Nebraska Public Power District
Nebraska's Energy Leader

NLS2002111
November 14, 2002

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555-0001

Subject: Inservice Testing Program Relief Request RP-06, RP-07
Cooper Nuclear Station, NRC Docket 50-298, DPR-46

The purpose of this letter is to request that the NRC grant the Nebraska Public Power District (NPPD) relief from certain Inservice Testing (IST) code requirements pursuant to 10 CFR 50.55a(a)(3)(ii). The details and basis for these relief requests are provided in the attachments to this letter. NPPD requests relief for the remainder of the Cooper Nuclear Station (CNS) Third Ten-year Inservice Testing Program.

Relief Request RP-06 requests relief from the requirements to obtain broad-band (unfiltered) vibration measurements for CNS Core Spray Pump CS-P-B during required testing as required by ASME/ANSI OMa-1988, Part 6. A similar relief request has been approved by the NRC for the Sequoyah Nuclear Plant.

Relief Request RP-07 requests relief from the requirements of OMa-1988, Part 6, Paragraph 6.1 which requires increased frequency testing where test parameters fall outside the Alert Range of Table 3, and declaration of inoperability and correction of the condition if test parameters fall outside of the Action Range of Table 3. The 1998 Edition, 2000 Addenda of the OM-Code, paragraph ISTB-6200(c), provides a means to analyze, and if justified, establish new reference values for pump testing, and was incorporated by reference in 10 CFR 50.55a with an amendment to that regulation effective October 28, 2002. A similar relief request has been approved by the NRC for the Vermont Yankee Nuclear Power Plant.

NPPD requests NRC approval of this relief request by April 18, 2003 to enable return of CS-P-B to the normal testing interval.

A047

Should you have any questions concerning this matter, please contact Paul V. Fleming at (402) 825-2774.

Sincerely,

Michael T. Coyle
Nuclear Site Vice President

/mjb
Attachments

cc: Regional Administrator
USNRC - Region IV

Senior Project Manager
USNRC - NRR Project Directorate IV-1

Senior Resident Inspector
USNRC

NPG Distribution

COOPER NUCLEAR STATION
THIRD INTERVAL
INSERVICE TESTING PROGRAM

RELIEF REQUEST RP-06 (Rev 0)

PUMP: Core Spray CS-P-B

CLASS: ASME Code Class 2

FUNCTION: The core spray pump has an active safety function to provide cooling spray water to the reactor vessel to mitigate the consequences of a Loss of Coolant Accident. The pump delivers water from the suppression pool to the spray spargers in the reactor vessel above the fuel to cool the core and limit cladding temperature. The pump must deliver a minimum of 4720 gpm at ≥ 113 psid to meet its safety function. Injection to the vessel occurs only after pressure has dropped below 436 psig, which allows the injection check valve to open.

REQUIRED TEST: OMa 1988, Part 6, Paragraph 4.6.1.6, Frequency Response Range, which states:

> "The frequency response range of the vibration measuring transducers and their readout system shall be from one-third minimum pump shaft rotational speed to at least 1000 Hz."

OMa 1988, Part 6, Paragraph 5.2.(d), which states, in part:

> "Vibration measurements are to be broad band (unfiltered)."

BASIS FOR RELIEF: Summary of Basis for Request: The Nebraska Public Power District (NPPD) submits this relief request for Nuclear Regulatory Commission (NRC) review and approval in accordance with 10CFR50.55a (a)(3)(ii). Compliance with the specified requirement results in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Relief is requested to exclude the consideration of vibration in the response range from one-third pump rotational speed up to one-half pump rotational speed. Excluding this low frequency vibration band will filter out piping-induced vibration that is not indicative of CS-P-B performance and enable restoring CS-P-B to a normal testing frequency. Restoring CS-P-B to its normal testing frequency will prevent unnecessary pump wear, potential challenges to the plant, and entry into Technical Specifications Limiting Conditions for Operation associated with the increased testing frequency.

Background and Corrective Actions Taken: CS-P-B has consistently required increased frequency Inservice Testing (IST) testing due to vibrations being in the alert range. CS-P-B is a Byron Jackson 8 x 14 x 30 DVSS, vertical mount, single stage centrifugal pump. The pump impeller is mounted on the pump motor's extended shaft.

NPPD identified excessive pump and piping vibration on both Core Spray subsystems during pre-operational testing. Subsequent evaluation by the pump vendor, Byron Jackson, concluded that the vibration was piping-induced, and at the low frequencies experienced, would not impact the operational life of the pump. However, additional piping restraints were added which reduced the piping system vibration.

In 1993, a deficiency report was written to address increased frequency IST testing of CS-P-B due to vibration. It was suspected that the pump vibrations were piping-induced. Preliminary investigation of the vibration issue concluded that cavitation at the Core Spray test return line throttle valve and/or restriction orifices was likely causing the elevated piping vibration in both Core Spray System loops. Vibration testing of the Core Spray piping confirmed this conclusion.

To reduce these flow-induced vibrations, Design Change 94-046 was developed to replace the existing simple, single-stage orifices on both Core Spray subsystem test return lines with multi-stage orifices. Post-installation testing with these multi-stage orifices resulted in improvements to CS-P-A vibrations levels, but worsened vibration levels in CS-P-B. A multi-orifice single-stage orifice was fabricated and installed in the CS-P-B test return line (and later in the CS-P-A test return line) with significantly improved results. Visual observation and vibration data collected during acceptance testing determined that CS-P-B pump vibrations had been reduced, but one direction (location 1H in Figure 1, next page) still demonstrated peak velocity reading in the alert range. The pump vibrations in the 1H direction were occurring at frequencies much lower than the pump operating speed. The major vibration peaks were occurring at approximately 700 cycles per minute (cpm), while the pump speed is at 1780 cpm, indicating that the vibration was piping induced. It was also observed during acceptance testing that vibrations were minimal during operation in the minimum flow condition.

In 2001, Machinery Solutions, Inc was retained to perform an independent study of the CS-P-B vibrations. The natural frequency of the pump-motor-piping structure was determined via impact testing. The natural frequencies were determined to be approximately 830 cpm in line with discharge and 670 cpm perpendicular to discharge. Such a vibration response is typical for vertical pumps. Spectrum plots generated from data taken with the pump operating at full speed (~ 1780 cpm) showed predominant motor top vibration peaks occurring at approximately 870 cpm inline with discharge (point 5H below) and approximately 630 cpm perpendicular to discharge (point 1H below). These occurred at less than half the pump operating speed of 1780 cpm, and at frequencies very close to the measured natural frequencies of the pump-motor-piping structure. Machinery Solutions noted that the measured vibration amplitude on the motor casing changed dramatically, going from brief periods of excitation to brief periods of no excitation, consistent with turbulent flow-induced vibration response. Based on this test data, Machinery Solutions concluded that the CS-P-B vibrations are likely originating from flow turbulence induced from an S-curve in the pump discharge piping.

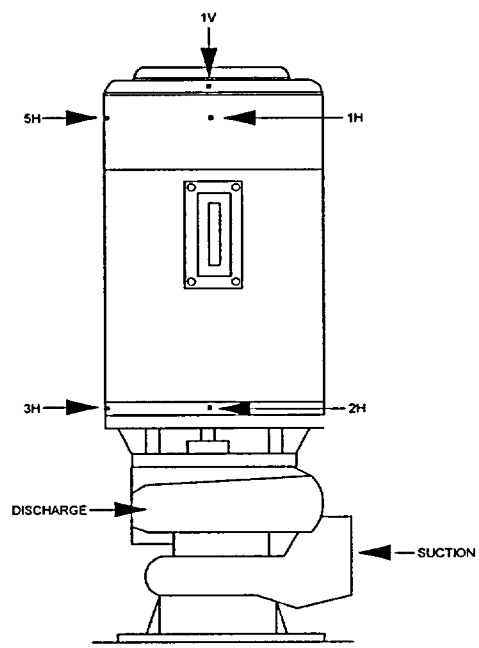


Figure 1 - CS-P-B Vibration Monitoring Points

Evaluation of Recent Pump Data: Recent CS-P-B IST vibration trend graphs (Figures 2-6) show flat or slightly downward trends, indicating that CS-P-B vibration is not increasing in magnitude. These trends also show that points 1H and 5H often exceed the alert range criteria. Figures 7 - 11 show the most current spectrum plots for CS-P-B, as well as spectrum trends for approximately the last year. Markers drawn on these plots show that the peak energy spikes for points 1H and 5H remain below one-half pump running speed and that the pump vibration signature remains fairly uniform. Figure 12 shows that pump differential pressure is consistently acceptable. This data validates the analysis performed by Machinery Solutions, Inc, and the earlier conclusions that the elevated vibrations are piping-induced, and not indicative of degraded pump performance. This test data also shows that the vibrations experienced remain in the region of the CS-P-B pump-motor-piping system natural frequency, at less than half the pump's operating speed.

For this type of pump, no failure modes exist that would induce vibrations lower than one-half pump speed. Vibrations occurring at these low frequencies should not be detrimental to the long term reliability of either the pump or the motor. Typical pump faults, i.e., impeller wear, bearing problems, alignment problems, shaft bow, etc., would result in measurable vibration response in frequencies equal to or greater than one-half of pump running speed. Such faults would also be evident in pump trends. However, the vibrations are being experienced below one-half pump operating speed, have existed since initial operation, and are not trending higher. Visual inspection by Machinery Solutions in 2001 of the pump baseplate, soleplate, and grout identified no visible cracks or degradation. Further, they concluded that the balance condition and shaft alignment of the pump and motor were acceptable, and detected no evidence of motor bearing wear.

NPPD has concluded that testing CS-P-B on an increased frequency provides no added benefit to monitoring pump performance. NRC approval of this relief request would allow exclusion of vibration data between 1/3 and ½ pump speed. Vibration data in this frequency range is not an accurate indicator of pump performance. Restoring CS-P-B to a quarterly testing frequency would reduce pump wear, reduce potential challenges to the plant, and reduce entries into Technical Specifications Limiting Conditions for Operation for test performance.

ALTERNATE TEST: During the performance of CS-P-B inservice testing, pump vibration shall be monitored in accordance with OMa-1988 Part 6, 4.6.1.6, and 4.6.4 with one exception. The vibration data shall be filtered, removing the measurement of vibrational energy associated with the piping induced vibration occurring at less than 1/2 of the pump operating speed. The acceptance criteria of OMa-1988 Part 6, Table 3a shall then be applied to the resultant vibration levels. The duration of this alternate testing is until the end of the current 10 year interval (March 2006).

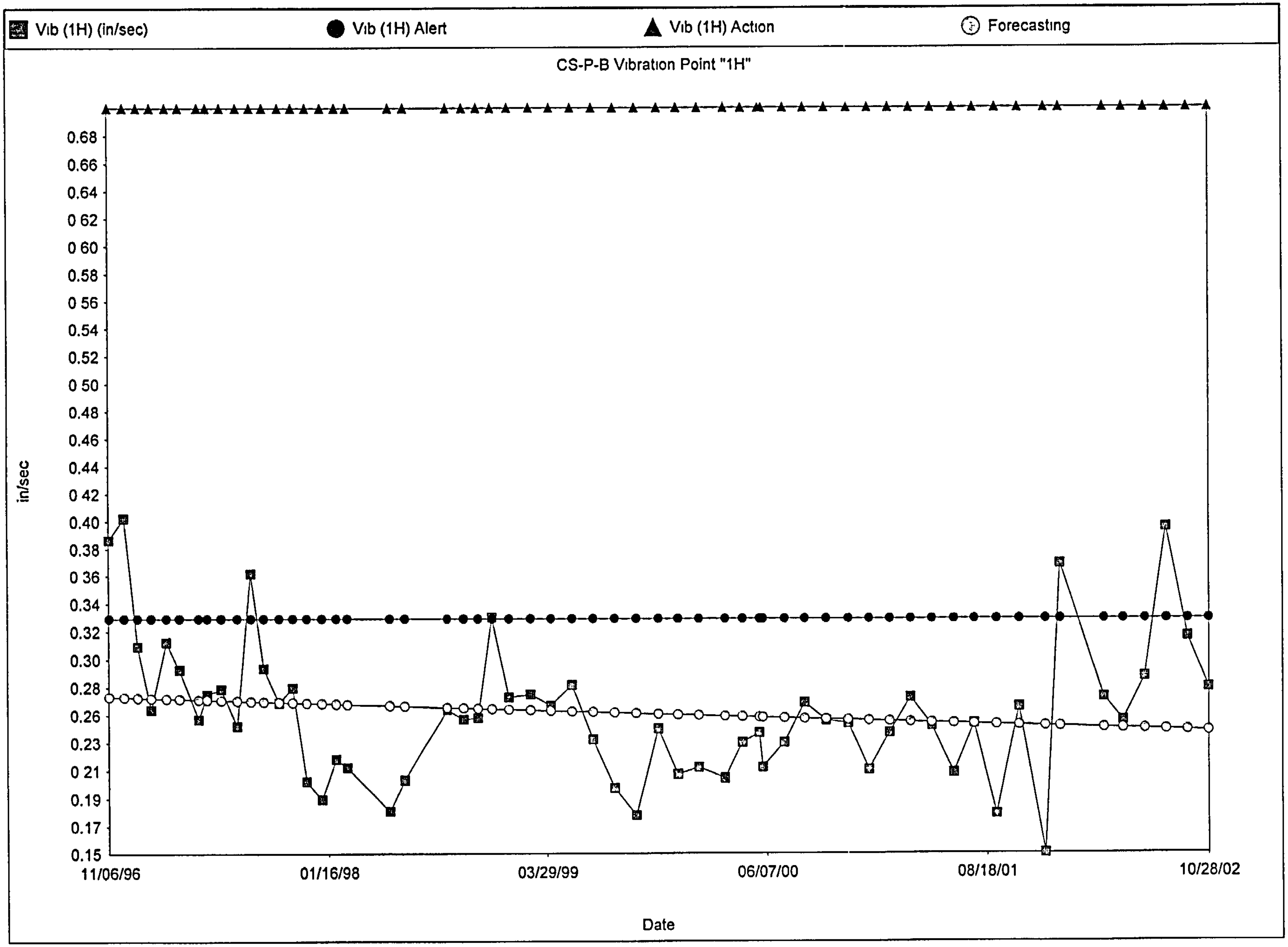

Vib (1H) (in/sec)
Vib (1H) Alert
Vib (1H) Action
Forecasting
CS-P-B Vibration Point "1H"
in/sec
0.68
0.66
0.64
0.62
0.60
0.58
0.56
0.54
0.52
0.50
0.48
0.46
0.44
0.42
0.40
0.38
0.36
0.34
0.32
0.30
0.28
0.26
0.23
0.21
0.19
0.17
0.15
11/06/96
01/16/98
03/29/99
06/07/00
08/18/01
10/28/02
Date

Figure 2

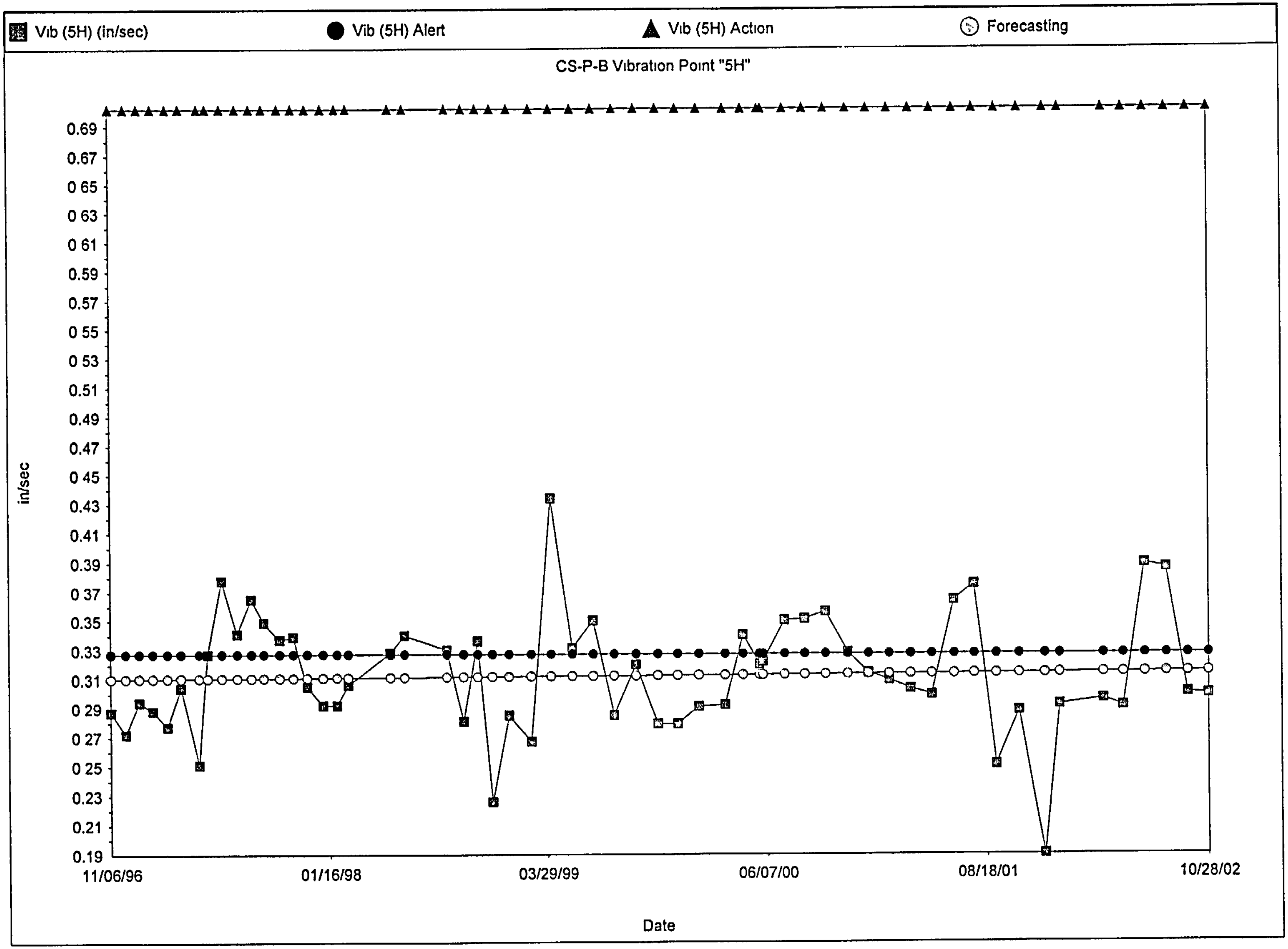

Vib (5H) (in/sec)
Vib (5H) Alert
Vib (5H) Action
Forecasting
CS-P-B Vibration Point "5H"
in/sec
0.69
0.67
0.65
0.63
0.61
0.59
0.57
0.55
0.53
0.51
0.49
0.47
0.45
0.43
0.41
0.39
0.37
0.35
0.33
0.31
0.29
0.27
0.25
0.23
0.21
0.19
11/06/96
01/16/98
03/29/99
06/07/00
08/18/01
10/28/02
Date

Figure 3

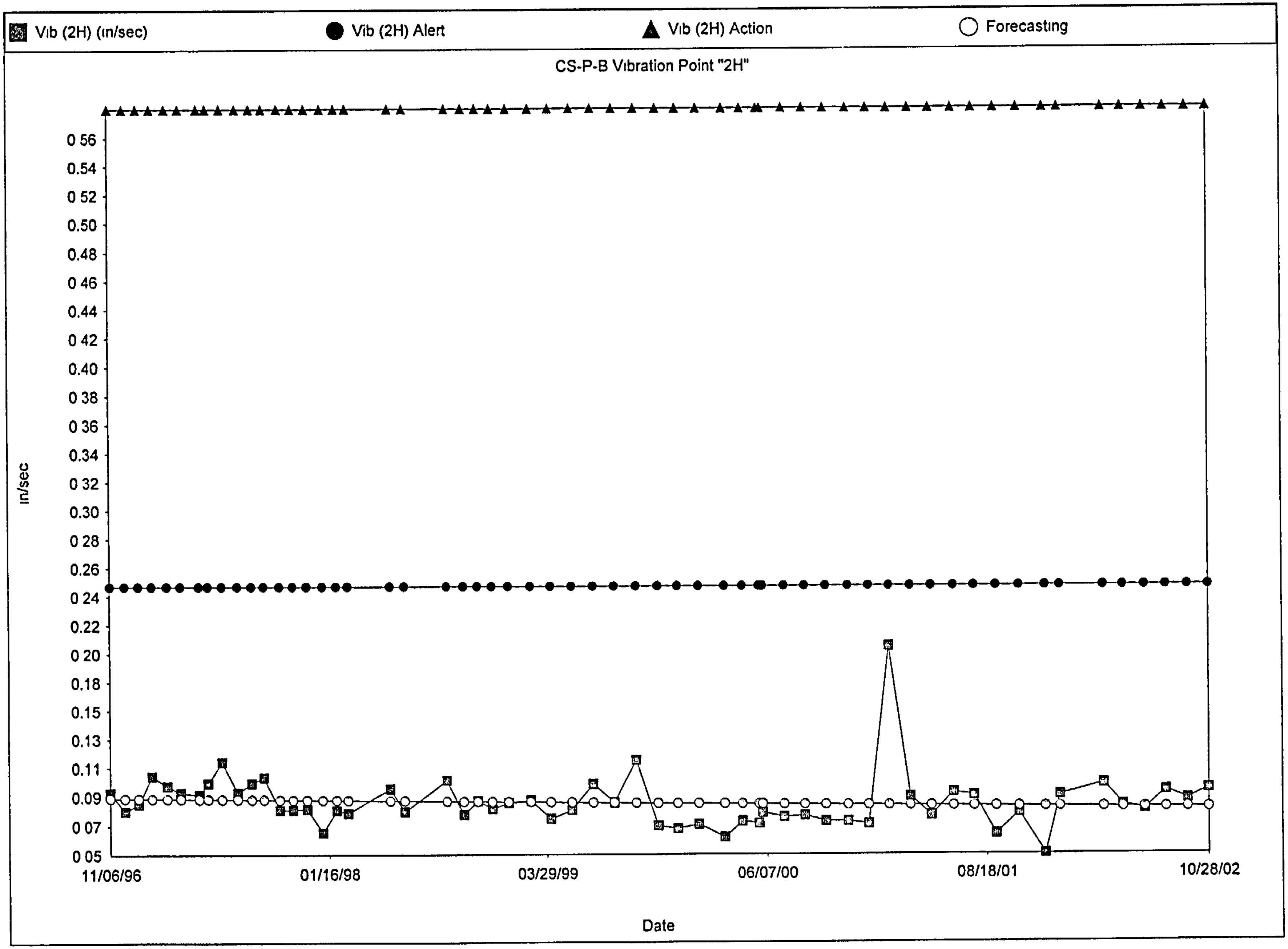

Vib (2H) (in/sec)
Vib (2H) Alert
Vib (2H) Action
Forecasting
CS-P-B Vibration Point "2H"
in/sec
0 56
0.54
0 52
0.50
0.48
0 46
0.44
0 42
0.40
0 38
0 36
0.34
0 32
0.30
0 28
0.26
0 24
0.22
0 20
0.18
0.15
0.13
0.11
0.09
0 07
0 05
11/06/96
01/16/98
03/29/99
06/07/00
08/18/01
10/28/02
Date

Figure 4

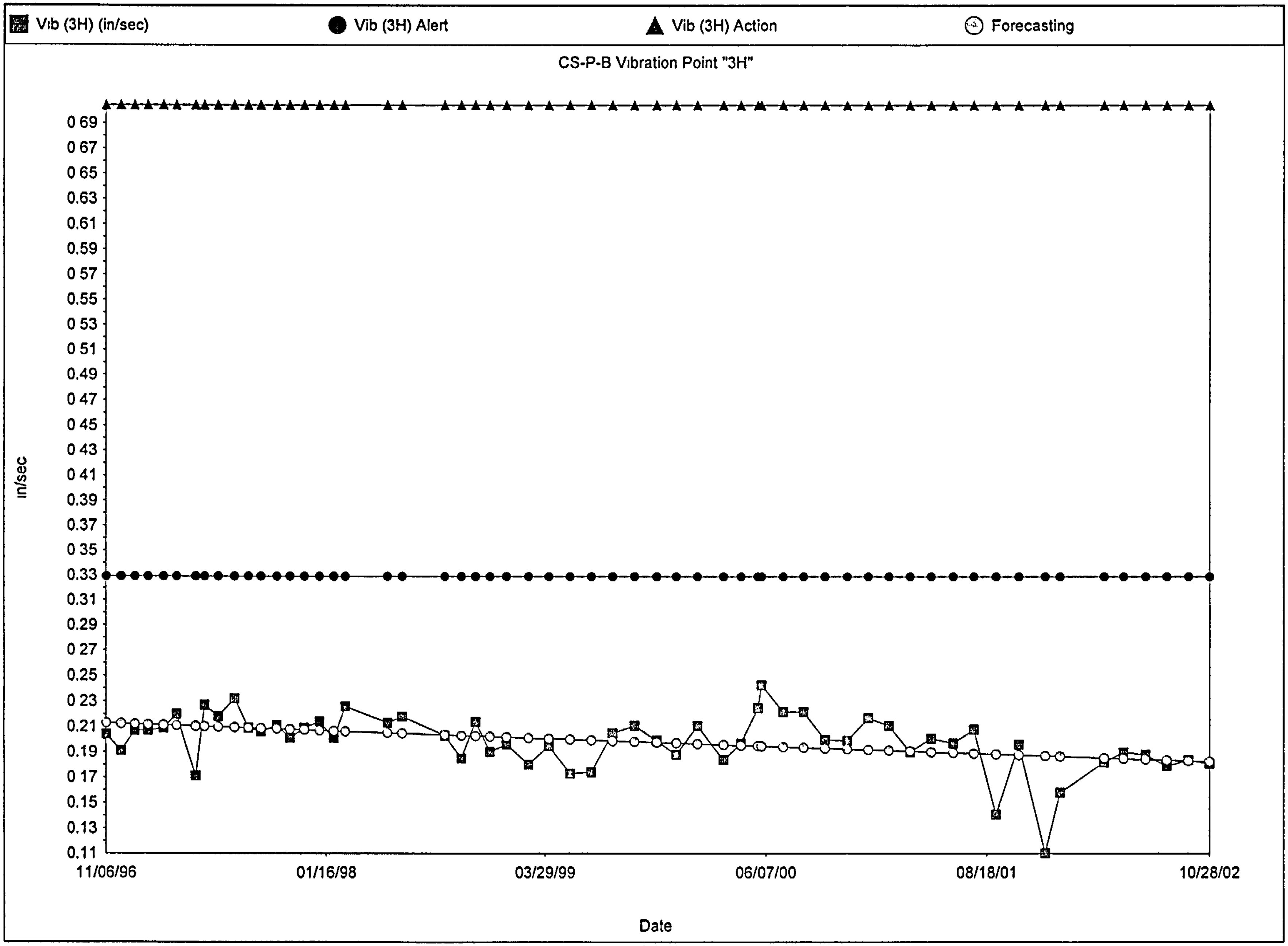

Vib (3H) (in/sec)
Vib (3H) Alert
Vib (3H) Action
Forecasting
CS-P-B Vibration Point "3H"
in/sec
0 69
0 67
0 65
0.63
0.61
0.59
0 57
0.55
0 53
0 51
0.49
0 47
0 45
0 43
0 41
0.39
0.37
0 35
0.33
0.31
0.29
0 27
0.25
0 23
0.21
0.19
0 17
0.15
0.13
0.11
11/06/96
01/16/98
03/29/99
06/07/00
08/18/01
10/28/02
Date

Figure 5

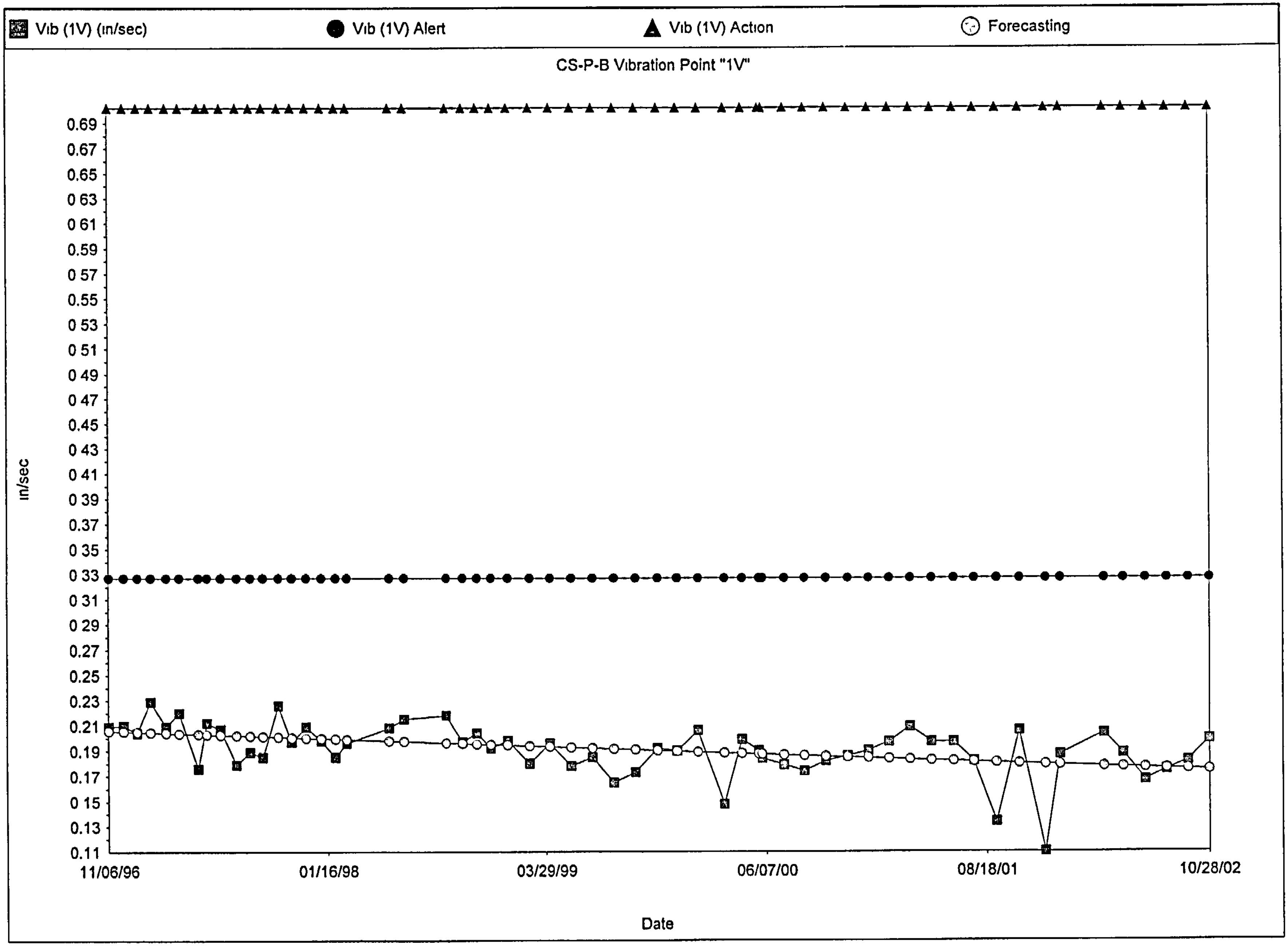
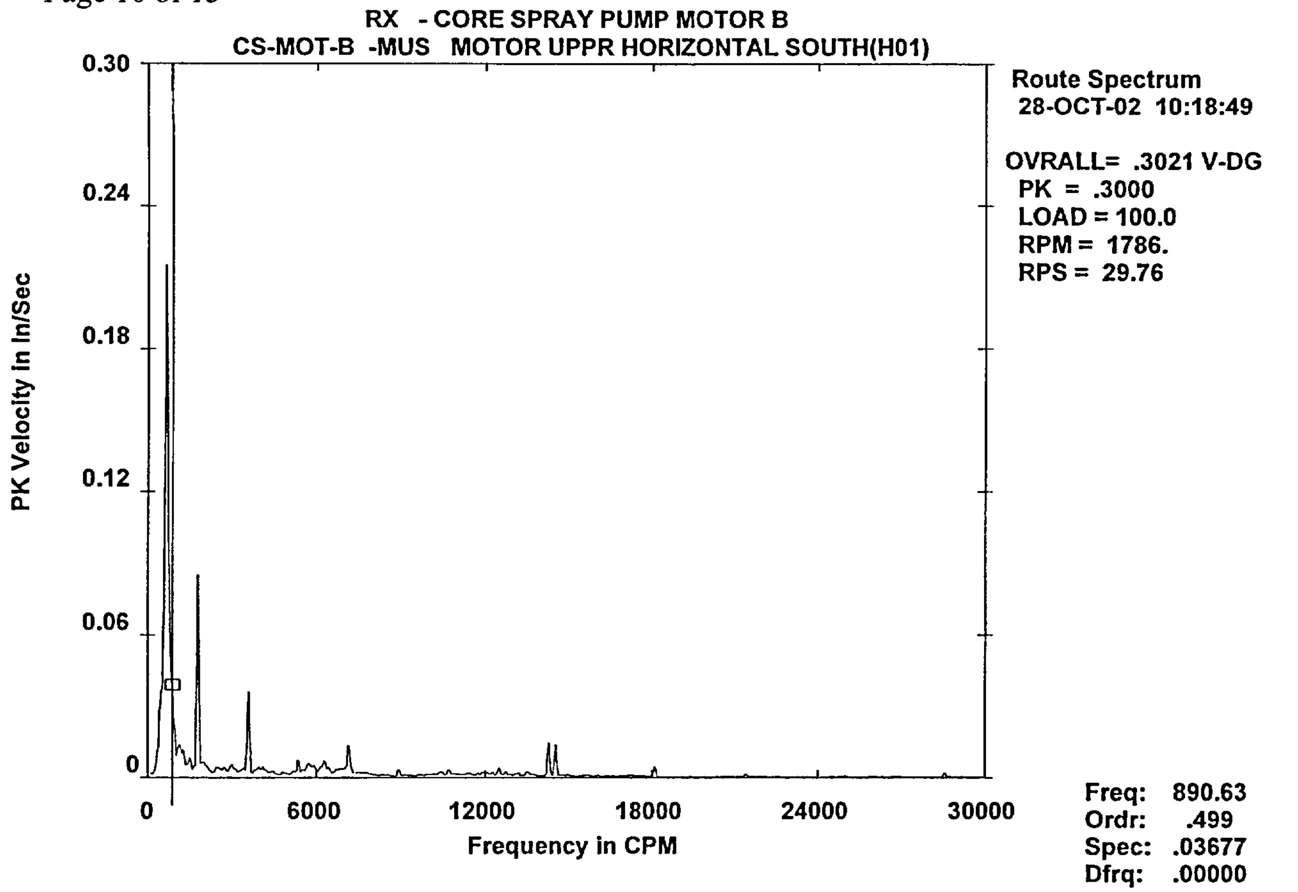

Vib (1V) (in/sec)
Vib (1V) Alert
Vib (1V) Action
Forecasting
CS-P-B Vibration Point "1V"
in/sec
0.69
0.67
0.65
0 63
0 61
0.59
0 57
0.55
0 53
0 51
0 49
0 47
0.45
0 43
0 41
0 39
0.37
0 35
0 33
0 31
0 29
0.27
0.25
0.23
0.21
0.19
0.17
0 15
0.13
0.11
11/06/96
01/16/98
03/29/99
06/07/00
08/18/01
10/28/02
Date

Figure 6


RX - CORE SPRAY PUMP MOTOR B
CS-MOT-B -MUS MOTOR UPPR HORIZONTAL SOUTH(H01)
Route Spectrum
28-OCT-02 10:18:49
OVRALL= .3021 V-DG
PK = .3000
LOAD = 100.0
RPM = 1786.
RPS = 29.76
PK Velocity in In/Sec
0.30
0.24
0.18
0.12
0.06
0
0
6000
12000
18000
24000
30000
Frequency in CPM
Freq: 890.63
Ordr: .499
Spec: .03677
Dfrq: .00000

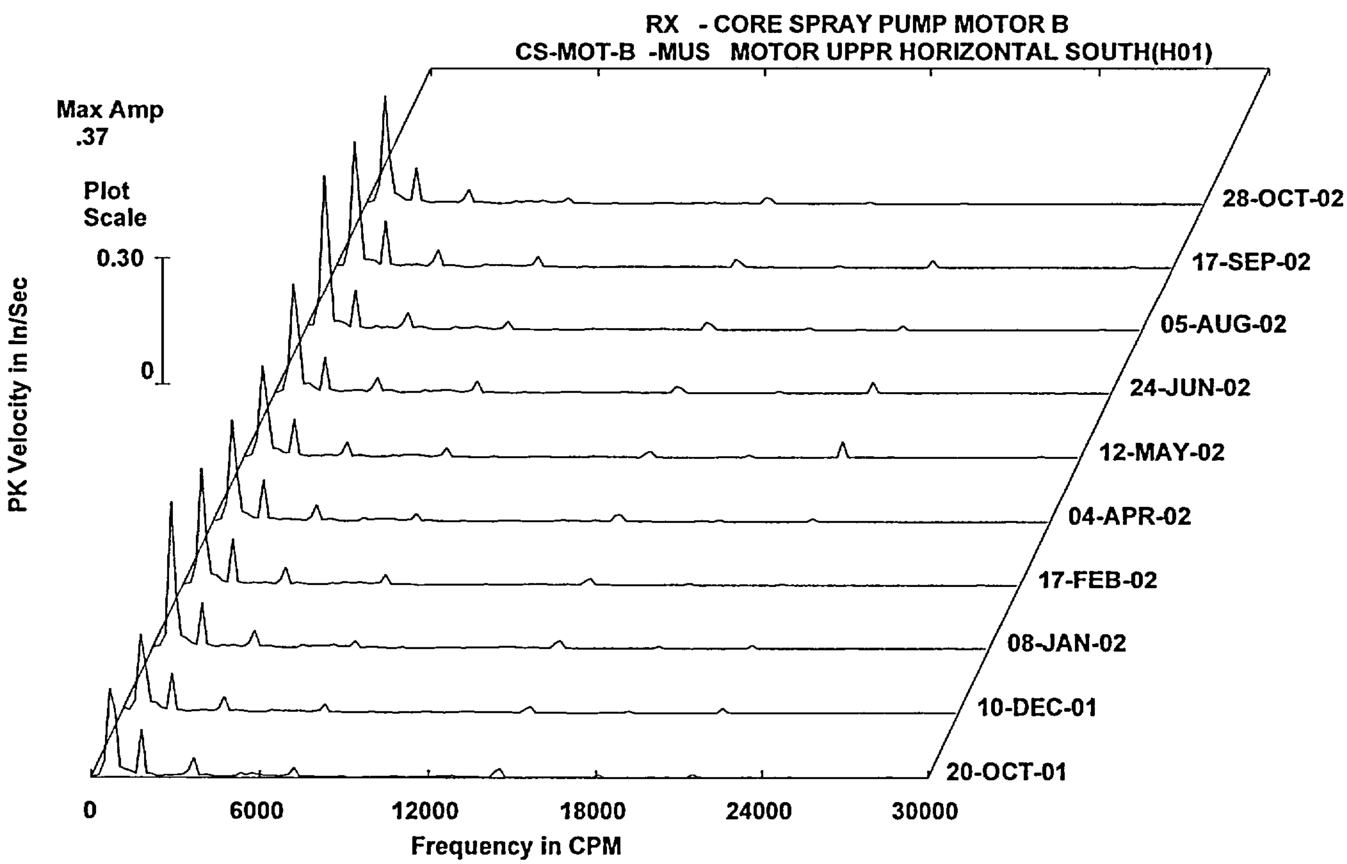
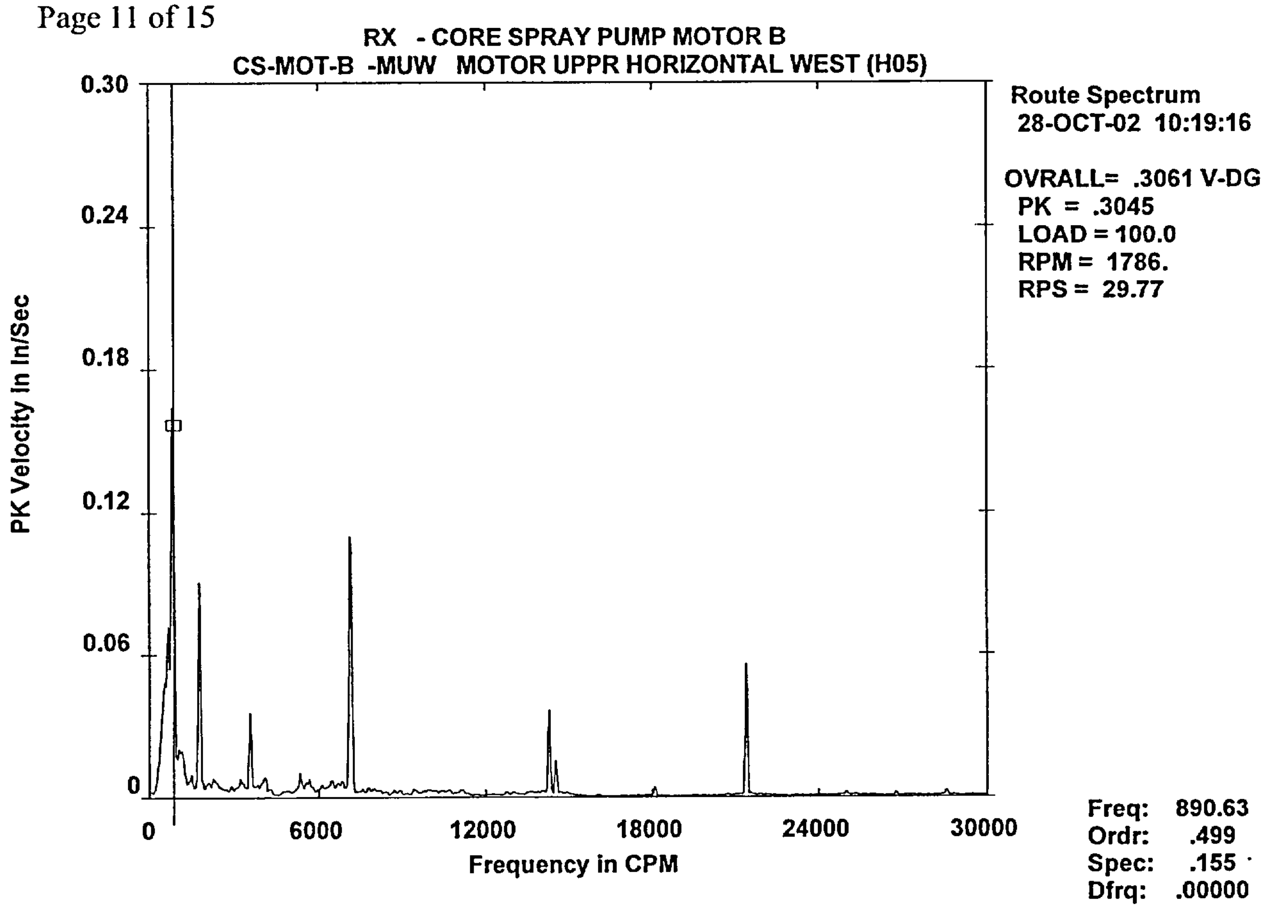

RX - CORE SPRAY PUMP MOTOR B
CS-MOT-B -MUS MOTOR UPPR HORIZONTAL SOUTH(H01)
Max Amp
.37
Plot
Scale
0.30
0
PK Velocity in In/Sec
28-OCT-02
17-SEP-02
05-AUG-02
24-JUN-02
12-MAY-02
04-APR-02
17-FEB-02
08-JAN-02
10-DEC-01
20-OCT-01
0
6000
12000
18000
24000
30000
Frequency in CPM

Figure 7


RX - CORE SPRAY PUMP MOTOR B
CS-MOT-B -MUW MOTOR UPPR HORIZONTAL WEST (H05)
PK Velocity In In/Sec
0.30
0.24
0.18
0.12
0.06
0
0
6000
12000
18000
24000
30000
Frequency in CPM
Route Spectrum
28-OCT-02 10:19:16
OVRALL= .3061 V-DG
PK = .3045
LOAD = 100.0
RPM = 1786.
RPS = 29.77
Freq: 890.63
Ordr: .499
Spec: .155
Dfrq: .00000

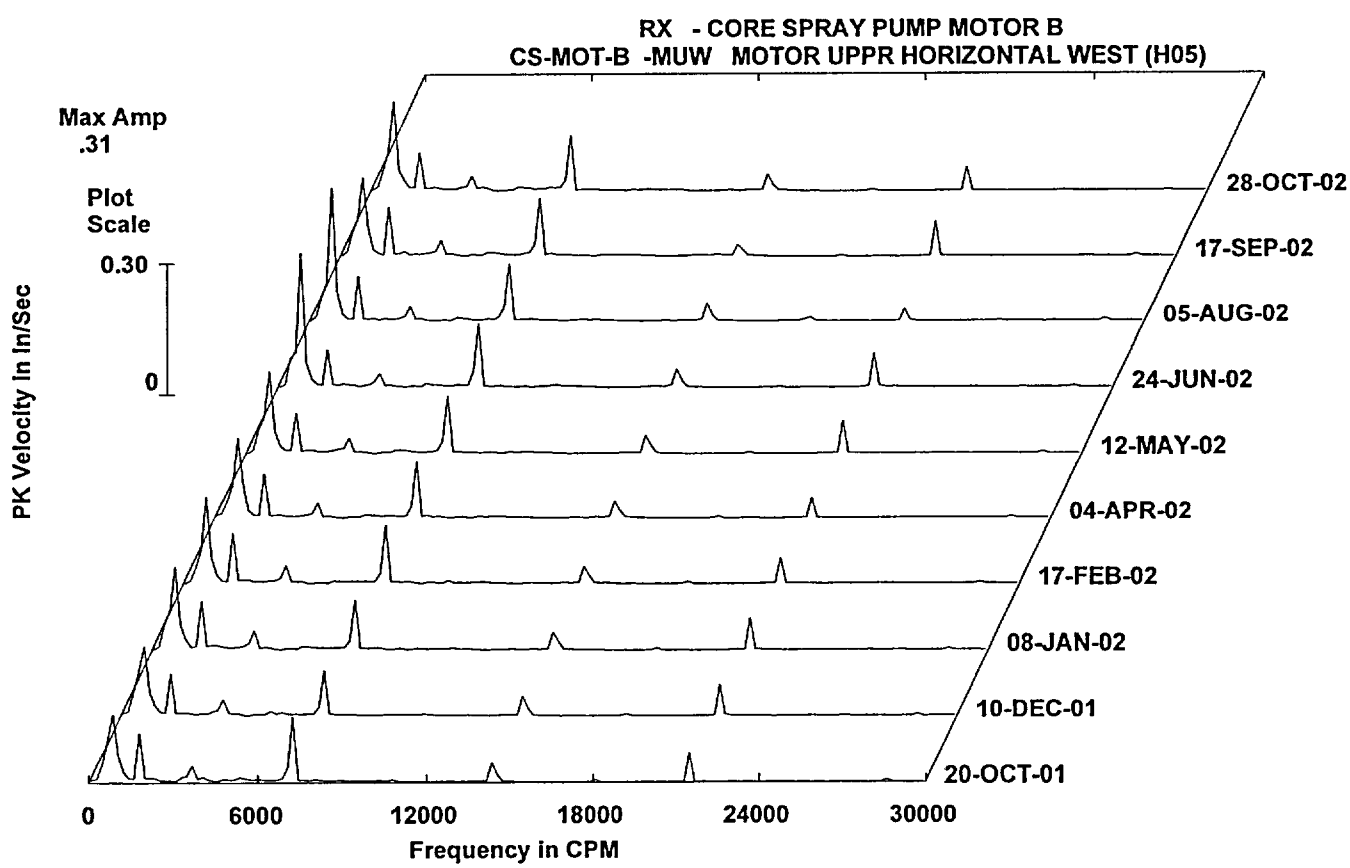
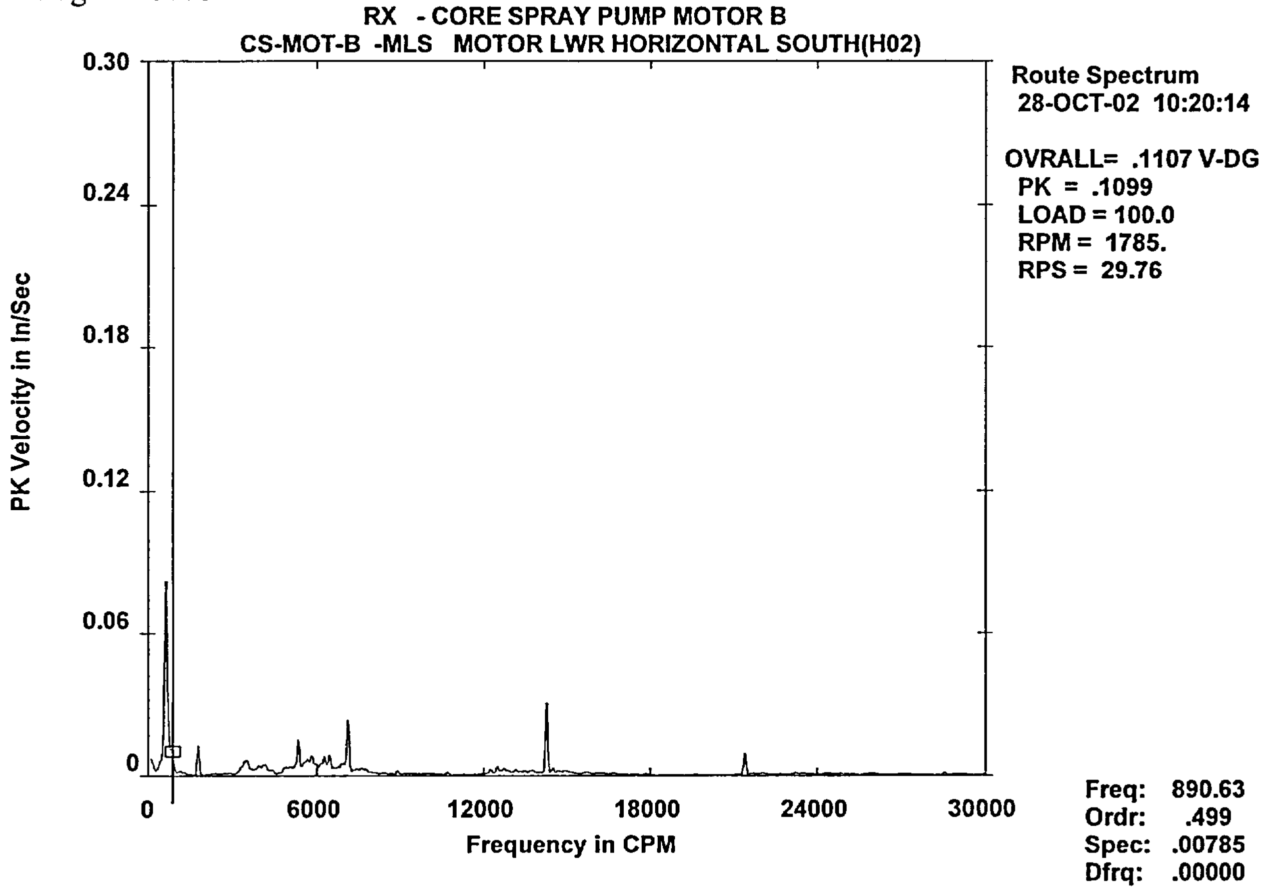

RX - CORE SPRAY PUMP MOTOR B
CS-MOT-B -MUW MOTOR UPPR HORIZONTAL WEST (H05)
Max Amp
.31
Plot
Scale
0.30
0
PK Velocity In In/Sec
28-OCT-02
17-SEP-02
05-AUG-02
24-JUN-02
12-MAY-02
04-APR-02
17-FEB-02
08-JAN-02
10-DEC-01
20-OCT-01
0
6000
12000
18000
24000
30000
Frequency in CPM

Figure 8


RX - CORE SPRAY PUMP MOTOR B
CS-MOT-B -MLS MOTOR LWR HORIZONTAL SOUTH(H02)
0.30
0.24
0.18
0.12
0.06
0
PK Velocity in In/Sec
Route Spectrum
28-OCT-02 10:20:14
OVRALL= .1107 V-DG
PK = .1099
LOAD = 100.0
RPM = 1785.
RPS = 29.76
0
6000
12000
18000
24000
30000
Frequency in CPM
Freq: 890.63
Ordr: .499
Spec: .00785
Dfrq: .00000

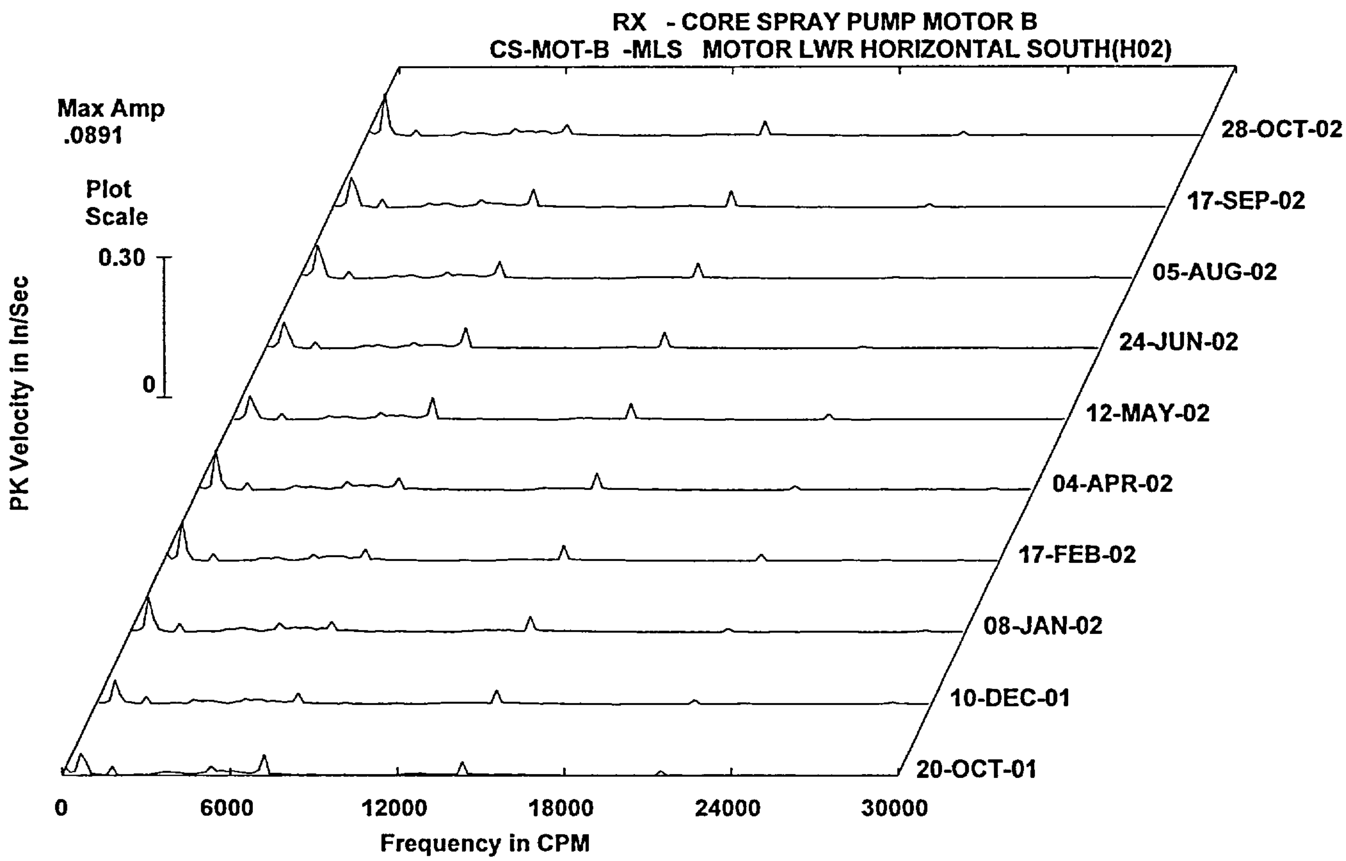
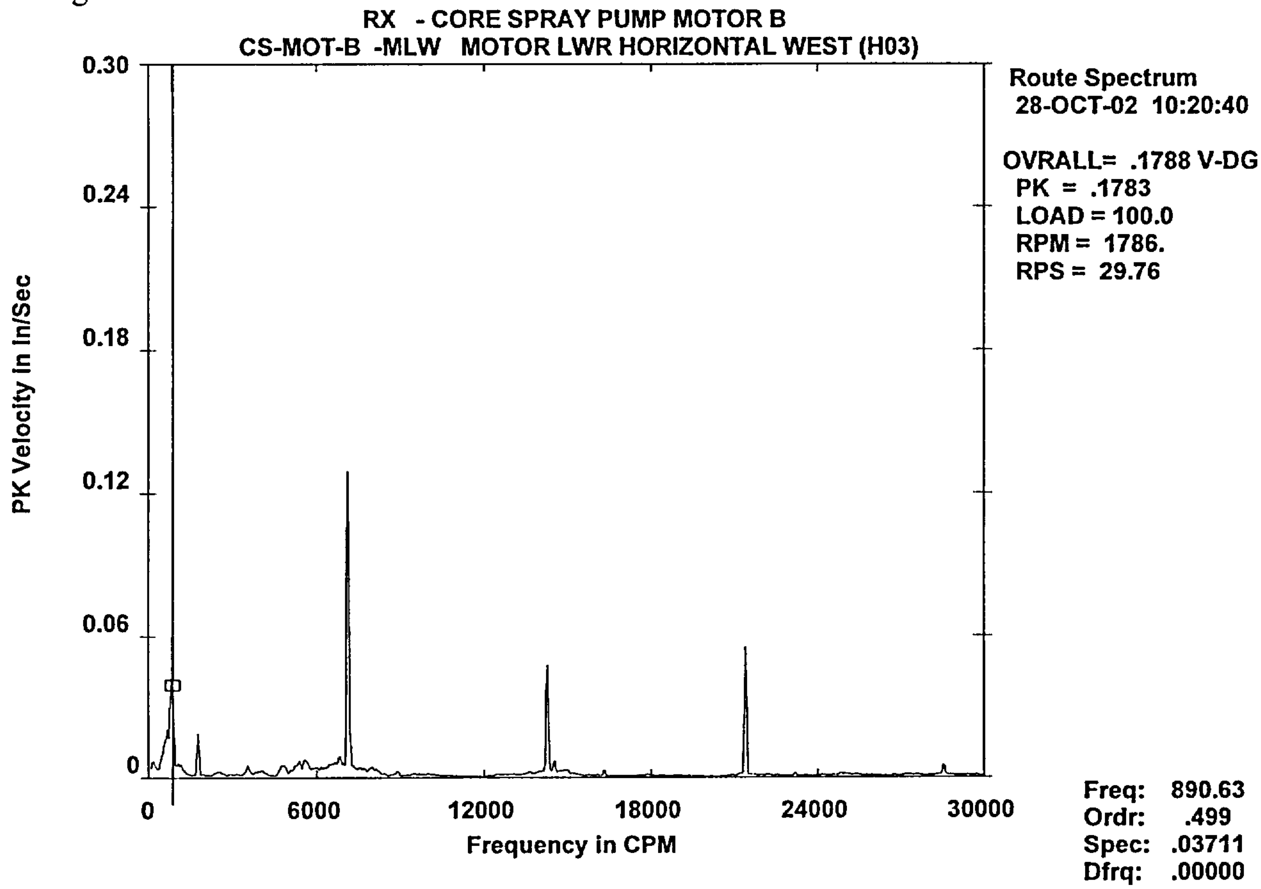

RX - CORE SPRAY PUMP MOTOR B
CS-MOT-B -MLS MOTOR LWR HORIZONTAL SOUTH(H02)
Max Amp
.0891
Plot
Scale
0.30
0
PK Velocity in In/Sec
28-OCT-02
17-SEP-02
05-AUG-02
24-JUN-02
12-MAY-02
04-APR-02
17-FEB-02
08-JAN-02
10-DEC-01
20-OCT-01
0
6000
12000
18000
24000
30000
Frequency in CPM

Figure 9


RX - CORE SPRAY PUMP MOTOR B
CS-MOT-B -MLW MOTOR LWR HORIZONTAL WEST (H03)
PK Velocity in In/Sec
0.30
0.24
0.18
0.12
0.06
0
0
6000
12000
18000
24000
30000
Frequency in CPM
Route Spectrum
28-OCT-02 10:20:40
OVRALL= .1788 V-DG
PK = .1783
LOAD = 100.0
RPM = 1786.
RPS = 29.76
Freq: 890.63
Ordr: .499
Spec: .03711
Dfrq: .00000

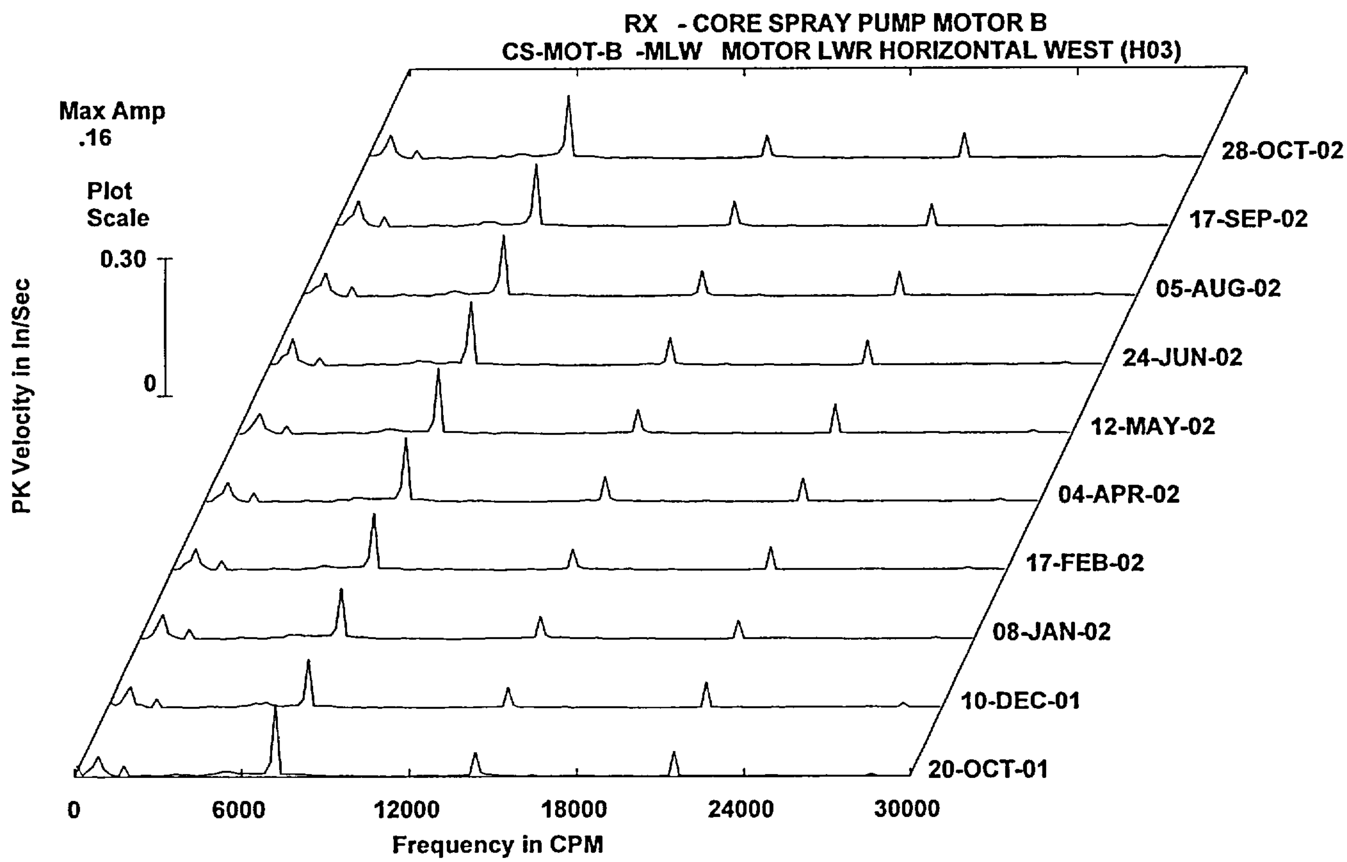
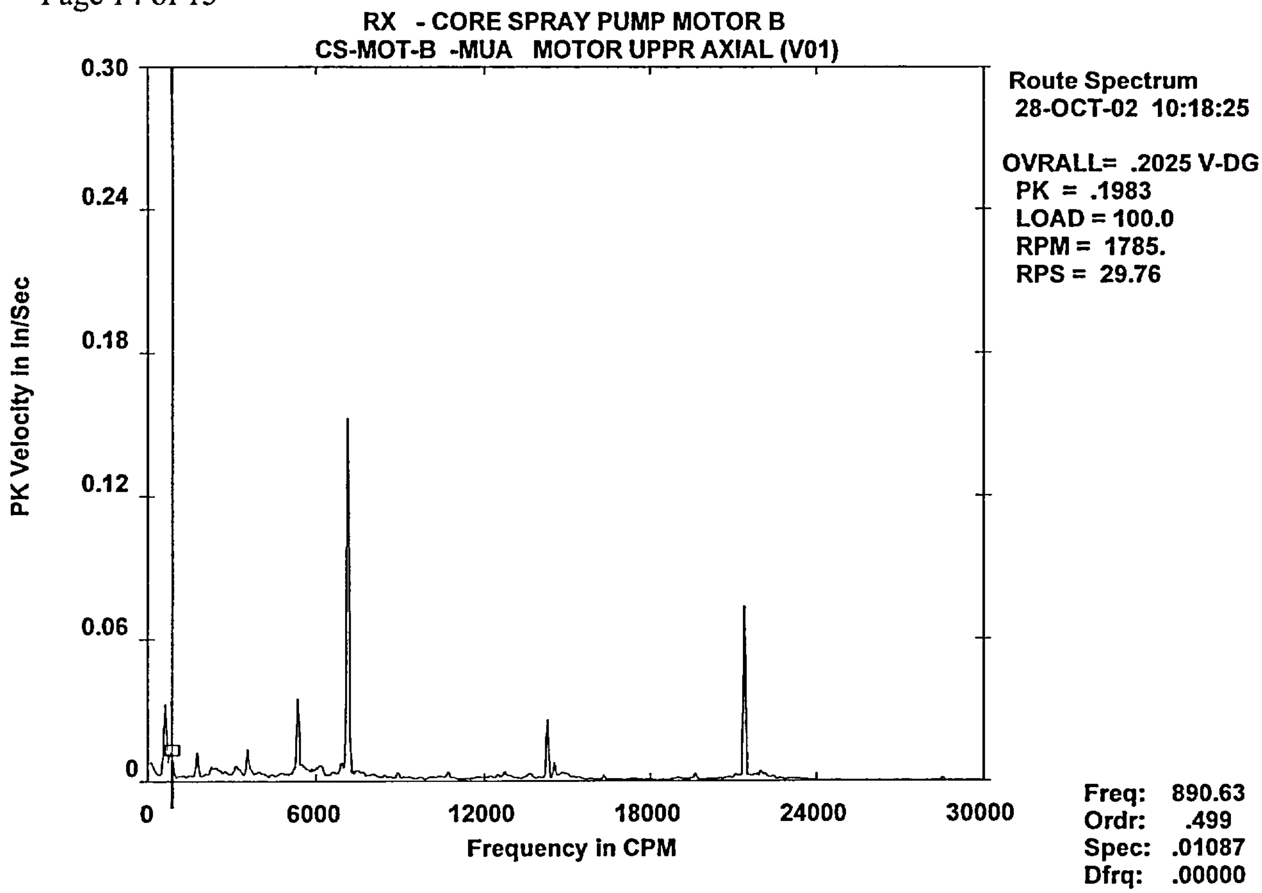

RX - CORE SPRAY PUMP MOTOR B
CS-MOT-B -MLW MOTOR LWR HORIZONTAL WEST (H03)
Max Amp
.16
Plot
Scale
0.30
0
PK Velocity in In/Sec
28-OCT-02
17-SEP-02
05-AUG-02
24-JUN-02
12-MAY-02
04-APR-02
17-FEB-02
08-JAN-02
10-DEC-01
20-OCT-01
0
6000
12000
18000
24000
30000
Frequency in CPM

Figure 10


RX - CORE SPRAY PUMP MOTOR B
CS-MOT-B -MUA MOTOR UPPR AXIAL (V01)
Route Spectrum
28-OCT-02 10:18:25
OVRALL= .2025 V-DG
PK = .1983
LOAD = 100.0
RPM = 1785.
RPS = 29.76
PK Velocity in In/Sec
0.30
0.24
0.18
0.12
0.06
0
0
6000
12000
18000
24000
30000
Frequency in CPM
Freq: 890.63
Ordr: .499
Spec: .01087
Dfrq: .00000

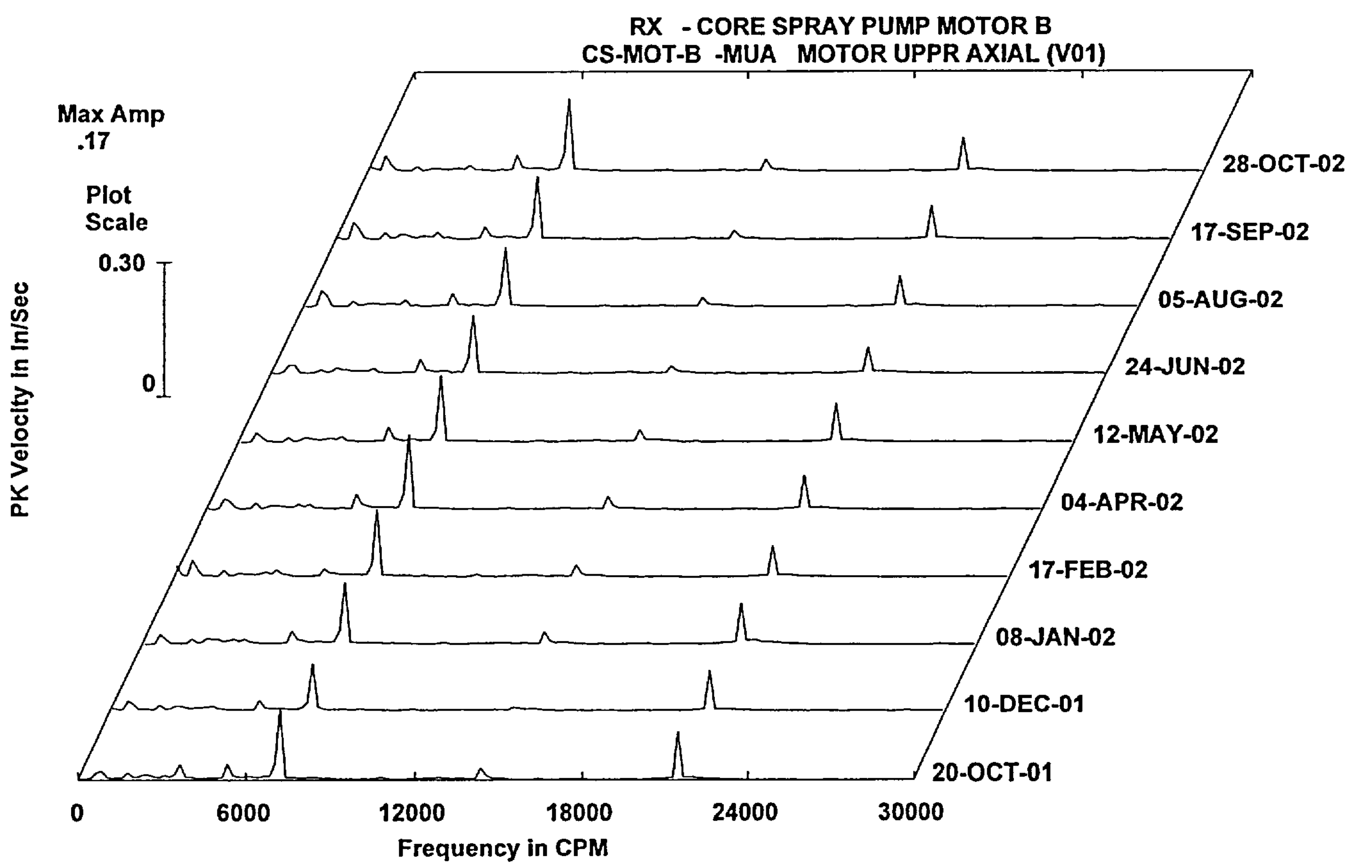

RX - CORE SPRAY PUMP MOTOR B
CS-MOT-B -MUA MOTOR UPPR AXIAL (V01)
Max Amp
.17
Plot
Scale
0.30
0
PK Velocity in In/Sec
28-OCT-02
17-SEP-02
05-AUG-02
24-JUN-02
12-MAY-02
04-APR-02
17-FEB-02
08-JAN-02
10-DEC-01
20-OCT-01
0
6000
12000
18000
24000
30000
Frequency in CPM

Figure 11

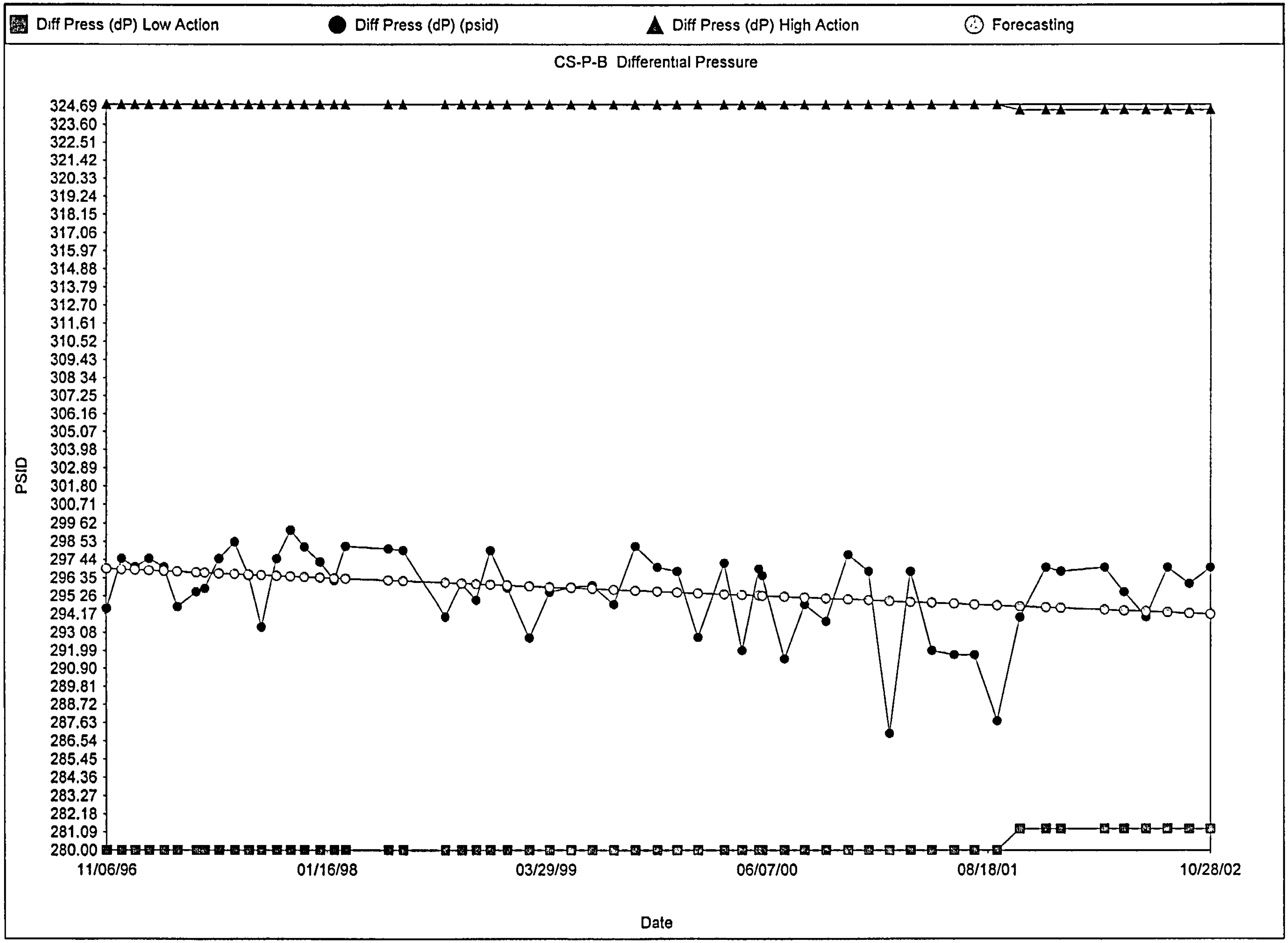

Diff Press (dP) Low Action
Diff Press (dP) (psid)
Diff Press (dP) High Action
Forecasting
CS-P-B Differential Pressure
PSID
324.69
323.60
322.51
321.42
320.33
319.24
318.15
317.06
315.97
314.88
313.79
312.70
311.61
310.52
309.43
308 34
307.25
306.16
305.07
303.98
302.89
301.80
300.71
299 62
298 53
297 44
296 35
295 26
294.17
293 08
291.99
290.90
289.81
288.72
287.63
286.54
285.45
284.36
283.27
282.18
281.09
280.00
11/06/96
01/16/98
03/29/99
06/07/00
08/18/01
10/28/02
Date

Figure 12

COOPER NUCLEAR STATION
THIRD INTERVAL
INSERVICE TESTING PROGRAM

RELIEF REQUEST RP-07 (Rev 0)

PUMP:	All IST Pumps
CLASS:	Various
FUNCTION:	Various
CODE REQUIREMENT:	OMa-1988, Part 6, Paragraph 6.1 states that if deviations fall within the alert range of Table 3, the frequency of testing specified in paragraph 5.1 shall be doubled until the cause of the deviation is determined and the condition corrected. If deviations fall within the required action range of Table 3, the pump shall be declared inoperable until the cause of the deviation has been determined and the condition corrected.
BASIS FOR RELIEF:	The Nebraska Public Power District (NPPD) submits this relief request for Nuclear Regulatory Commission (NRC) review and approval in accordance with 10CFR50.55a (a)(3)(ii). Compliance with the specified requirement results in hardship or unusual difficulty without a compensating increase in the level or quality and safety.

OMa-1988, Part 6, Paragraph 6.1 does not specifically state it is permissible to analyze pumps that have entered the alert or required action ranges. The 1998 Edition, 2000 Addenda of the OM-Code, paragraph ISTB-6200(c), provides the option to analyze pumps in the alert or required action ranges. This edition and addenda of the code have been incorporated by reference in 10 CFR 50.55a with an amendment to that regulation effective October 28, 2002. Per 10CFR50.55a(f)(4)(iv), inservice tests of pumps and valves may meet the requirements set forth in subsequent editions and addenda that are incorporated by reference in paragraph (b) of this section, subject to the limitations and modifications listed in paragraph (b) of this section, and subject to Commission approval. Portions of editions or addenda may be used provided that all related requirements of the respective editions or addenda are met.

There may be times when it is appropriate to analyze a pump that enters the alert range, but remains below the required action limit. For example, if a very smooth running pump is re-baselined following pump replacement, the actual "break-in" vibration or D/P data may not be apparent until the pump has been operating for some time period. Therefore, later testing of the pump may result in approaching or exceeding the alert limit without actually representing a degraded pump condition. Per the applicable code of record, this would result in the need to place the pump on increased frequency testing until the cause of the deviation has been determined and the condition has been corrected. For cases such as these, an analysis could be utilized to re-baseline the pump to create new, more appropriate, alert and required action limits, without exceeding the absolute limits identified in Table 3 of OMa-1988, Part 6. Therefore, by incorporating ISTB-6200(c), there would be clear guidance to allow evaluation of pumps that have entered the alert range. The current code of record does not clearly state that this is an acceptable course of action.

Relief is requested per 10CFR50.55a(a)(3)(ii), in that compliance with the current Code requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. It is an unnecessary hardship to continue to test a pump on increased frequency or to perform unnecessary maintenance on a pump to satisfy the requirements of OMa-1988, Part 6, should it be clear that the pump is operating acceptably. Unnecessary testing or maintenance reduces system availability and increases entries into Technical Specification Limiting Conditions for Operation. Further, the performance of additional testing or maintenance in cases where a documented analysis could demonstrate pump acceptability does not result in a compensating increase in the level of quality and safety.

ALTERNATE METHOD:

In addition to meeting the requirements of OMa-1988, Part 6, Paragraph 6.1, if pump test data falls within the existing alert or required action limits of Table 3 of OMa-1988, Part 6, an analysis may be performed in accordance with ISTB-6200(c) of the 1998 Edition of the OM-Code. In cases where the pump's test parameters are within either the alert or required action ranges of Table 3 of OMa-1988, Part 6, as applicable, and the pump's continued use at the changed values is supported by an analysis, a new set of reference values may be established. This analysis shall include verification of the pump's operational readiness. The analysis shall include both a pump level and a system level evaluation of operational readiness, the cause of the change in pump performance, and an evaluation of all trends indicated by available data. The results of this analysis shall be documented in the record of tests.

Only the requirements associated with performing an acceptable analysis per paragraph ISTB-6200(c), will be incorporated. No other requirements of the 1998 OM-Code regarding pump testing are included with this request for relief.

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The following table identifies those actions committed to by Nebraska Public Power District (NPPD) in this document. Any other actions discussed in the submittal represent intended or planned actions by NPPD. They are described for information only and are not regulatory commitments. Please notify the NL&S Manager at Cooper Nuclear Station of any questions regarding this document or any associated regulatory commitments.

COMMITMENT	COMMITTED DATE OR OUTAGE
None	N/A