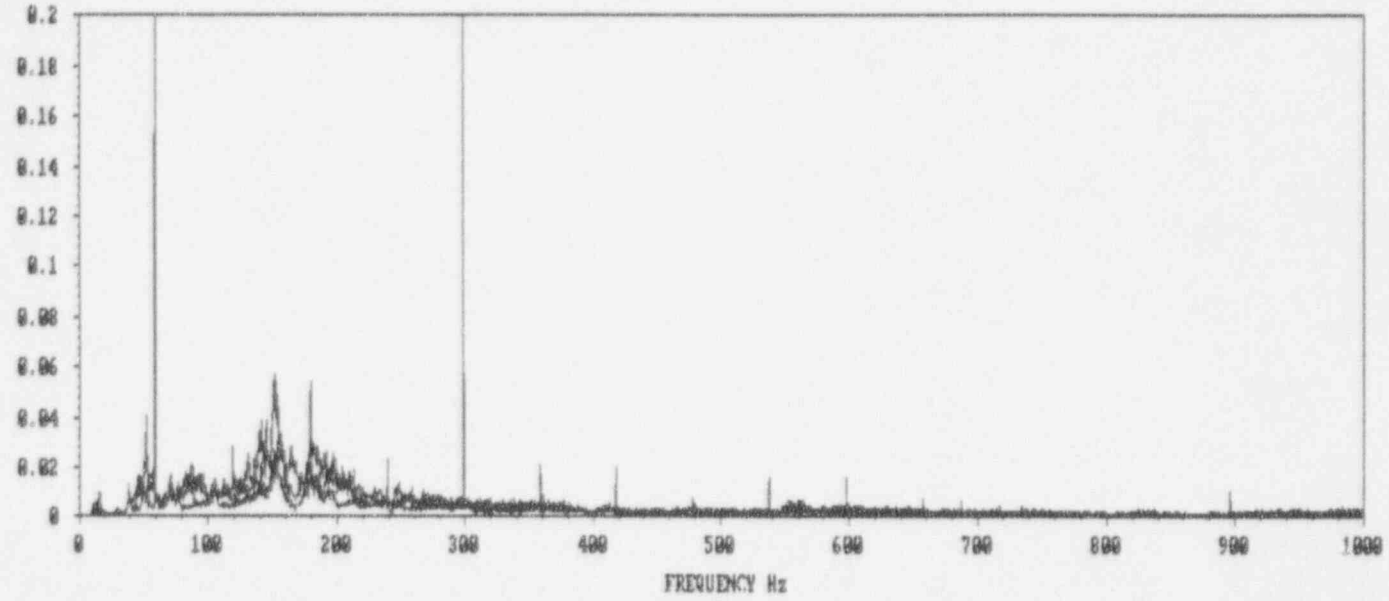
(B) SET: SI-3B COLD DESC: SI-3B COLD PUMP
ID: SI-3B IB HORZ. DESC: PUMP INBOARD HORIZONTAL
DATE: 23-SEP-93 13:01:30 FULL SCALE: 1 IPS
FREQ. RNG: 0 - 1000 Hz FFT LINES: 3200 RPM: 3585

(C) SET: SI-3B COLD DESC: SI-3B COLD PUMP
ID: SI-3B OB VERT. DESC: PUMP OUTBOARD VERTICAL
DATE: 23-SEP-93 13:22:53 FULL SCALE: 1 IPS
FREQ. RNG: 0 - 1000 Hz FFT LINES: 3200 RPM: 3584

*** (D) SET: SI-3B COLD DESC: SI-3B COLD PUMP
ID: SI-3B OB HORZ. DESC: PUMP OUTBOARD HORZ.
DATE: 23-SEP-93 13:15:06 FULL SCALE: 1 IPS
FREQ. RNG: 0 - 1000 Hz FFT LINES: 3200 RPM: 3584

OVERLAY SPECTRAL PLOT

FREQ: 0.31



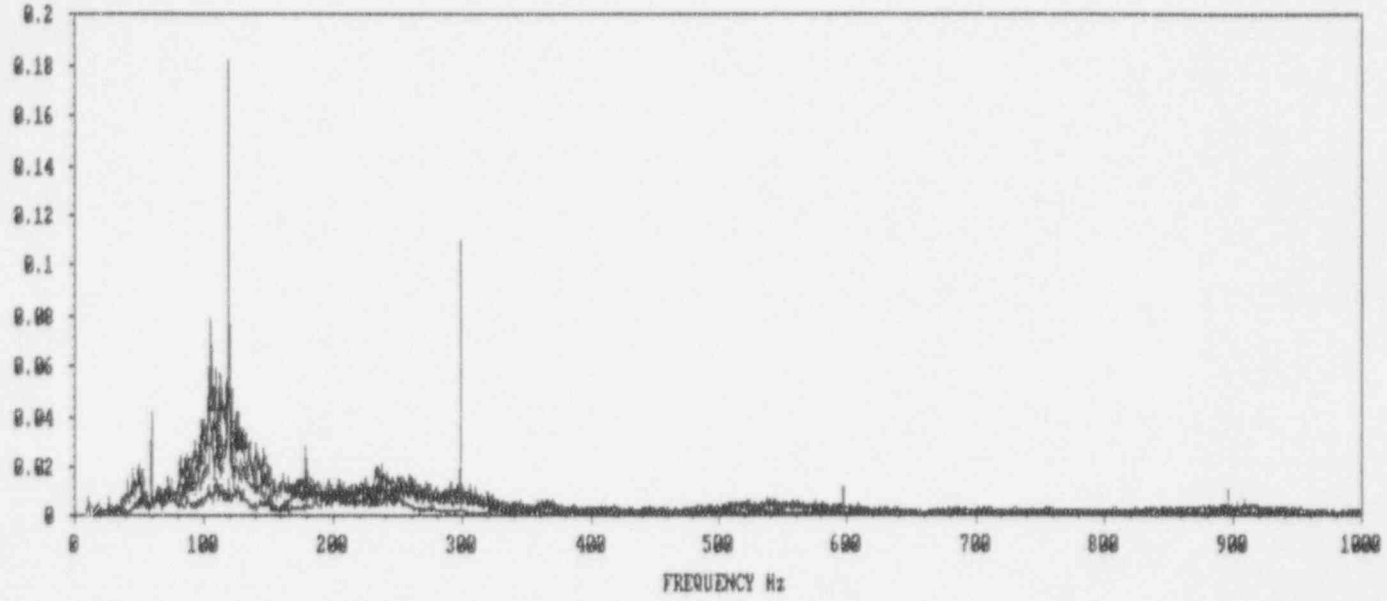
(A) SET: SI-3C COLD DESC: SI-3B COLD PUMP
ID: SI-3C IB VERT. DESC: PUMP INBOARD VERT.
DATE: 23-SEP-93 13:33:29 FULL SCALE: 1 IPS
FREQ. RNG: 0 - 1000 Hz FFT LINES: 3200 RPM: 3585

(B) SET: SI-3C COLD DESC: SI-3B COLD PUMP
ID: SI-3C IB HORZ. DESC: PUMP INBOARD HORIZONTAL
DATE: 23-SEP-93 13:29:04 FULL SCALE: 1 IPS
FREQ. RNG: 0 - 1000 Hz FFT LINES: 3200 RPM: 3585

*** (C) SET: SI-3C COLD DESC: SI-3B COLD PUMP
ID: SI-3C OB VERT. DESC: PUMP OUTBOARD VERTICAL
DATE: 23-SEP-93 13:41:17 FULL SCALE: 1 IPS
FREQ. RNG: 0 - 1000 Hz FFT LINES: 3200 RPM: 3585

OVERLAY SPECTRAL PLOT

FREQ: 0.31



(A) SET: SI-1A COLD DESC: LPSI PUMP SI-1A
ID: SI-1A IB VERT. DESC: QUARTERLY TEST
DATE: 14-SEP-93 10:01:36 FULL SCALE: 0.2 IPS
FREQ. RNG: 0 - 1000 Hz FFT LINES: 3200 RPM: 3583

(B) SET: SI-1A COLD DESC: LPSI PUMP SI-1A
ID: SI-1A IB HORZ. DESC: QUARTERLY TEST
DATE: 14-SEP-93 09:57:17 FULL SCALE: 0.2 IPS
FREQ. RNG: 0 - 1000 Hz FFT LINES: 3200 RPM: 3583

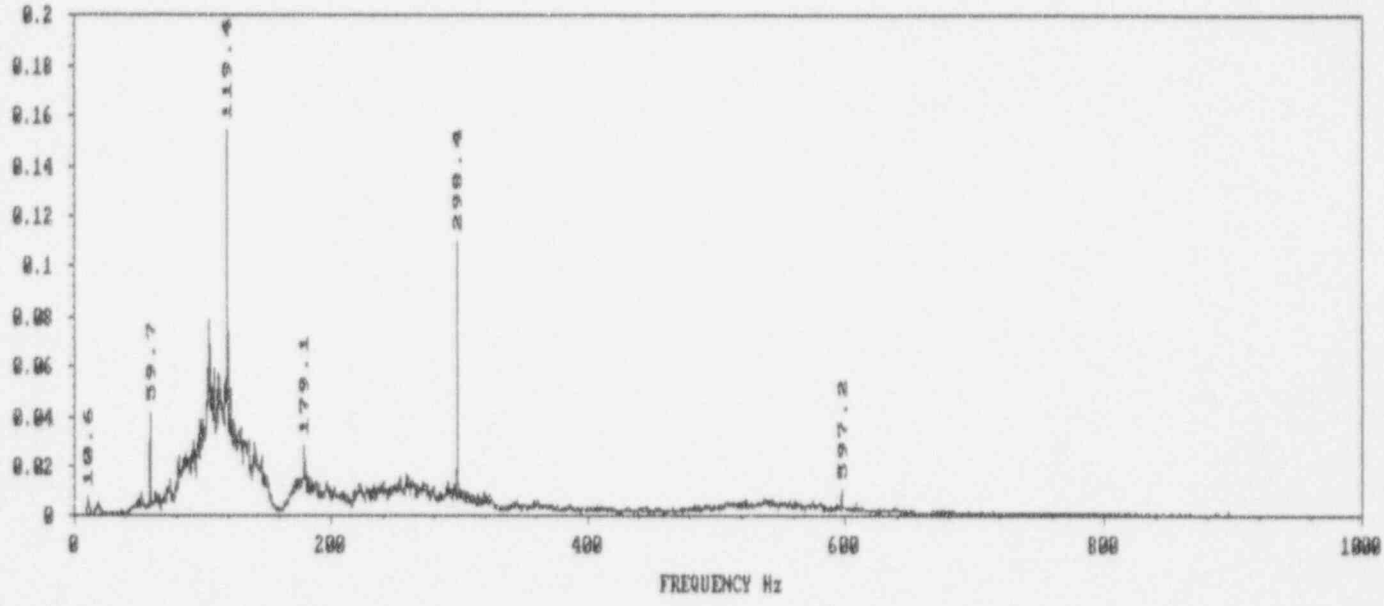
(C) SET: SI-1A COLD DESC: LPSI PUMP SI-1A
ID: SI-1A OB VERT. DESC: QUARTERLY TEST
DATE: 14-SEP-93 10:10:51 FULL SCALE: 0.2 IPS
FREQ. RNG: 0 - 1000 Hz FFT LINES: 3200 RPM: 3582

*** (D) SET: SI-1A COLD DESC: LPSI PUMP SI-1A
ID: SI-1A OB HORZ. DESC: QUARTERLY TEST
DATE: 14-SEP-93 10:06:09 FULL SCALE: 0.2 IPS
FREQ. RNG: 0 - 1000 Hz FFT LINES: 3200 RPM: 3583

SINGLE SPECTRUM PLOT

S SI-1A COLD TYPE: FFT DATE: 14-SEP-93 10:01:36
POINT ID: SI-1A IB VERT. DESC: QUARTERLY TEST
WINDOW: HANNING LINES: 3200 AVER: 10 FREQ: 0 - 1000 Hz
DETECT: PEAK RPM: 3583 THRESHOLD: 0.0439 UNITS: IPS

FREQ: 0.31 AMP: 0 ORDER: 0.005 DEG: ---



IDENTIFICATION OF SPECTRAL PEAKS ABOVE THRESHOLD

NO.	AMP.	FREQ.	ORDER	NO.	AMP.	FREQ.	ORDER
1.	0.0478	103.8	1.737	9.	0.0507	114.1	1.910
2.	0.0789	105.6	1.769	10.	0.0454	115.0	1.926
3.	0.0525	107.2	1.795	11.	0.0534	117.5	1.968
4.	0.0511	108.4	1.816	12.	0.0505	118.4	1.983
5.	0.0597	109.1	1.826	13.	0.1538	119.4	1.999
6.	0.0507	111.3	1.863	14.	0.0440	120.9	2.025
7.	0.0568	112.5	1.884	15.	0.0510	121.9	2.041
8.	0.0559	113.1	1.894	16.	0.1100	298.4	4.998

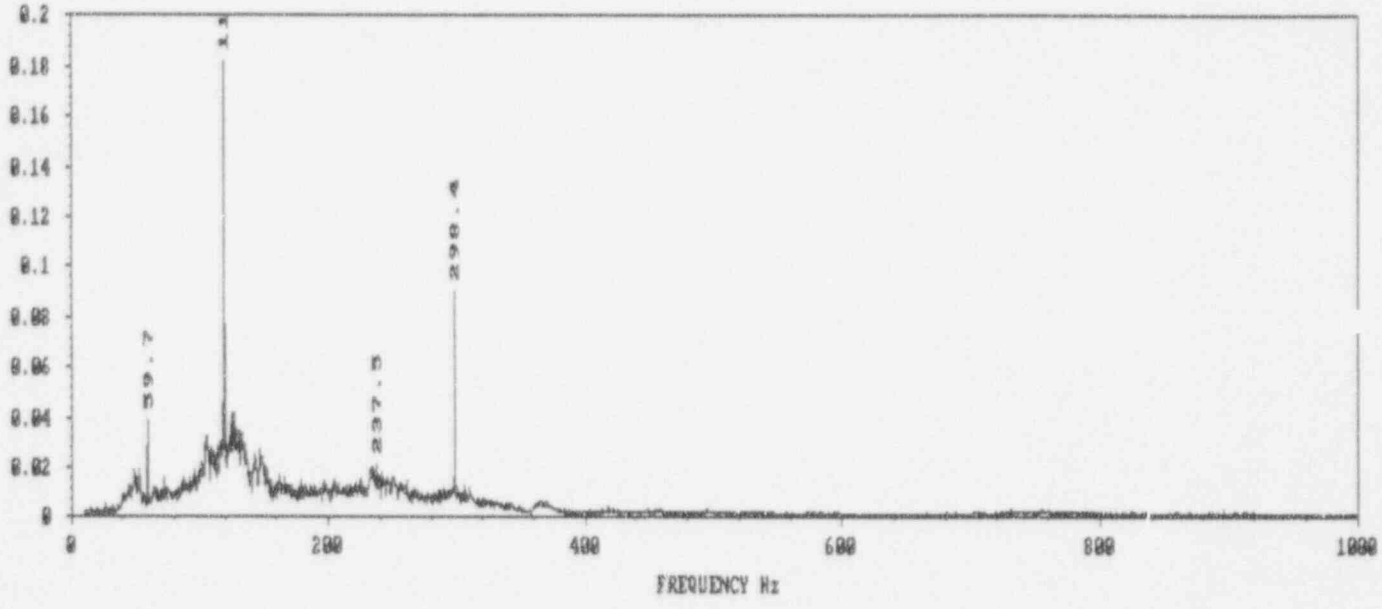
SPECTRAL ENERGY SUMMARY

OVERALL	SYNC	SUBSYNC	NONSYNC
0.5056	0.2091	0.03504	0.459

SINGLE SPECTRUM PLOT

SET: SI-1A COLD TYPE: FFT DATE: 14-SEP-93 09:57:17
POINT ID: SI-1A IB HORZ. DESC: QUARTERLY TEST
WINDOW: HANNING LINES: 3200 AVER: 10 FREQ: 0 - 1000 Hz
DETECT: PEAK RPM: 3583 THRESHOLD: 0.0303 UNITS: IPS

FREQ: 0.31 AMP: 0 ORDER: 0.005 DEG: ---



IDENTIFICATION OF SPECTRAL PEAKS ABOVE THRESHOLD

NO.	AMP.	FREQ.	ORDER	NO.	AMP.	FREQ.	ORDER
1.	0.0384	59.7	1.000	9.	0.0412	127.2	2.130
2.	0.0329	105.6	1.769	10.	0.0358	128.1	2.146
3.	0.0316	106.6	1.785	11.	0.0320	128.8	2.156
4.	0.0303	116.6	1.952	12.	0.0343	130.9	2.193
5.	0.0310	118.1	1.978	13.	0.0327	132.5	2.219
6.	0.1817	119.4	1.999	14.	0.0333	133.1	2.229
7.	0.0321	123.4	2.067	15.	0.0327	133.8	2.240
8.	0.0422	125.0	2.093	16.	0.0897	298.4	4.998

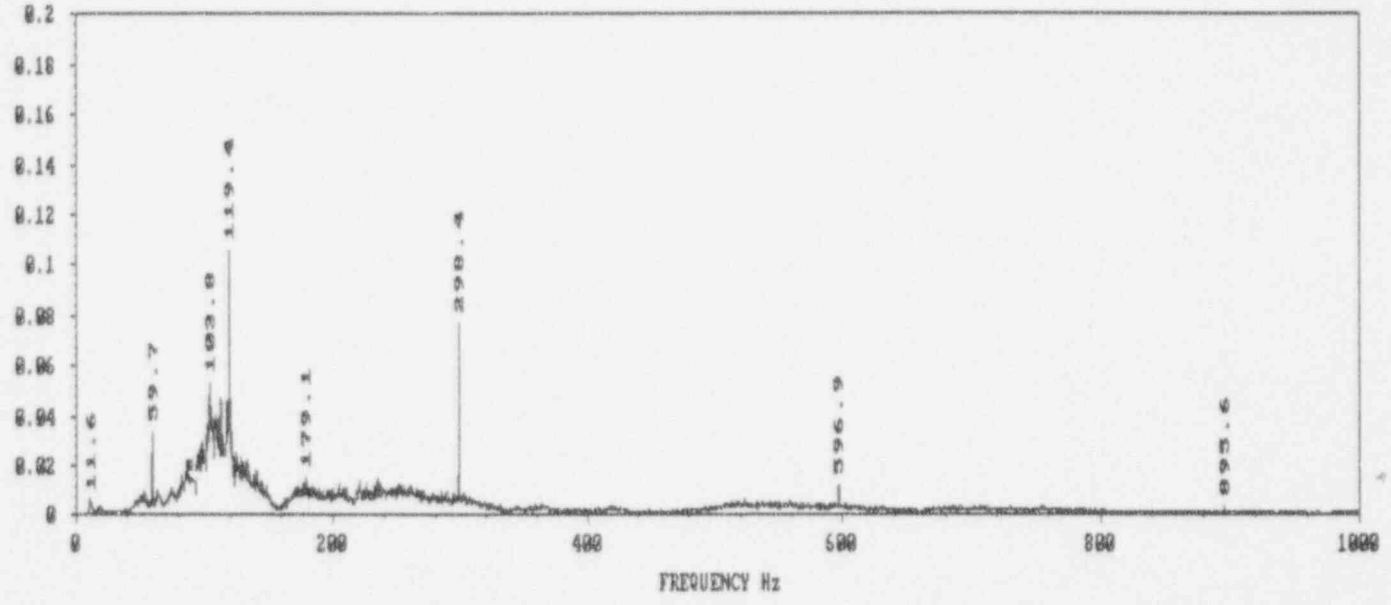
SPECTRAL ENERGY SUMMARY

OVERALL	SYNC	SUBSYNC	NONSYNC
0.4233	0.2146	0.07567	0.3569

SINGLE SPECTRUM PLOT

SET: SI-1A COLD TYPE: FFT DATE: 14-SEP-93 10:10:51
POINT ID: SI-1A OB VERT. DESC: QUARTERLY TEST
WINDOW: HANNING LINES: 3200 AVER: 10 FREQ: 0 - 1000 Hz
DETECT: PEAK RPM: 3582 THRESHOLD: 0.0331 UNITS: IPS

FREQ: 0.31 AMP: 0 ORDER: 0.005 DEG: ---



IDENTIFICATION OF SPECTRAL PEAKS ABOVE THRESHOLD

NO.	AMP.	FREQ.	ORDER	NO.	AMP.	FREQ.	ORDER
1.	0.0331	59.7	1.000	9.	0.0387	110.0	1.842
2.	0.0363	101.9	1.706	10.	0.0399	111.3	1.863
3.	0.0528	103.8	1.738	11.	0.0470	112.5	1.884
4.	0.0435	105.0	1.759	12.	0.0459	113.1	1.895
5.	0.0359	106.6	1.785	13.	0.0454	117.8	1.973
6.	0.0386	107.5	1.801	14.	0.1052	119.4	1.999
7.	0.0405	108.4	1.816	15.	0.0359	120.6	2.020
8.	0.0372	109.1	1.827	16.	0.0765	298.4	4.999

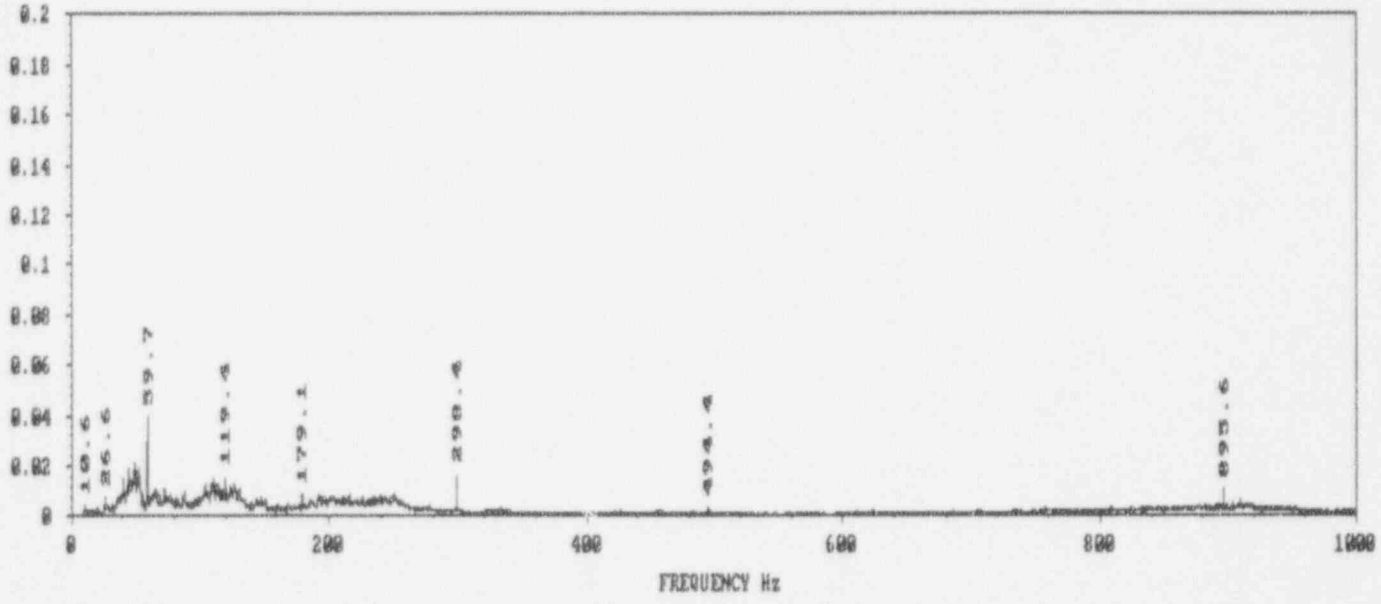
SPECTRAL ENERGY SUMMARY

OVERALL	SYNC	SUBSYNC	NONSYNC
0.3674	0.1417	0.03718	0.337

SINGLE SPECTRUM PLOT

SET: SI-1A COLD TYPE: FFT DATE: 14-SEP-93 10:06:09
POINT ID: SI-1A OB HORZ. DESC: QUARTERLY TEST
WINDOW: HANNING LINES: 3200 AVER: 10 FREQ: 0 - 1000 Hz
DETECT: PEAK RPM: 3583 THRESHOLD: 0.0133 UNITS: IPS

FREQ: 0.31 AMP: 0 ORDER: 0.005 DEG: ---



IDENTIFICATION OF SPECTRAL PEAKS ABOVE THRESHOLD

NO.	AMP.	FREQ.	ORDER	NO.	AMP.	FREQ.	ORDER
1.	0.0147	40.6	0.680	9.	0.0398	59.7	1.000
2.	0.0196	45.0	0.754	10.	0.0134	104.4	1.748
3.	0.0154	46.3	0.775	11.	0.0135	109.7	1.837
4.	0.0142	47.2	0.790	12.	0.0147	110.3	1.847
5.	0.0186	48.8	0.816	13.	0.0135	111.9	1.874
6.	0.0211	50.0	0.837	14.	0.0156	119.4	1.999
7.	0.0197	52.5	0.879	15.	0.0136	126.3	2.114
8.	0.0159	53.8	0.900	16.	0.0166	298.4	4.998

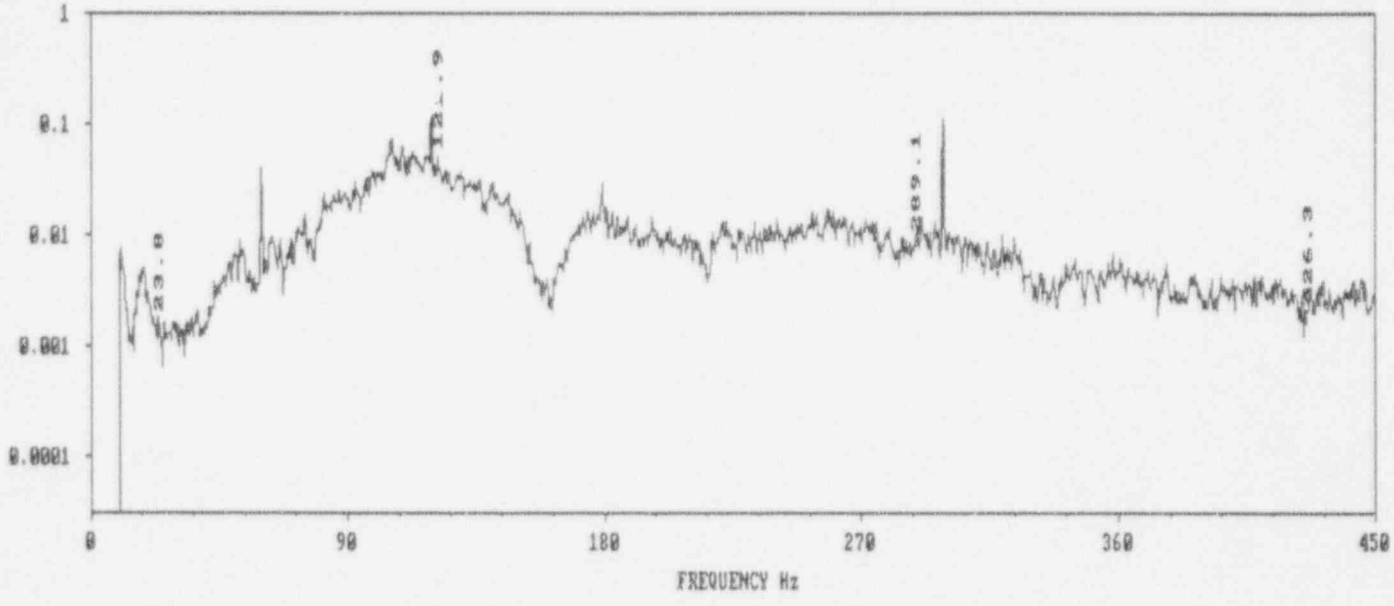
SPECTRAL ENERGY SUMMARY

OVERALL	SYNC	SUBSYNC	NONSYNC
0.1862	0.05191	0.08192	0.159

SINGLE SPECTRUM PLOT

SET: SI-1A COLD TYPE: FFT DATE: 14-SEP-93 10:01:36
POINT ID: SI-1A 7B VERT. DESC: QUARTERLY TEST
WINDOW: HANNING LINES: 3200 AVER: 10 FREQ: 0 - 1000 Hz
DETECT: PEAK RPM: 3583 THRESHOLD: 0.0000 UNITS: IPS

FREQ: 0.31 AMP: 0 ORDER: 0.005 DEG: ---



IDENTIFICATION OF SPECTRAL PEAKS ABOVE THRESHOLD

NO.	AMP.	FREQ.	ORDER	NO.	AMP.	FREQ.	ORDER
1.	0.0478	103.8	1.737	9.	0.0507	114.1	1.910
2.	0.0789	105.6	1.769	10.	0.0454	115.0	1.926
3.	0.0525	107.2	1.795	11.	0.0534	117.5	1.968
4.	0.0511	108.4	1.816	12.	0.0505	118.4	1.983
5.	0.0597	109.1	1.826	13.	0.1538	119.4	1.999
6.	0.0507	111.3	1.863	14.	0.0440	120.9	2.025
7.	0.0568	112.5	1.884	15.	0.0510	121.9	2.041
8.	0.0559	113.1	1.894	16.	0.1100	298.4	4.998

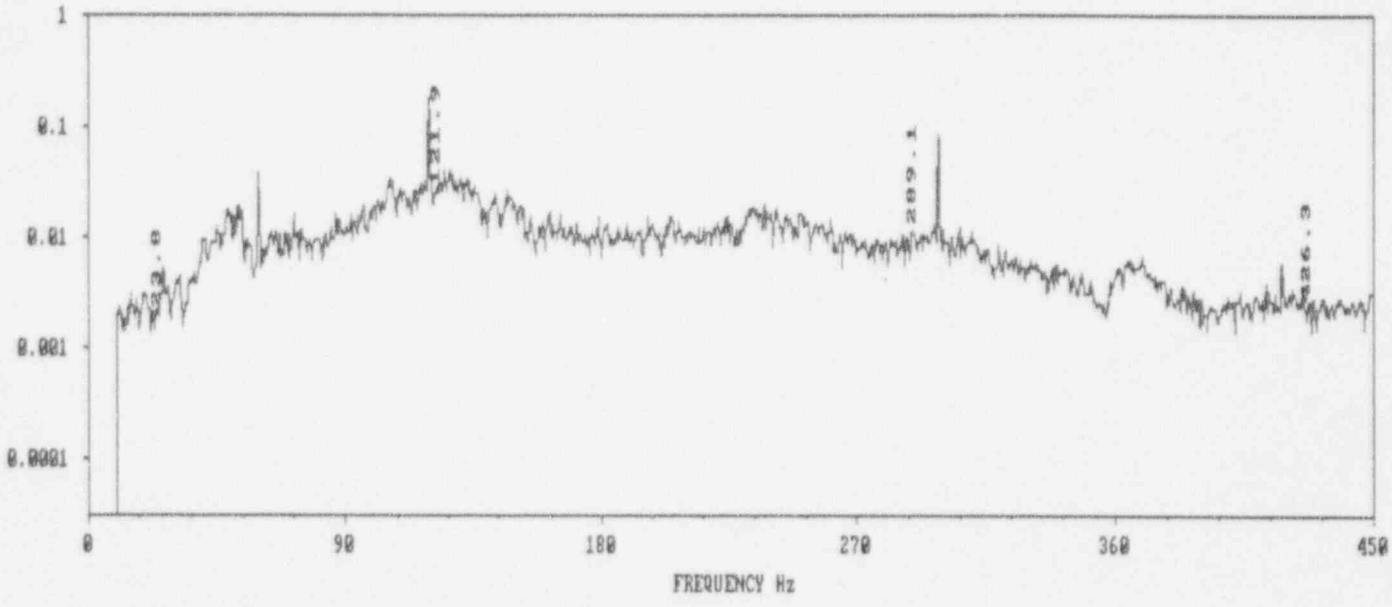
SPECTRAL ENERGY SUMMARY

OVERALL	SYNC	SUBSYNC	NONSYNC
0.5056	0.2091	0.03504	0.459

SINGLE SPECTRUM PLOT

SET: SI-1A COLD TYPE: FFT DATE: 14-SEP-93 09:57:17
POINT ID: SI-1A IB HORZ. DESC: QUARTERLY TEST
WINDOW: HANNING LINES: 3200 AVER: 10 FREQ: 0 - 1000 Hz
DETECT: PEAK RPM: 3583 THRESHOLD: 0.0000 UNITS: IPS

FREQ: 0.31 AMP: 0 ORDER: 0.005 DEG: ---



IDENTIFICATION OF SPECTRAL PEAKS ABOVE THRESHOLD

NO.	AMP.	FREQ.	ORDER	NO.	AMP.	FREQ.	ORDER
1.	0.0384	59.7	1.000	9.	0.0412	127.2	2.130
2.	0.0329	105.6	1.769	10.	0.0358	128.1	2.146
3.	0.0316	106.6	1.785	11.	0.0320	128.8	2.156
4.	0.0303	116.6	1.952	12.	0.0343	130.9	2.193
5.	0.0310	118.1	1.978	13.	0.0327	132.5	2.219
6.	0.1817	119.4	1.999	14.	0.0333	133.1	2.229
7.	0.0321	123.4	2.067	15.	0.0327	133.8	2.240
8.	0.0422	125.0	2.093	16.	0.0897	298.4	4.998

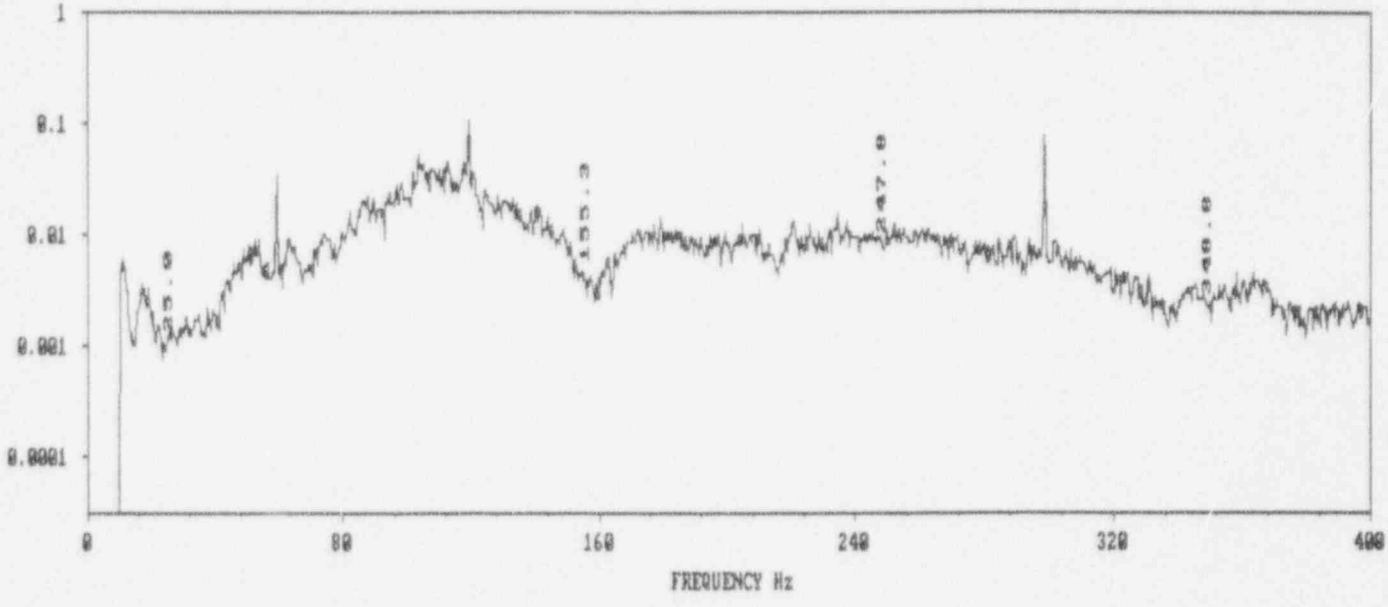
SPECTRAL ENERGY SUMMARY

OVERALL	SYNC	SUBSYNC	NONSYNC
0.4233	0.2146	0.07567	0.3569

SINGLE SPECTRUM PLOT

SET: SI-1A COLD TYPE: FFT DATE: 14-SEP-93 10:10:51
POINT ID: SI-1A OB VERT. DESC: QUARTERLY TEST
WINDOW: HANNING LINES: 3200 AVER: 10 FREQ: 0 - 1000 Hz
DETECT: PEAK RPM: 3582 THRESHOLD: 0.0000 UNITS: IPS

FREQ: 0.31 AMP: 0 ORDER: 0.005 DEG: ---



IDENTIFICATION OF SPECTRAL PEAKS ABOVE THRESHOLD

NO.	AMP.	FREQ.	ORDER	NO.	AMP.	FREQ.	ORDER
1.	0.0331	59.7	1.000	9.	0.0387	110.0	1.842
2.	0.0363	101.9	1.706	10.	0.0399	111.3	1.863
3.	0.0528	103.8	1.738	11.	0.0470	112.5	1.884
4.	0.0435	105.0	1.759	12.	0.0459	113.1	1.895
5.	0.0359	106.6	1.785	13.	0.0454	117.8	1.973
6.	0.0386	107.5	1.801	14.	0.1052	119.4	1.999
7.	0.0405	108.4	1.816	15.	0.0359	120.6	2.020
8.	0.0372	109.1	1.827	16.	0.0765	298.4	4.999

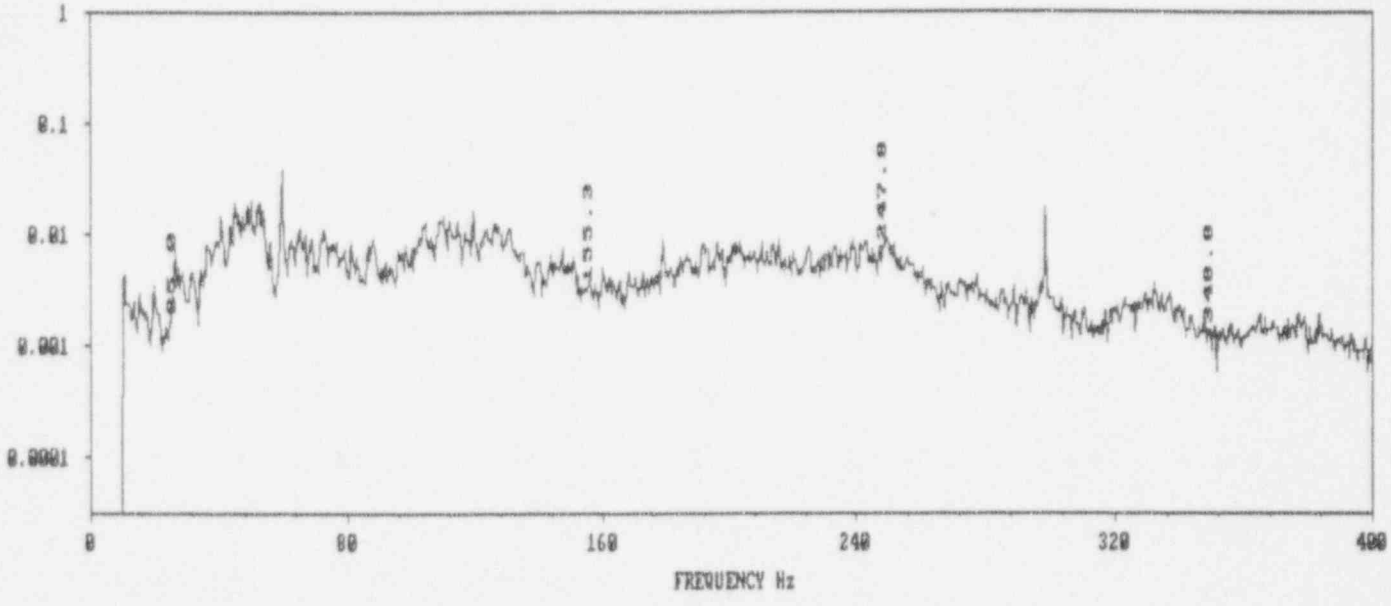
SPECTRAL ENERGY SUMMARY

OVERALL	SYNC	SUBSYNC	NONSYNC
0.3674	0.1417	0.03718	0.337

SINGLE SPECTRUM PLOT

SET: SI-1A COLD TYPE: FFT DATE: 14-SEP-93 10:06:09
POINT ID: SI-1A OB HORZ. DESC: QUARTERLY TEST
WINDOW: HANNING LINES: 3200 AVER: 10 FREQ: 0 - 1000 Hz
DETECT: PEAK RPM: 3583 THRESHOLD: 0.0000 UNITS: IPS

FREQ: 0.31 AMP: 0 ORDER: 0.005 DEG: ---



IDENTIFICATION OF SPECTRAL PEAKS ABOVE THRESHOLD

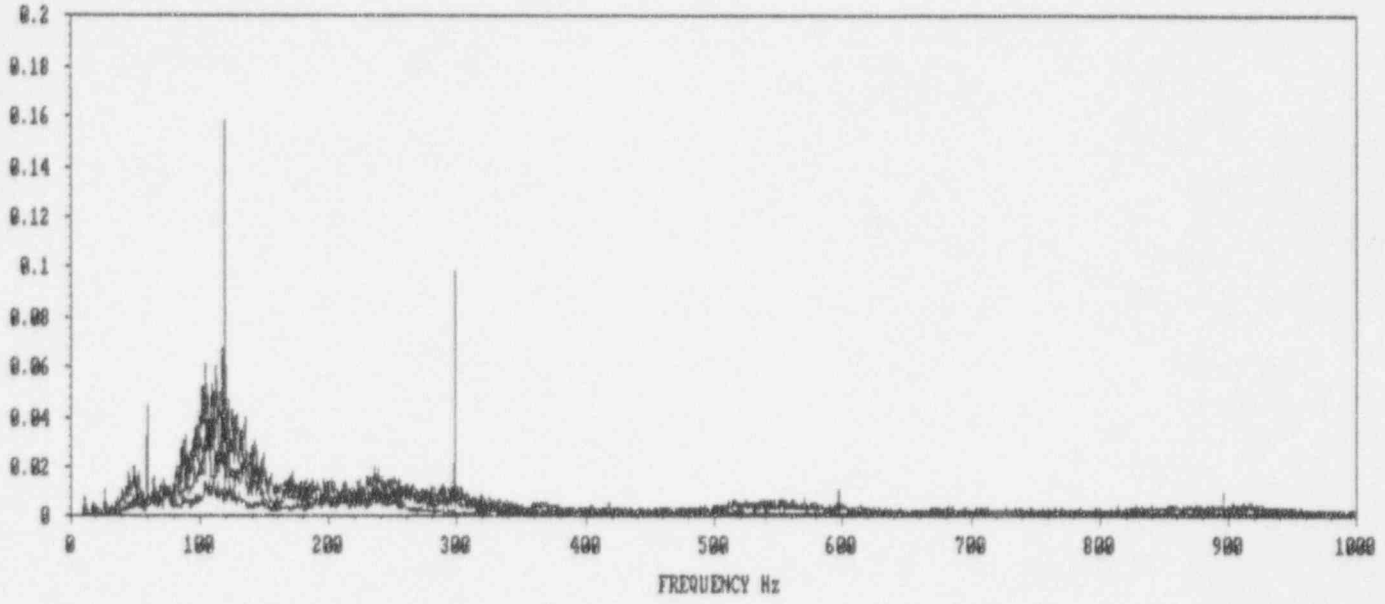
NO.	AMP.	FREQ.	ORDER	NO.	AMP.	FREQ.	ORDER
1.	0.0147	40.6	0.680	9.	0.0398	59.7	1.000
2.	0.0196	45.0	0.754	10.	0.0134	104.4	1.748
3.	0.0154	46.3	0.775	11.	0.0135	109.7	1.837
4.	0.0142	47.2	0.790	12.	0.0147	110.3	1.847
5.	0.0186	48.8	0.816	13.	0.0135	111.9	1.874
6.	0.0211	50.0	0.837	14.	0.0156	119.4	1.999
7.	0.0197	52.5	0.879	15.	0.0136	126.3	2.114
8.	0.0159	53.8	0.900	16.	0.0166	298.4	4.998

SPECTRAL ENERGY SUMMARY

OVERALL	SYNC	SUBSYNC	NONSYNC
0.1862	0.05191	0.08192	0.159

OVERLAY SPECTRAL PLOT

FREQ: 0.31



(A) SET: SI-1A COLD DESC: LPSI PUMP SI-1A
ID: SI-1A IB VERT. DESC: QUARTERLY TEST
DATE: 23-SEP-93 09:31:42 FULL SCALE: 0.2 IPS
FREQ. RNG: 0 - 1000 Hz FFT LINES: 3200 RPM: 3583

(B) SET: SI-1A COLD DESC: LPSI PUMP SI-1A
ID: SI-1A IB HORZ. DESC: QUARTERLY TEST
DATE: 23-SEP-93 09:26:41 FULL SCALE: 0.2 IPS
FREQ. RNG: 0 - 1000 Hz FFT LINES: 3200 RPM: 3583

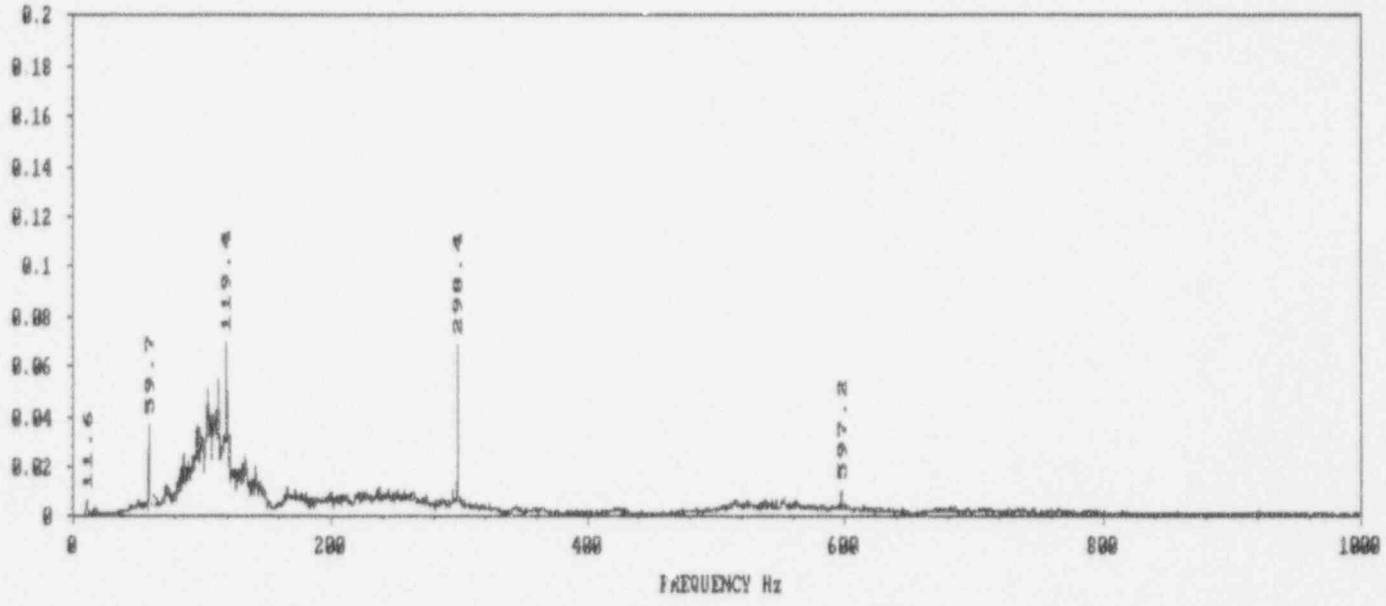
(C) SET: SI-1A COLD DESC: LPSI PUMP SI-1A
ID: SI-1A OB VERT. DESC: QUARTERLY TEST
DATE: 23-SEP-93 09:42:13 FULL SCALE: 0.2 IPS
FREQ. RNG: 0 - 1000 Hz FFT LINES: 3200 RPM: 3582

*** (D) SET: SI-1A COLD DESC: LPSI PUMP SI-1A
ID: SI-1A OB HORZ. DESC: QUARTERLY TEST
DATE: 23-SEP-93 09:36:55 FULL SCALE: 0.2 IPS
FREQ. RNG: 0 - 1000 Hz FFT LINES: 3200 RPM: 3582

SINGLE SPECTRUM PLOT

SET: SI-1A COLD TYPE: FFT DATE: 23-SEP-93 09:31:42
POINT ID: SI-1A IB VERT. DESC: QUARTERLY TEST
WINDOW: HANNING LINES: 3200 AVER: 10 FREQ: 0 - 1000 Hz
DETECT: PEAK RPM: 3583 THRESHOLD: 0.0322 UNITS: IPS

FREQ: 0.31 AMP: 0 ORDER: 0.005 DEG: ---



IDENTIFICATION OF SPECTRAL PEAKS ABOVE THRESHOLD

NO.	AMP.	FREQ.	ORDER	NO.	AMP.	FREQ.	ORDER
1.	0.0364	59.7	1.000	9.	0.0367	110.0	1.842
2.	0.0369	96.9	1.622	10.	0.0374	110.6	1.853
3.	0.0360	99.1	1.659	11.	0.0431	111.3	1.863
4.	0.0515	105.0	1.759	12.	0.0551	113.1	1.895
5.	0.0451	105.6	1.769	13.	0.0323	117.5	1.968
6.	0.0374	107.2	1.795	14.	0.0695	119.4	1.999
7.	0.0408	107.8	1.806	15.	0.0328	122.2	2.046
8.	0.0403	109.4	1.832	16.	0.0689	298.4	4.998

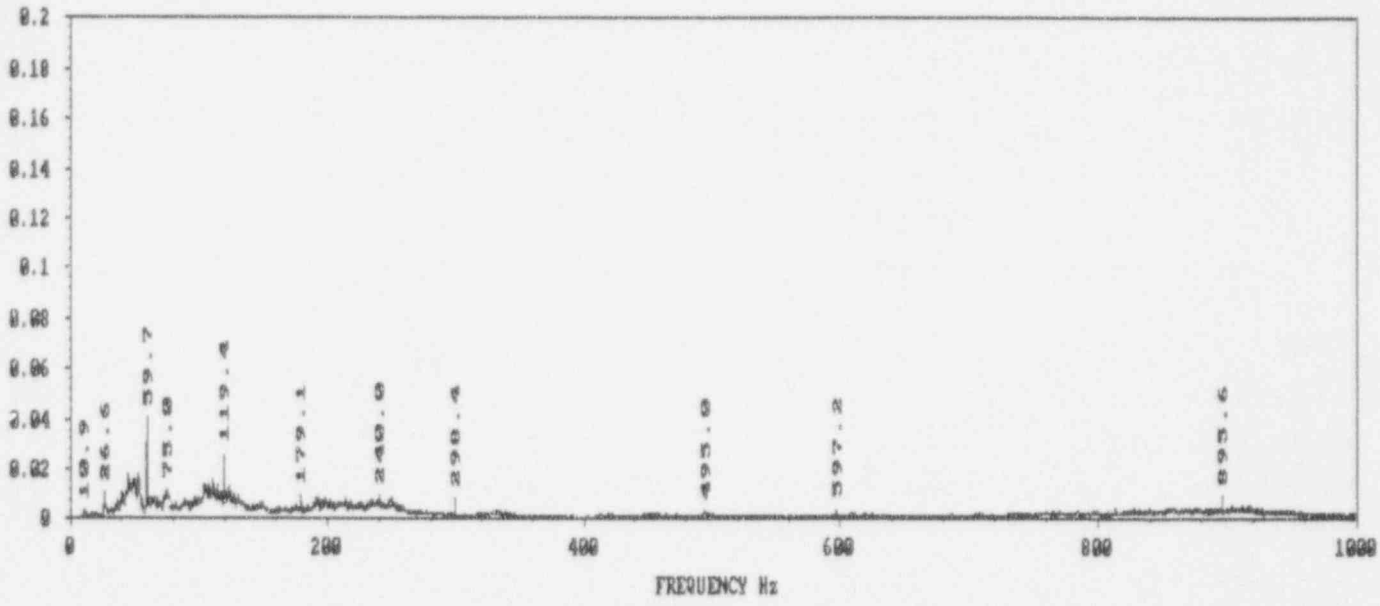
SPECTRAL ENERGY SUMMARY

OVERALL	SYNC	SUBSYNC	NONSYNC
0.3603	0.1167	0.03267	0.3393

SINGLE SPECTRUM PLOT

SET: SI-1A COLD TYPE: FFT DATE: 23-SEP-93 09:26:41
POINT ID: SI-1A IB HORZ. DESC: QUARTERLY TEST
WINDOW: HANNING LINES: 3200 AVER: 10 FREQ: 0 - 1000 Hz
DETECT: PEAK RPM: 3583 THRESHOLD: 0.0128 UNITS: IPS

FREQ: 0.31 AMP: 0 ORDER: 0.005 DEG: ---



IDENTIFICATION OF SPECTRAL PEAKS ABOVE THRESHOLD

NO.	AMP.	FREQ.	ORDER	NO.	AMP.	FREQ.	ORDER
1.	0.0180	45.3	0.759	9.	0.0139	103.4	1.732
2.	0.0130	47.5	0.795	10.	0.0134	104.4	1.748
3.	0.0162	48.8	0.816	11.	0.0134	105.3	1.764
4.	0.0158	49.4	0.827	12.	0.0139	107.2	1.795
5.	0.0153	50.0	0.837	13.	0.0160	110.3	1.847
6.	0.0184	52.5	0.879	14.	0.0141	114.4	1.915
7.	0.0159	54.1	0.905	15.	0.0259	119.4	1.999
8.	0.0411	59.7	1.000	16.	0.0129	123.1	2.062

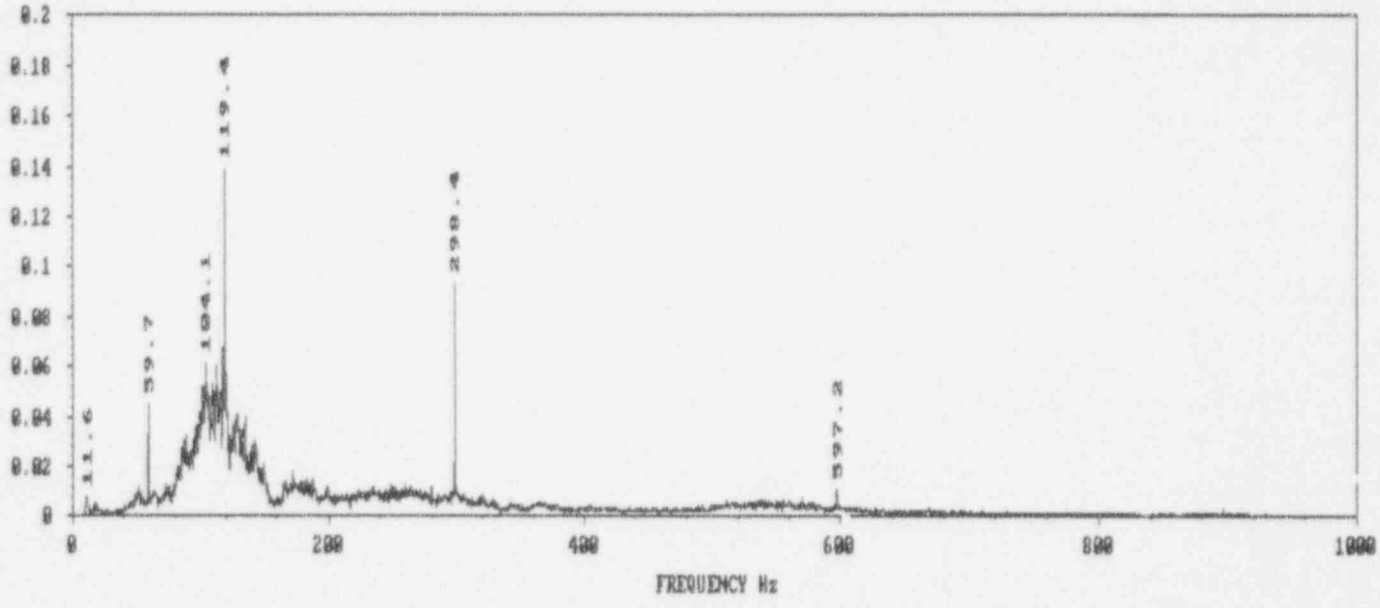
SPECTRAL ENERGY SUMMARY

OVERALL	SYNC	SUBSYNC	NONSYNC
0.1891	0.05522	0.07878	0.1627

SINGLE SPECTRUM PLOT

SET: SI-1A COLD TYPE: FFT DATE: 23-SEP-93 09:42:13
POINT ID: SI-1A OB VERT. DESC: QUARTERLY TEST
WINDOW: HANNING LINES: 3200 AVER: 10 FREQ: 0 - 1000 Hz
DETECT: PEAK RPM: 3582 THRESHOLD: 0.0443 UNITS: IPS

FREQ: 0.31 AMP: 0 ORDER: 0.005 DEG: ---



IDENTIFICATION OF SPECTRAL PEAKS ABOVE THRESHOLD

NO.	AMP.	FREQ.	ORDER	NO.	AMP.	FREQ.	ORDER
1.	0.0444	59.7	1.000	9.	0.0526	109.7	1.837
2.	0.0524	101.6	1.701	10.	0.0503	111.6	1.869
3.	0.0614	104.1	1.743	11.	0.0599	112.2	1.879
4.	0.0602	104.7	1.753	12.	0.0502	113.4	1.900
5.	0.0533	105.3	1.764	13.	0.0501	115.6	1.937
6.	0.0489	106.3	1.780	14.	0.0673	117.5	1.968
7.	0.0479	108.1	1.811	15.	0.1391	119.4	2.000
8.	0.0448	108.8	1.822	16.	0.0928	298.4	4.999

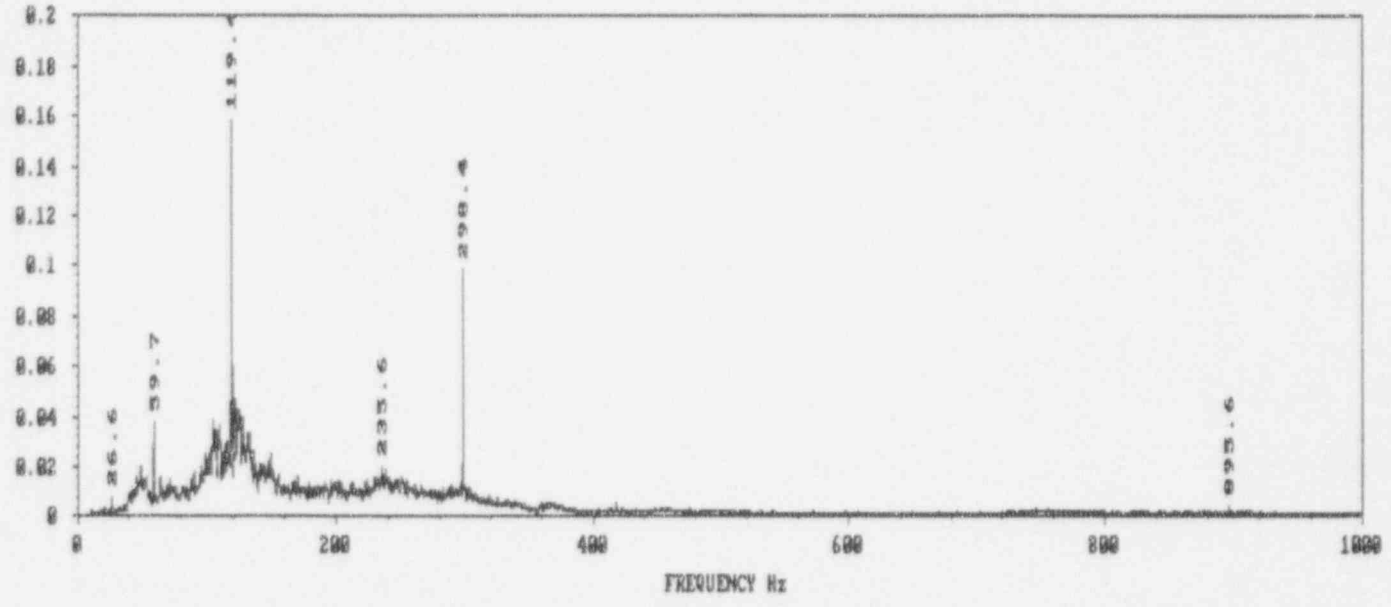
SPECTRAL ENERGY SUMMARY

OVERALL	SYNC	SUBSYNC	NONSYNC
0.4837	0.1769	0.04513	0.4479

SINGLE SPECTRUM PLOT

SET: SI-1A COLD TYPE: FFT DATE: 23-SEP-93 09:36:55
POINT ID: SI-1A OB HORZ. DESC: QUARTERLY TEST
WINDOW: HANNING LINES: 3200 AVER: 10 FREQ: 0 - 1000 Hz
DETECT: PEAK RPM: 3582 THRESHOLD: 0.0316 UNITS: IPS

FREQ: 0.31 AMP: 0 ORDER: 0.005 DEG: ---



IDENTIFICATION OF SPECTRAL PEAKS ABOVE THRESHOLD

NO.	AMP.	FREQ.	ORDER	NO.	AMP.	FREQ.	ORDER
1.	0.0378	59.7	1.000	9.	0.0427	124.7	2.088
2.	0.0388	105.6	1.769	10.	0.0429	125.6	2.104
3.	0.0316	106.6	1.785	11.	0.0394	126.9	2.125
4.	0.0349	108.8	1.822	12.	0.0406	128.1	2.146
5.	0.0316	109.4	1.832	13.	0.0334	131.3	2.198
6.	0.0266	110.3	1.848	14.	0.0333	131.9	2.209
7.	0.1583	119.4	2.000	15.	0.0336	133.4	2.235
8.	0.0471	122.5	2.052	16.	0.0985	298.4	4.999

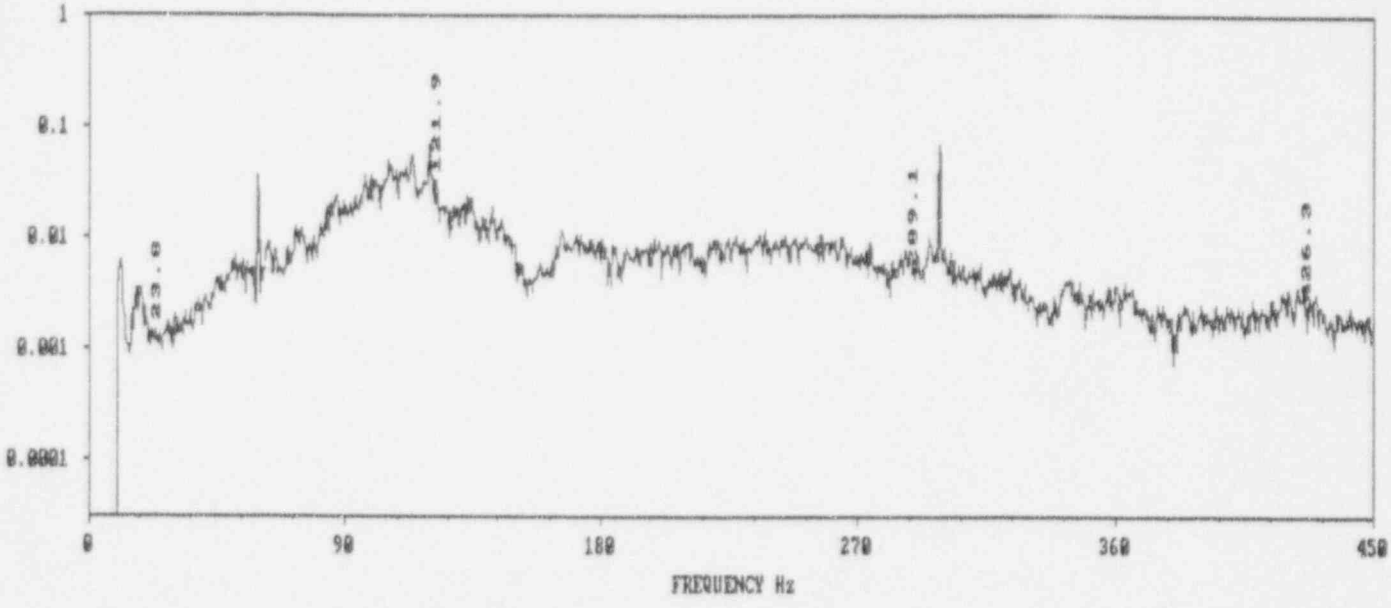
SPECTRAL ENERGY SUMMARY

OVERALL	SYNC	SUBSYNC	NONSYNC
0.4181	0.1952	0.07502	0.3621

SINGLE SPECTRUM PLOT

SET: SI-1A COLD TYPE: FFT DATE: 23-SEP-93 09:31:42
POINT ID: SI-1A IB VERT. DESC: QUARTERLY TEST
WINDOW: HANNING LINES: 3200 AVER: 10 FREQ: 0 - 1000 Hz
DETECT: PEAK RPM: 3583 THRESHOLD: 0.0000 UNITS: IPS

FREQ: 0.31 AMP: 0 ORDER: 0.005 DEG: ---



IDENTIFICATION OF SPECTRAL PEAKS ABOVE THRESHOLD

NO.	AMP.	FREQ.	ORDER	NO.	AMP.	FREQ.	ORDER
1.	0.0364	59.7	1.000	9.	0.0367	110.0	1.842
2.	0.0369	96.9	1.622	10.	0.0374	110.6	1.853
3.	0.0360	99.1	1.659	11.	0.0431	111.3	1.863
4.	0.0515	105.0	1.759	12.	0.0551	113.1	1.895
5.	0.0451	105.6	1.769	13.	0.0323	117.5	1.968
6.	0.0374	107.2	1.795	14.	0.0695	119.4	1.999
7.	0.0408	107.8	1.806	15.	0.0328	122.2	2.046
8.	0.0403	109.4	1.832	16.	0.0689	298.4	4.998

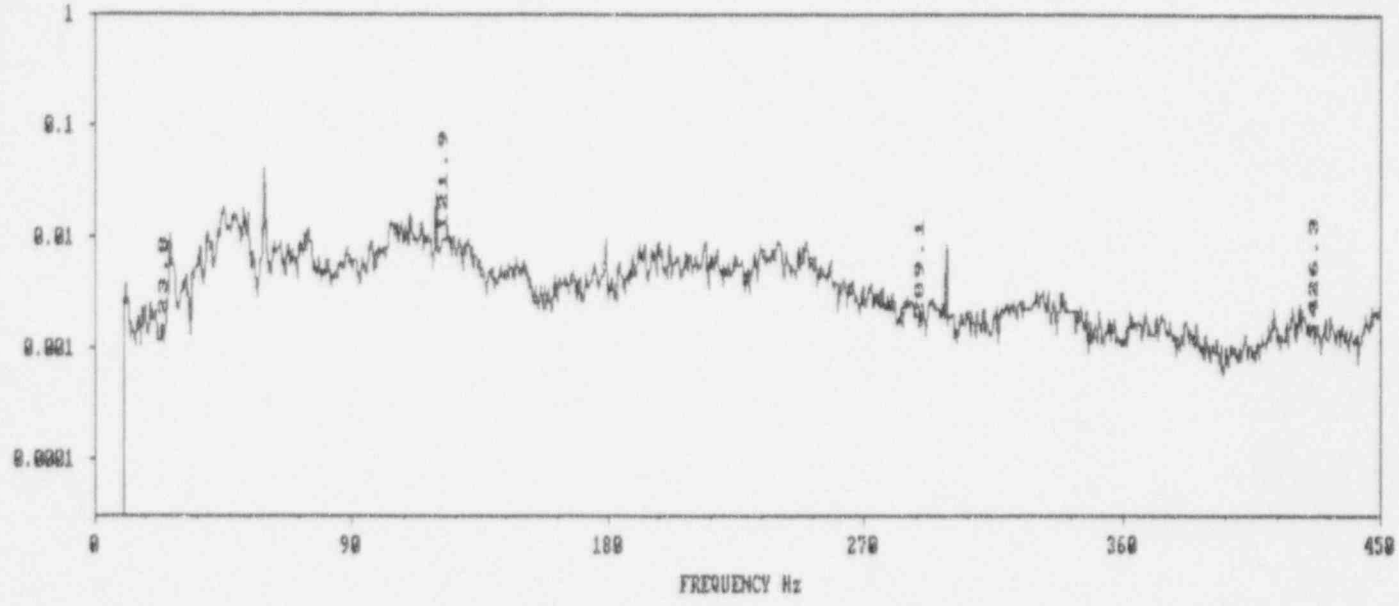
SPECTRAL ENERGY SUMMARY

OVERALL	SYNC	SUBSYNC	NONSYNC
0.3603	0.1167	0.03267	0.3393

SINGLE SPECTRUM PLOT

SET: SI-1A COLD TYPE: FFT DATE: 23-SEP-93 09:26:41
POINT ID: SI-1A IB HORZ. DESC: QUARTERLY TEST
WINDOW: HANNING LINES: 3200 AVER: 10 FREQ: 0 - 1000 Hz
DETECT: PEAK RPM: 3583 THRESHOLD: 0.0000 UNITS: IPS

FREQ: 0.31 AMP: 0 ORDER: 0.005 DEG: ---



IDENTIFICATION OF SPECTRAL PEAKS ABOVE THRESHOLD

NO.	AMP.	FREQ.	ORDER	NO.	AMP.	FREQ.	ORDER
1.	0.0180	45.3	0.759	9.	0.0139	103.4	1.732
2.	0.0130	47.5	0.795	10.	0.0134	104.4	1.748
3.	0.0162	48.8	0.816	11.	0.0134	105.3	1.764
4.	0.0158	49.4	0.827	12.	0.0139	107.2	1.795
5.	0.0153	50.0	0.837	13.	0.0160	110.3	1.847
6.	0.0184	52.5	0.879	14.	0.0141	114.4	1.915
7.	0.0159	54.1	0.905	15.	0.0259	119.4	1.999
8.	0.0411	59.7	1.000	16.	0.0129	123.1	2.062

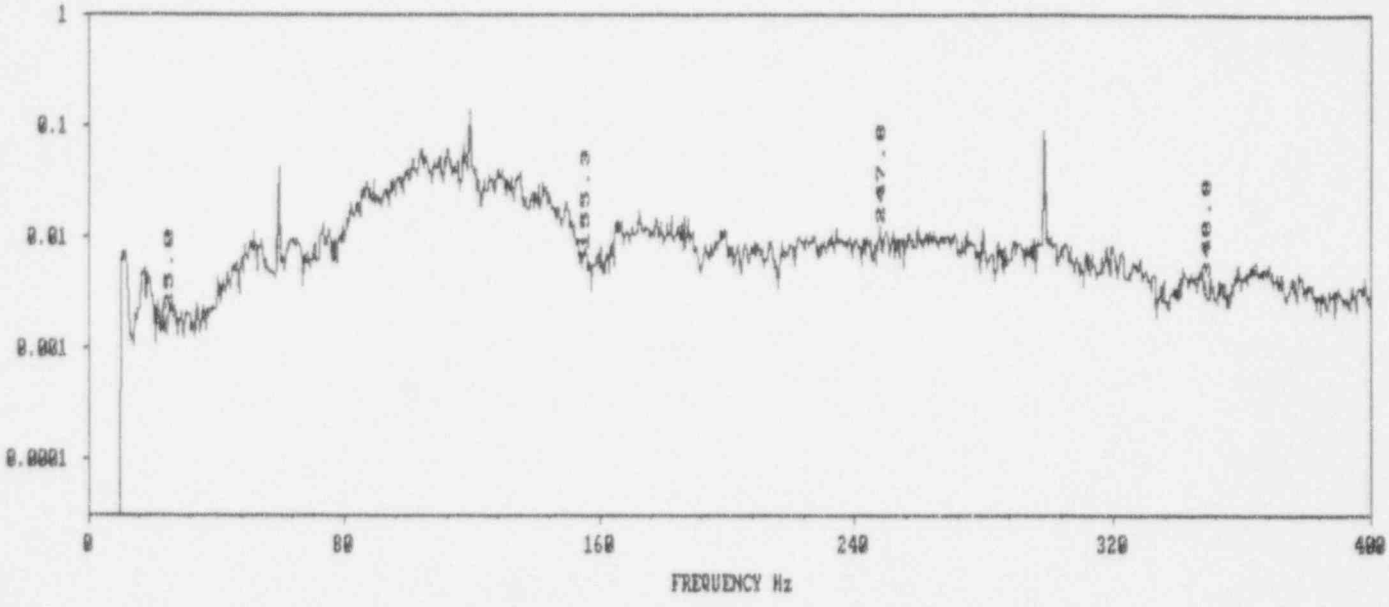
SPECTRAL ENERGY SUMMARY

OVERALL	SYNC	SUBSYNC	NONSYNC
0.1891	0.05522	0.07878	0.1627

SINGLE SPECTRUM PLOT

SET: SI-1A COLD TYPE: FFT DATE: 23-SEP-93 09:42:13
POINT ID: SI-1A OB VERT. DESC: QUARTERLY TEST
WINDOW: HANNING LINES: 3200 AVER: 10 FREQ: 0 - 1000 Hz
DETECT: PEAK RPM: 3582 THRESHOLD: 0.0000 UNITS: IPS

FREQ: 0.31 AMP: 0 ORDER: 0.005 DEG: ---



IDENTIFICATION OF SPECTRAL PEAKS ABOVE THRESHOLD

NO.	AMP.	FREQ.	ORDER	NO.	AMP.	FREQ.	ORDER
1.	0.0444	59.7	1.000	9.	0.0526	109.7	1.837
2.	0.0524	101.6	1.701	10.	0.0503	111.6	1.869
3.	0.0614	104.1	1.743	11.	0.0599	112.2	1.879
4.	0.0602	104.7	1.753	12.	0.0502	113.4	1.900
5.	0.0533	105.3	1.764	13.	0.0501	115.6	1.937
6.	0.0489	106.3	1.780	14.	0.0673	117.5	1.968
7.	0.0479	108.1	1.811	15.	0.1391	119.4	2.000
8.	0.0448	108.8	1.822	16.	0.0928	298.4	4.999

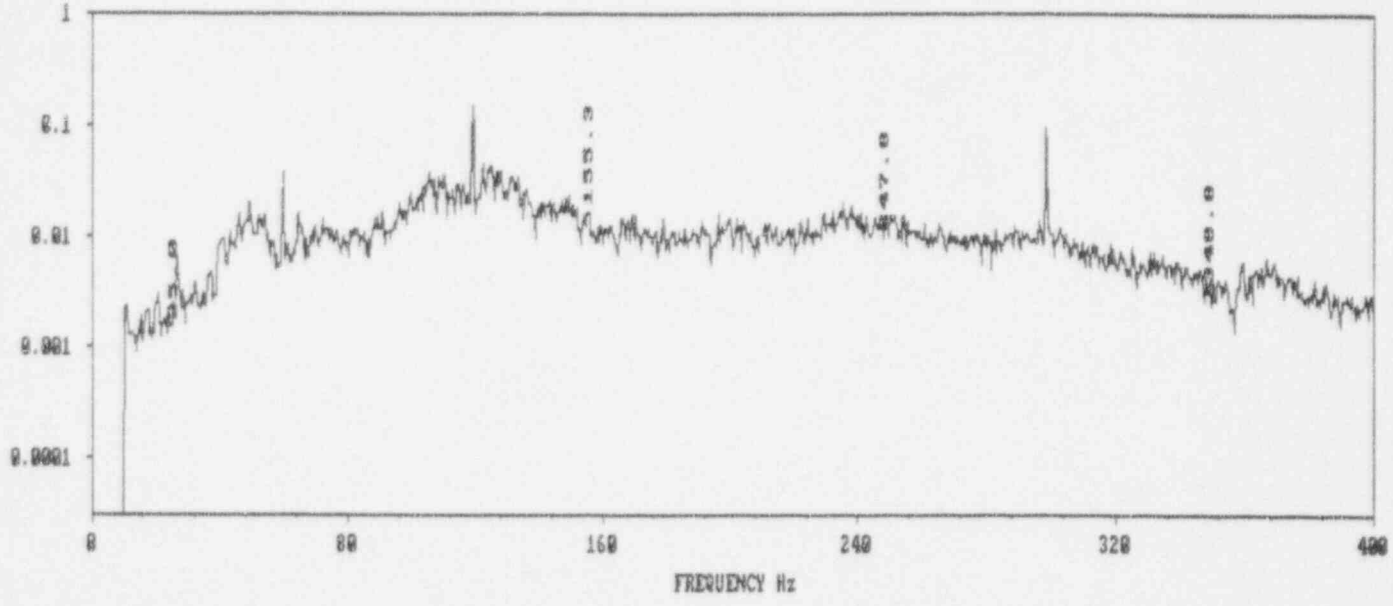
SPECTRAL ENERGY SUMMARY

OVERALL	SYNC	SUBSYNC	NONSYNC
0.4837	0.1769	0.04513	0.4479

SINGLE SPECTRUM PLOT

SET: SI-1A COLD TYPE: FFT DATE: 23-SEP-93 09:36:55
POINT ID: SI-1A OB HORZ. DESC: QUARTERLY TEST
WINDOW: HANNING LINES: 3200 AVER: 10 FREQ: 0 - 1000 Hz
DETECT: PEAK RPM: 3582 THRESHOLD: 0.0000 UNITS: IPS

FREQ: 0.31 AMP: 0 ORDER: 0.005 DEG: ---



IDENTIFICATION OF SPECTRAL PEAKS ABOVE THRESHOLD

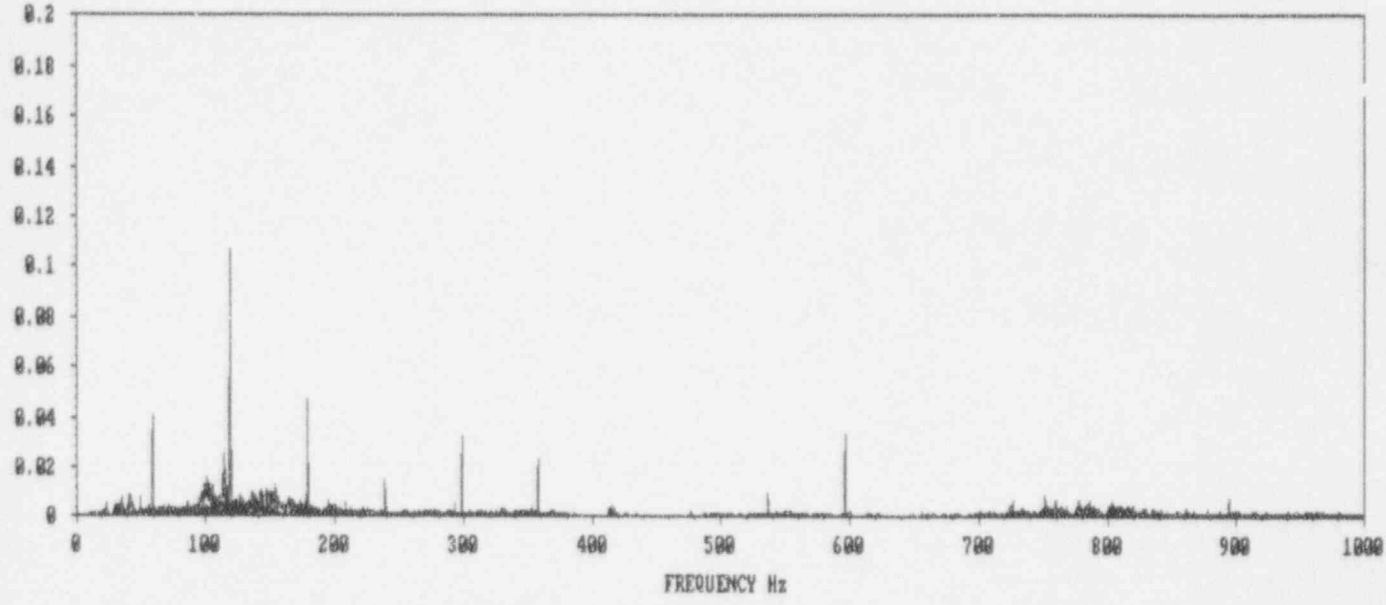
NO.	AMP.	FREQ.	ORDER	NO.	AMP.	FREQ.	ORDER
1.	0.0378	59.7	1.000	9.	0.0427	124.7	2.088
2.	0.0388	105.6	1.769	10.	0.0429	125.6	2.104
3.	0.0316	106.6	1.785	11.	0.0394	126.9	2.125
4.	0.0349	108.8	1.822	12.	0.0406	128.1	2.146
5.	0.0316	109.4	1.832	13.	0.0334	131.3	2.198
6.	0.0366	110.3	1.848	14.	0.0333	131.9	2.209
7.	0.1583	119.4	2.000	15.	0.0336	133.4	2.235
8.	0.0471	122.5	2.052	16.	0.0985	298.4	4.999

SPECTRAL ENERGY SUMMARY

OVERALL	SYNC	SUBSYNC	NONSYNC
0.4181	0.1952	0.07502	0.3621

OVERLAY SPECTRAL PLOT

FREQ: 0.31



(A) SET: SI-1A HOT
ID: SI-1A IB VERT.
DATE: 27-SEP-93 20:22:31
FREQ. RNG: 0 - 1000 Hz
DESC: LPSI PUMP SI-1A
DESC: SHUTDOWN COOLING FLOW (HOT)
FULL SCALE: 0.2 IPS
FFT LINES: 3200 RPM: 3577

(B) SET: SI-1A HOT
ID: SI-1A IB HORZ.
DATE: 27-SEP-93 20:19:45
FREQ. RNG: 0 - 1000 Hz
DESC: LPSI PUMP SI-1A
DESC: SHUTDOWN COOLING FLOW (HOT)
FULL SCALE: 0.2 IPS
FFT LINES: 3200 RPM: 3577

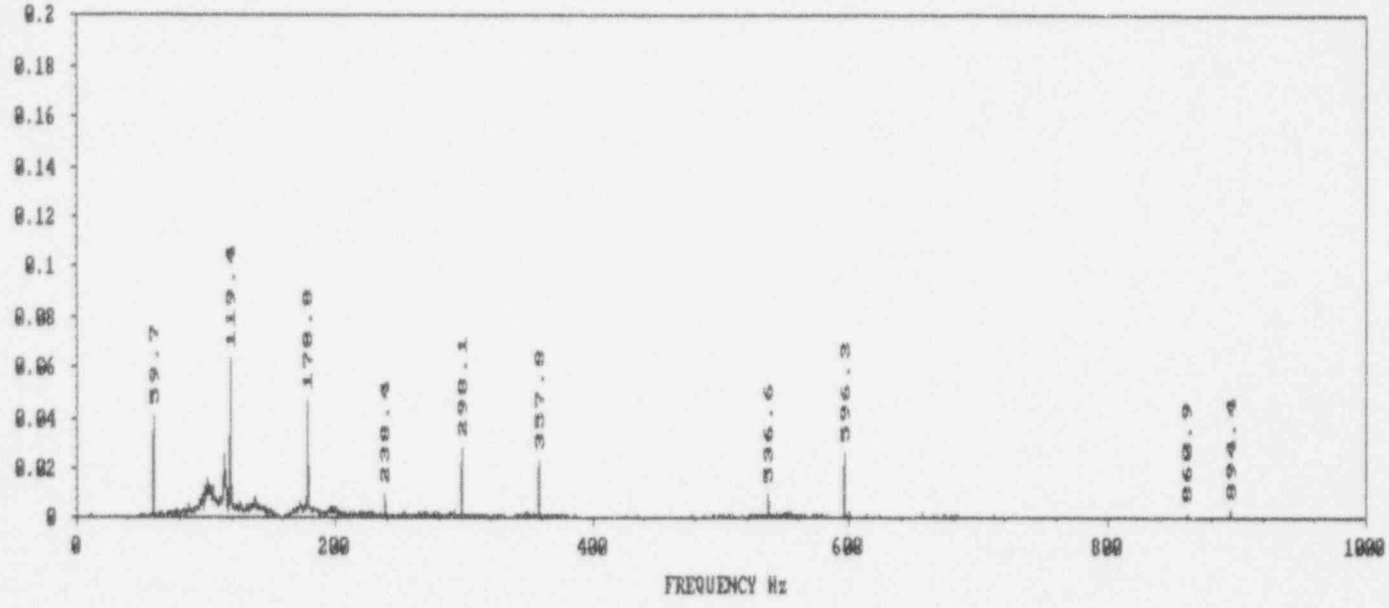
(C) SET: SI-1A HOT
ID: SI-1A OB VERT.
DATE: 27-SEP-93 20:27:22
FREQ. RNG: 0 - 1000 Hz
DESC: LPSI PUMP SI-1A
DESC: SHUTDOWN COOLING FLOW (HOT)
FULL SCALE: 0.2 IPS
FFT LINES: 3200 RPM: 3577

*** (D) SET: SI-1A HOT
ID: SI-1A OB HORZ.
DATE: 27-SEP-93 20:25:03
FREQ. RNG: 0 - 1000 Hz
DESC: LPSI PUMP SI-1A
DESC: SHUTDOWN COOLING FLOW (HOT)
FULL SCALE: 0.2 IPS
FFT LINES: 3200 RPM: 3578

SINGLE SPECTRUM PLOT

SET: SI-1A HOT TYPE: FFT DATE: 27-SEP-93 20:22:31
POINT ID: SI-1A IB VERT. DESC: SHUTDOWN COOLING FLOW (HOT)
WINDOW: HANNING LINES: 3200 AVER: 6 FREQ: 0 - 1000 Hz
DETECT: PEAK RPM: 3577 THRESHOLD: 0.0105 UNITS: IPS

FREQ: 0.31 AMP: 0 ORDER: 0.005 DEG: ---



IDENTIFICATION OF SPECTRAL PEAKS ABOVE THRESHOLD

NO.	AMP.	FREQ.	ORDER	NO.	AMP.	FREQ.	ORDER
1.	0.0409	59.7	1.001	9.	0.0157	113.4	1.903
2.	0.0110	97.8	1.641	10.	0.0249	114.4	1.918
3.	0.0132	99.7	1.672	11.	0.0187	115.3	1.934
4.	0.0106	100.6	1.688	12.	0.0629	119.4	2.002
5.	0.0157	101.6	1.703	13.	0.0464	178.8	2.998
6.	0.0126	102.8	1.724	14.	0.0280	298.1	5.000
7.	0.0128	103.4	1.735	15.	0.0231	357.8	6.001
8.	0.0127	105.9	1.777	16.	0.0266	596.3	10.000

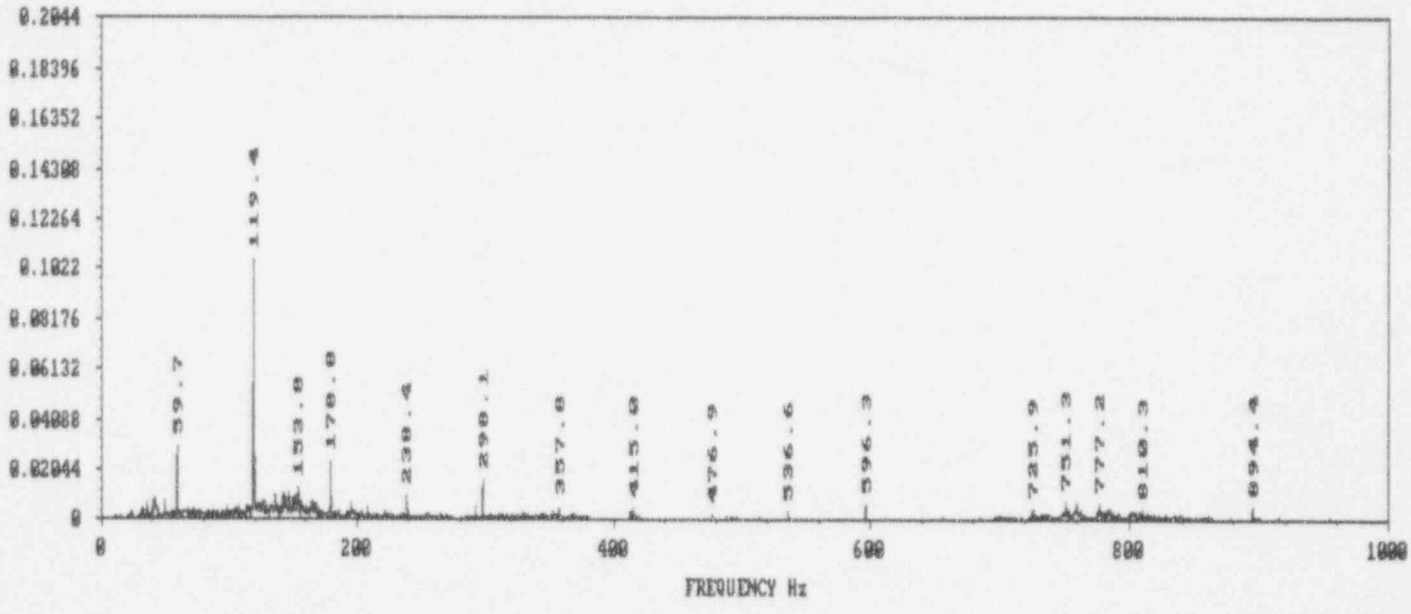
SPECTRAL ENERGY SUMMARY

OVERALL	SYNC	SUBSYNC	NONSYNC
0.1454	0.1058	0.007246	0.09939

SINGLE SPECTRUM PLOT

SET: SI-1A HOT TYPE: FFT DATE: 27-SEP-93 20:19:45
POINT ID: SI-1A IB HORZ. DESC: SHUTDOWN COOLING FLOW (HOT)
WINDOW: HANNING LINES: 3200 AVER: 2 FREQ: 0 - 1000 Hz
DETECT: PEAK RPM: 3577 THRESHOLD: 0.0083 UNITS: IPS

FREQ: 0.31 AMP: 0 ORDER: 0.005 DEG: ---



IDENTIFICATION OF SPECTRAL PEAKS ABOVE THRESHOLD

NO.	AMP.	FREQ.	ORDER	NO.	AMP.	FREQ.	ORDER
1.	0.0088	41.6	0.697	9.	0.0093	150.0	2.516
2.	0.0303	59.7	1.001	10.	0.0100	151.6	2.542
3.	0.1063	119.4	2.002	11.	0.0133	153.8	2.579
4.	0.0101	135.9	2.280	12.	0.0106	154.7	2.595
5.	0.0111	142.2	2.385	13.	0.0240	178.8	2.998
6.	0.0097	143.4	2.406	14.	0.0095	238.4	3.999
7.	0.0092	144.7	2.427	15.	0.0161	298.1	5.001
8.	0.0112	146.9	2.464	16.	0.0084	751.3	12.601

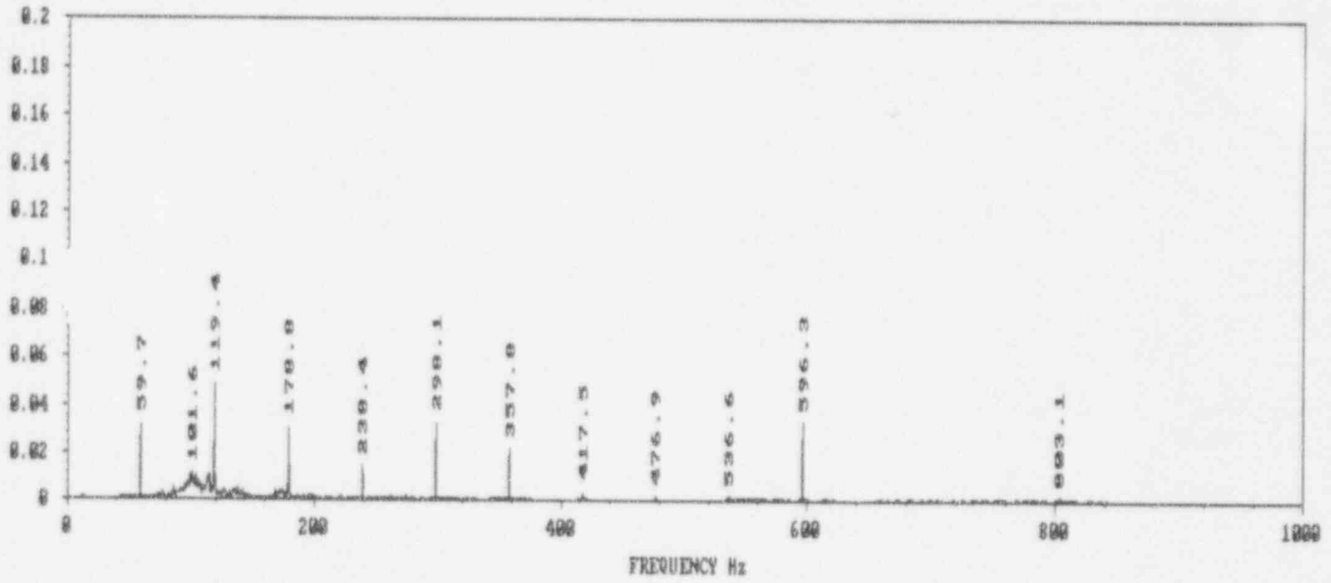
SPECTRAL ENERGY SUMMARY

OVERALL	SYNC	SUBSYNC	NONSYNC
0.1619	0.1284	0.029	0.09423

SINGLE SPECTRUM PLOT

SET: SI-1A HOT TYPE: FFT DATE: 27-SEP-93 20:27:22
POINT ID: SI-1A OB VERT. DESC: SHUTDOWN COOLING FLOW (HOT)
WINDOW: HANNING LINES: 3200 AVER: 5 FREQ: 0 - 1000 Hz
DETECT: PEAK RPM: 3577 THRESHOLD: 0.0078 UNITS: IPS

FREQ: 0.31 AMP: 0 ORDER: 0.005 DEG: ---



IDENTIFICATION OF SPECTRAL PEAKS ABOVE THRESHOLD

NO.	AMP.	FREQ.	ORDER	NO.	AMP.	FREQ.	ORDER
1.	0.0320	59.7	1.001	9.	0.0110	115.0	1.929
2.	0.0107	99.1	1.662	10.	0.0493	119.4	2.002
3.	[illegible]0099	100.6	1.688	11.	0.0314	178.8	2.998
4.	[illegible]0116	101.6	1.703	12.	0.0148	238.4	3.999
5.	[illegible]0106	103.8	1.740	13.	0.0332	298.1	5.000
6.	0.0084	106.6	1.787	14.	0.0224	357.8	6.001
7.	0.0078	107.2	1.798	15.	0.0337	596.3	10.001
8.	0.0102	113.4	1.903				

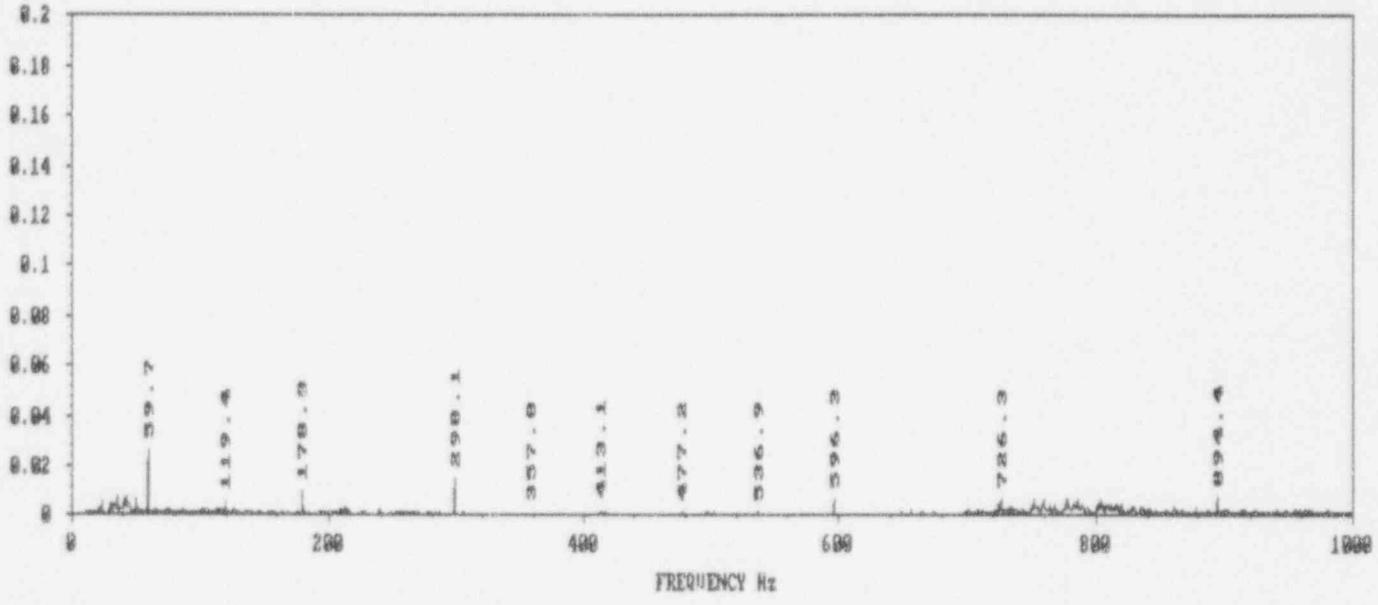
SPECTRAL ENERGY SUMMARY

OVERALL	SYNC	SUBSYNC	NONSYNC
0.1181	0.0912	0.008793	0.07456

SINGLE SPECTRUM PLOT

SET: SI-1A HOT TYPE: FFT DATE: 27-SEP-93 20:25:03
POINT ID: SI-1A OB HORZ. DESC: SHUTDOWN COOLING FLOW (HOT)
WINDOW: HANNING LINES: 3200 AVER: 5 FREQ: 0 - 1000 Hz
DETECT: PEAK RPM: 3578 THRESHOLD: 0.0060 UNITS: IPS

FREQ: 0.31 AMP: 0 ORDER: 0.005 DEG: ---



IDENTIFICATION OF SPECTRAL PEAKS ABOVE THRESHOLD

NO.	AMP.	FREQ.	ORDER	NO.	AMP.	FREQ.	ORDER
1.	0.0075	35.3	0.592	9.	0.0072	726.3	12.178
2.	0.0071	40.9	0.686	10.	0.0070	752.2	12.613
3.	0.0082	42.8	0.718	11.	0.0070	760.0	12.744
4.	0.0069	50.0	0.838	12.	0.0071	777.2	13.033
5.	0.0264	59.7	1.001	13.	0.0060	783.8	13.143
6.	0.0097	178.8	2.997	14.	0.0066	785.9	13.179
7.	0.0152	298.1	4.999	15.	0.0070	803.1	13.468
8.	0.0064	596.3	9.998	16.	0.0079	894.4	14.998

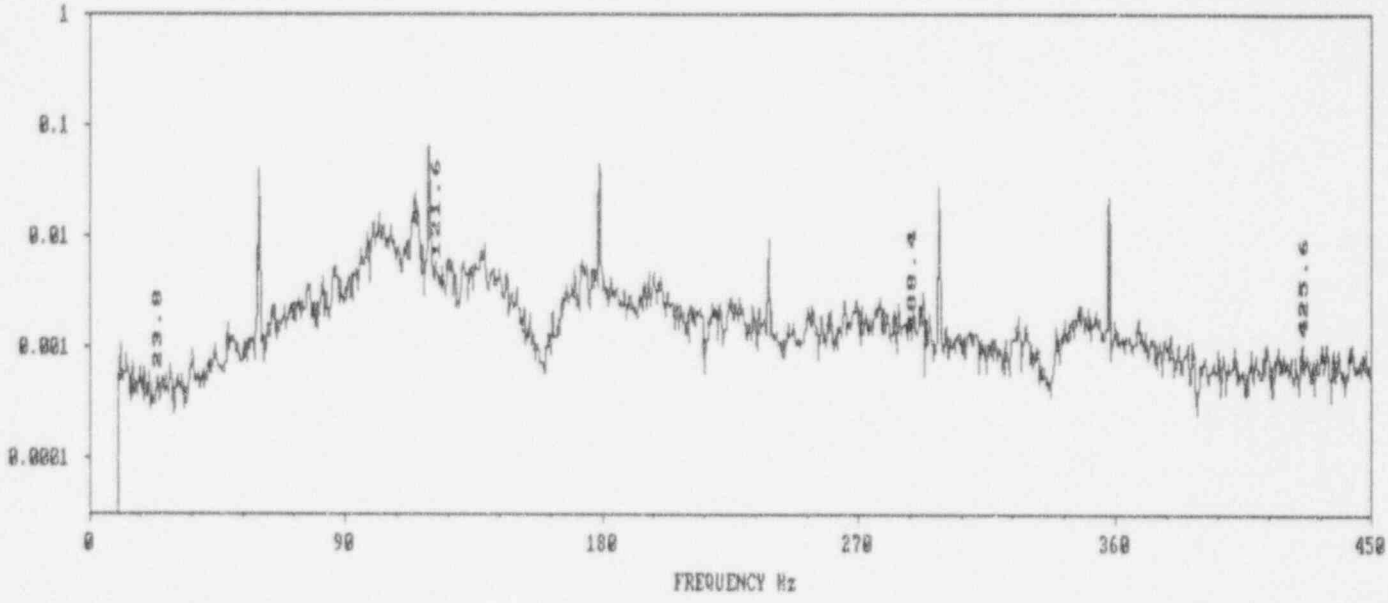
SPECTRAL ENERGY SUMMARY

OVERALL	SYNC	SUBSYNC	NONSYNC
0.08218	0.03665	0.03127	0.06657

SINGLE SPECTRUM PLOT

SET: SI-1A HOT TYPE: FFT DATE: 27-SEP-93 20:22:31
POINT ID: SI-1A IB VERT. DESC: SHUTDOWN COOLING FLOW (HOT)
WINDOW: HANNING LINES: 3200 AVER: 6 FREQ: 0 - 1000 Hz
DETECT: PEAK RPM: 3577 THRESHOLD: 0.0000 UNITS: IPS

FREQ: 0.31 AMP: 0 ORDER: 0.005 DEG: ---



IDENTIFICATION OF SPECTRAL PEAKS ABOVE THRESHOLD

NO.	AMP.	FREQ.	ORDER	NO.	AMP.	FREQ.	ORDER
1.	0.0409	59.7	1.001	9.	0.0127	105.9	1.777
2.	0.0110	97.8	1.641	10.	0.0157	113.4	1.903
3.	0.0132	99.7	1.672	11.	0.0249	114.4	1.918
4.	0.0106	100.6	1.688	12.	0.0187	115.3	1.934
5.	0.0157	101.6	1.703	13.	0.0629	119.4	2.002
6.	0.0126	102.8	1.724	14.	0.0464	178.8	2.998
7.	0.0128	103.4	1.735	15.	0.0280	298.1	5.000
8.	0.0098	104.4	1.751	16.	0.0231	357.8	6.001

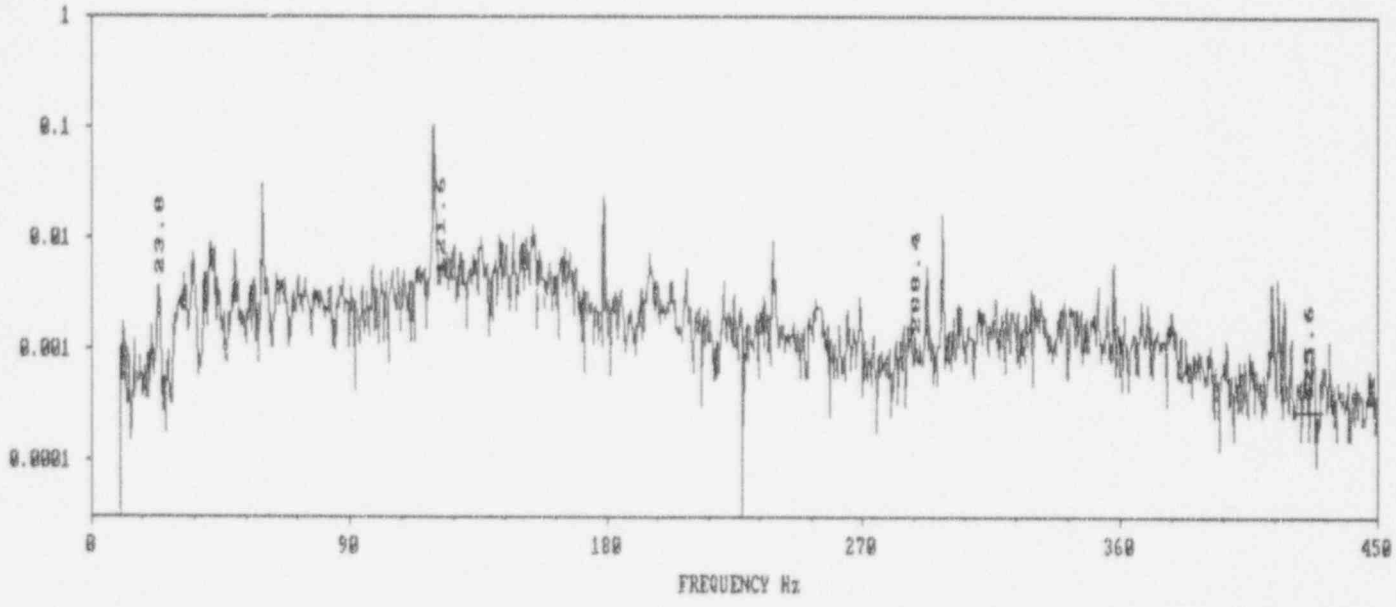
SPECTRAL ENERGY SUMMARY

OVERALL	SYNC	SUBSYNC	NONSYNC
0.1454	0.1058	0.007246	0.09939

SINGLE SPECTRUM PLOT

SET: SI-1A HOT TYPE: FFT DATE: 27-SEP-93 20:19:45
POINT ID: SI-1A IB HORZ. DESC: SHUTDOWN COOLING FLOW (HOT)
WINDOW: HANNING LINES: 3200 AVER: 2 FREQ: 0 - 1000 Hz
DETECT: PEAK RPM: 3577 THRESHOLD: 0.0000 UNITS: IPS

FREQ: 425.63 AMP: 0.0002 ORDER: 7.139 DEG: ---



IDENTIFICATION OF SPECTRAL PEAKS ABOVE THRESHOLD

NO.	AMP.	FREQ.	ORDER	NO.	AMP.	FREQ.	ORDER
1.	0.0088	41.6	0.697	9.	0.0112	146.9	2.464
2.	0.0303	59.7	1.001	10.	0.0093	150.0	2.516
3.	0.1063	119.4	2.002	11.	0.0100	151.6	2.542
4.	0.0083	126.6	2.123	12.	0.0133	153.8	2.579
5.	0.0101	135.9	2.280	13.	0.0106	154.7	2.595
6.	0.0111	142.2	2.385	14.	0.0240	178.8	2.998
7.	0.0097	143.4	2.406	15.	0.0095	238.4	3.999
8.	0.0092	144.7	2.427	16.	0.0161	298.1	5.001

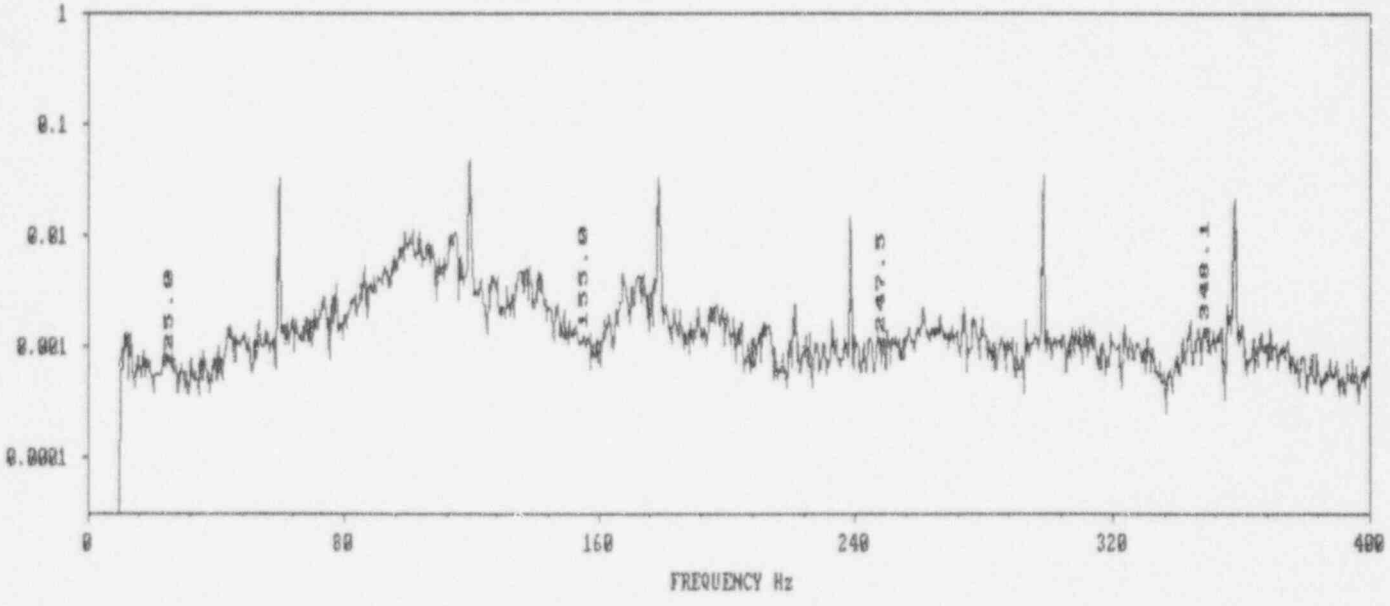
SPECTRAL ENERGY SUMMARY

OVERALL	SYNC	SUBSYNC	NONSYNC
0.1619	0.1284	0.029	0.09423

SINGLE SPECTRUM PLOT

SET: SI-1A HOT TYPE: FFT DATE: 27-SEP-93 20:27:22
POINT ID: SI-1A OB VERT. DESC: SHUTDOWN COOLING FLOW (HOT)
WINDOW: HANNING LINES: 3200 AVER: 5 FREQ: 0 - 1000 Hz
DETECT: PEAK RPM: 3577 THRESHOLD: 0.0000 UNITS: IPS

FREQ: 0.31 AMP: 0 ORDER: 0.005 DEG: ---



IDENTIFICATION OF SPECTRAL PEAKS ABOVE THRESHOLD

NO.	AMP.	FREQ.	ORDER	NO.	AMP.	FREQ.	ORDER
1.	0.0320	59.7	1.001	9.	0.0078	107.8	1.808
2.	0.0077	98.4	1.651	10.	0.0102	113.4	1.903
3.	0.0107	99.1	1.662	11.	0.0110	115.0	1.929
4.	0.0099	100.6	1.688	12.	0.0493	119.4	2.002
5.	0.0116	101.6	1.703	13.	0.0314	178.8	2.998
6.	0.0106	103.8	1.740	14.	0.0148	238.4	3.999
7.	0.0084	106.6	1.787	15.	0.0332	298.1	5.000
8.	0.0078	107.2	1.798	16.	0.0224	357.8	6.001

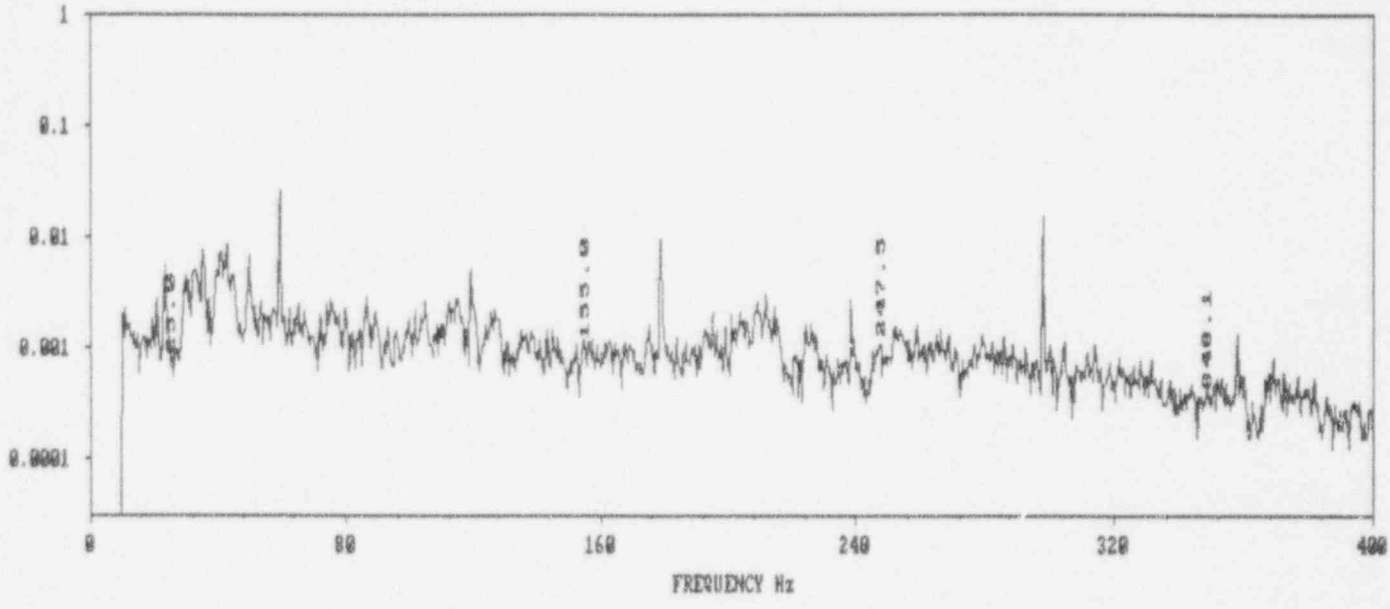
SPECTRAL ENERGY SUMMARY

OVERALL	SYNC	SUBSYNC	NONSYNC
0.1181	0.0912	0.008793	0.07456

SINGLE SPECTRUM PLOT

SET: SI-1A HOT TYPE: FFT DATE: 27-SEP-93 20:25:03
POINT ID: SI-1A OB HORZ. DESC: SHUTDOWN COOLING FLOW (HOT)
WINDOW: HANNING LINES: 3200 AVER: 5 FREQ: 0 - 1000 Hz
DETECT: PEAK RPM: 3578 THRESHOLD: 0.0000 UNITS: IPS

FREQ: 0.31 AMP: 0 ORDER: 0.005 DEG: ---



IDENTIFICATION OF SPECTRAL PEAKS ABOVE THRESHOLD

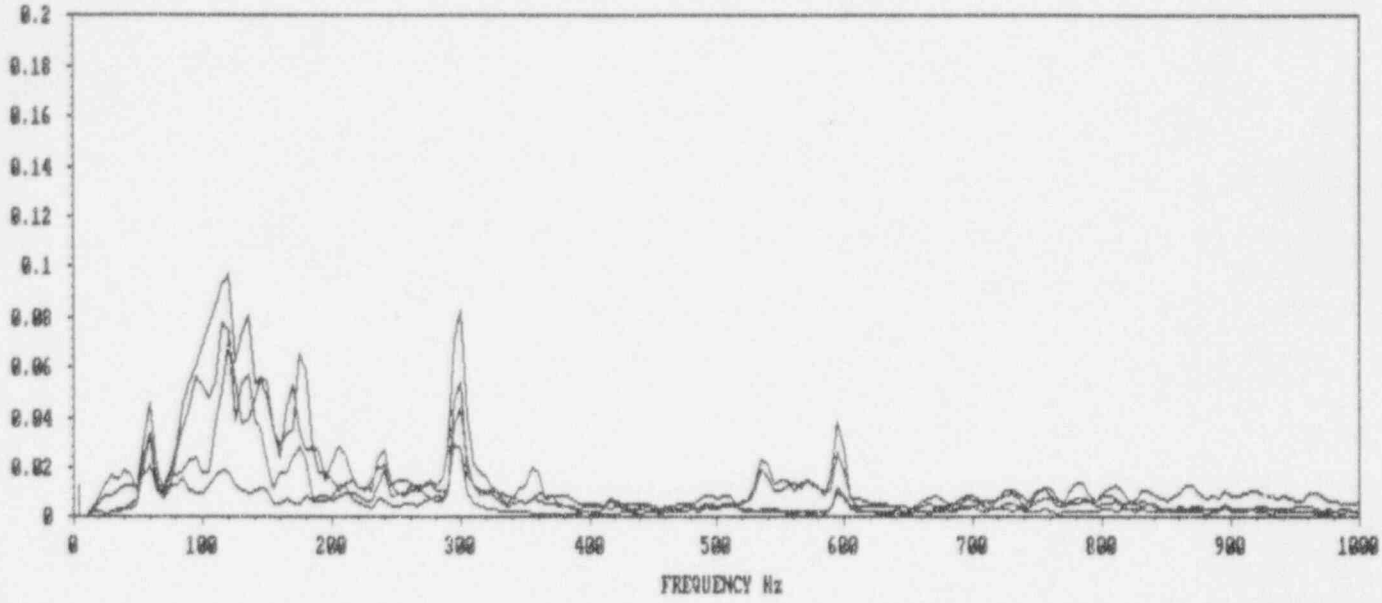
NO.	AMP.	FREQ.	ORDER	NO.	AMP.	FREQ.	ORDER
1.	0.0059	23.8	0.398	9.	0.0059	42.2	0.707
2.	0.0045	30.0	0.503	10.	0.0082	42.8	0.718
3.	0.0040	30.9	0.519	11.	0.0048	45.3	0.760
4.	0.0052	32.8	0.550	12.	0.0069	50.0	0.838
5.	0.0045	33.8	0.566	13.	0.0264	59.7	1.001
6.	0.0075	35.3	0.592	14.	0.0056	119.4	2.002
7.	0.0051	39.7	0.666	15.	0.0097	178.8	2.997
8.	0.0071	40.9	0.686	16.	0.0152	298.1	4.999

SPECTRAL ENERGY SUMMARY

OVERALL	SYNC	SUBSYNC	NONSYNC
0.08218	0.03665	0.03127	0.06657

OVERLAY SPECTRAL PLOT

FREQ: 5.00



(A) SET: SI-1A MILS/IPS DESC: LPSI PUMP SI-1A
ID: SI-1A IB V IPS DESC: SHUTDOWN COOLING FLOW (COLD)
DATE: 01-OCT-93 10:50:35 FULL SCALE: 0.2 IPS
FREQ. RNG: 0 - 2000 Hz FFT LINES: 400 RPM: 3577

(B) SET: SI-1A MILS/IPS DESC: LPSI PUMP SI-1A
ID: SI-1A IB H IPS DESC: SHUTDOWN COOLING FLOW (COLD)
DATE: 01-OCT-93 10:49:20 FULL SCALE: 0.2 IPS
FREQ. RNG: 0 - 2000 Hz FFT LINES: 400 RPM: 3577

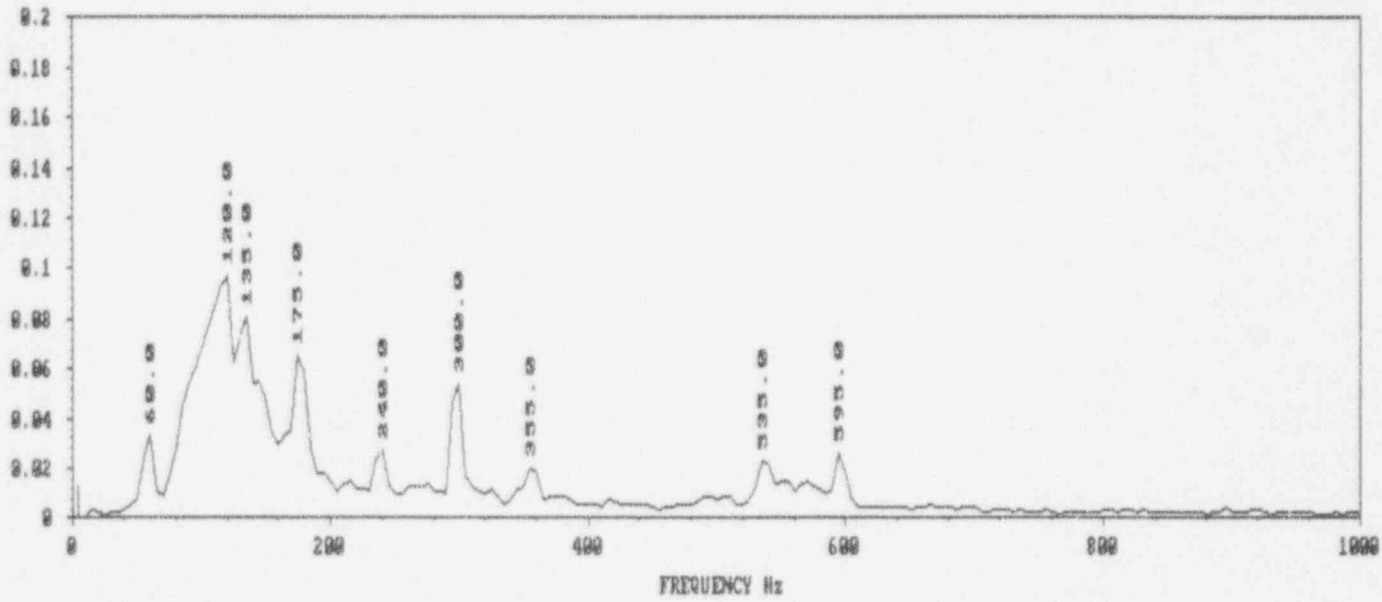
(C) SET: SI-1A MILS/IPS DESC: LPSI PUMP SI-1A
ID: SI-1A OB V IPS DESC: SHUTDOWN COOLING FLOW (COLD)
DATE: 01-OCT-93 10:53:24 FULL SCALE: 0.2 IPS
FREQ. RNG: 0 - 2000 Hz FFT LINES: 400 RPM: 3577

*** (D) SET: SI-1A MILS/IPS DESC: LPSI PUMP SI-1A
ID: SI-1A OB H IPS DESC: SHUTDOWN COOLING FLOW (COLD)
DATE: 01-OCT-93 10:51:47 FULL SCALE: 0.2 IPS
FREQ. RNG: 0 - 2000 Hz FFT LINES: 400 RPM: 3577

SINGLE SPECTRUM PLOT

SET: SI-1A MILS/IPS TYPE: FFT DATE: 01-OCT-93 10:50:35
POINT ID: SI-1A IB V IPS DESC: SHUTDOWN COOLING FLOW (COLD)
WINDOW: HANNING LINES: 400 AVER: 15 FREQ: 0 - 2000 Hz
DETECT: PEAK RPM: 3577 THRESHOLD: 0.0128 UNITS: IPS

FREQ: 5.00 AMP: 0 ORDER: 0.084 DEG: ---



IDENTIFICATION OF SPECTRAL PEAKS ABOVE THRESHOLD

NO.	AMP.	FREQ.	ORDER	NO.	AMP.	FREQ.	ORDER
1.	0.0334	60.0	1.006	9.	0.0129	260.0	4.361
2.	0.0976	120.0	2.013	10.	0.0139	275.0	4.613
3.	0.0808	135.0	2.264	11.	0.0544	300.0	5.032
4.	0.0551	145.0	2.432	12.	0.0202	355.0	5.954
5.	0.0655	175.0	2.935	13.	0.0230	535.0	8.974
6.	0.0185	195.0	3.271	14.	0.0151	555.0	9.309
7.	0.0148	215.0	3.606	15.	0.0147	570.0	9.561
8.	0.0276	240.0	4.026	16.	0.0260	595.0	9.980

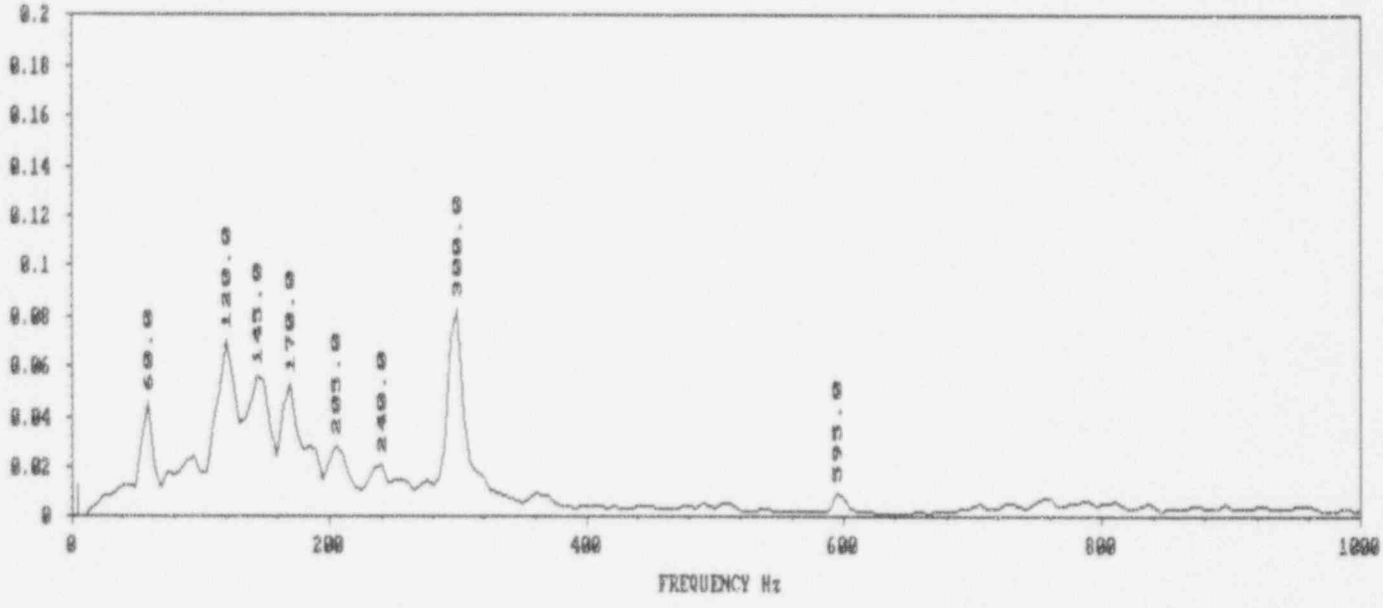
SPECTRAL ENERGY SUMMARY

OVERALL	SYNC	SUBSYNC	NONSYNC
0.2634	0.1699	0.007317	0.2011

SINGLE SPECTRUM PLOT

SET: SI-1A MILS/IPS TYPE: FFT DATE: 01-OCT-93 10:49:20
POINT ID: SI-1A IB H IPS DESC: SHUTDOWN COOLING FLOW (COLD)
WINDOW: HANNING LINES: 400 AVER: 15 FREQ: 0 - 2000 Hz
DETECT: PEAK RPM: 3577 THRESHOLD: 0.0076 UNITS: IPS

FREQ: 5.00 AMP: 0 ORDER: 0.084 DEG: ---



IDENTIFICATION OF SPECTRAL PEAKS ABOVE THRESHOLD

NO.	AMP.	FREQ.	ORDER	NO.	AMP.	FREQ.	ORDER
1.	0.0128	40.0	0.671	9.	0.0284	205.0	3.438
2.	0.0462	60.0	1.006	10.	0.0213	240.0	4.025
3.	0.0176	75.0	1.258	11.	0.0153	255.0	4.277
4.	0.0243	95.0	1.593	12.	0.0147	275.0	4.612
5.	0.0704	120.0	2.013	13.	0.0828	300.0	5.032
6.	0.0564	145.0	2.432	14.	0.0097	360.0	6.038
7.	0.0531	170.0	2.851	15.	0.0099	595.0	9.979
8.	0.0287	185.0	3.103	16.	0.0077	760.0	12.747

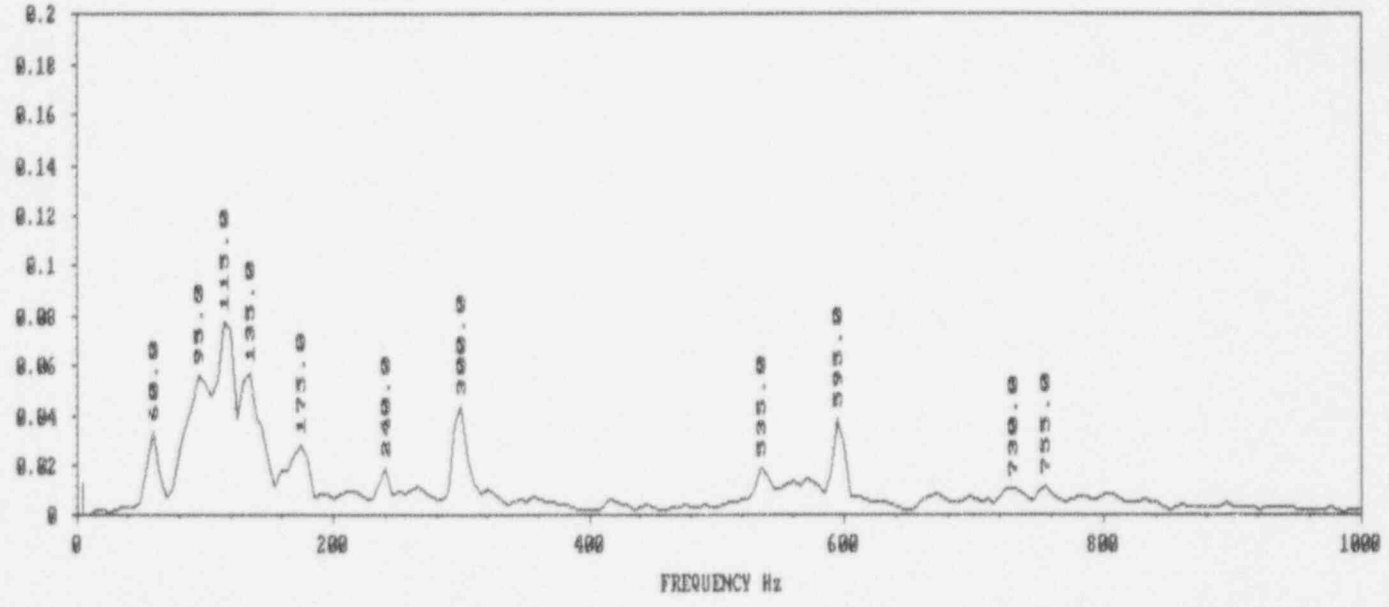
SPECTRAL ENERGY SUMMARY

OVERALL	SYNC	SUBSYNC	NONSYNC
0.209	0.1471	0.02063	0.1469

SINGLE SPECTRUM PLOT

SET: SI-1A MILS/IPS TYPE: FFT DATE: 01-0 93 10:53:24
POINT ID: SI-1A OB V IPS DESC: SHUTDOWN COOLING P (COLD)
WINDOW: HANNING LINES: 400 AVER: 15 FREQ: 0 - Hz
DETECT: PEAK RPM: 3577 THRESHOLD: 0.0123 UNI IPS

FREQ: 5.00 AMP: 0 ORDER: 0.084 DEG: ---



IDENTIFICATION OF SPECTRAL PEAKS ABOVE THRESHOLD

NO.	AMP.	FREQ.	ORDER	NO.	AMP.	FREQ.	ORDER
1.	0.0331	60.0	1.006	9.	0.0434	300.0	5.032
2.	0.0562	95.0	1.594	10.	0.0187	535.0	8.974
3.	0.0778	115.0	1.929	11.	0.0143	560.0	9.393
4.	0.0570	135.0	2.264	12.	0.0148	570.0	9.561
5.	0.0180	160.0	2.684	13.	0.0390	595.0	9.980
6.	0.0285	175.0	2.935				
7.	0.0189	240.0	4.026				
8.	0.0123	265.0	4.445				

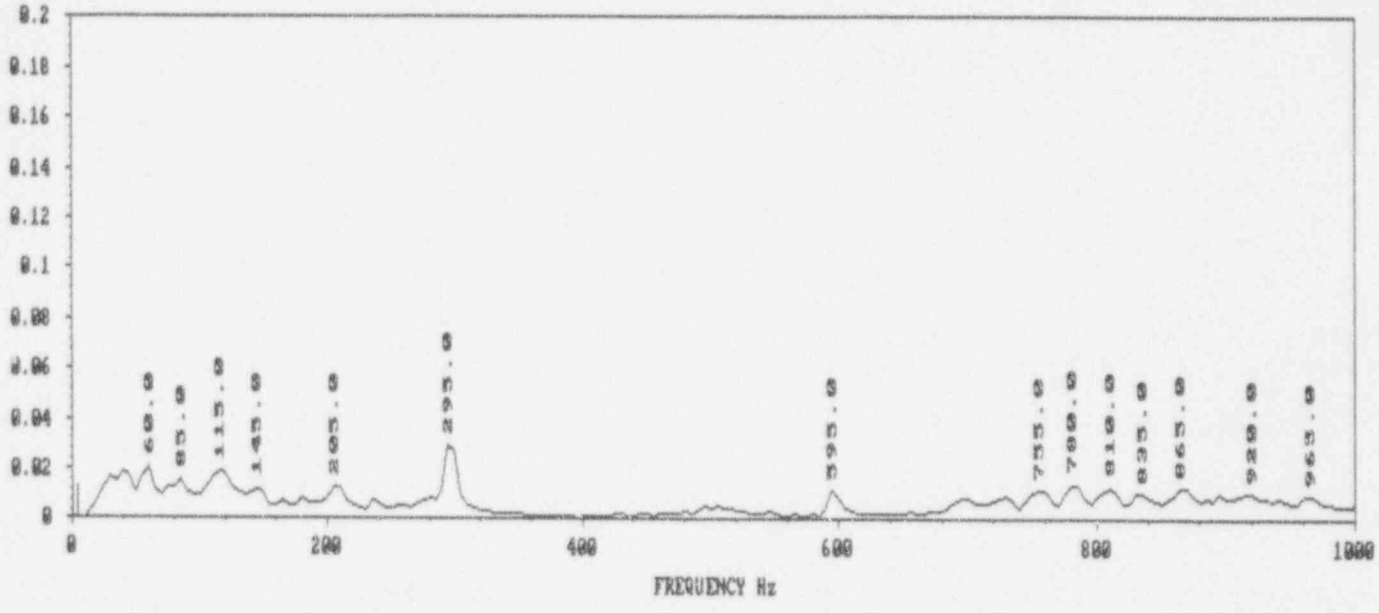
SPECTRAL ENERGY SUMMARY

OVERALL	SYNC	SUBSYNC	NONSYNC
0.2051	0.1325	0.006346	0.1564

SINGLE SPECTRUM PLOT

SET: SI-1A MILS/IPS TYPE: FFT DATE: 01-OCT-93 10:51:47
POINT ID: SI-1A OB H IPS DESC: SHUTDOWN COOLING FLOW (COLD)
WINDOW: HANNING LINES: 400 AVER: 15 FREQ: 0 - 2000 Hz
DETECT: PEAK RPM: 3577 THRESHOLD: 0.0105 UNITS: IPS

FREQ: 5.00 AMP: 0 ORDER: 0.084 DEG: ---



IDENTIFICATION OF SPECTRAL PEAKS ABOVE THRESHOLD

NO.	AMP.	FREQ.	ORDER	NO.	AMP.	FREQ.	ORDER
1.	0.0170	30.0	0.503	9.	0.0122	595.0	9.980
2.	0.0188	40.0	0.671	10.	0.0121	755.0	12.664
3.	0.0213	60.0	1.006	11.	0.0145	780.0	13.084
4.	0.0163	85.0	1.426	12.	0.0134	810.0	13.587
5.	0.0191	115.0	1.929	13.	0.0105	835.0	14.006
6.	0.0124	145.0	2.432	14.	0.0131	865.0	14.509
7.	0.0131	205.0	3.439	15.	0.0107	895.0	15.013
8.	0.0291	295.0	4.948	16.	0.0111	920.0	15.432

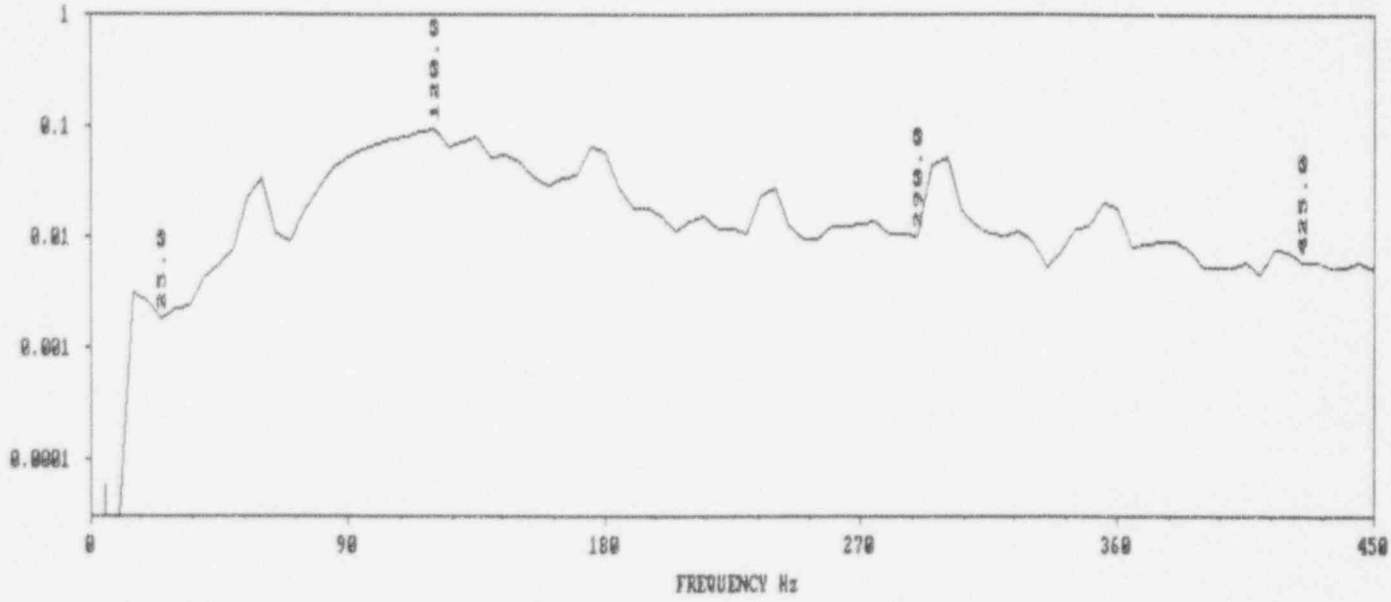
SPECTRAL ENERGY SUMMARY

OVERALL	SYNC	SUBSYNC	NONSYNC
0.1055	0.06251	0.0307	0.07926

SINGLE SPECTRUM PLOT

SET: SI-1A MILS/IPS TYPE: FFT DATE: 01-OCT-93 10:50:35
POINT ID: SI-1A IB V IPS DESC: SHUTDOWN COOLING FLOW (COLD)
WINDOW: HANNING LINES: 400 AVER: 15 FREQ: 0 - 2000 Hz
DETECT: PEAK RPM: 3577 THRESHOLD: 0.0000 UNITS: IPS

FREQ: 5.00 AMP: 0 ORDER: 0.084 DEG: ---



IDENTIFICATION OF SPECTRAL PEAKS ABOVE THRESHOLD

NO.	AMP.	FREQ.	ORDER	NO.	AMP.	FREQ.	ORDER
1.	0.0334	60.0	1.006	9.	0.0276	240.0	4.026
2.	0.0976	120.0	2.013	10.	0.0129	260.0	4.361
3.	0.0808	135.0	2.264	11.	0.0139	275.0	4.613
4.	0.0551	145.0	2.432	12.	0.0544	300.0	5.032
5.	0.0655	175.0	2.935	13.	0.0117	325.0	5.451
6.	0.0185	195.0	3.271	14.	0.0202	355.0	5.954
7.	0.0148	215.0	3.606	15.	0.0093	380.0	6.374
8.	0.0121	225.0	3.774	16.	0.0074	415.0	6.961

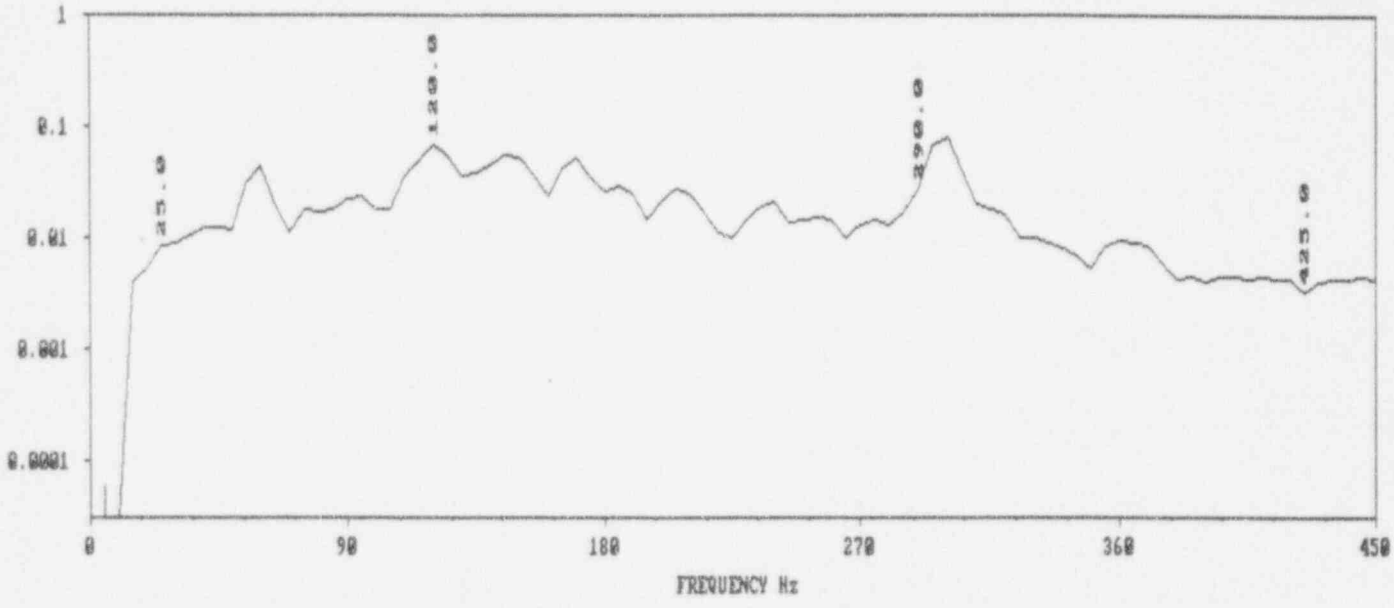
SPECTRAL ENERGY SUMMARY

OVERALL	SYNC	SUBSYNC	NONSYNC
0.2634	0.1699	0.007317	0.2011

SINGLE SPECTRUM PLOT

SET: SI-1A MILS/IPS TYPE: FFT DATE: 01-OCT-93 10:49:20
POINT ID: SI-1A IB H IPS DESC: SHUTDOWN COOLING FLOW (COLD)
WINDOW: HANNING LINES: 400 AVER: 15 FREQ: 0 - 2000 Hz
DETECT: PEAK RPM: 3577 THRESHOLD: 0.0000 UNITS: IPS

FREQ: 5.00 AMP: 0 ORDER: 0.084 DEG: ---



IDENTIFICATION OF SPECTRAL PEAKS ABOVE THRESHOLD

NO.	AMP.	FREQ.	ORDER	NO.	AMP.	FREQ.	ORDER
1.	0.0128	40.0	0.671	9.	0.0284	205.0	3.438
2.	0.0462	60.0	1.006	10.	0.0213	240.0	4.025
3.	0.0176	75.0	1.258	11.	0.0153	255.0	4.277
4.	0.0243	95.0	1.593	12.	0.0147	275.0	4.612
5.	0.0704	120.0	2.013	13.	0.0828	300.0	5.032
6.	0.0564	145.0	2.432	14.	0.0097	360.0	6.038
7.	0.0531	170.0	2.851	15.	0.0046	400.0	6.709
8.	0.0287	185.0	3.103	16.	0.0047	445.0	7.463

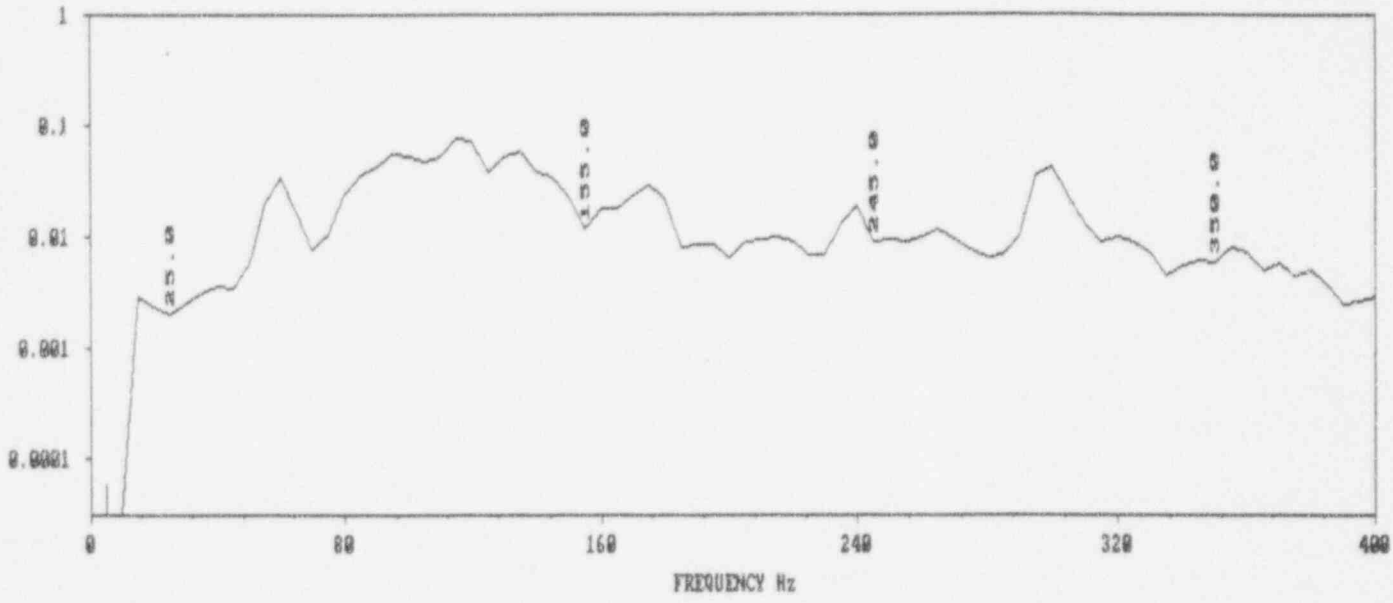
SPECTRAL ENERGY SUMMARY

OVERALL	SYNC	SUBSYNC	NONSYNC
0.209	0.1471	0.02063	0.1469

SINGLE SPECTRUM PLOT

SET: SI-1A MILS/IPS TYPE: FFT DATE: 01-OCT-93 10:53:24
POINT ID: SI-1A OB V IPS DESC: SHUTDOWN COOLING FLOW (COLD)
WINDOW: HANNING LINES: 400 AVER: 15 FREQ: 0 - 2000 Hz
DETECT: PEAK RPM: 3577 THRESHOLD: 0.0000 UNITS: IPS

FREQ: 5.00 AMP: 0 ORDER: 0.084 DEG: ---



IDENTIFICATION OF SPECTRAL PEAKS ABOVE THRESHOLD

NO.	AMP.	FREQ.	ORDER	NO.	AMP.	FREQ.	ORDER
1.	0.0331	60.0	1.006	9.	0.0189	240.0	4.026
2.	0.0562	95.0	1.594	10.	0.0095	250.0	4.193
3.	0.0778	115.0	1.929	11.	0.0123	265.0	4.445
4.	0.0570	135.0	2.264	12.	0.0434	300.0	5.032
5.	0.0180	160.0	2.684	13.	0.0104	320.0	5.368
6.	0.0285	175.0	2.935	14.	0.0064	345.0	5.787
7.	0.0087	190.0	3.187	15.	0.0077	355.0	5.955
8.	0.0100	215.0	3.606	16.	0.0059	370.0	6.206

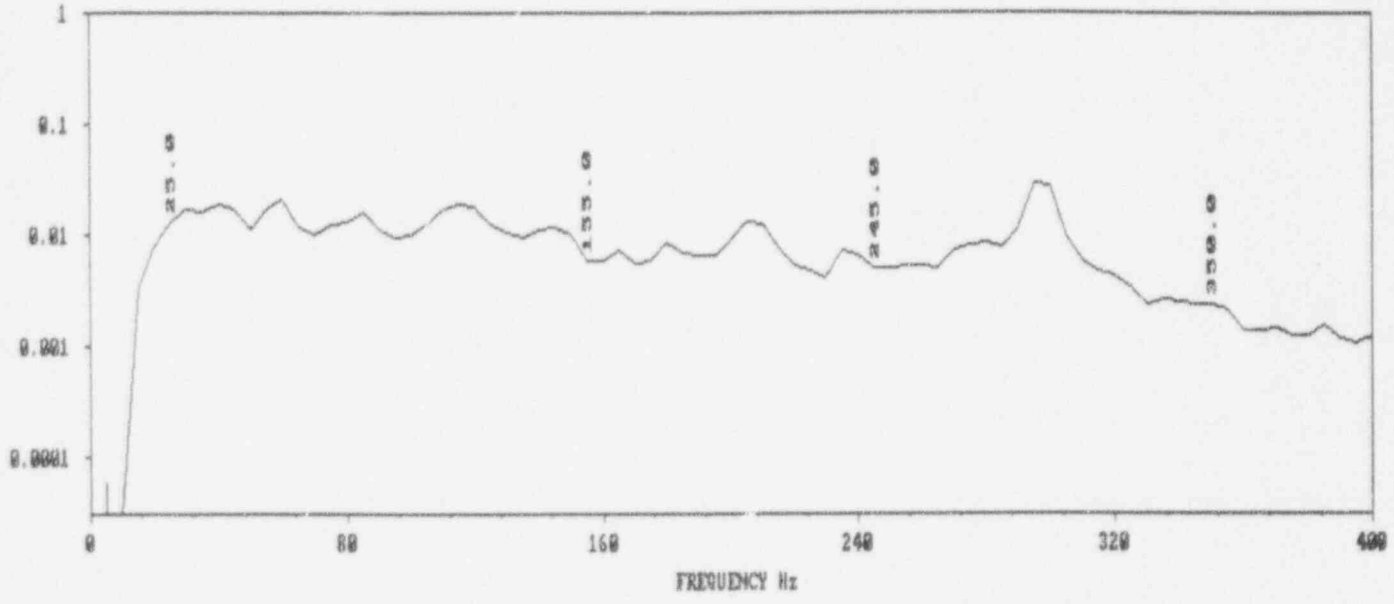
SPECTRAL ENERGY SUMMARY

OVERALL	SYNC	SUBSYNC	NONSYNC
0.2051	0.1325	0.006346	0.1564

SINGLE SPECTRUM PLOT

SET: SI-1A MILS/IPS TYPE: FFT DATE: 01-OCT-93 10:51:47
POINT ID: SI-1A OB H IPS DESC: SHUTDOWN COOLING FLOW (COLD)
WINDOW: HANNING LINES: 400 AVER: 15 FREQ: 0 - 2000 Hz
DETECT: PEAK RPM: 3577 THRESHOLD: 0.0000 UNITS: IPS

FREQ: 5.00 AMP: 0 ORDER: 0.084 DEG: ---



IDENTIFICATION OF SPECTRAL PEAKS ABOVE THRESHOLD

NO.	AMP.	FREQ.	ORDER	NO.	AMP.	FREQ.	ORDER
1.	0.0170	30.0	0.503	9.	0.0131	205.0	3.439
2.	0.0188	40.0	0.671	10.	0.0073	235.0	3.942
3.	0.0213	60.0	1.006	11.	0.0054	260.0	4.361
4.	0.0163	85.0	1.426	12.	0.0086	280.0	4.697
5.	0.0191	115.0	1.929	13.	0.0291	295.0	4.948
6.	0.0124	145.0	2.432	14.	0.0028	335.0	5.619
7.	0.0073	165.0	2.768	15.	0.0015	370.0	6.206
8.	0.0087	180.0	3.019	16.	0.0016	385.0	6.458

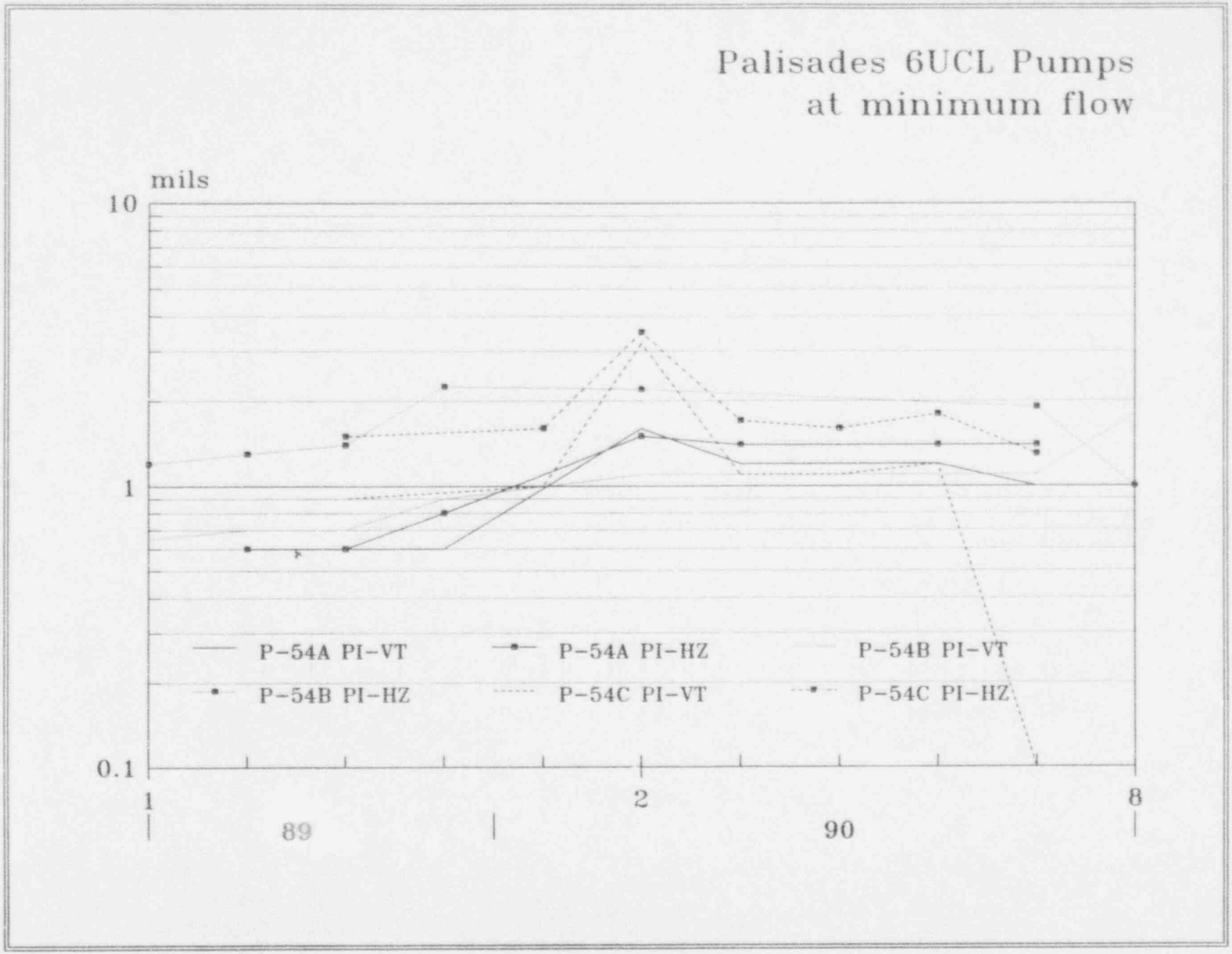
SPECTRAL ENERGY SUMMARY

OVERALL	SYNC	SUBSYNC	NONSYNC
0.1055	0.06251	0.0307	0.07926

LIC-94-0159

ENCLOSURE

ATTACHMENT 2



ATTACHMENT 2

Palisades 6UCL Pump Vibrations (Mils)

Date	P-54A PI-VT	P-54A PI-HZ	P-54B PI-VT	P-54B PI-HZ	P-54C PI-VT	P-54C PI-HZ
01/89			0.65	1.20		
03/89	0.60	0.60	0.70	1.30		
06/89	0.60	0.60	0.70	1.40	0.90	1.50
09/89	0.60	0.80	0.90	2.25		
01/90					1.00	1.60
02/90	1.60	1.50	1.10	2.20	3.20	3.50
02/90	1.20	1.40			1.10	1.70
02/90					1.10	1.60
03/90	1.20	1.40			1.20	1.80
06/90	1.00	1.40	1.10	1.90	0.01	1.30
08/90			1.80	1.00		

LIC-94-0159

ENCLOSURE

ATTACHMENT 3

TITAN OIL ANALYSIS
Customer Report

OMAHA PUBLIC POWER DISTRICT
NORTH OMAHA STATION
24TH & CRAIG AVE.
OMAHA, NE 68112.0000

ATTN: CRAIG LAMBART

CUSTOMER NUMBER:
UNIT NUMBER: 1351
PHONE NUMBER: SI-3C
RECEIVED DATE: 402-636-2627
01/21/93

EQUIPMENT:
SENDER: INGERSOL RAND CONT S
SAMPLE FROM:
PRODUCT: PUMP
SAE: MOBIL 797

SAMPLE DATE: 01/13/93

	PHYSICAL TESTS				WEAR METAL, PPM							ADDITIVES AND OTHER METALS, PPM												
LAB NO.	VISCOSITY SUS-210°F	SAE GRADE 210°F	SOLIDS % VOLUME	WATER FUEL DILUTION ANTI-FREEZE	CHROMIUM	COPPER	IRON	LEAD	TIN	ALUMINUM	SILICON (DIRT)	ANTIMONY	BARIUM	BORON	CADMIUM	CALCIUM	MAGNESIUM	MOLYBDENUM	NICKEL	PHOSPHORUS	SILVER	SODIUM	TITANIUM	ZINC
1																								
IN3821	42	10	0.0	NNN	0	2	3	1	0	0	1	0	0	0	0	1	0	0	0	40		10		4
2																								
IW0108	42	10	0.0	NNN	0	0	4	0	0	0	1	0	0	0	0	24	0	0	0	120		20		18
3																								
IX6574	42	10	0.0	NNN	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	30		00		2
4																								
JD6384	43	10	0.0	NNN	0	1	1	0	0	0	1	0	0	1	0	0	0	0	0	30		20		7
5																								
JL7781	43	10	0.0	NNN	0	1	1	1	0	0	1	0	0	0	0	0	0	0	0	00		20		3
6																								
JV6182	43	10	0.0	NNN	0	1	0	0	0	0	1	0	0	0	0	4	7	0	0	10		10		3
7																								
8																								

MAINTENANCE RECOMMENDATIONS (CURRENT SAMPLE ONLY)
VALUES NORMAL FOR THIS SAMPLE. RESAMPLE AT NORMAL INTERVAL.

TITAN LABORATORIES
1380 ZUNI STREET
DENVER, COLORADO 80204
(303) 893-3211
1-800-848-4825

	TEST DATE	NONE	OIL ADDED	
	041389	0	0	1
	052190	0	0	2
	080190	0	0	3
	032991	0	0	4
	011792	0	0	5
	012193	0	0	6
				7

TITAN OIL ANALYSIS
Customer Report

OMAHA PUBLIC POWER DISTRICT
NORTH OMAHA STATION
24TH & CRAIG AVE.
OMAHA, NE 68112.0000

ATTN: CRAIG LAMBART

CUSTOMER NUMBER: 1361
UNIT NUMBER: SI-3B
PHONE NUMBER: 402-536-4685
RECEIVED DATE: 11/13/91

EQUIPMENT: INGERSOLL RAND
SENDER:
SAMPLE FROM: CONT SPRAY PUMP
PRODUCT: MOBIL 797
SAE:

SAMPLE DATE: 10/29/91

	PHYSICAL TESTS				WEAR METAL, PPM							ADDITIVES AND OTHER METALS, PPM												
LAB NO.	VISCOSITY SUS-210°F	SAE GRADE 210°F	SOLIDS % VOLUME	WATER FUEL DILUTION ANTI-FREEZE	CHROMIUM	COPPER	IRON	LEAD	TIN	ALUMINUM	SILICON (DIRT)	ANTIMONY	BARIUM	BORON	CADMIUM	CALCIUM	MAGNESIUM	MOLYBDENUM	NICKEL	PHOSPHORUS	SILVER	SODIUM	TITANIUM	ZINC
N3550	41	10	0.2	NNN	0	2	3	1	0	0	1	0	0	0	0	1	0	0	0	60		10		5
Z8832	42	10	0.0	NNN	0	6	6	1	0	0	1	0	0	1	0	24	0	0	0	30		20		6
JK0290	43	10	0.0	NNN	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	00		00		3

MAINTENANCE RECOMMENDATIONS (CURRENT SAMPLE ONLY)
VALUES NORMAL FOR THIS SAMPLE. RESAMPLE AT NORMAL INTERVAL.

TITAN LABORATORIES
1380 ZUNI STREET
DENVER, COLORADO 80204
(303) 893-3211
1-800-848-4826

	TEST DATE	DRAIN NONE	OIL ADDED	
	041289	0	0	1
	103190	0	0	2
	111391	0	0	3
				4
				5
				6

32

TITAN OIL ANALYSIS
Customer Report

CUSTOMER NUMBER: 1361
UNIT NUMBER: SI-3A
PHONE NUMBER: 402-636-2627
RECEIVED DATE: 07/27/93

OMAHA PUBLIC POWER DISTRICT
NORTH OMAHA STATION
24TH & CRAIG AVE.
OMAHA, NE 68112.0000

ATTN: CRAIG LAMBART

EQUIPMENT: INGERSOL RAND
SENDER:
SAMPLE FROM: CONT SPRAY PUMP
PRODUCT: MOBIL 797
SAE:

SAMPLE DATE: 07/13/93

	PHYSICAL TESTS				WEAR METAL, PPM							ADDITIVES AND OTHER METALS, PPM												
LAB NO.	VISCOSITY SUS-210°F	SAE GRADE 210°F	SOLIDS % VOLUME	WATER FUEL DILUTION ANTI-FREEZE	CHROMIUM	COPPER	IRON	LEAD	TIN	ALUMINUM	SILICON (DIRT)	ANTIMONY	BARIUM	BORON	CADMIUM	CALCIUM	MAGNESIUM	MOLYBDENUM	NICKEL	PHOSPHORUS	SILVER	SODIUM	TITANIUM	ZINC
1 IN8445	43	10	0.0	NNN	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0	4
2 JA0405	42	10	0.0	NNN	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	2	0	6
3 JJ6292	43	10	0.0	NNN	0	1	0	1	0	0	1	0	0	0	0	2	0	0	0	2	0	2	0	7
4 KA2578	43	10	0.0	NNN	0	0	0	1	0	0	1	2	0	0	0	0	3	0	0	0	0	0	0	4
5																								
6																								
7																								
8																								

MAINTENANCE RECOMMENDATIONS (CURRENT SAMPLE ONLY)
VALUES NORMAL FOR THIS SAMPLE. RESAMPLE AT NORMAL INTERVAL.

TITAN LABORATORIES
1380 ZUNI STREET
DENVER, COLORADO 80204
(303) 893-3211
1-800-848-4826

	TEST DATE	DRAIN NONE	OIL ADDED
1	050489	0	0
2	110790	0	0
3	102991	0	0
4	072793	0	0
5			
6			
7			

3-3

TITAN OIL ANALYSIS
Customer Report

CUSTOMER NUMBER: 1361
UNIT NUMBER: S1-1B
PHONE NUMBER: 402-636-2627
RECEIVED DATE: 01/13/94

OMAHA PUBLIC POWER DISTRICT
NORTH OMAHA STATION
24TH & CRAIG AVE.
OMAHA, NE 68112-0000

ATTN: CRAIG LAMBART

EQUIPMENT: INGERSOLL RAND LPSI
SENDER:
SAMPLE FROM: PUMP
PRODUCT: MOBIL 797
SAE:

SAMPLE DATE: 12/16/93

	PHYSICAL TESTS				WEAR METAL, PPM							ADDITIVES AND OTHER METALS, PPM												
LAB NO.	VISCOSITY SUS-210°F	SAE GRADE 210°F	SOLIDS % VOLUME	WATER FUEL DILUTION ANTI-FREEZE	CHROMIUM	COPPER	IRON	LEAD	TIN	ALUMINUM	SILICON (DIRT)	ANTIMONY	BARIUM	BORON	CADMIUM	CALCIUM	MAGNESIUM	MOLYBDENUM	NICKEL	PHOSPHORUS	SILVER	SODIUM	TITANIUM	ZINC
1 IN3549	42	10	3.0	NNN	0	5	1	1	0	0	1	0	0	0	0	1	0	0	0	1	0	1	0	3
2 JC8203	43	10	0.0	NNN	0	5	2	1	0	0	1	0	0	0	0	0	0	0	0	3	0	3	0	5
3 KF4740	43	10	0.0	NNN	0	7	1	1	0	0	1	1	0	0	0	18	3	0	0	0	0	2	0	3
4																								
5																								
6																								
7																								
8																								

MAINTENANCE RECOMMENDATIONS (CURRENT SAMPLE ONLY)

VALUES NORMAL FOR THIS SAMPLE. RESAMPLE AT NORMAL INTERVAL.

TITAN LABORATORIES
1380 ZUNI STREET
DENVER, COLORADO 80204
(303) 893-3211
1-800-848-4826

	TEST DATE	DRAIN NONE	OIL ADDED
1	041289	0	0
2	022891	0	0
3	011394	0	0
4			
5			
6			
7			
8			

3-4

TITAN OIL ANALYSIS
Customer Report

CUSTOMER NUMBER: 1361
UNIT NUMBER: SI-1A
PHONE NUMBER: 402-636-2627
RECEIVED DATE: 03/21/94

OMAHA PUBLIC POWER DISTRICT
NORTH OMAHA STATION
24TH & CRAIG AVE.
OMAHA, NE 68112-0000

ATTN: CRAIG LAMBART

EQUIPMENT: LPSI PUMP
SENDER:
SAMPLE FROM:
PRODUCT: MOBIL 797
SAE:

SAMPLE DATE: 03/09/94

	PHYSICAL TESTS				WEAR METAL, PPM							ADDITIVES AND OTHER METALS, PPM													
LAB NO.	VISCOSITY SUS-210°F	SAE GRADE 210°F	FUEL SOOT % WT	WATER FUEL DILUTION ANTI-FREEZE	CHROMIUM	COPPER	IRON	LEAD	TIN	ALUMINUM	SILICON (DIRT)	ANTIMONY	BARIUM	BORON	CADMIUM	CALCIUM	MAGNESIUM	MOLYBDENUM	NICKEL	PHOSPHORUS	SILVER	SODIUM	TITANIUM	ZINC
1 JD8223	43	10	0.0	NNN	0	11	2	2	0	0	1	1	0	0	0	0	0	0	0	20		30		2
2 KH8494	43	10	0.0	NNN	0	15	4	2	0	0	1	0	0	0	0	6	6	0	0	60		10		7
3																								
4																								
5																								
6																								
7																								
8																								

MAINTENANCE RECOMMENDATIONS (CURRENT SAMPLE ONLY)
VALUES NORMAL FOR THIS SAMPLE. RESAMPLE AT NORMAL INTERVAL.

TITAN LABORATORIES
1380 ZUNI STREET
DENVER, COLORADO 80204
(303) 893-3211
1-800-848-4826

	TEST DATE	DRAIN NONE	OIL ADDED
1	050492	0	0
2	032194	0	0
3			
4			
5			
6			
7			
8			

3-5