


<b>Ref. No. HY/PULV/CAPITAL/2009-10/007, Dated: 16/12/2009</b>					
	<b>BHARAT HEAVY ELECTRICAL LIMITED</b>			<b>Enquiry No. :</b>	
	<b>UNIT'S ADDRESS:</b>			<b>Due Date :</b>	
	<b>UNIT'S PHONE NOS.</b>			<b>Supplier Qtn. No.:</b>	
<b>CONTACT PERSON'S NAME/DESIGN./PHONE NO./E-MAIL (FROM PURCHASE DEP'T.)</b>			<b>Date :</b>		
<b>SPECIFICATION CUM COMPLIANCE CERTIFICATE FOR PORTABLE VIBRATION ANALYSER.</b>					
<b>NOTE:-</b>					
<b>1. Vendor must submit complete information against clause no. 18.0 The offer meeting this clause would only be processed.</b>					
<b>2. Inadequate / incomplete, ambiguous, or unsustainable information against any of the clauses of the</b>					
<b>3. The offer and all documents enclosed with offer should be in English language only.</b>					
<b>ADDRESS OF THE SUPPLIER :</b>			<b>ADDRESS OF THE INDIAN</b>		
<b>TELEPHONE NOS.:</b>			<b>TELEPHONE NOS.:</b>		
<b>FAX NOS.:</b>			<b>FAX NOS.:</b>		
<b>E-MAIL ADDRESS :</b>			<b>E-MAIL ADDRESS :</b>		
<b>SCOPE: SUPPLY &amp; COMMISSIONING OF PORTABLE VIBRATION ANALYSER WITH SPECIFICATION AS BELOW</b>					
<b>SI. NO</b>	<b>DESCRIPTION FOR BHEL REQUIREMENT</b>	<b>SPECIFIED</b>	<b>OFFERED</b>	<b>DEVIATIONS</b>	<b>REMARKS</b>
<b>1</b>	<b>PURPOSE</b>				
1.1	The Portable Vibration Analyser is required to record standard vibration sweeps, FFT & spectrograms in frequency amplitude, angle and order domain by using vibration sensors / transducers like ICP accelerometers, velocity and eddy current probes or its equivalent to carry out RPM based spectral analysis for rotating shafts, machine enclosure casing bodies, including low speed multistage gear boxes having input speed in the range (600 to 1500 RPM) and out put speed in the range (25 to 100 RPM) in accordance with latest revisions of API613 & ISO standard. The above analysis should also support measurement of shaft vibrations using proximity sensors.	Vendor to Confirm			

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1.2	The portable vibration 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 detecting gear fault frequencies during analysis for multistage low speed gear boxes as above.	Vendor to Confirm			
1.3	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			
1.4	The gearbox will be driven by belt pulley mechanism. The instrument should be able to filter out the defects caused by the drive. Example : belt slippage / unbalance, pulley unbalance etc.	Vendor to Confirm			
<b>2.0</b>	<b>Technical Specification :</b>				
2.1	The equipment should have minimum of 6 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. The dynamic signal analyser shall be compatible to Ext synch/trigger/tach signals with buffer outputs for external use.	Vendor to Confirm			
2.2	<b>Analyzer basic Hardware should support the following measurements and analysis capabilities.:</b>				
	a) Time domain analysis	Vendor to Confirm			
	b) Amplitude spectrum	Vendor to Confirm			
	c) Auto power spectrum, cross spectrum	Vendor to Confirm			

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	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) Frequency response, Impulse response, Coherence	Vendor to Confirm			
	f) Frequency resolution 6400 lines or higher	Vendor to Confirm			
	g) Cursor modes:	main, secondary, delta, harmonics, sideband markers			
	h) Levels : True Peak estimation, peak to peak RMS effective value, over all value estimation	Vendor to Confirm			
	i) Filters : HP,LP-BP BS- Integrator/simple & double	classical IIR/FIR filters, narrowband filter, notch/peak filter, comb filter			
	j) Comprehensive statistical analysis and long duration view of time domain signal (320ms to 4 Hrs or higher)	Vendor to Confirm			
	k) Data presentation:	Bode, Nyquist, polar, orbit, waterfall plots			
	l) Demodulation : Envelop demodulation signal,simultaneous with spectra,zoomed spectra & envelop spectra	Vendor to Confirm			
	m) Analyze data in 1/2/4/8 graphs	Vendor to Confirm			
	n) Synchronous Order tracking and analysis	Vendor to Confirm			
	o) Envelop analysis & Correlation	Vendor to Confirm			
	p) Gear & bearing analysis	Vendor to Confirm			
	q) Cepstrum analysis: cross cepstrum,zoomed cepstrum,instantaneous &averaged results	Vendor to Confirm			
2.3	Display characteristic:	Spectrogram, fine Spectrogram, water falls,3D Surface & 3D Cascade			
2.4	Display types :	Magnitude, Log magnitude, db magnitude, Real, imaginary, phase			
2.5	<b>Window characteristic:</b>				
2.5.1	Traces up to 16 signals per window with selectable grids detail level, Control of colours applies to traces grids, axis, test, Cursors and markers.	Vendor to Confirm			

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2.5.2	Templates and textures to set all of the graphic parameters to any saved windows, selectable texture and size of all line and symbol graphic parameters.	Vendor to Confirm			
2.6	Trace characteristics for available test type				
	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 , Imaginary, Phase, Nyquist , Polar, Polar run out.			
2.7	<b>Cursors :</b>				
	a) Type :	Single, dual, harmonic,			
	b) Peak pick Form:	vertical line intersecting trace			
	c) Read out:	test box identification of trace and X-Y Co ordinates.			
	d) Harmonic cursor:	To track up to 100 harmonics to position line.			
	e) Peak-pick cursor:	To shift mouse click, focus between traces or harmonic/peak points			
	f) Copy, paste and link :	To copy any cursor location/position from windows to other location to move all linked cursor together.			
2.8	<b>Trace statistic and other tests:</b>	histograms counts, Skewness, Kurtosis, max, min, rms, peak-peak,			
2.9	<b>The equipment should basically support the following analyses &amp; measurements with softwares for comprehensive analysis for each type of analysis mode.</b>	Vendor to Confirm			
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			

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2.10.2	Time domain analysis	Vendor to Confirm			
2.10.3	Narrow band spectral analysis (DC to band width frequency )	Vendor to Confirm			
2.11	RPM based spectral analysis:	Vendor to Confirm			
2.11.1	This single or multi channel analysis shall provide measurements synchronised to shaft speed for monitoring rotating machinery RPM sweeps that continuously monitors and triggers spectrum measurements (un-averaged) based on specified RPM intervals.	Vendor to Confirm			
2.11.2	It shall provide RPM Stepped averaged measurements at a sequence of equally spaced RPM intervals, RPM steady averaging to monitor fluctuation of shaft speed within an RPM band and shall assign measured RPM to measurement in RPM off mode while accepting keyed RPM entry from an external source.	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 analysis on the captured waveforms suitable for in vehicle or field testing even in the absence of line power.	Vendor to Confirm			
2.12.2	Data streaming feature that can be used to capture, view and store long-duration and high-speed multi-channel aquired data. simultaneously, data play-back and post-analysis with all the analysis functions.	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 .			
2.13	Water fall and spectrogram analysis	Vendor to Confirm			
2.13.1	This single or multichannel Water fall analysis shall provide water falls and related three dimensional display of all vibration signals in standard water fall formats, Display contents include records, stop on full, continuous etc.	Vendor to Confirm			

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2.13.2	It shall also provides standard cursor measurements in X,Y &Z axis with read out in order number amplitude & RPM read out.	Vendor to Confirm			
2.13.3	Other additional functions which supports this analysis are auto scaling, rotate view, perspective, manually set RPM, order track add record slice, copy graph. Record pacing in Time, average, manual, RPM for adding water falls to new records.	Vendor to Confirm			
2.14	<b>Synchronous Order tracking &amp; analysis for Rotating equipment</b>	Vendor to Confirm			
2.14.1	This option shall provide measurements in single or multichannel and synchronise the sampling of input signals to the instantaneous angular position of machine shaft.	Vendor to Confirm			
2.14.2	Simultaneously it shall provide measurement of RPM in other channel and read RPM from a once per revolution or multiple pulses per revolution.	Vendor to Confirm			
2.14.3	Measurements are tagged with current RPM and tachometer signals can be recorded to disk for later post processing with Throughput-to-disk option if available.	Vendor to Confirm			
2.14.4	The basic measurements shall include Time history (the signal prior to re-sampling), Linear spectrum (instantaneous spectrum with constant frequency resolution), Revolution history (The time history resample on a constant shaft angle basis for single rotation orbit plots.	Vendor to Confirm			
2.14.5	Average revolution history; Order linear spectrum (instantaneous spectrum with constant order resolution. Order auto power spectrum for phase less power averaged order spectrum.	Vendor to Confirm			
2.14.6	Range & revolution Max order : up to 500, Revolution per capture: 1 to 512	Vendor to Confirm			
2.14.7	Delta orders:	0.00195 to 1 in 15 steps,			
2.14.8	Max speed (RPM)	Less than or equal to 60,000/ max order.			
2.14.9	<b>Envelope analysis for gear boxes &amp; Rotating machinery :</b>	Vendor to Confirm			

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2.15	<b>Demodulation spectrum : simultaneous with spectra , zoomed spectra &amp; envelope spectra</b>	Vendor to Confirm			
2.15.1	Rotating machinery module for Bearing fault analysis	Vendor to Confirm			
2.15.2	Fault frequencies associated with gearboxes, belt drives, pumps, fans, and other user-defined (BPFO, BPF1, BFF, and FTF).	Vendor to Confirm			
2.16	<b>Gear &amp; Bearing analysis : To identify defects associated with gears &amp; bearings</b>	Vendor to Confirm			
2.17	<b>Cepstrum analysis: Cross &amp; zoomed cepstrum</b>	Vendor to Confirm			
2.18	<b>Comprehensive measurements:</b>				
2.18.1	The signal analyser so supplied shall perform analyses in the time, frequency, order and amplitude domains by synchronous averaging to recover repetitive events buried in correlate signals to discover their similarity and time alignment.	Vendor to Confirm			
2.18.2	Also power spectrum analysis to identify dominant frequencies and spectral densities are the additional features required characterising linear system by their transfer.	Vendor to Confirm			
2.18.3	Coherence and impulse response functions to measure probability functions to normalise experimental data	Vendor to Confirm			
2.19	<b>Real time Zoom and high resolution</b>				
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	<b>Accelerometer Transducer power &amp; calibration:</b>				
2.20.1	The Signal analyser shall have direct powering arrangements to power accelerometer sensors without additional signal conditioning electronics.	Vendor to Confirm			
2.20.2	Signal analyser should automatically perform transducer sensitivity measurements on command transferring the resulting sensitivities to current set up for recording history of calibration.	Vendor to Confirm			
2.20.3	Transducer Calibration :				

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	a) In built software shall take care of Transducer sensitivity (0-1000,000 mv/EU) measurement automatically and calibrate against linear or decibel reference stimulus	Vendor to Confirm			
2.20.4	Accelerometer transducer supply:				
	a) Built in 10Volts sources at 2 ma each channel for powering accelerometer transducers with standard high sensitivity cable.	Vendor to Confirm			
2.21	<b>Measurements in comprehensive engineering units:</b>				
2.21.1	The vibrations signal 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			
2.22	Vibration signal analyser should provide broad range of export formats storing its measurements in the native format of other popular application. Excel and other popular technical application to use measurements directly without programming.	Vendor to Confirm			
2.22.1	It should also support concurrently with other window application such as word processor and spreadsheets where graphics can be paste and copied easily to the reports.	Vendor to Confirm			
<b>3.0</b>	<b>Hardware Requirement / Specification :</b>				
3.1	<b>Analogue input channels</b>				
3.1.1	6 optically isolated AC/DC/ICP coupled single ended & differential type 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	<b>Input impedance:</b>				
3.2.1	20 K $\Omega$ to 100K $\Omega$ for standard & high sensitivity cable.	Vendor to Confirm			
3.3	<b>Dynamic Range &amp; ADC type:</b>				
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, 110 dB or higher dynamic range.			

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3.3.2	The ADC features combined with Zoom and high resolution to identify two closely spaced separate signals differing in amplitude by a factor of 100,000:1 (100 dB), the feature which makes the analyser most versatile	Vendor to Confirm			
3.4	<b>Tachometer input channel :</b>				
	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	<b>Bandwidth :</b>				
	a) frequency range	45 KHz			
	b) Max sample rate :	102.4 Ksamples/sec			
	c) Accuracy	100 PPM			
3.6	<b>Base band resolution :</b>				
	a) block wise size :	16,384 to 65,536 or higher			
	b) No of spectral Lines :	6400 to 25600 lines or higher			
3.7	<b>Zoom processing :</b>				
	a) Frequency span	( 2.5 kHz, 1.25 kHz, 625Hz ..4.88281Hz ) 36 ranges from 4.88Hz			
	b) Frequency Resolution :	6400 to 25600 lines or higher			
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 10Hz to 45Khz			
4.2.0	<b>Rotating Machinery Module</b>				
4.2.1	Calculating bearing faults (BPFO, BPFI, BFF, and FTF). Fault frequencies associated with gearboxes, belt drives, pumps, fans, and other user-defined mechanical components.	Vendor to Confirm			
4.2.2	Averaging functions :	Stable (Summation), Exponential, Peak, Hold, Live (Instantaneous)			

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4.2.3	Triggering functions:	Mode free run, Input source			
4.2.4	Tach Level:	Adjustable in volts or % ADC selectable positive or negative			
4.2.5	Window functions:	Rectangular for transient signals, Hanning for continuous signal, Flat top: periodic signals.			
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			
4.3.2	Data scaling: A transducer sensitivity (mv/EU) is assigned to each input channel.	Vendor to Confirm			
4.3.3	Internal format: All measurements made are to be retained in their corresponding standard/ International SI units.	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 for easy formatting and running the program for data storage. Formatting Selection of measurements for export format.	Vendor to Confirm			
4.3.6	Hierarchy	Test / Run / save directory structure			
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 and recall previously stored measurements with point number and direction. Stores selected measurements in native format of other programs with store comments with measurements script prompts for obligatory user entry.	Vendor to Confirm			
4.6	<b>Minimum P C requirement</b>	LAPTOP (latest)			
4.6.1	Operating system	Windows XP Professional latest version			
4.6.2	Memory :	4 GB RAM Or Higher			
4.6.3	Disk space:	500 GB Or higher			



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7.2	Weather conditions are tropical, Atmosphere may be dust laden during some part of the year. Equipment shall be kept in the normal shop floor condition. Max. temperature variation is 25 deg Celsius in 24 hours.	Vendor to Confirm			
7.3	Thermal Stability of the complete equipment keeping in view specified Ambient Conditions and accuracy requirements of BHEL and trouble free operation of the equipment should be ensured by vendor.	Vendor to Confirm			
7.4	If any safety / environmental protection enclosure is required it should be built in the system by the vendor.	Vendor to Confirm			
<b>8.0</b>	<b>ELECTRICAL :</b>				
8.1	230V $\pm$ 10%, 50HZ $\pm$ 3 Hz, 1 Phase AC (2 wire system with neutral) Power Supply will be provided by BHEL at a single point near the machine. All types of cables, like ethernet cables, data transfer cable and set of BNC cables required for connecting equipment to the sensors directly shall be the responsibility of vendor.	Vendor to Confirm			
8.2	<b>Tropicalization:</b> All electrical / electronic equipment shall be tropicalized	Vendor to Confirm			
8.3	All electrical / electronic control panels should be dust and vermin proof	Vendor to Confirm			
<b>9.0</b>	<b>SAFETY ARRANGEMENTS:</b>				
9.1	The System / Equipment should have adequate and reliable safety interlocks / devices to avoid damage to the equipment due to the malfunctioning or mistakes. System / Equipment functions should be continuously monitored and warning indications through lights with messages (On display panels) should be available.	Vendor to Confirm			
9.2	A detailed list of all indications provided on the equipment should be submitted by the supplier.	Required			
<b>10.0</b>	<b>DOCUMENTATION :</b> Five sets of following documents (Hard copies) <b><u>in English</u></b> language should be supplied along with the equipment.	Vendor to Confirm			
10.1	Operating and maintenance manuals of the Equipment	Vendor to Confirm			

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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			
<b>11.0</b>	<b>Prove out of the Equipment :</b>				
11.1	Complete prove out of the <b>Vibration Analyser</b> 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 testing along with software to be demonstrated satisfactorily. Vendor shall be responsible for any deviations that may be observed during proveout of the equipment & software due to malfunctioning / failure of input / output data.	Vendor to Confirm			
<b>12.0</b>	<b>Data to be furnished with in 15 Days of Letter of Intent / P.O :</b>				
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			
<b>13</b>	<b>COMMISSIONING OF THE EQUIPMENT</b>				
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 <b>clause 15</b> ( 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			
<b>14.0</b>	<b>EQUIPMENT ACCEPTANCE: (Tests/Activities should be Performed by Vendor)</b>	Vendor to Confirm			
14.1	<b>Tests/Activities should be carried out at supplier's works on the equipment before dispatch :</b>	As per Cl. No. 6			
14.2	<b>Tests/Activities should be carried out at BHEL works while commissioning the equipment :</b>	As per Cl. No. 6			
14.2.1	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			
14.2.2	Prove out of the equipment with BHEL components as per Cl. No. 12.0	Vendor to Confirm			
14.2.3	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			
<b>15.0</b>	<b>PACKING:</b>				
15.1	Sea worthy & rigid packing for all items of complete equipment including accessories to avoid any damage/loss in transit.	Vendor to Confirm			
<b>16</b>	<b>GUARANTEE :</b>				
16.1	24 months from the date of acceptance of the equipment.	Vendor to Confirm			
<b>17</b>	<b>GENERAL :</b>				

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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			
<b>18</b>	<b>REFERENCE LIST / QUALIFYING CONDITIONS :</b>				
	Only those vendors (OEM's), who have supplied and commissioned atleast one vibration analyzer 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			

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	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			
<b>19.0</b>	<b>Delivery</b>	Specify			