


Ref. No. HY/PULV/CAPITAL/2015/007, Dated: 28/07/2015

	BHARAT HEAVY ELECTRICAL LIMITED		Enquiry No. :
	UNIT'S ADDRESS:		Due Date :
	UNIT'S PHONE NOS.		No.:
	CONTACT PERSON'S NAME/DESIGN./PHONE NO./E-MAIL (FROM PURCHASE DEP'T.)		Date :

SPECIFICATION CUM COMPLIANCE CERTIFICATE FOR ROLLING ELEMENT BEARING ANALYSER

- NOTE:-**
1. Vendor must submit complete information against clause no. 18.0 The offer meeting this clause would only be processed.
 2. Inadequate / incomplete, ambiguous, or unsustainable information against any of the clauses of the
 3. The offer and all documents enclosed with offer should be in English language only.

ADDRESS OF THE SUPPLIER :		ADDRESS OF THE INDIAN
TELEPHONE NOS.:		TELEPHONE NOS.:
FAX NOS.:		FAX NOS.:
E-MAIL ADDRESS :		E-MAIL ADDRESS :

SCOPE: SUPPLY & COMMISSIONING OF ROLLING ELEMENT BEARING ANALYSER WITH SPECIFICATION AS BELOW

SI. NO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED	OFFERED	DEVIATIONS	REMARKS
1	PURPOSE				
1.1	The equipment shall be used for diagnostics /investigation of machines where faults have modulated effect on the characteristic frequencies of the machines Examples includes gear boxes ,Rolling element bearings. The equipment shall be used to identify and diagnose local faults in the rolling element bearings & gear boxes by adopting latest techniques such as Time domain analysis/Amplitude demodulation/envelope and cepstrum analysis.And must be capable of recording standard vibration sweeps, FFT & spectrograms in frequency amplitude, angle and order domain by using Vibration sensors/ transducers like ICP accelerometers, velocity probes enabling physical measurements directly in transducer units displaying displacement, velocity &acceleration simultaneously from a single sensor.	Vendor to Confirm			

SI. NO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED	OFFERED	DEVIATIONS	REMARKS
1.2	The portable Rolling element bearing analyzer shall be used to analyse problems in the low speed multistage planetary gear boxes and other types also using worm , pinion bevel combination. The analyzer should be capable of diagnosing for early detection of faults in rolling element bearing & gear boxes by using advanced techniques such as Envelope and cepstrum analyses.	Vendor to Confirm			
1.3	Should have facility to record physical measurements directly in transducer units and derive related measurements for displaying displacement, velocity & acceleration simultaneously from a single sensor.	Vendor to Confirm			
2.0	Technical Specification :				
2.1	The equipment should have minimum of 2 input channel, channels utilising the latest advances in analogue and digital electronics, including digital signal processing and the industry's highest resolution A/D converter to provide both speed and accuracy in the data collection process. The dynamic Signal analyser interfacing Lap top PC should have either of PCMCIA, USB II or Ethernet Type of communication for data collection and recording , incorporating digital signal processing, analogue to digital and digital to analogue conversion with anti aliasing and anti imaging filters incorporating tachometer timer.	Vendor to Confirm			
2.2	Analyzer basic Hardware should support the following measurements and analysis capabilities.:				
a	Time domain analysis	Vendor to Confirm			
b	Amplitude spectrum	Vendor to Confirm			
c	Auto power spectrum, cross spectrum	Vendor to Confirm			
d	Narrow band spectrum (DC to band width frequency with zoom multiplier to increase the spectral resolution in the frequency bands 0.5Hz to 200Hz & 0.5Hz to 2000Hz)	Vendor to Confirm			
e	should have over 6400 lines to achieve the desired level of resolution.	Vendor to Confirm			
f	Levels : True Peak estimation, peak to peak RMS effective value, over all value estimation	Vendor to Confirm			
g	Filters : HP,LP-BP BS- Integrator/simple & double	classical IIR/FIR filters, narrowband filter, notch/peak			

Sl. NO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED	OFFERED	DEVIATIONS	REMARKS
h	Comprehensive statistical analysis and long duration view of time domain signal	Vendor to Confirm			
i	Data presentation:	Envelope spectrum,Cepstrum, Time waveform, Rolling element bearing fault frequencies display with frequency markers , harmonics			
j	Demodulation : Envelop demodulation signal,simultaneous with spectra,zoomed spectra & envelop spectra	Vendor to Confirm			
k	Envelop analysis for early detection of faults in rolling element bearings	Vendor to Confirm			
l	should be capable to measure crest factors & kurthosis Nos for diagnosing nature of impacts in the waveforms associated with problems such as rolling element bearing wear and gear tooth wear.	Vendor to Confirm			
m	Cepstrum analysis for early detection of faults in multistage gear boxes by utilizing cross cepstrum,zoomed cepstrum,instantaneous &averaged results	Vendor to Confirm			
2.3	Display characteristic:	Spectrogram, fine Spectrogram, water falls,order spectrum			
2.4	Display types :	Magnitude, Log magnitude, db magnitude, Real, imaginary, phase			
2.5	Window characteristic:				
	a) Display scaling:	Auto, Default, User defined			
	b) X-axis:	Linear, log, real, imaginary.			
	c) Display types y-axis :	Magnitude, Log magnitude, dB magnitude, Real ,			
2.7	Cursors :				
	a) Type :	Single, dual, harmonic,			
	b) Harmonic cursor:	To track up to 100 harmonics to position line.			
2.9	The equipment should basically support the following analyses & measurements with softwares for comprehensive analysis for each type of analysis mode.	Vendor to Confirm			

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2.10	Fast fourier Transformation (FFT) (DC to bandwidth with zoom mutiplier)	Vendor to Confirm			
2.10.1	Real Time Zoom analysis	Vendor to Confirm			
2.10.2	Time domain analysis	Vendor to Confirm			
2.10.3	Narrow band spectral analysis (DC to band width frequency)	Vendor to Confirm			
2.12	Disk Recording, Analysis and DAC Play back	Vendor to Confirm			
2.12.1	The equipment should incorporate latest data recording practices to carry out analyses on disk recorded data in play back mode to perform FFT & Time domain analysis on the captured waveforms suitable for in vehicle or field testing even in the absence of line power.	Vendor to Confirm			
2.12.3	Through put to disk , disk play back & Replay analysis :	Gap free real time recording to disk, simultaneous measurements & playback to DAC .			
2.14.8	Max speed (RPM)	Less than or equal to 60,000/ max order.			
2.14.9	Envelope analysis for early detection of faults in Rolling element bearing :	Vendor to Confirm			
2.15	Demodulation spectrum : simultaneous with spectra , zoomed spectra & envelope spectra	Vendor to Confirm			
2.15.1	Should have cross channel phase analysis for determining relative phase between vibration waveforms.	Vendor to Confirm			
2.15.2	Software should contain data base for different Fault frequencies Like Bearing defect frequencies(BPFO,BPFI,BSF and FTF). gear mesh frequencies associated with bearings & gearboxes.	Vendor to Confirm			
2.17	Should have Cepstrum analysis for detecting early faults in gear boxes by utilizing Cross & zoomed cepstrum results.	Vendor to Confirm			
2.18	Comprehensive measurements:				
2.18.2	should have Power spectrum analysis to identify dominant frequencies and orders associated with gear mesh and bearing defect frequencies .	Vendor to Confirm			
2.19	Real time Zoom and high resolution				
2.19.1	The signal analyser shall provide base band measurements using captured block size up to 65,536 time samples or more.	Vendor to Confirm			
2.19.2	The high-resolution option should additionally provide and transform sizes up to 65,536 time samples with associated spectral resolution of 6400 to 25,600 lines or higher Lines.	Vendor to Confirm			
2.20	Accelerometer Transducer power supply :				

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2.20.1	The Signal analyser should have internal power source to meet excitation current requirement of ICP Accelerometer sensors, without any external signal conditioning unit.	Vendor to Confirm			
2.20.2	Built in 10Volts sources at 2 ma each channel for powering accelerometer transducers with standard high sensitivity cable.	Vendor to Confirm			
2.21	Measurements in comprehensive engineering units:				
2.21.1	The Analyser shall capture and record physical measurements in the units of transducer for display of Displacement, velocity and acceleration simultaneously from single sensors for rotating shafts and vibrating machine enclosures, bodies etc.	Vendor to Confirm			
3.0	Hardware Requirement / Specification :				
3.1	Analogue input channels				
3.1.1	2 optically isolated AC/DC/ICP coupled single ended & differential type independently selectable measuring channels that can accept inputs in the range from +/-17mv to +/-10V (0 - to -peak) with Built-in anti-aliasing filter.	Vendor to Confirm			
3.2	Input impedance:				
3.2.1	20 K Ω to 100K Ω for standard & high sensitivity cable.	Vendor to Confirm			
3.3	Dynamic Range & ADC type:				
3.3.1	High quality delta sigma converters with (24 bit or higher) floating point arithmetic leading edge design are required for spectral measurements.	(24 bit or higher) ADC, 90 to 110 dB or higher dynamic range.			
3.4	Tachometer input channel :				
	a) Source channel : Analogue inputs Range	5 < RPM < 300000			
	b) Max Tach frequency	20 kHz.			
	c) PPR :	0.01 to 4096 RPM			
	d) RPM Read out accuracy	1 RPM			
3.5	Bandwidth :				
	a) frequency range	40 KHz			
	b) Max sample rate :	102.4 Ksamples/sec			
	c) Accuracy	100 PPM			
3.6	Base band resolution :				
	a) block wise size :	16,384 to 65,536 or higher			
	b) No of spectral Lines :	Over 6400			
3.7	Zoom processing :				
	a) Frequency span	(2.5 kHz, 1.25 kHz, 625Hz ..4.88281Hz) 36 ranges from 4.88Hz			

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	b) Frequency Resolution :	Over 6400 lines			
3.8	Time :	Block size 16384 to 65,536 or higher			
3.9	Format :	(24 bit or higher)			
3.9.1	Amplitude accuracy for all measured vibration values	1% in the range 0.5Hz to 45Khz			
4.2.2	Averaging functions :	Linear,Stable (Summation), Exponential,Time synchronous, Peak, Hold, Live (Instantaneous)			
4.2.3	Triggering functions:	Mode free run, Input source			
4.2.5	Window functions:	Rectangular,Hanning,Blackman,Bartlett, Flat top, Kaiser.			
4.3	Dimensional analysis:				
4.3.1	Input units: Selection of Engineering units (EU) for each input channel from available list for easy configuration.	Vendor to Confirm			
4.3.4	Integration / differentiation: Display units in any domain are to be derived by integration or differentiation with respect to time.	Vendor to Confirm			
4.3.5	Measurements file storage : Software shall include the following features, each measurement shall be stored in disk as well as computer memory, stored data shall be used for post analysis.Each measurement file should have set up that can be used for feature measurement.	Vendor to Confirm			
4.3.6	Hierarchy	Test / Run / save directory structure			

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4.4	Operating convenience feature:				
4.5	This feature shall enable to analyse previously measured data and append additional measurements to previously stored test run. Automatically overlay graphs feature enable to compare old data with new data for same measurement location.	Vendor to Confirm			
4.6	Minimum P C requirement	LAPTOP (latest)			
4.6.1	Operating system	Windows XP or windows 7 Professional latest version			
4.6.2	Memory :	4 GB RAM Or Higher			
4.6.3	Disk space:	500 GB Or higher			
4.6.4	Display	800 x 600 SVGA or better			
4.7	Interface & Connectivity through	Type III PCMCIA slot Ethernet or USB Type II slot			
4.8	Customised Header/footer template for printed reports. Recall parameters to caption Header/footer and graph annotations and insert company logo, Bitmap etc. Out put to all printers supported with print screen	Vendor to Confirm			
5.0	Reports & Output Data :				
a)	shall provide a familiar, Windows Explorer-like environment to organize data, graphs, test setup, etc.	Vendor to Confirm			
b)	Should create customized reports and export them to various formats, such as Word, Excel, and HTML and sound recording MP3 ,MP4 player	Vendor to Confirm			
c)	Shall be Capable of browsing, viewing, copying, and pasting data for report generation to any word or excel data sheets & Bit map format	Vendor to Confirm			
d)	Simple wizards for automatic report generation.	Vendor to Confirm			
6.0	Testing				
6.1	The vibration analyzer shall be tested in accordance with applicable Standard.	Vendor to specify applicable Standard.			
6.2	Additional tests, if any shall be specified in the offer & vendor to include these tests in the offer	Vendor to Confirm			
6.3	Test reports of all the tests to be carried out on the vibration analyzer along with calibration reports shall be furnished .	Vendor to Confirm			

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9.2	A detailed list of all indications provided on the equipment should be submitted by the supplier.	Required			
10.0	DOCUMENTATION : Five sets of following documents (Hard copies) in English language should be supplied along with the equipment.	Vendor to Confirm			
10.1	Operating and maintenance manuals of the Equipment	Vendor to Confirm			
10.2	Detailed Maintenance manual of the equipment with all drawings of assemblies/sub-assemblies/parts including Electrical/Electronic circuit diagrams. All Assembly / Sub Assembly Drawings shall be supplied with part list also.	Vendor to Confirm			
10.3	Catalogues, O&M Manuals of all bought out items including drawings, wherever applicable.	Vendor to Confirm			
10.4	One additional set of all the above documentation on CD ROM, wherever possible.	Vendor to Confirm			
11.0	Prove out of the Equipment :				
11.1	Complete prove out of the equipment shall be done at BHEL works to the BHEL requirements through application software development. After commissioning the equipment 2 No.s of Planetary Gear Box's test run vibration data will be analysed and demonstrated satisfactorily for assessing the equipment technical capability in detecting bearing defect frequencies and tooth wear . Vendor shall be responsible for any deviations that may be observed during proveout of the equipment &	Vendor to Confirm			
12.0	Data to be furnished with in 15 Days of Letter of Indent / P.O				
12.1	Vendor shall submit the complete details of the equipment including electrical / electronic circuite drawings for getting BHEL's approval within 15 days from the date of Letter of Intent (LOI) / P.O. which ever is earlier. The details should consist of all requirements pertaining to complete equipment / system including space requirement.	Vendor to Confirm			
13	COMMISSIONING OF THE EQUIPMENT				
13.1	Supplier to take full responsibility for carrying out the commissioning, start up, testing of the equipment and it's controls etc. Service requirement like power etc. shall be provided by BHEL at only one point as indicated by supplier in their equipment detail drawings.	Vendor to Confirm			

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13.2	Successful proving of the equipment for BHEL components by the supplier shall be considered as part of commissioning. All tests, as mentioned at clause 15 (Equipment Acceptance) shall form part of the commissioning activity.	Vendor to Confirm			
13.3	Commissioning of the equipment is in vendor's scope .	Vendor to Confirm			
14.0	EQUIPMENT ACCEPTANCE: (Tests/Activities should be Performed by Vendor)	Vendor to Confirm			
14.1	Tests/Activities should be carried out at supplier's works on the equipment before dispatch :	As per Cl. No. 6			
14.2	Tests/Activities should be carried out at BHEL works while commissioning the equipment :	As per Cl. No. 6			
14.3	Demonstration of all features of the system / equipment, control system & accessories to the satisfaction of BHEL for efficient and effective use of the equipment.	Vendor to Confirm			
14.4	Prove out of the equipment with BHEL components as per Cl. No. 11.0	Vendor to Confirm			
14.5	Training of BHEL personnel in operation of complete equipment including electrical / electronic maintenance & accessories etc by the supplier's experts / engineers during their stay at BHEL works	Vendor to Confirm			
15.0	PACKING:				
15.1	Sea worthy & rigid packing for all items of complete equipment including accessories to avoid any damage/loss in transit.	Vendor to Confirm			
16	GUARANTEE :				
16.1	24 months from the date of acceptance of the equipment.	Vendor to Confirm			
17	GENERAL :				
17.1	Equipment should be portable, light weight having simple modular construction suitable for interfacing any modern day LAPTOP PC for in house as well as field based analysis and application. The equipment weight including lap top, dynamic signal analyser and accessories should not exceed 3 to 6 kg max making it ultra portable for the purpose of easy handling & transportation.				
17.2	Equipment Model No.	Specify			
17.3	Floor area required (Length, Width, Height) for complete equipment & accessories	Specify			
17.4	Total weight of the equipment	Specify			
18	REFERENCE LIST / QUALIFYING CONDITIONS :				

Sl. NO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED	OFFERED	DEVIATIONS	REMARKS
	Only those vendors (OEM's), who have supplied and commissioned atleast one Analyser of same or higher capacity for similar applications in the past ten years (on the date of opening of tender) and such equipment is presently working satisfactorily for more than one year with out any problem after commissioning should quote. The following information should be submitted by the vendor about the companies where referred equipments have been supplied. This is required from all the vendors for qualification of their offer.	Vendor to Confirm			
	1. Name of the customer / company where similar equipment is installed.	Specify			
	2. Complete postal address of the customer.	Specify			
	3. Month & Year of commissioning.	Specify			
	4. Broad Specifications of the equipment.	Specify			
	5. Application for which the equipment is supplied with details of accuracies achieved on the job.	Specify			
	6. Name and designation of the contact person of the customer.	Specify			
	7. Phone, FAX no. and email address of the contact person of the customer.	Specify			
	8. Performance certificate from the customers regarding satisfactory performance of equipment supplied to them	Vendor to Confirm			
	9. BHEL reserves the right to verify the information provided by vendor. In case the information provided by vendor is found to be false/incorrect, the offer shall be rejected.	Vendor to Confirm			
19.0	Delivery	Specify			