ITEM NO: 009-104
DATE: ***01 OCT 2018***
CATEGORY: II

1. SCOPE:

1.1 Title: Vibration Testing and Analysis; accomplish

2. REFERENCES:

2.1 S9073-AX-SPN-010/MVA, Vibration Analysis, Machinery

2.2 Equipment Technical Manual

3. REQUIREMENTS:

3.1 Minimum personnel qualifications:

3.1.1 For vibration testing, personnel ***must*** have the equivalent of 1,000 man hours of combined experience in: vibration concepts and terminology, the use of vibration equipment, performing equipment calibration, using electronic data collectors for monitoring and recording of vibration data, the attachment of transducer mounting disks and blocks, the selection and location of transducers, calculating machine frequencies, and have a qualified Vibration Category I certification from the Vibration Institute, or equivalent experience and training.

3.1.2 For vibration analysis, personnel ***must*** have the equivalent of 3,000 man hours experience in: the use of FFT analyzers and data collectors, identifying machinery faults, performing spectral analysis, performing vibration testing, and have a knowledge of the engineering units involved, have a qualified Vibration Category II certification from the Vibration Institute, or equivalent experience and training.

3.1.3 Submit one legible copy, in hard copy or approved transferrable media, of written substantiation of the credentials of the personnel to the SUPERVISOR 7 days prior to the start of vibration testing.

3.1.3.1 Submit any change of certification and/or personnel as it occurs to the SUPERVISOR.

(V) (G) "TESTING AND ANALYSIS"

3.2 Accomplish vibration testing and analysis of the equipment in accordance with 2.1, using the ship’s applicable Vibration Test and Analysis Guide (VTAG), and the following.

3.2.1 Test the equipment at normal operational speed and load, using 2.2 for guidance. Commence vibration testing upon satisfactory completion of shipboard operational testing.

3.2.2 Vibration data ***must*** be recorded after obtaining stabilized bearing temperatures for continuous duty equipment.

3.2.2.1 Prior to collecting any data, operate pumps with electric motor drivers a minimum of 4 hours.

3.2.2.2 Operate pumps with auxiliary turbine drivers a minimum of 2 hours.

3.2.2.3 Operate other equipment a minimum of one hour.

3.2.2.4 For auxiliary turbine drivers or other variable speed equipment, data ***must*** be acquired within plus or minus 5 percent of the specified speed.

3.2.3 Intermittent or special duty equipment ***must*** have vibration data collected during the normal operating cycle.

3.2.4 Acceptable vibration data results ***must*** not exceed like unit average machine values (statistically averaged signatures maintained in the ship's/Class program database). New or newly overhauled units ***must*** be compared to the Mean plus one Standard Deviation of the statistically averaged machine data as criteria. If only one component, the driver or the driven component, was replaced or overhauled and no repair action was accomplished to the other, the unit vibration signature ***must*** be compared to the Mean plus 2 Standard Deviations of the statistically averaged machine data as criteria.

3.2.5 If VTAG information is not available, collect and analyze vibration data in accordance with the following:

3.2.5.1 Record vibration data in accordance with Paragraph 3.1.2 and 3.3 of 2.1.

3.2.5.2 Vibration data ***must*** not exceed the criteria of Paragraph 3.4.3 of 2.1.

3.2.5.3 Test equipment in accordance with 3.2.1 through 3.2.3.

3.2.5.4 For reciprocating machinery, take a minimum of 2 data points, one at each end of the crankshaft centerline, or as close to centerline as possible.

3.2.5.5 Number each vibration measurement location, starting on the driver end furthest from the driven unit. For 2 drivers on a single driven unit, the numbering ***must*** be from one driver end to the other. For 2 driven units from a single driver, the numbering ***must*** be from one driven unit to the other.

3.2.5.6 Provide a sketch of the unit with the following information:

Drive Unit(s)
Driven Unit(s)
Location of Bearings
Location and numbering of vibration measurement points

3.2.5.7 Scale vibration amplitudes on plot to show the best representation of the magnitudes.

3.2.5.8 For machinery consisting of a drive and driven unit, take vibration data on both pieces of equipment, even if only one piece of equipment was subject to overhaul, to allow a complete analysis of the vibration data, including vibration transmitted between the pieces of equipment.

3.2.6 Record results of vibration analysis on a test data sheet, Attachment A.

3.2.6.1 Submit one legible copy, in hard copy or approved transferrable media, of the following to the SUPERVISOR within 2 days of completion of vibration analysis:

Completed Attachment A
Machine's vibration data plots
VTAG applicable to the machine
Average machine values applicable to the machine

4. NOTES:

4.1 Equipment performance ***must*** satisfy vibration requirements of specific average machine values if the machinery item is included in the ship's machinery vibration analysis (MVA) program. Such programs are in compliance with 2.1 and depend on the ship's applicable VTAG to identify machinery, provide pertinent measurement locations, numbering conventions, test conditions, manufacturer's configuration information, analysis ranges and major forcing frequencies.

4.2 For surface ships, other than aircraft carriers, VTAG and average machine values are available from Technical Points of Contact (TPOCs) at 215-897-8471 or 215-897-7424.

4.3 For aircraft carriers, VTAG and average machine values are available from Supervisor of Shipbuilding Newport News, Aircraft Carrier Planning Office (757-688-5183).

4.4 Equipment Technical Manual will be listed in the invoking Work Item.

4.5 For new or newly overhauled equipment, start of vibration testing can only commence upon satisfactory completion of shipboard operational testing, which will be addressed in the invoking Work Item. Also consider any other adjacent work in the machinery space that may affect accomplishment of vibration testing.

ATTACHMENT A

MACHINERY VIBRATION ANALYSIS REPORT

DATE OF VIBRATION TEST: _____

SHIP NAME_____ HULL: _____

CONTRACT/JOB ORDER NO.:_____ WORK ITEM NO.:_____

IDENTIFY: DRIVER OVERHAULED ☐ YES ☐ NO
DRIVEN OVERHAULED ☐ YES ☐ NO

EQUIPMENT NAME: _____ EQUIP. NO.: _____

DRIVER MANUFACTURER: _____ SERIAL NO.: _____

DRIVEN MANUFACTURER: _____ SERIAL NO.: _____

VTAG USED: HULL APPLICABILITY: _____, SWAB: _____, MID: _____

RECORD ACTUAL OPERATING CONDITIONS:
(SPEED, LOAD, PRESSURE, ETC., OR OTHER CONDITIONS AFFECTING THE TEST)
_____
_____
_____
TEST RPM:_____

RECORD VIBRATION TEST EQUIPMENT USED:

COMPONENT	MANUFACTURER	MODEL
ANALYZER		
ACCELEROMETER		
CALIBRATOR		

REPORTING CONTRACTOR: _____

PRINTED NAME: _____

TESTS RESULTS: SAT ☐ UNSAT ☐ (Provide recommendation for corrective action(s) if UNSAT)
_____
_____
_____

SIGNATURE: _____ PHONE
SIGNATURE OF PERSON PERFORMING ANALYSIS (INDICATES VIBRATION TESTING IS COMPLETE INCLUDING RECORDING RESULTS/DATA)
ATTACH COPY OF VIBRATION SIGNATURES, APPLICABLE VTAG AND AVERAGE MACHINE DATA. FOR NON-VTAG UNITS, PROVIDE BASIC SKETCH.

ATTACHMENT A

MACHINERY VIBRATION ANALYSIS REPORT DATA SHEET

DATE: _____

SHIP NAME: HULL:

EQUIPMENT NAME AND POSITION:

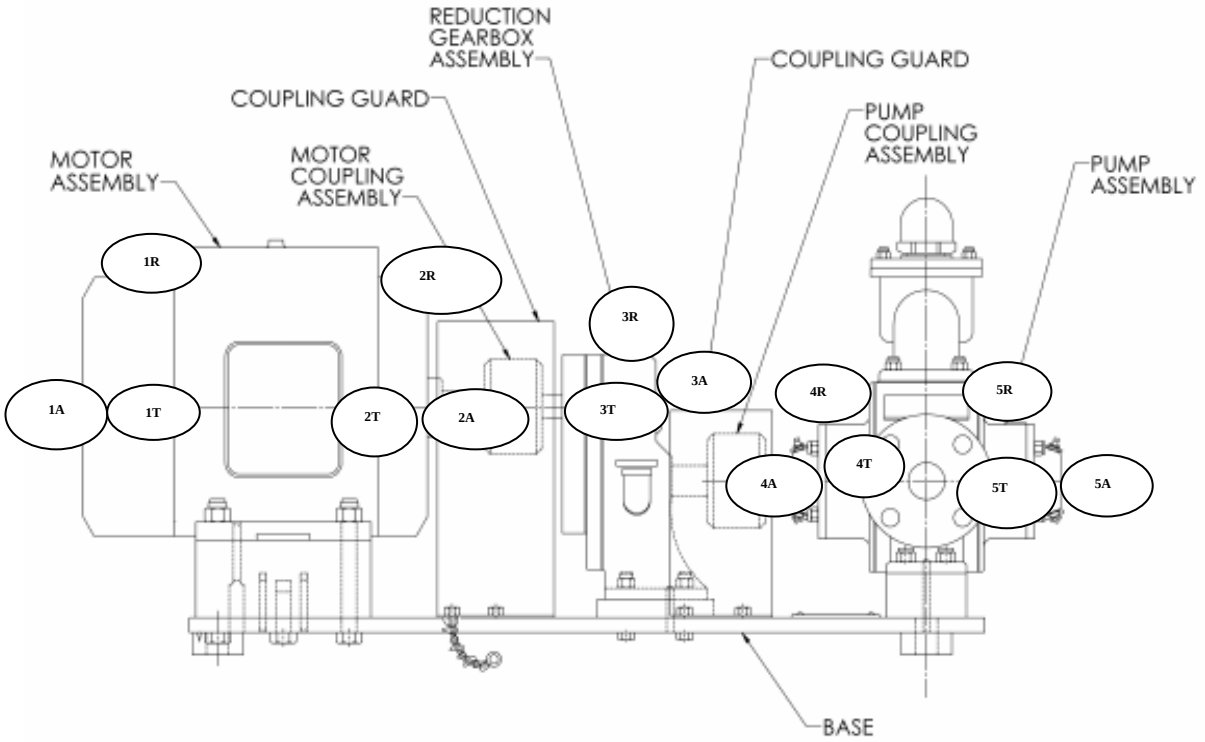
Type and method of recording test (X applicable): Velocity (VdB) ___ / Velocity (in/sec peak) ___ / Displacement (mils peak to peak) ___ / Cross-channel ___ / Absolute ___

Comments:

Equipment Sketch

POSITION	AMP	PHASE	POSITION	AMP	PHASE	POSITION	AMP	PHASE

EXAMPLE SKETCH AND READINGS FOR ATTACHMENT A



POSITION	AMP	PHASE	POSITION	AMP	PHASE	POSITION	AMP	PHASE
1R	.006	0°	4R	.004	0°			
1A	.030	180°	4A	.006	180°			
1T	.043	90°	4T	.026	90°			
2R	.036	0°	5R	.470	0°			
2A	.020	180°	5A	.003	180°			
2T	.047	90°	5T	.018	90°			
3T	.333	0°						
3R	.014	270°						
3A	.036	45°						

List of Abbreviations: R= Vertical / A= Axial / T= Tangential

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