# VIBRATION ACCEPTANCE TEST REPORT

## SAMPLE REPORT

Data Collected: 5/31/13

Condition Monitoring Services Inc.

# SAMPLE REPORT

## TABLE OF CONTENTS

**CLICK ON THE AREA OF INTEREST BELOW:**



**ATTACHMENTS**

To: Sample Client June 11, 2013

RE: **Job Number ABC**

To Whom it May Concern,

As requested, please find the results of the shop vibration data collection and bearing temperature readings taken on the pumps at your facility on May 31, 2013.

**Scope:**

Vibration was collected using a portable CSI 2130 vibration analyzer and 100 mV/g accelerometer connected to a 70lb pull rated magnetic base. Data was collected at 1600 lines resolution exceeding 40 orders of shaft rpm. In review of the pump type and applicable standards, the test pass criteria is based on meeting Hydraulic Institute Applied standard - 9.9.4.2.5.1c Allowable pump vibration, Solids Handling pump types located in ANSI/HI PUB 9.6.4 – 2009.

This particular standard does not allow for separate levels of criteria between shop and field testing. This criterion also only refers to specific measurement point locations at the base of the motor support flange. For the balance of the data collected the limitations of .40 ips/rms and 6.0 mils/pk was applied.

Data was reviewed in Acceleration and Velocity on a frequency basis for the presence of non-synchronous energy that would indicate the presence of defects within the motor bearing raceways, rollers, and cage assembly and found to be acceptable. A table of common bearing defect frequencies is provided below and is referred to in orders of 1x shaft rpm:

| BRG ID | BEARING TYPE | #B/R | FTF | BSF | BPFO | BPFI |
|---|---|---|---|---|---|---|
| Top Guide Bearing | 3318 | 14 | .415 | 2.413 | 5.806 | 8.194 |
| Bottom Guide Bearing | 6310 | 8 | .381 | 1.980 | 3.047 | 4.953 |

Bearing temperature was recorded at start, mid 15 min intervals, and then at end run. The bearing temperature data refers to end run values and was stable throughout test. Flow, amperage, voltage, and discharge pressure values were also recorded. Pumps were run with clear liquid at 60 Hz line frequency. Bump tests were performed at each location in the X, Y, and Axial planes on the motor top and bottom bearings, pump volute, suction and discharge locations.

**Tabular information overview:**

The bump test table provides the frequency response of each axis with least desirable response identified and is tabulated in three formats that refer to orders of shaft rpm, actual frequency in CPM, and percent of allowable band tolerances. Where there is no entry, there was no frequency response. Generally speaking, these pumps had a lower maximum response of .5 x shaft speed and upper response of 1.7 x shaft speed, which are both well away from the 15% band of shaft speed that would be considered unacceptable. There were no higher frequencies noted in the bump test and there was no discernible vane pass vibration energy noted in the spectral data, so for this test consideration of resonant responses is limited to shaft rpm.

For the vibration results the measurement points are listed with results in velocity and displacement and indication of pass or fail along with the applied limits.

**Additional information:**

Attached at the end of this report are analyst certifications and analyzer calibration certificate.

I trust this report content meets your requirements.

Please free to touch base at anytime if you need additional information.

Best Regards,

Kirk Cormany
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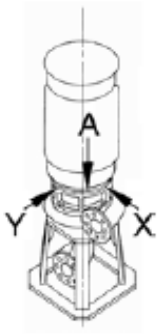
Condition Monitoring Services, Inc
kcormany@conditionmonitoringservices.com
Cell 805-478-0797
Office 888-359-3277

CMS | Condition Monitoring Services, Inc.

# VIBRATION ACCEPTANCE TEST REPORT

| | | | |
|---|---|---|---|
| **COMPANY:** | Sample Client | **VSD DRIVE HERTZ:** | 60 |
| **PUMP SERIAL:** | A1 | **AMPERAGE:** | 48 |
| **PUMP DISCHARGE PSI:** | 41 | **VOLTAGE:** | 448 |
| **FLOW GPM:** | 722 | **HEADER SIZE:** | 6" |
| | | **PUMP RPM:** | 1780 |




Vertical solids, close coupled

**Recorded Motor Bearing Temperatures °F**

Top 93 °F Bottom 98 °F

## STANDARDS

**Standard** - . 32 IPS / RMS (no allowance for shop testing)
**Applied standard** - 9.9.4.2.5.1c Allowable pump vibration, Solids Handling pump types.
**Reference:** Hydraulic Institute Standard 9.6.4 - 2009

**Other applicable standards** - .40 IPS or 6 Mils Pk at any point
**Reference:** Customer Documentation
**Bump Testing:** Frequency responses cannot be within 15% of known rotational forces. (1x shaft speed and vane pass at 9x)

## Bump Test Frequency Responses

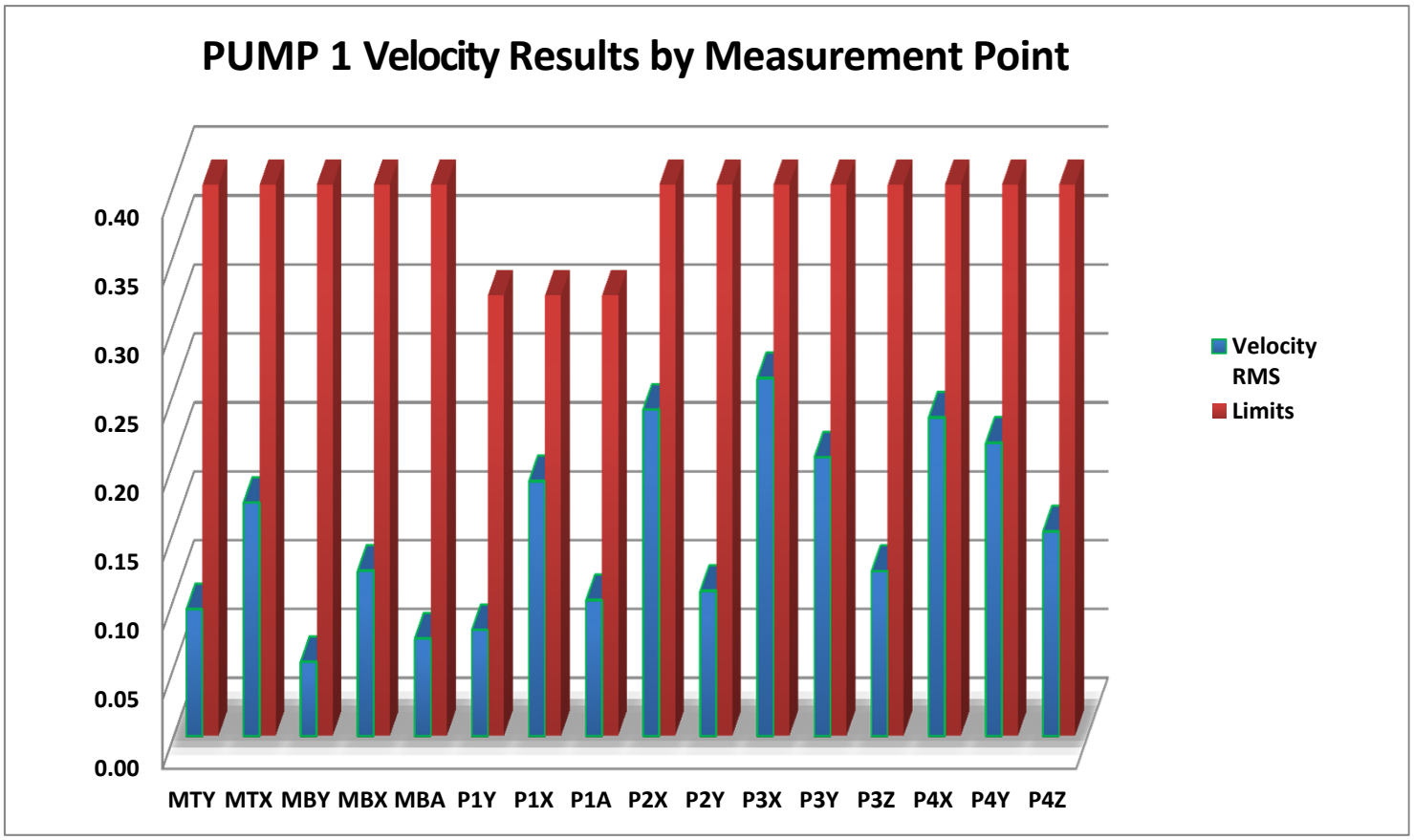
| | Orders | | CPM | | Percent Shaft 1x | |
|---|---|---|---|---|---|---|
| X - Crossline to flow | 0.65 | 1.83 | 1179.75 | 3321.45 | 65% | 183% |
| Y - Inline with flow | 0.51 | 1.57 | 925.65 | 2849.55 | 51% | 157% |
| A - Axial | 0.53 | N/A | 961.95 | N/A | 53% | N/A |
| **Response limits** based on 15% band | 0.85 | 1.15 | 1542.75 | 2087.25 | 85% | 115% |

## Vibration Results

| | | | Vel / RMS | Std | Pass/Fail | Mils PK | Std | Pass/Fail |
|---|---|---|---|---|---|---|---|---|
| MTY | - | MOTOR TOP BEARING INLINE (Y) | 0.13 | 0.4 | PASS | 3.2 | 6 | PASS |
| MTX | - | MOTOR TOP BEARING CROSSLINE (X) | 0.18 | 0.4 | PASS | 4.3 | 6 | PASS |
| MBY | - | MOTOR BTTM INLINE TO FLOW (Y) | 0.06 | 0.4 | PASS | 0.5 | 6 | PASS |
| MBX | - | MOTOR BTTM CROSSLINE TO FLOW (X) | 0.12 | 0.4 | PASS | 1.5 | 6 | PASS |
| MBA | - | MOTOR BTTM AXIAL CROSSLINE (A) | 0.11 | 0.4 | PASS | 3.4 | 6 | PASS |
| P1Y | - | PUMP INLINE TO FLOW (Y) 9.6.4 | 0.06 | 0.32 | PASS | 0.7 | 6 | PASS |
| P1X | - | PUMP CROSSLINE TO FLOW (X) 9.6.4 | 0.12 | 0.32 | PASS | 2.0 | 6 | PASS |
| P1A | - | PUMP AXIAL (A) 9.6.4 | 0.09 | 0.32 | PASS | 1.8 | 6 | PASS |
| P2X | - | PUMP BTTM CROSSLINE TO FLOW (X) | 0.18 | 0.4 | PASS | 3.4 | 6 | PASS |
| P2Y | - | PUMP BTTM INLINE TO FLOW (Y) | 0.11 | 0.4 | PASS | 1.3 | 6 | PASS |
| P3X | - | PUMP SUCTION PIPE (X) | 0.25 | 0.4 | PASS | 3.5 | 6 | PASS |
| P3Y | - | PUMP SUCTION PIPE (Y) | 0.18 | 0.4 | PASS | 1.5 | 6 | PASS |
| P3Z | - | PUMP SUCTION PIPE (Z) | 0.13 | 0.4 | PASS | 1.6 | 6 | PASS |
| P4X | - | PUMP DISCHARGE PIPE (X) | 0.30 | 0.4 | PASS | 4.4 | 6 | PASS |
| P4Y | - | PUMP DISCHARGE PIPE (Y) | 0.22 | 0.4 | PASS | 1.8 | 6 | PASS |
| P4Z | - | PUMP DISCHARGE PIPE (Z) | 0.17 | 0.4 | PASS | 1.9 | 6 | PASS |

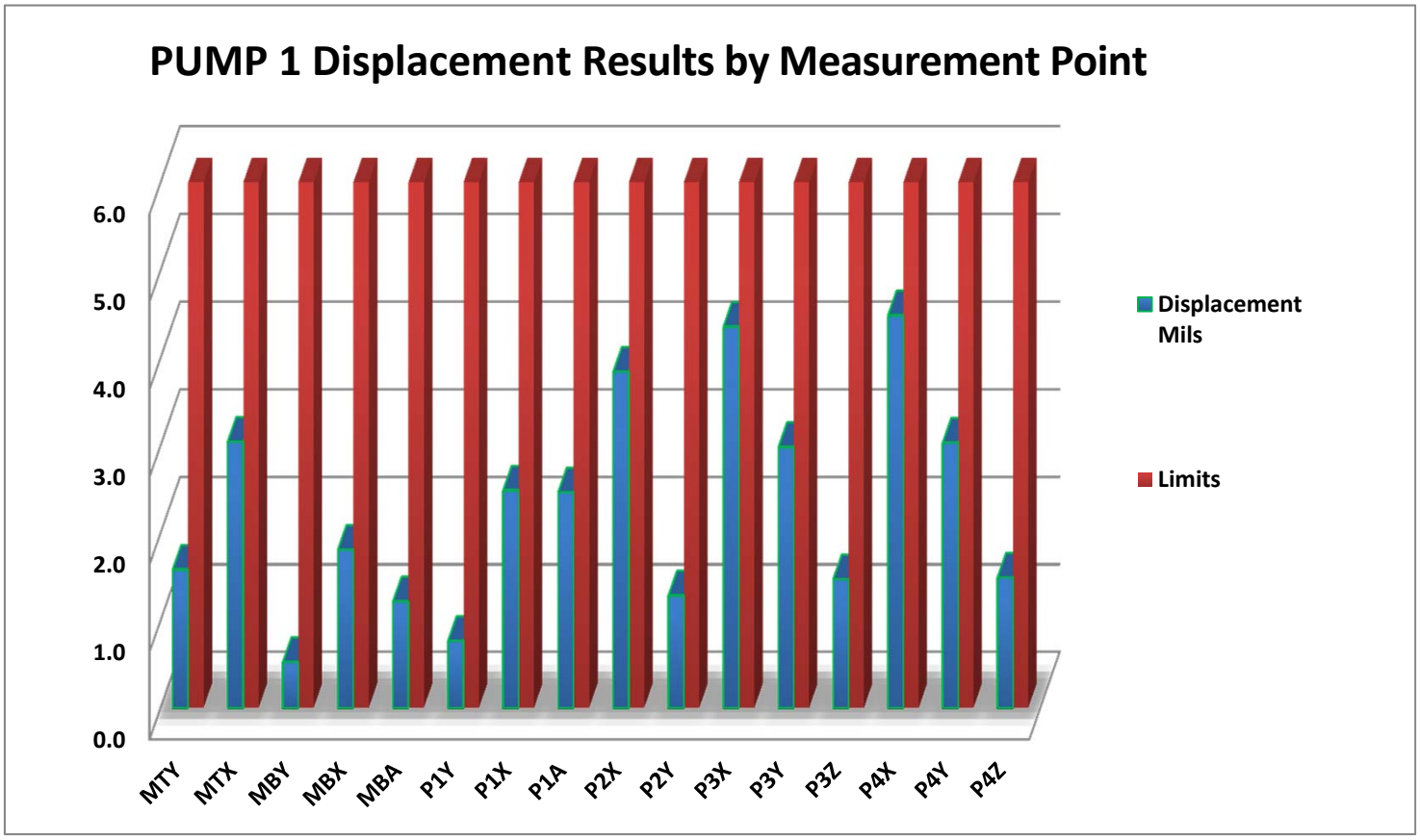
# PUMP 1

## VELOCITY VALUES VS. LIMIT



# PUMP 1

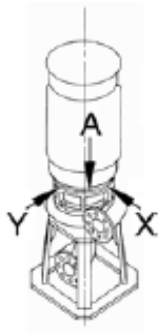
## DISPLACEMENT VALUES VS. LIMIT



CMS Condition Monitoring Services, Inc.

# VIBRATION ACCEPTANCE TEST REPORT

| | | | |
|---|---|---|---|
| **COMPANY:** | SAMPLE CLIENT | **VSD DRIVE HERTZ:** | 60 |
| **PUMP SERIAL:** | B2 | **AMPERAGE:** | 47 |
| **PUMP DISCHARGE PSI:** | 37 | **VOLTAGE:** | 452 |
| **FLOW GPM:** | 715 | **HEADER SIZE:** | 6" |
| | | **PUMP RPM:** | 1780 |




Vertical solids, close coupled

**Recorded Motor Bearing Temperatures °F**

Top 94 °F Bottom 100 °F

## STANDARDS

**Standard** - . 32 IPS / RMS (no allowance for shop testing)
**Applied standard** - 9.9.4.2.5.1c Allowable pump vibration, Solids Handling pump types.
**Reference:** Hydraulic Institute Standard 9.6.4 - 2009

**Other applicable standards** - .40 IPS or 6 Mils Pk at any point
**Reference:** Customer Documentation
**Bump Testing:** Frequency responses cannot be within 15% of known rotational forces. (1x shaft speed and vane pass at 9x)

## Bump Test Frequency Responses

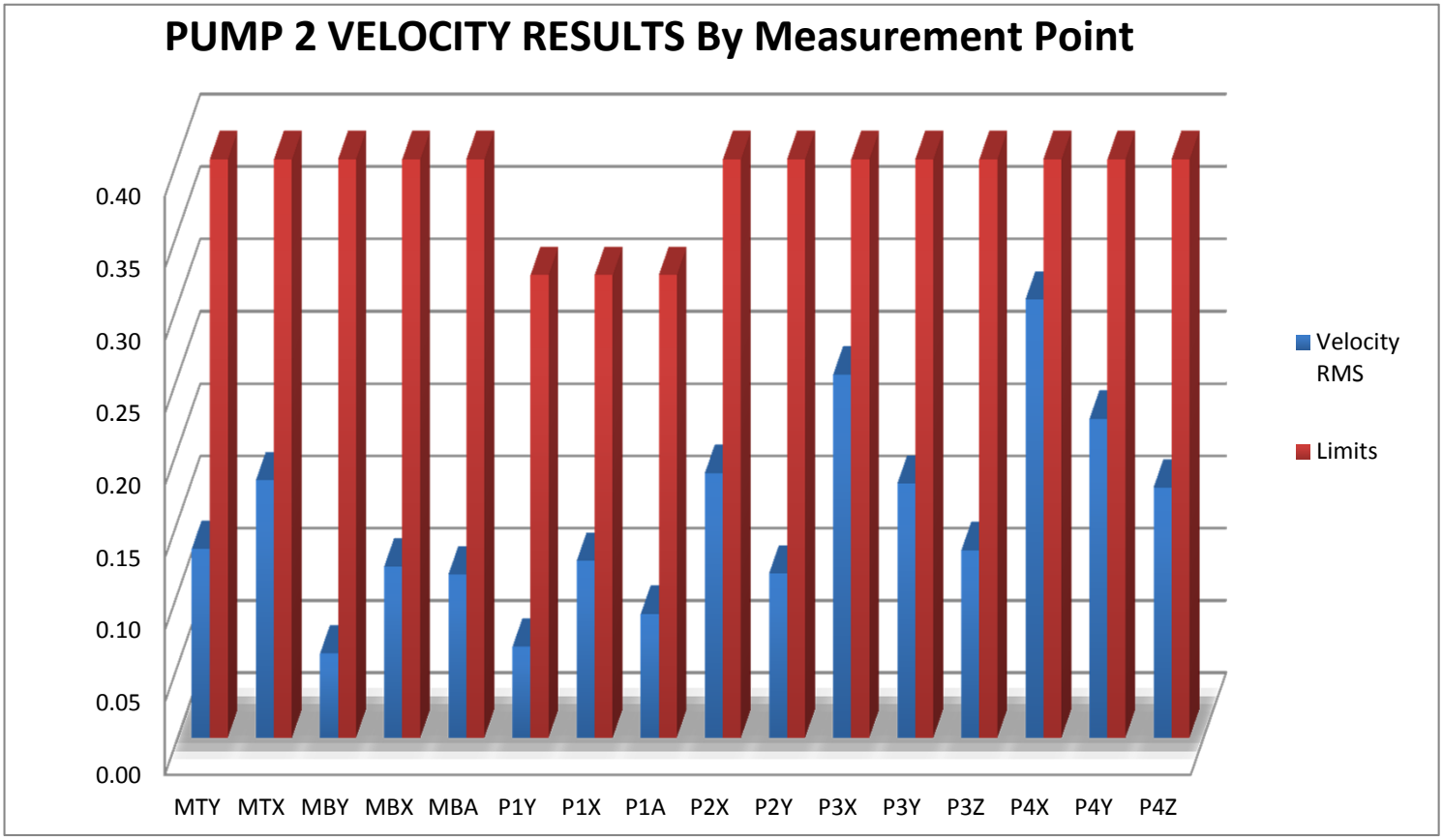
| | Orders | | CPM | | Percent Shaft 1x | |
|---|---|---|---|---|---|---|
| X - Crossline to flow | 0.44 | 1.76 | 798.6 | 3194.4 | 44% | 176% |
| Y - Inline with flow | 0.44 | 1.48 | 798.6 | 2686.2 | 44% | 148% |
| A - Axial | 0.49 | N/A | 889.35 | N/A | 49% | N/A |
| **Response limits** based on 15% band | 0.85 | 1.15 | 1542.75 | 2087.25 | 85% | 115% |

## Vibration Results

| | | | Vel / RMS | Std | Pass/Fail | Mils PK | Std | Pass/Fail |
|---|---|---|---|---|---|---|---|---|
| MTY | - | MOTOR TOP BEARING INLINE (Y) | 0.10 | 0.4 | PASS | 3.1 | 6 | PASS |
| MTX | - | MOTOR TOP BEARING CROSSLINE (X) | 0.19 | 0.4 | PASS | 2.2 | 6 | PASS |
| MBY | - | MOTOR BTTM INLINE TO FLOW (Y) | 0.05 | 0.4 | PASS | 0.8 | 6 | PASS |
| MBX | - | MOTOR BTTM CROSSLINE TO FLOW (X) | 0.12 | 0.4 | PASS | 0.8 | 6 | PASS |
| MBA | - | MOTOR BTTM AXIAL CROSSLINE (A) | 0.08 | 0.4 | PASS | 1.5 | 6 | PASS |
| P1Y | - | PUMP INLINE TO FLOW (Y) 9.6.4 | 0.12 | 0.32 | PASS | 0.7 | 6 | PASS |
| P1X | - | PUMP CROSSLINE TO FLOW (X) 9.6.4 | 0.14 | 0.32 | PASS | 1.7 | 6 | PASS |
| P1A | - | PUMP AXIAL (A) 9.6.4 | 0.11 | 0.32 | PASS | 1.9 | 6 | PASS |
| P2X | - | PUMP BTTM CROSSLINE TO FLOW (X) | 0.21 | 0.4 | PASS | 1.7 | 6 | PASS |
| P2Y | - | PUMP BTTM INLINE TO FLOW (Y) | 0.14 | 0.4 | PASS | 0.6 | 6 | PASS |
| P3X | - | PUMP SUCTION PIPE (X) | 0.27 | 0.4 | PASS | 1.6 | 6 | PASS |
| P3Y | - | PUMP SUCTION PIPE (Y) | 0.23 | 0.4 | PASS | 1.9 | 6 | PASS |
| P3Z | - | PUMP SUCTION PIPE (Z) | 0.15 | 0.4 | PASS | 0.7 | 6 | PASS |
| P4X | - | PUMP DISCHARGE PIPE (X) | 0.26 | 0.4 | PASS | 3.0 | 6 | PASS |
| P4Y | - | PUMP DISCHARGE PIPE (Y) | 0.26 | 0.4 | PASS | 2.4 | 6 | PASS |
| P4Z | - | PUMP DISCHARGE PIPE (Z) | 0.18 | 0.4 | PASS | 3.0 | 6 | PASS |

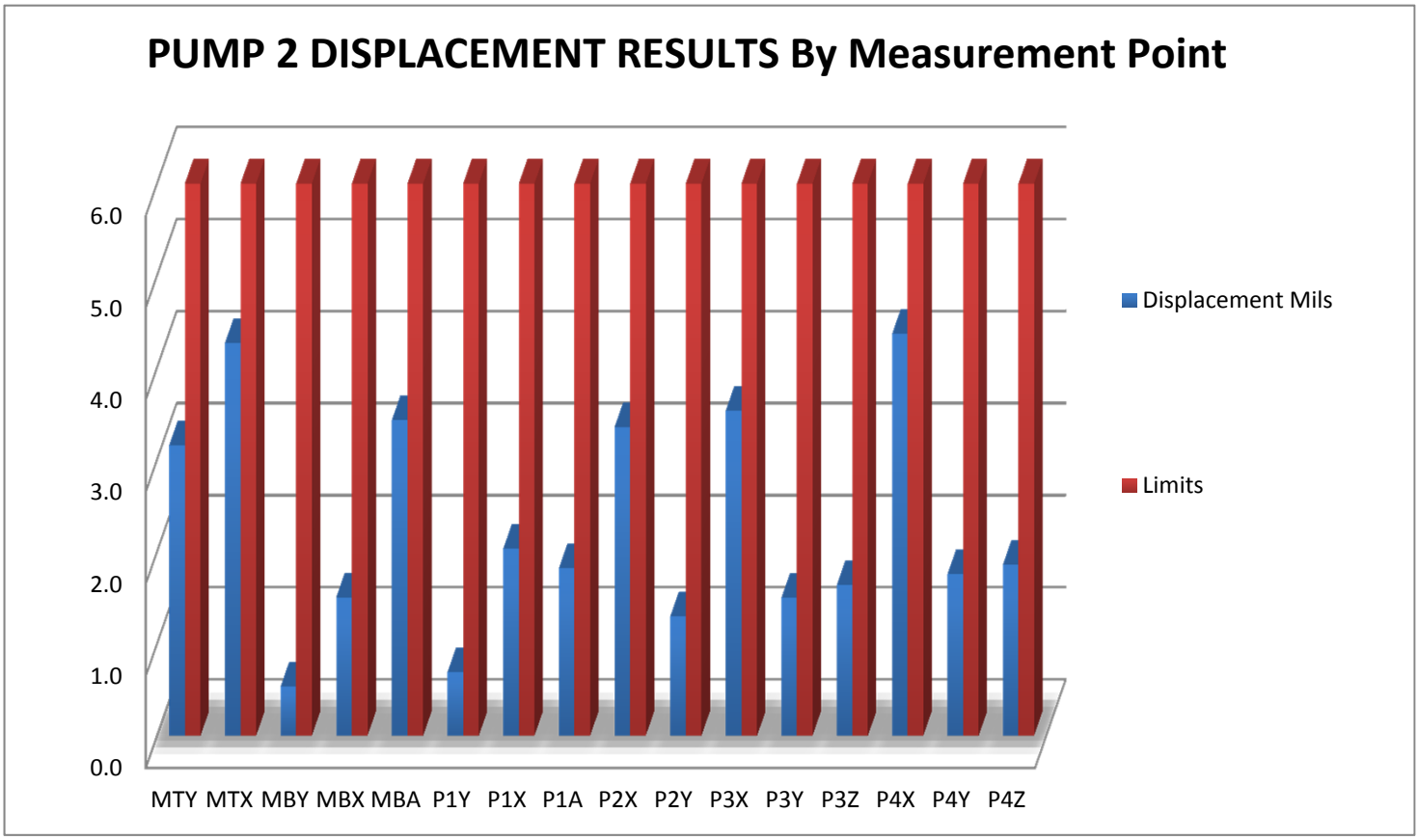
# PUMP 2

## VELOCITY VALUES VS. LIMITS



# PUMP 2

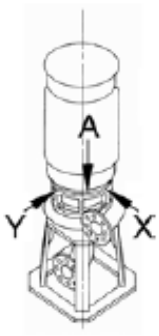
## DISPLACEMENT VALUES VS. LIMITS



CMS Condition Monitoring Services, Inc.

# VIBRATION ACCEPTANCE TEST REPORT

| | | | |
|---|---|---|---|
| **COMPANY:** | SAMPLE CLIENT | **VSD DRIVE HERTZ:** | 60 |
| **PUMP SERIAL:** | C3 | **AMPERAGE:** | 49 |
| **PUMP DISCHARGE PSI:** | 40.7 | **VOLTAGE:** | 445 |
| **FLOW GPM:** | 726 | **HEADER SIZE:** | 6" |
| | | **PUMP RPM:** | 1780 |



Vertical solids, close coupled

**Recorded Motor Bearing Temperatures °F**

Top 106 °F Bottom 100 °F

## STANDARDS

**Standard** - . 32 IPS / RMS (no allowance for shop testing)
**Applied standard** - 9.9.4.2.5.1c Allowable pump vibration, Solids Handling pump types.
**Reference:** Hydraulic Institute Standard 9.6.4 - 2009

**Other applicable standards** - .40 IPS or 6 Mils Pk at any point
**Reference:** Customer Documentation
**Bump Testing:** Frequency responses cannot be within 15% of known rotational forces. (1x shaft speed and vane pass at 9x)

## Bump Test Frequency Responses

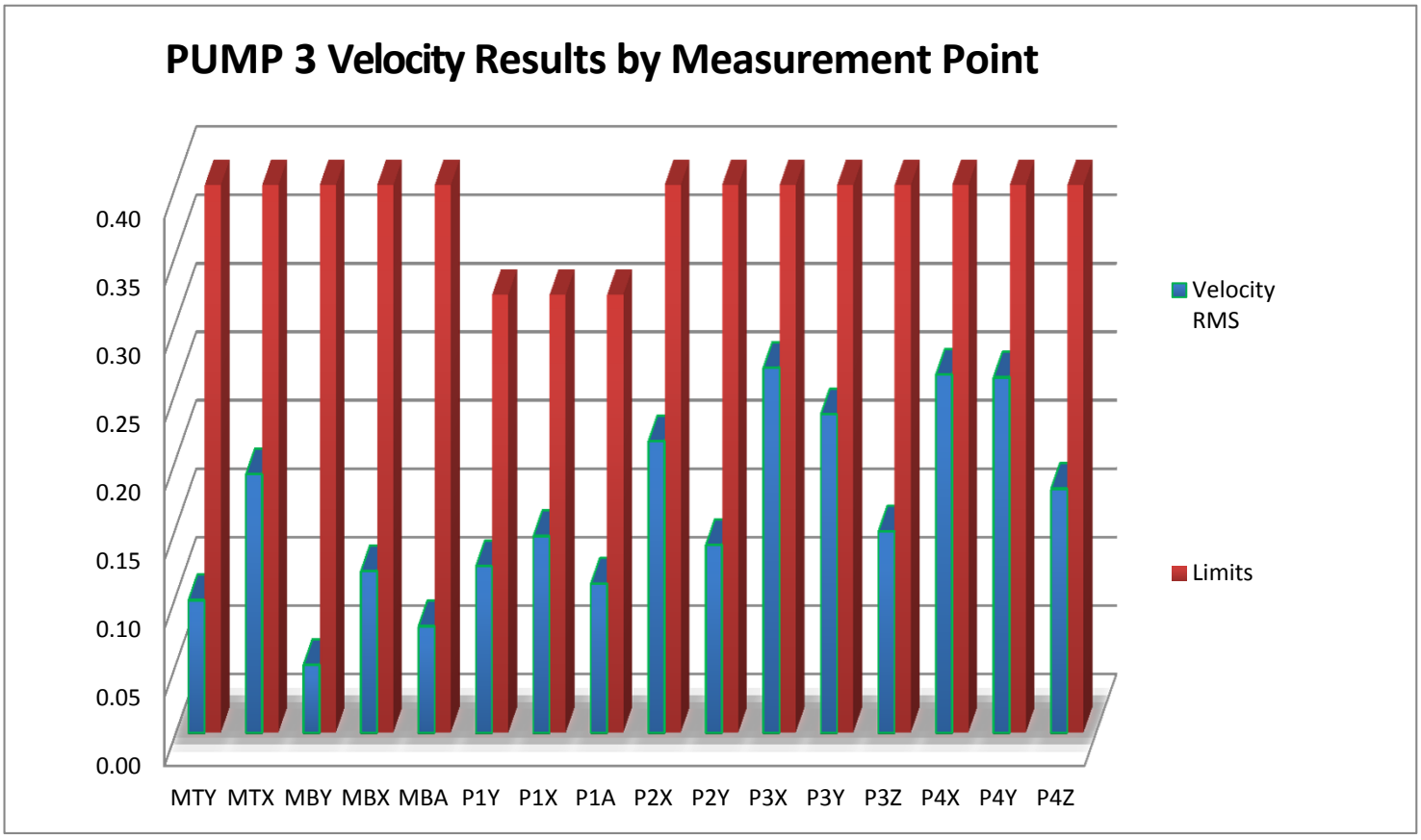
| | Orders | | CPM | | Percent Shaft 1x | |
|---|---|---|---|---|---|---|
| X - Crossline to flow | 0.16 | 1.85 | 290.4 | 3357.75 | 16% | 185% |
| Y - Inline with flow | 0.44 | 1.84 | 798.6 | 3339.6 | 44% | 184% |
| A - Axial | 0.50 | 1.78 | 907.5 | 3230.7 | 50% | 178% |
| **Response limits** based on 15% band | 0.85 | 1.15 | 1542.75 | 2087.25 | 85% | 115% |

## Vibration Results

| | | | Vel / RMS | Std | Pass/Fail | Mils PK | Std | Pass/Fail |
|---|---|---|---|---|---|---|---|---|
| MTY | - | MOTOR TOP BEARING INLINE (Y) | 0.09 | 0.4 | PASS | 1.6 | 6 | PASS |
| MTX | - | MOTOR TOP BEARING CROSSLINE (X) | 0.17 | 0.4 | PASS | 3.0 | 6 | PASS |
| MBY | - | MOTOR BTTM INLINE TO FLOW (Y) | 0.05 | 0.4 | PASS | 0.5 | 6 | PASS |
| MBX | - | MOTOR BTTM CROSSLINE TO FLOW (X) | 0.12 | 0.4 | PASS | 1.8 | 6 | PASS |
| MBA | - | MOTOR BTTM AXIAL CROSSLINE (A) | 0.07 | 0.4 | PASS | 1.2 | 6 | PASS |
| P1Y | - | PUMP INLINE TO FLOW (Y) 9.6.4 | 0.08 | 0.32 | PASS | 0.8 | 6 | PASS |
| P1X | - | PUMP CROSSLINE TO FLOW (X) 9.6.4 | 0.19 | 0.32 | PASS | 2.5 | 6 | PASS |
| P1A | - | PUMP AXIAL (A) 9.6.4 | 0.10 | 0.32 | PASS | 2.5 | 6 | PASS |
| P2X | - | PUMP BTTM CROSSLINE TO FLOW (X) | 0.24 | 0.4 | PASS | 3.8 | 6 | PASS |
| P2Y | - | PUMP BTTM INLINE TO FLOW (Y) | 0.11 | 0.4 | PASS | 1.3 | 6 | PASS |
| P3X | - | PUMP SUCTION PIPE (X) | 0.26 | 0.4 | PASS | 4.4 | 6 | PASS |
| P3Y | - | PUMP SUCTION PIPE (Y) | 0.20 | 0.4 | PASS | 3.0 | 6 | PASS |
| P3Z | - | PUMP SUCTION PIPE (Z) | 0.12 | 0.4 | PASS | 1.5 | 6 | PASS |
| P4X | - | PUMP DISCHARGE PIPE (X) | 0.23 | 0.4 | PASS | 4.5 | 6 | PASS |
| P4Y | - | PUMP DISCHARGE PIPE (Y) | 0.21 | 0.4 | PASS | 3.0 | 6 | PASS |
| P4Z | - | PUMP DISCHARGE PIPE (Z) | 0.15 | 0.4 | PASS | 1.5 | 6 | PASS |

# PUMP 3

## VELOCITY VALUES VS. LIMIT



# PUMP 3

## DISPLACEMENT VALUES VS. LIMIT