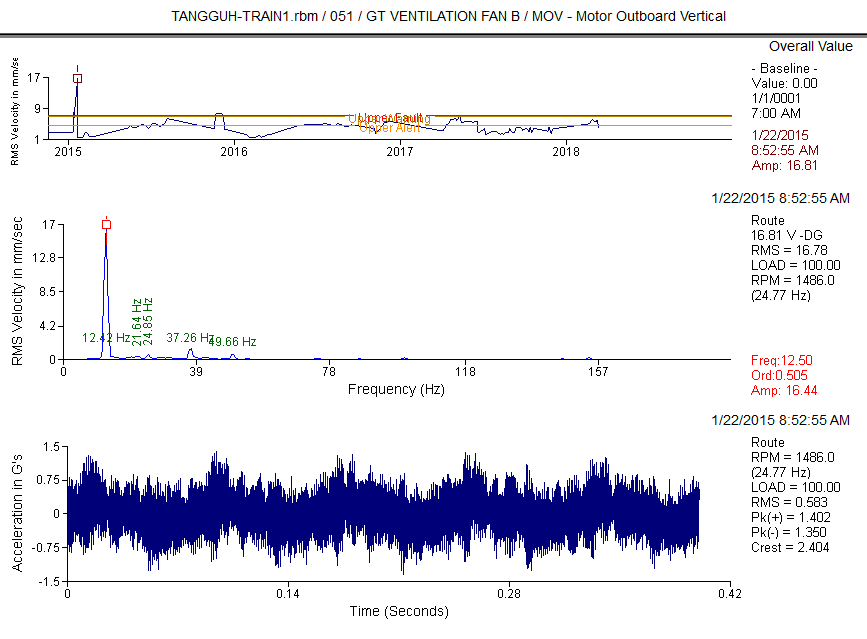
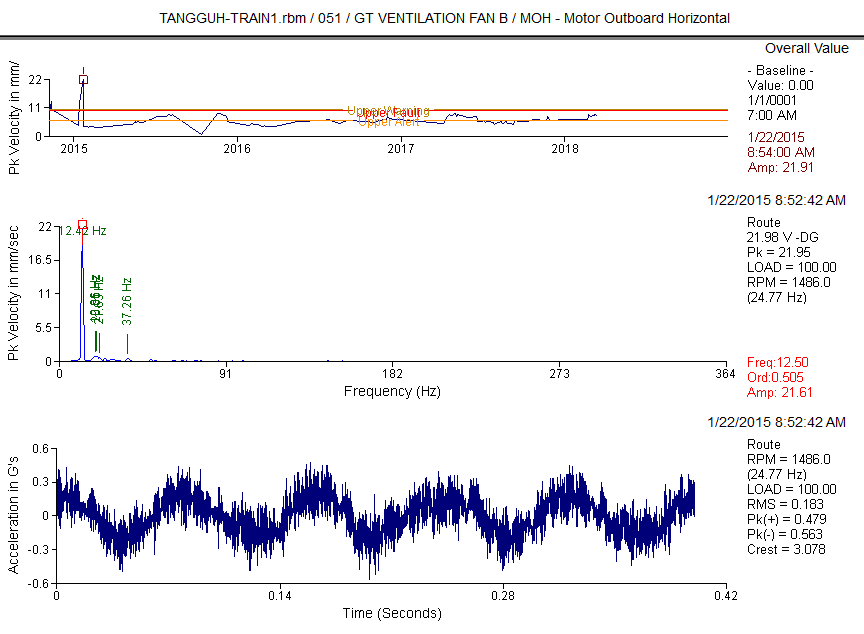
# Vibration Analysis on GT Ventilation Fan of LNG Cryogenic Process

**ATTACHMENT OF THE JOURNAL**

# Mochamad Bhakti Prasastia Utama



Graphic 1 MOH



Graphic 2 MOH

Measurement Point History

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

Database: TANGGUH-TRAIN1.rbm

Area: PR & MR Compressor (051) Report Date: 20-Feb-19 09:13

Period Reported: 22-Jan-15 To 22-Jan-15

Equipment 1: GT VENTILATION FAN B

DATE TIME RPM LOAD OVERALL PAR#1 PAR#2 PAR#3 PAR#4 PAR#5 PAR#6

51CG101C2B-MOH (RPM) APS 25 mm/Sec G-s mm/Sec mm/Sec mm/Sec mm/Sec

15.54

22-Jan-15 08:52 1486. 100.0

51CG101C2B-MOV (RPM) APS 25 mm/Sec

22-Jan-15 08:52 1486. 100.0

16.81

51CG101C2B-MIH (RPM) APS 25 mm/Sec

22-Jan-15 08:53 1486. 100.0

13.97

1CG101C2B-M1H (RPM) APS 33 mm/Sec

22-Jan-15 08:53 1486. 100.0

13.86

51CG101C2B-MIV (RPM) APS 25 mm/Sec

22-Jan-15 08:54 1486. 100.0

14.21

51CG101C2B-M1V (RPM) APS 33 mm/Sec

14.04

22-Jan-15 08:54 1486. 100.0

51CG101C2B-MIA (RPM) APS 25 mm/Sec

22-Jan-15 08:54 1486. 100.0 3.947

22-Jan-15 08:55 722. 100.0

8.815

51CG101C2B-F1V (RPM) APS 34 mm/Sec

22-Jan-15 08:55 722. 100.0

8.767

51CG101C2B-FIA (RPM) APS 71 mm/Sec

7.141

22-Jan-15 08:56 722. 100.0

51CG101C2B-FOH (RPM) APS 71 mm/Sec

16.39

22-Jan-15 08:56 722. 100.0

51CG101C2B-FOV (RPM) APS 71 mm/Sec

22-Jan-15 08:56 722. 100.0

11.29

51CG101C2B-FOA (RPM) APS 71 mm/Sec

22-Jan-15 08:57 722. 100.0

6.802

1.042 3.076 15.47 .974 .572 .414

G-s mm/Sec mm/Sec mm/Sec mm/Sec 2.752 2.404 16.65 1.012 1.762 .473

G-s mm/Sec mm/Sec mm/Sec mm/Sec 1.655 2.980 13.86 1.149 .937 .462

G-s mm/Sec mm/Sec mm/Sec mm/Sec 1.647 2.980 13.76 1.149 .934 .457

G-s mm/Sec mm/Sec mm/Sec mm/Sec 2.086 3.237 14.15 .965 .607 .486

G-s mm/Sec mm/Sec mm/Sec mm/Sec 2.078 3.237 13.98 .962 .596 .482

G-s mm/Sec mm/Sec mm/Sec mm/Sec

.570 3.525 3.830 .336 .792 .359

5.399 3.419 .215 8.621 1.415 1.039

G-s mm/Sec mm/Sec mm/Sec mm/Sec 1.028 3.504 .228 8.584 1.374 1.012

G-s mm/Sec mm/Sec mm/Sec mm/Sec 2.239 3.294 .984 6.645 .337 2.379

G-s mm/Sec mm/Sec mm/Sec mm/Sec 6.516 4.010 .550 16.29 1.112 1.282

G-s mm/Sec mm/Sec mm/Sec mm/Sec 6.007 4.357 .129 11.18 .925 1.019

G-s mm/Sec mm/Sec mm/Sec mm/Sec 1.690 3.441 .690 6.363 .345 2.242

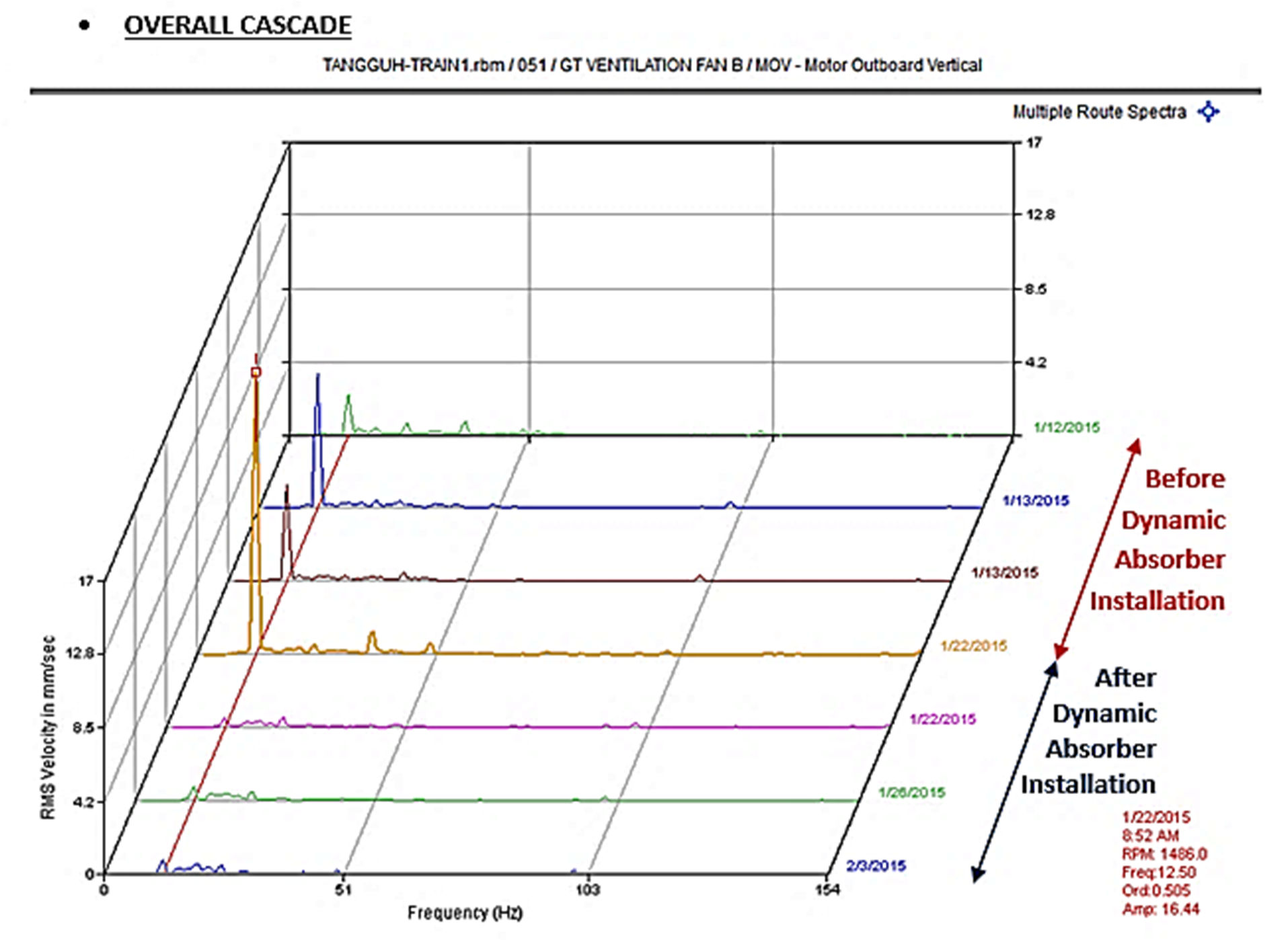
Clarification Of Vibration Units: Acc --> G-s RMS

Vel --> mm/Sec RMS

Table 1 Overall Value

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Candidate** | **Common Solving Method** | **Finding & Analysis** | | **Summary** | **Recommendation** |
| **Aggravating √** | **Disanvantaging X** |  |  |
| Unbalance | Perform Onsite Balancing | Seems like purely Sinusoidal waveforms occur | Sinusoidal waveforms aren't generated by 1X RPM of Motor | No | None |
| Misalignment | Check face to face uniformity of the coupling then Perform Laser Alignment | High Vibration phenomenon may be caused by Misalignment Problem | There's no 2x RPM frequency shown at the spectrum  There's no Out of Phase symptom at two pedestal bearing coupling | No | None |
| Bearing Problem | Perform Bearing Replacement | One of the most common problems which generate High Vibration phenomenon may be caused by Bearing Problem  1x RPM at Fan Side was occur | There's no harmonics pattern shown at the high frequencies of the spectrum | No | None |
| Looseness | Perform retighten on the system or relieve foot stress using the Online Check phase  analysis method | Looseness also can generate high vibration on the system  1x RPM was occur both at X- axis and Y-axis | There are no multiplies of 1x RPM harmonics pattern shown at the spectrum, it may be caused by spring effect at base frame was  too dominant | Yes | None |

Tabel 4.1.1 Fault Tree Analysis Tabel (Non-Scoring Mode)



Picture 10 Confirmed at the time of dynamic absorber installation according to the recommendations, that the overall vibration tend to low

**Measurement Point History**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **22-Jan-15** | **08:54** | **1486.** | **100.0** | **14.04** | **2.078** | **3.237** | **13.98** | **.962** | **.596** | **.482** |
| **22-Jan-15** | **15:06** | **1486.** | **100.0** | **2.901** | **1.671** | **3.108** | **2.333** | **1.449** | **.707** | **.530** |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **22-Jan-15** | **08:54** | **1486.** | **100.0** | **3.947** | **.570** | **3.525** | **3.830** | **.336** | **.792** | **.359** |
| **22-Jan-15** | **15:06** | **1486.** | **100.0** | **1.344** | **.738** | **3.167** | **1.053** | **.454** | **.617** | **.312** |

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

## Database: TANGGUH-TRAIN1.rbm

**Area:** **PR & MR Compressor (051) Report Date:** **20-Feb-19** **09:13**

## Period Reported: 22-Jan-15 To 22-Jan-15

**Equipment** **1:** **GT VENTILATION FAN B**

## DATE TIME RPM LOAD OVERALL PAR#1 PAR#2 PAR#3 PAR#4 PAR#5 PAR#6

## 51CG101C2B-MOH (RPM) APS 25 mm/Sec G-s mm/Sec mm/Sec mm/Sec mm/Sec

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **22-Jan-15** | **08:52** | **1486.** | **100.0** | **15.54** | **1.042** | **3.076** | **15.47** | **.974** | **.572** | **.414** |
| **22-Jan-15** | **15:05** | **1486.** | **100.0** | **2.626** | **.933** | **2.949** | **2.279** | **1.239** | **.207** | **.323** |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **22-Jan-15** | **08:52** | **1486.** | **100.0** | **16.81** | **2.752** | **2.404** | **16.65** | **1.012** | **1.762** | **.473** |
| **22-Jan-15** | **15:05** | **1486.** | **100.0** | **1.433** | **.909** | **2.949** | **.937** | **.844** | **.450** | **.505** |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Early Warning Limits** | | **---** | **7.407** | **4.348** | **4.045** | **7.342** | **1.574** | **.320** | **.426** |
| **Alert Limit Values** | | **---** | **4.500** | **10.00** | **4.000** | **0.** | **0.** | **0.** | **0.** |
| **Fault Limit Values** | | **---** | **7.100** | **20.00** | **6.000** | **0.** | **0.** | **0.** | **0.** |
| **51CG101C2B-MOV** | **(RPM) APS 25** | | **mm/Sec** | **G-s** | **mm/Sec** | | **mm/Sec** | **mm/Sec** | **mm/Sec** |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Early Warning Limits** | | **---** | **6.887** | **2.678** | **4.057** | **6.807** | **1.479** | **.597** | **.497** |
| **Alert Limit Values** | | **---** | **4.500** | **10.00** | **4.000** | **0.** | **0.** | **0.** | **0.** |
| **Fault Limit Values** | | **---** | **7.100** | **20.00** | **6.000** | **0.** | **0.** | **0.** | **0.** |
| **51CG101C2B-MIH** | **(RPM) APS 25** | | **mm/Sec** | **G-s** | **mm/Sec** | | **mm/Sec** | **mm/Sec** | **mm/Sec** |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Early Warning Limits** | **---** | **7.660** | **5.411** | **3.717** | **7.584** | **1.087** | **.434** | **.522** |
| **Alert Limit Values** | **---** | **4.500** | **10.00** | **4.000** | **0.** | **0.** | **0.** | **0.** |
| **Fault Limit Values** | **---** | **7.100** | **20.00** | **6.000** | **0.** | **0.** | **0.** | **0.** |

**51CG101C2B-M1H** **(RPM) APS 33** **mm/Sec** **G-s** **mm/Sec mm/Sec mm/Sec mm/Sec**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **22-Jan-15** | **08:53** | **1486.** | **100.0** | **13.97** | **1.655** | **2.980** | **13.86** | **1.149** | **.937** | **.462** |
| **22-Jan-15** | **15:05** | **1486.** | **100.0** | **2.370** | **1.768** | **3.112** | **2.154** | **.753** | **.505** | **.362** |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **22-Jan-15** | **08:53** | **1486.** | **100.0** | **13.86** | **1.647** | **2.980** | **13.76** | **1.149** | **.934** | **.457** |
| **22-Jan-15** | **15:05** | **1486.** | **100.0** | **2.356** | **1.767** | **3.112** | **2.117** | **.769** | **.505** | **.362** |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **22-Jan-15** | **08:54** | **1486.** | **100.0** | **14.21** | **2.086** | **3.237** | **14.15** | **.965** | **.607** | **.486** |
| **22-Jan-15** | **15:06** | **1486.** | **100.0** | **2.883** | **1.677** | **3.108** | **2.337** | **1.440** | **.691** | **.534** |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Early Warning Limits** | | **---** | **7.588** | **5.403** | **3.709** | **7.507** | **1.062** | **.424** | **.520** |
| **Alert Limit Values** | | **---** | **4.500** | **10.00** | **4.000** | **0.** | **0.** | **0.** | **0.** |
| **Fault Limit Values** | | **---** | **7.100** | **20.00** | **6.000** | **0.** | **0.** | **0.** | **0.** |
| **51CG101C2B-MIV** | **(RPM) APS 25** | | **mm/Sec** | **G-s** | **mm/Sec** | | **mm/Sec** | **mm/Sec** | **mm/Sec** |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Early Warning Limits** | | **---** | **11.94** | **4.765** | **3.837** | **11.79** | **1.795** | **.705** | **.732** |
| **Alert Limit Values** | | **---** | **4.500** | **10.00** | **4.000** | **0.** | **0.** | **0.** | **0.** |
| **Fault Limit Values** | | **---** | **7.100** | **20.00** | **6.000** | **0.** | **0.** | **0.** | **0.** |
| **51CG101C2B-M1V** | **(RPM) APS 33** | | **mm/Sec** | **G-s** | **mm/Sec** | | **mm/Sec** | **mm/Sec** | **mm/Sec** |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Early Warning Limits** | | **---** | **11.78** | **4.668** | **3.868** | **11.64** | **1.791** | **.665** | **.731** |
| **Alert Limit Values** | | **---** | **4.500** | **10.00** | **4.000** | **0.** | **0.** | **0.** | **0.** |
| **Fault Limit Values** | | **---** | **7.100** | **20.00** | **6.000** | **0.** | **0.** | **0.** | **0.** |
| **51CG101C2B-MIA** | **(RPM) APS 25** | | **mm/Sec** | **G-s** | **mm/Sec** | | **mm/Sec** | **mm/Sec** | **mm/Sec** |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Early Warning Limits** | **---** | **4.184** | **1.063** | **4.165** | **4.153** | **.696** | **.540** | **.513** |
| **Alert Limit Values** | **---** | **4.500** | **10.00** | **4.000** | **0.** | **0.** | **0.** | **0.** |
| **Fault Limit Values** | **---** | **7.100** | **20.00** | **6.000** | **0.** | **0.** | **0.** | **0.** |

## 51CG101C2B-FIH (RPM) APS 71 mm/Sec G-s mm/Sec mm/Sec mm/Sec mm/Sec

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **22-Jan-15** | **08:55** | **722.** | **100.0** | **19.18** | **9.792** | **3.826** | **.644** | **18.98** | **1.366** | **2.189** |
| **22-Jan-15** | **15:07** | **722.** | **100.0** | **2.041** | **10.06** | **4.095** | **.280** | **1.652** | **.854** | **.688** |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **22-Jan-15** | **08:55** | **722.** | **100.0** | **19.07** | **1.841** | **4.512** | **.476** | **18.87** | **1.326** | **2.206** |
| **22-Jan-15** | **15:07** | **722.** | **100.0** | **2.054** | **1.541** | **4.032** | **.349** | **1.609** | **.908** | **.686** |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **22-Jan-15** | **08:55** | **722.** | **100.0** | **8.815** | **5.399** | **3.419** | **.215** | **8.621** | **1.415** | **1.039** |
| **22-Jan-15** | **15:08** | **722.** | **100.0** | **1.185** | **16.23** | **4.419** | **.180** | **.648** | **.803** | **.521** |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **22-Jan-15** | **08:55** | **722.** | **100.0** | **8.767** | **1.028** | **3.504** | **.228** | **8.584** | **1.374** | **1.012** |
| **22-Jan-15** | **15:08** | **722.** | **100.0** | **1.130** | **1.079** | **3.727** | **.202** | **.638** | **.703** | **.533** |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **22-Jan-15** | **08:56** | **722.** | **100.0** | **7.141** | **2.239** | **3.294** | **.984** | **6.645** | **.337** | **2.379** |
| **22-Jan-15** | **15:08** | **722.** | **100.0** | **2.052** | **3.494** | **3.966** | **.909** | **1.371** | **.584** | **1.049** |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **22-Jan-15** | **08:56** | **722.** | **100.0** | **16.39** | **6.516** | **4.010** | **.550** | **16.29** | **1.112** | **1.282** |
| **22-Jan-15** | **15:08** | **722.** | **100.0** | **2.087** | **10.71** | **4.634** | **.465** | **1.853** | **.467** | **.496** |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **22-Jan-15** | **08:56** | **722.** | **100.0** | **11.29** | **6.007** | **4.357** | **.129** | **11.18** | **.925** | **1.019** |
| **22-Jan-15** | **15:09** | **722.** | **100.0** | **1.105** | **8.315** | **3.981** | **.081** | **.699** | **.695** | **.438** |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **22-Jan-15** | **08:57** | **722.** | **100.0** | **6.802** | **1.690** | **3.441** | **.690** | **6.363** | **.345** | **2.242** |
| **22-Jan-15** | **15:09** | **722.** | **100.0** | **1.874** | **3.972** | **3.899** | **.495** | **1.452** | **.453** | **.954** |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Early Warning Limits** | | **---** | **12.33** | **27.16** | **4.684** | **.371** | **12.28** | **1.113** | **.849** |
| **Alert Limit Values** | | **---** | **4.500** | **10.00** | **4.000** | **0.** | **0.** | **0.** | **0.** |
| **Fault Limit Values** | | **---** | **7.100** | **20.00** | **6.000** | **0.** | **0.** | **0.** | **0.** |
| **51CG101C2B-F1H** | **(RPM) APS 34** | | **mm/Sec** | **G-s** | **mm/Sec** | | **mm/Sec** | **mm/Sec** | **mm/Sec** |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Early Warning Limits** | | **---** | **12.18** | **2.496** | **5.391** | **.639** | **12.12** | **1.087** | **.881** |
| **Alert Limit Values** | | **---** | **4.500** | **10.00** | **4.000** | **0.** | **0.** | **0.** | **0.** |
| **Fault Limit Values** | | **---** | **7.100** | **20.00** | **6.000** | **0.** | **0.** | **0.** | **0.** |
| **51CG101C2B-FIV** | **(RPM) APS 71** | | **mm/Sec** | **G-s** | **mm/Sec** | | **mm/Sec** | **mm/Sec** | **mm/Sec** |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Early Warning Limits** | | **---** | **2.851** | **26.75** | **4.466** | **.913** | **2.825** | **1.079** | **.684** |
| **Alert Limit Values** | | **---** | **4.500** | **10.00** | **4.000** | **0.** | **0.** | **0.** | **0.** |
| **Fault Limit Values** | | **---** | **7.100** | **20.00** | **6.000** | **0.** | **0.** | **0.** | **0.** |
| **51CG101C2B-F1V** | **(RPM) APS 34** | | **mm/Sec** | **G-s** | **mm/Sec** | | **mm/Sec** | **mm/Sec** | **mm/Sec** |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Early Warning Limits** | | **---** | **2.855** | **1.990** | **4.463** | **1.209** | **2.792** | **1.060** | **.703** |
| **Alert Limit Values** | | **---** | **4.500** | **10.00** | **4.000** | **0.** | **0.** | **0.** | **0.** |
| **Fault Limit Values** | | **---** | **7.100** | **20.00** | **6.000** | **0.** | **0.** | **0.** | **0.** |
| **51CG101C2B-FIA** | **(RPM) APS 71** | | **mm/Sec** | **G-s** | **mm/Sec** | | **mm/Sec** | **mm/Sec** | **mm/Sec** |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Early Warning Limits** | | **---** | **5.660** | **18.15** | **4.408** | **.701** | **5.613** | **.734** | **1.196** |
| **Alert Limit Values** | | **---** | **4.500** | **10.00** | **4.000** | **0.** | **0.** | **0.** | **0.** |
| **Fault Limit Values** | | **---** | **7.100** | **20.00** | **6.000** | **0.** | **0.** | **0.** | **0.** |
| **51CG101C2B-FOH** | **(RPM) APS 71** | | **mm/Sec** | **G-s** | **mm/Sec** | | **mm/Sec** | **mm/Sec** | **mm/Sec** |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Early Warning Limits** | | **---** | **11.92** | **18.58** | **4.870** | **.526** | **11.88** | **.676** | **.510** |
| **Alert Limit Values** | | **---** | **4.500** | **10.00** | **4.000** | **0.** | **0.** | **0.** | **0.** |
| **Fault Limit Values** | | **---** | **7.100** | **20.00** | **6.000** | **0.** | **0.** | **0.** | **0.** |
| **51CG101C2B-FOV** | **(RPM) APS 71** | | **mm/Sec** | **G-s** | **mm/Sec** | | **mm/Sec** | **mm/Sec** | **mm/Sec** |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Early Warning Limits** | | **---** | **2.952** | **19.14** | **5.627** | **.215** | **2.972** | **1.164** | **.576** |
| **Alert Limit Values** | | **---** | **4.500** | **10.00** | **4.000** | **0.** | **0.** | **0.** | **0.** |
| **Fault Limit Values** | | **---** | **7.100** | **20.00** | **6.000** | **0.** | **0.** | **0.** | **0.** |
| **51CG101C2B-FOA** | **(RPM) APS 71** | | **mm/Sec** | **G-s** | **mm/Sec** | | **mm/Sec** | **mm/Sec** | **mm/Sec** |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Early Warning Limits** | **---** | **2.908** | **13.54** | **5.023** | **.762** | **2.557** | **.777** | **1.192** |
| **Alert Limit Values** | **---** | **4.500** | **10.00** | **4.000** | **0.** | **0.** | **0.** | **0.** |
| **Fault Limit Values** | **---** | **7.100** | **20.00** | **6.000** | **0.** | **0.** | **0.** | **0.** |