

Indent No. : 20150344,
20144697

SCOPE: SUPPLY & COMMISSIONING OF NATURAL FREQUENCY MEASURING INSTRUMENT WITH SPECIFICATIONS AS BELOW :
No of Machines : 03(02+01) Nos

SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	REMARKS
1.0	PURPOSE & WORK PIECE MATERIAL			
1.1	Purpose: The vibration frequency measuring instrument is intended to be used in shop floor for natural frequency testing of turbine blades in static conditions. Blade types : Maximum blade length will be upto 1500 mm and weight upto 70 kg, width upto 450mm. The machine will be used for blades having different sizes of roots of curved Fir-tree , T root, fork (finger type) & dove-tail.	Vendor to accept		
1.2	Major Technical Specification:			
1.2.1	Minimum two Nos. active input Channel; one number output channel for self calibration & signal generation.	Vendor to confirm		
1.2.2	Connectors: BNC Type with 10-32UNF female for accelerometer connection	Vendor to confirm		
1.2.3	Connectors: AC/DC Adapter for power supply	Vendor to confirm		
1.2.4	Dynamic range : 120 dB or more	Vendor to confirm		
1.2.5	AC/DC/ICP coupling	Vendor to confirm		
1.2.6	Frequency Range : Suitable Instrument to measure Frequency 20Hz TO 2000Hz atleast.	Vendor to confirm		
1.2.7	Frequency resolution: 6400 lines or more	Vendor to confirm		
1.2.8	Window Function: Hamming at least	Vendor to confirm		
1.2.9	Average Mode: Time (STA), Spectral, Linear Exponential peak hold and reference peak hold modes.	Vendor to confirm		
1.2.10	Measurement Mode: On-line and Off-line	Vendor to confirm		
1.2.11	Measuring accuracy: All input ranges at 1KHz:±0.05dB (typical 0.015 dB) at Temperature variability :< 0.1 dB/10 deg C	Vendor to confirm		
1.2.12	Analyser type : Channel Processing Should be Real time.	Vendor to confirm		
1.2.13	Display Type : Time signal, Spectral, monitoring waterfall, Monitoring / Compressed signal, Constant Band Tracking at least, more than 5" inbuilt colour LCD display.	Vendor to confirm		
1.2.14	Display Resolution: Input resolution: 24 bits (144dB) or better	Vendor to confirm		

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SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	REMARKS
1.2.15	Display Mode : Time signal, Spectral, Orbit, waterfall, Monitoring/ Compressed signal, Profile, Complex profile, Constant Band Tracking at least	Vendor to confirm		
1.2.16	Display Y/ Vertical axis unit: Any physical quantity in any physical unit (in Linear, Log and dB). Display in RMS, Peak, Peak-peak, RMS at least.	Vendor to confirm		
1.2.17	Display X/Horizontal axis : Linear, Logarithmic of frequency in Hz	Vendor to confirm		
1.2.18	operating temperature condition : 0 to 50 deg C	Vendor to confirm		
1.2.19	It should be portable in nature having weight(including battery) not more than 5 kg, and dimension within 300x250x150	Vendor to confirm		
1.2.20	Input Range : $\pm 10V_{pk}$ or wider.	Vendor to confirm		
1.2.21	Power supply : 100 to 240 V AC to adapter. Instrument should be operated under battery DC and also directly with adapter. High performance battery with more than 8 hrs of continuous use.	Vendor to confirm		
1.3 REPORTING SOFTWARE :				
1.3.1	Instrument should be capable to transfer data to PC and have internal memory of 4GB atleast.	Vendor to confirm		
1.3.2	Instrument should be capable to store data of frequency peaks slected by operator for a lot (having specific blade IDs) and it can be possible to download same data in excel format in PC.	Vendor to confirm		
1.4 General requirements				
1.4.1	Party should quote all the items required for satisfactory operation of the equipment even if it is not specified in item list.	Vendor to confirm		
1.4.2	The Party should commission the equipments at our works on the minimum two set of (fir-tree blade Drawing Nos 01030756002, 01030756004 or any other design) blades. During commissioning Party should also demonstrate interfacing of instrument with personal computer & data transfer to computer.	Vendor to accept		
1.4.3	The Party will provide 04 sets of the following documents in English Language in Hard copy and one soft copy on CD:	Vendor to confirm		
1.4.3.1	Technical Operational manual including Operating instructions for the Software, data trasfering to PC , DO's and Don't's during operation.etc .	Vendor to confirm		
1.4.4	Accelerometer and cable should be detachable separate item identity.	Vendor to accept		



SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	REMARKS
1.4.5	Throughout the guarantee period, in the event of breakdown, if equipment needs any repair and needs to be taken out of the plant, the same shall be done by the vendor after providing a standby equipment.	Vendor to accept		
1.5	ACCESSORIES & MANDATORY SPARES			
1.5.1	ACCESSORIES :			
1.5.1.1	Data uploading/down loading software for the measuring unit along with connecting cable (if required) should be supplied alongwith the equipment	Vendor to confirm and provide details		
1.5.2	MANDATORY SPARES:			
1.5.2.1	ICP Type with minimum 10mV/g sensitivity, more than 7KHz frequency range, weight not more than 10gms, measuring range minimum 250 gpk, Connection 10-32 UNF at side or top mounting.	Vendor to quote on single piece basis		
1.5.2.2	Flexible cable of 3m length, 3-4mm diameter with end protection (for preventing breakage/ discontinuity at connectors joint) inbuilt with both side connector 10-32 UNF (male). Suitable BNC connectors required to connect cable with instrument .	Vendor to quote on single piece basis		
1.5.2.3	AC adaptor (with indian system of plugs) to power supply socket for running analyzer with AC supply apart from DC battery..	Vendor to quote on single piece basis		
1.5.2.4	Hard Flight Case.	Vendor to quote on single piece basis		
1.6	ACCURACY TESTS			
1.6.1	Accuracy Tests shall be done at supplier's end & shall be reported in calibration certificate. Same calibration certificate with test results shall be provided.	Vendor to confirm and provide.		
1.6.2	Repeatability of measured values shall be proved at BHEL within +/- 0.5Hz.	Vendor to confirm and provide.		
1.7	TRAINING			
1.7.1	Competent, English speaking experts shall be arranged by the vendor for satisfactory & effective training of BHEL personnel for total three days during commissioning at BHEL works.	Vendor to accept & confirm		
1.8	COMMISSIONING			

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SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	REMARKS
1.8.1	Supplier to take full responsibility for carrying out commissioning of all types of equipment/ accessories. Service requirement like power shall be provided by BHEL at only one point. Helping personnel shall be provided by BHEL. Details of these requirements should be informed/discussed by vendor and agreed with BHEL in advance.	Vendor to confirm		
1.8.2	Successful proving of BHEL components by the supplier shall be considered as part of commissioning. Repeatability test, as mentioned in Sl. No 1.6.2 , shall also be part of the commissioning activity.	Vendor to confirm		
1.8.3	Tools, Tackles, Test Mandrels, instruments and other necessary equipment required to carry out all commissioning activities should be arranged and brought by the supplier.	Vendor to confirm		
1.8.4	Any spare item, required for commissioning of the machine within stipulated time, shall be brought by the supplier on returnable basis.	Vendor to confirm		
1.8.5	Charges, duration, terms & conditions for Commissioning should be furnished in detail separately by vendor along with offer.	Vendor to offer		
1.8.6	Final acceptance shall be made by BHEL Hardwar after completion of following activities:			
1.8.6.1	Training of BHEL machine operators in operation of complete machine, software & accessories etc by the supplier's experts / engineers during their stay at BHEL works.	Vendor to accept & confirm.		
1.8.6.2	Prove out of BHEL components as per CI 1.6.2	Vendor to accept & confirm.		
1.90	PACKING			
	Sea worthy & rigid packing for all items of complete machine, all Accessories and other supplied items to avoid any damage/loss in transit.	Vendor to confirm		
1.10	GUARANTEE			
	Guarantee for complete machine, softwares and all supplied accessories/equipments for 24 months from the date of commissioning.	Vendor to confirm		

Steel



VIBRATION MEASUREMENT OF TURBINE BLADES
(FREE STANDING FORGED BLADES)


FORMAT NO.:
QA-024
SHEET NO.:
2 OF 2

STAGE:			DRAWING NO.:			REV.:		SPEC.NO.: HW0990019 rev a			
PRODUCT:			PROJECT/UNIT:			W.O. NO.:					
FREQ. AS PER DRAWING			F1 (Hz)			F2 (Hz)			Q. NUMBER :		
SL NO.	SEQ. NO.	BLADE ID (ON EXIT FACE OF ROOT)	PRESS	ROTOR	DIFF.	PRESS	ROTOR	DIFF.	REMARKS FOR ASSEMBLY		
38											
39											
40											
41											
42											
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71											
72											
73											
74											
			TESTED BY			REVIEWED BY			CUSTOMER/TPI		
			NAME	SIGN.	DATE	NAME	SIGN.	DATE	NAME	SIGN.	DATE
PRESS											
ROTOR											

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Annex-1

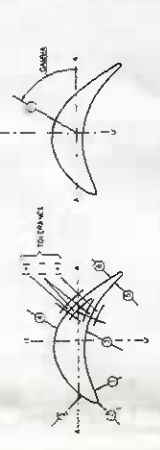
 QAX 4700			VIBRATION MEASUREMENT OF TURBINE BLADES (FREE STANDING FORGED BLADES)						FORMAT NO.: QA-024 SHEET NO.: 1 OF 2		
STAGE:		DRAWING NO.:			REV.:		SPEC.NO.: HW0990019 rev a				
PRODUCT:		PROJECT/UNIT:			W.O. NO.:						
FREQ. AS PER DRAWING			F1 (Hz)			F2 (Hz)			Q. NUMBER :		
SL NO.	SEQ. NO.	BLADE ID (ON EXIT FACE OF ROOT)	PRESS	ROTOR	DIFF.	PRESS	ROTOR	DIFF.	REMARKS FOR ASSEMBLY		
1											
2											
3											
4											
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37											
			TESTED BY			REVIEWED BY			CUSTOMER/TPI		
			NAME	SIGN.	DATE	NAME	SIGN.	DATE	NAME	SIGN.	DATE
PRESS											
ROTOR											

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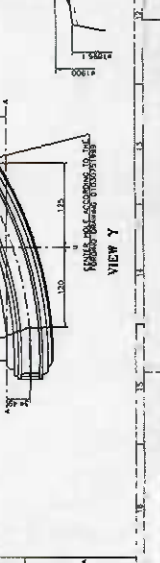
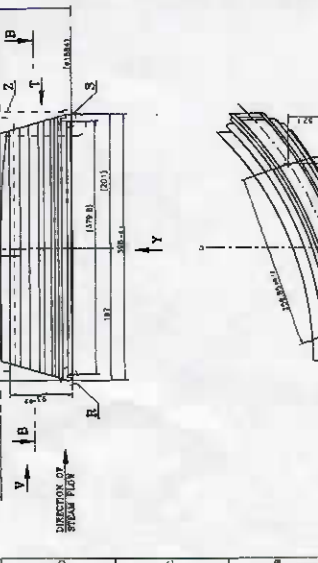
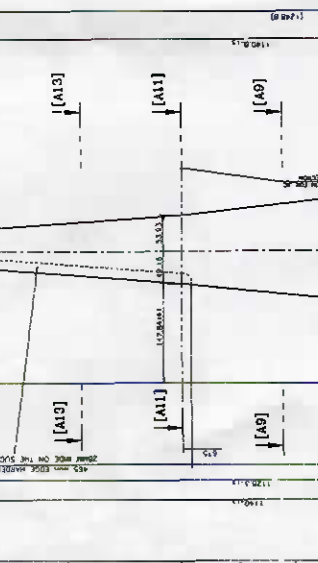
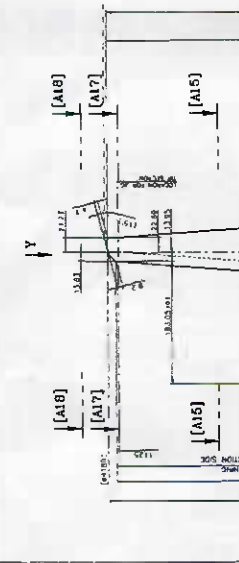
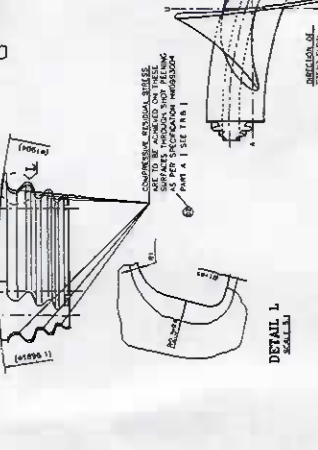
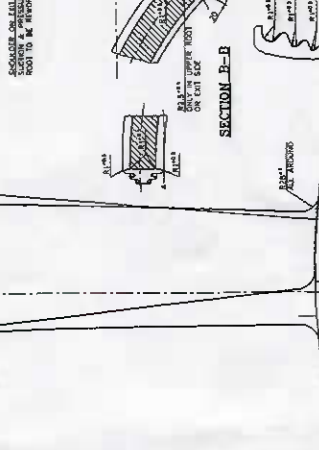
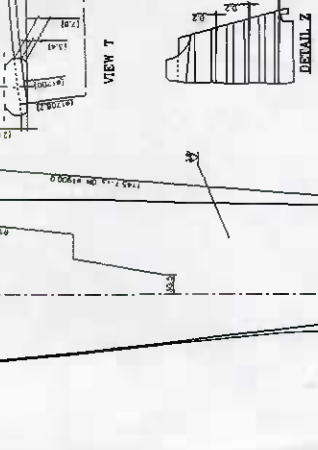
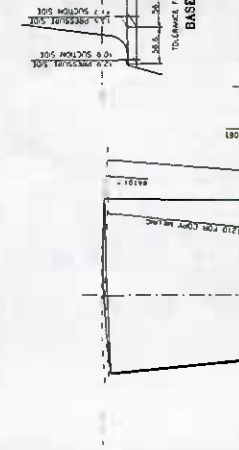
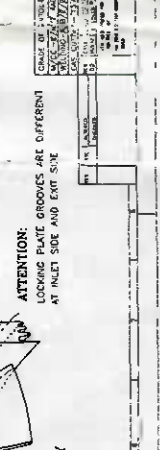
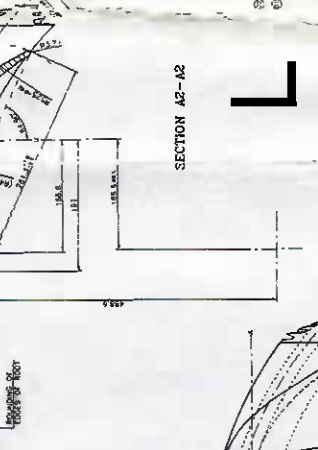
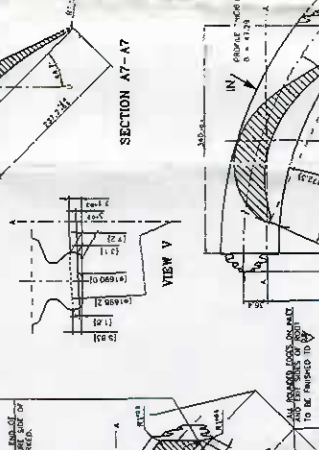
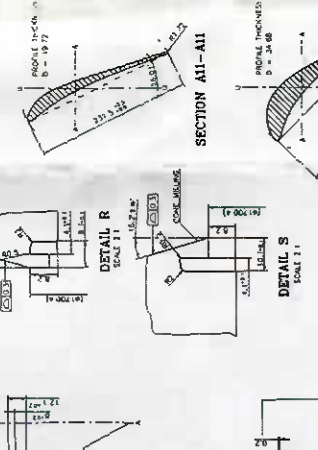
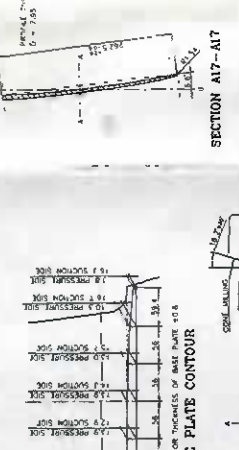
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 ALL OTHER DIMENSIONS ARE IN INCHES.
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TECHNICAL REQUIREMENTS:

- 1. TO FINISH VALUES FOR PROFILE.
- 2. PROFILE TO BE CHECKED AS PER DRAWING NO. 010007000000.
- 3. ALLOWABLE DEVIATION OF PROFILE WITH RESPECT TO ROOT BE CHECKED AS FOLLOWS:



FINISHED PART	CO-ORDINATES	AMISE	TOLERANCE	UNIFORM
1	SECTION A2	0.00	±0.05	0.0
2	SECTION A17	0.00	±0.05	0.0
3	SECTION A11	0.00	±0.05	0.0
4	SECTION A7	0.00	±0.05	0.0
5	SECTION A2	0.00	±0.05	0.0
6	SECTION A17	0.00	±0.05	0.0
7	SECTION A11	0.00	±0.05	0.0
8	SECTION A7	0.00	±0.05	0.0
9	SECTION A2	0.00	±0.05	0.0
10	SECTION A17	0.00	±0.05	0.0
11	SECTION A11	0.00	±0.05	0.0
12	SECTION A7	0.00	±0.05	0.0
13	SECTION A2	0.00	±0.05	0.0
14	SECTION A17	0.00	±0.05	0.0
15	SECTION A11	0.00	±0.05	0.0
16	SECTION A7	0.00	±0.05	0.0
17	SECTION A2	0.00	±0.05	0.0
18	SECTION A17	0.00	±0.05	0.0
19	SECTION A11	0.00	±0.05	0.0
20	SECTION A7	0.00	±0.05	0.0
21	SECTION A2	0.00	±0.05	0.0
22	SECTION A17	0.00	±0.05	0.0
23	SECTION A11	0.00	±0.05	0.0
24	SECTION A7	0.00	±0.05	0.0
25	SECTION A2	0.00	±0.05	0.0
26	SECTION A17	0.00	±0.05	0.0
27	SECTION A11	0.00	±0.05	0.0
28	SECTION A7	0.00	±0.05	0.0
29	SECTION A2	0.00	±0.05	0.0
30	SECTION A17	0.00	±0.05	0.0
31	SECTION A11	0.00	±0.05	0.0
32	SECTION A7	0.00	±0.05	0.0
33	SECTION A2	0.00	±0.05	0.0
34	SECTION A17	0.00	±0.05	0.0
35	SECTION A11	0.00	±0.05	0.0
36	SECTION A7	0.00	±0.05	0.0
37	SECTION A2	0.00	±0.05	0.0
38	SECTION A17	0.00	±0.05	0.0
39	SECTION A11	0.00	±0.05	0.0
40	SECTION A7	0.00	±0.05	0.0
41	SECTION A2	0.00	±0.05	0.0
42	SECTION A17	0.00	±0.05	0.0
43	SECTION A11	0.00	±0.05	0.0
44	SECTION A7	0.00	±0.05	0.0
45	SECTION A2	0.00	±0.05	0.0
46	SECTION A17	0.00	±0.05	0.0
47	SECTION A11	0.00	±0.05	0.0
48	SECTION A7	0.00	±0.05	0.0
49	SECTION A2	0.00	±0.05	0.0
50	SECTION A17	0.00	±0.05	0.0
51	SECTION A11	0.00	±0.05	0.0
52	SECTION A7	0.00	±0.05	0.0
53	SECTION A2	0.00	±0.05	0.0
54	SECTION A17	0.00	±0.05	0.0
55	SECTION A11	0.00	±0.05	0.0
56	SECTION A7	0.00	±0.05	0.0
57	SECTION A2	0.00	±0.05	0.0
58	SECTION A17	0.00	±0.05	0.0
59	SECTION A11	0.00	±0.05	0.0
60	SECTION A7	0.00	±0.05	0.0
61	SECTION A2	0.00	±0.05	0.0
62	SECTION A17	0.00	±0.05	0.0
63	SECTION A11	0.00	±0.05	0.0
64	SECTION A7	0.00	±0.05	0.0
65	SECTION A2	0.00	±0.05	0.0
66	SECTION A17	0.00	±0.05	0.0
67	SECTION A11	0.00	±0.05	0.0
68	SECTION A7	0.00	±0.05	0.0
69	SECTION A2	0.00	±0.05	0.0
70	SECTION A17	0.00	±0.05	0.0
71	SECTION A11	0.00	±0.05	0.0
72	SECTION A7	0.00	±0.05	0.0
73	SECTION A2	0.00	±0.05	0.0
74	SECTION A17	0.00	±0.05	0.0
75	SECTION A11	0.00	±0.05	0.0
76	SECTION A7	0.00	±0.05	0.0
77	SECTION A2	0.00	±0.05	0.0
78	SECTION A17	0.00	±0.05	0.0
79	SECTION A11	0.00	±0.05	0.0
80	SECTION A7	0.00	±0.05	0.0
81	SECTION A2	0.00	±0.05	0.0
82	SECTION A17	0.00	±0.05	0.0
83	SECTION A11	0.00	±0.05	0.0
84	SECTION A7	0.00	±0.05	0.0
85	SECTION A2	0.00	±0.05	0.0
86	SECTION A17	0.00	±0.05	0.0
87	SECTION A11	0.00	±0.05	0.0
88	SECTION A7	0.00	±0.05	0.0
89	SECTION A2	0.00	±0.05	0.0
90	SECTION A17	0.00	±0.05	0.0
91	SECTION A11	0.00	±0.05	0.0
92	SECTION A7	0.00	±0.05	0.0
93	SECTION A2	0.00	±0.05	0.0
94	SECTION A17	0.00	±0.05	0.0
95	SECTION A11	0.00	±0.05	0.0
96	SECTION A7	0.00	±0.05	0.0
97	SECTION A2	0.00	±0.05	0.0
98	SECTION A17	0.00	±0.05	0.0
99	SECTION A11	0.00	±0.05	0.0
100	SECTION A7	0.00	±0.05	0.0



NO.	SECTION	DATE	BY	CHECKED	APPROVED
1	A17-A11	1970-01-15	J. S. ...	M. S. ...	L. S. ...
2	A11-A11	1970-01-15	J. S. ...	M. S. ...	L. S. ...
3	A7-A7	1970-01-15	J. S. ...	M. S. ...	L. S. ...
4	A2-A2	1970-01-15	J. S. ...	M. S. ...	L. S. ...

ATTENTION: LOCKING PLATE GROOVES ARE DIFFERENT AT INLET SIDE AND EXIT SIDE

STEAM TURBINE

MOVING BLADE LPSL

