MICRO GAS CHROMATOGRAPH SPECIFICATION

Ref: BHEL/CTP/MGC/15-16, REV :00

	BHARAT HEAVY ELECTRICAL LIMITED	**Enquiry No. :**	
	RAMACHANDRPURAM :: HYDERABAD 502 032.	**Due Date :**	
		Supplier Qtn. No.:	
	-	**Date :**	

TECHNICAL SPECIFICATION CUM COMPLIANCE CERTIFICATION FOR

MICRO GAS CHROMATOGRAPH FOR COMPRESSOR TEST PLANT

NOTE:-

1. Vendor shall submit complete information against clause no. 13.0. The offer meeting this clause would only be processed.

2. No deviations from the requirements of this specification are allowed unless itemized in the vendor's quotation and subsequently specifically agreed within the purchase order or order supplement documents. Failure to clearly identify specific deviations will be assumed by the purchaser to be total compliance with the specification.

3. The offer and all documents enclosed with offer should be in English language only.

4. Vendor to submit offer in two parts in closed envelops viz. Technical bid and Price bid.

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

SCOPE: Design, manufacture, testing, packing, dispatch, installation and commissioning of micro gas chromatograph including training to bhel executives on operation, analysis and maintanance of Micro GC.

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S.NO	DESCRIPTION OF BHEL REQUIREMENT		Offered	Deviations	Remarks
1.0	**Application of the Equipment:**				
1.1	Centrifugal compressors undergo performance test with various gases like FR-22, R-134A,He, CO2, N2 etc. Purity of gases need to be analyzed during the test using Micro Gas Chromotograph(GC).				
1.2	Micro GC shall have two independent column channels to analyze FR-22, R-134A, CO2, N2, He gases and gas mixtures during performance test of compressors is required.				
1.3	Micro GC shall give a detailed analysis with percentage of gas purity and percentage of various gases in the mixture.				
2.0	**Scope of Supply:**				
2.1	Vendor's ccope of supply covers the design, manufacturing, assembly, inspection, testing and supply at manufacturer's works. Micro gas chromatograph shall be compact, light weigth 10 kg (+/- 5kg) and portable.				
2.2	Installation, Commissioning of complete system at our works.				
2.3	Training for BHEL executives on operation, analysis and maintenance of Micro GC at BHEL works.				
3.0	**Technical Specification :**				
3.1	Equipment required	Micro Gas Chromatograph			
3.2	Gases to be analyzed	Refer Table 1			
3.3	**Detector/type**				
3.3.1	Micro machined Thermal conductivity detector (micro TCD) and heater elements with sufficient internal volume in nano Liters to eliminate peak broadening with linear dynamic range of 10^6 +/- 10%.				

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3.3.2	Separations should be fast, highly efficient and minimum detectable quantity shall be 10 ppm or better.			
3.3.3	Shall be micro electromechanical device fabricated from silicon or any other inert material.			
3.3.4	Operating concentration range shall be 1ppm to 100% level.			
3.4	**Sampling**			
3.4.1	Micro GC shall be capable of carrying online & offline sampling and analysis shall be software driven.			
3.4.2	Equipment shall be compatible to connect gas mixtures in gaseous phase at STP conditions. Typically for compounds with boiling point < 250 deg C.			
3.4.3	Gas Loop sample collection device to be provided. Pressure in the loop varies from 2 ata to 250 ata.			
3.4.4	Provision to connect sample collection device to Micro GC injection shall be provided.			
3.4.5	Proper internal and external pressure regulators to be provided to reduce pressure from loop pressure to required GC injection pressure.Pressure in the loop varies from 2 ata to 250 ata.			
3.5	**Carrier gas**			
3.5.1	GC shall be compatible with carrier gases He, Ar & N2. Input pressure for carrier gas shall be 80 PSI (+/-5 PSI).			
3.5.2	Consumption for analayis shall be as minimum as possible (in micro liters /analysis).			
3.5.3	Suitable adapters, pressure regulators & fittings shall be provided to connect carrier gas cylinders (external source, Maximum pressure in the cylinder is 300 ata) with GC.			
3.5.4	Carrier gas filter system with 5 Micron filter and moisture trap shall be provided			
3.5.5	Carrier gas cylinder will be provided by BHEL, however piping from carrier gas cylinder to Micro GC shall be provided by supplier.			

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3.6	**Columns**			
3.6.1	Column1: Micro GC Channel, MS 5A PLOT, 10 m(+/-2m), Heated Inj, Backflush. Factory Installed. Column installed: Molecular Sieve 5A PLOT, 0.25 mm ID, 10 m(+/-2m).			
3.6.2	Column2: Micro GC Channel, Pora PLOT Q, 10 m(+/-2m), Heated Injector. Factory Installed. Column installed: PoraPLOT Q 0.25 mm ID, 10 m (+/-2m).			
3.6.3	Micro GC with two independent capillary columns shall be suitable to analyze gas percentages for samples as mentioned in table 1.			
3.6.4	Columns with independent control.			
3.6.5	Column heater Range: 15 Deg C to 180 Deg C.			
3.6.6	Repeatability: 2% RSD or better			
3.6.7	Speed of analysis: 1-3 minutes			
3.7	**Injection System**:			
3.7.1	Micro machined with zero moving parts with software selectable injection volume, fabricated from silicon and other inert materials.			
3.7.2	Micro GC shall have internal vacuum pump for sampling.			
3.7.3	Micro GC shall be capable of heating the sample upto 100 Deg C.			
3.7.4	Suitable quick-fix connector shall be provided to connect sample device to GC.			
3.7.5	Capable of handling injection volumes 1 to 10 microliters for analyzing various gas mixtures as mentioned in table 1.			
3.7.6	Capable of back flushing (time programmable/fixed).			
3.7.7	Pressure regulator should be provided to reduce loop pressure to required pressure at gas chromatograph end. Pressure in the loop varies from 2 ata to 250 ata.			
3.7.8	Suitable temperature controller for the gases mentioned in Table-1			

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3.7.9	Five micron particle filter, moisture trap to remove particles and entrained liquids (mostly moisture and oil mist) present in the gas.			
3.7.10	Required vent ports shall be provided.			
3.8	**Power Supply**			
3.8.1	Micro GC input power source shall be of 230 V AC , 50-60 HZ voltage			
3.8.2	Adapters, cables from available source to GC input if any required shall be supplied.			
3.9	**PC/interface specifications with GC and GC software**			
3.9.1	Micro GC shall be supplied with either independent computer and software for analysis(Option-1) or Micro GC inbuilt control, analysis hardware and software(Option-2)			
3.9.2	**Option-1**			
3.9.2.1	compatible PC with Intel i5 processor or above and licensed Windows 7 or above, 19" LED/LCD Monitor with necessary accessories shall be priovided. Windows based PC shall be supplied from any one of the renouned vendors DELL, HP,lenovo.			
3.9.2.2	Micro GC software for instrument control (online and off-line sampling), digital data acquisition , data processing with creation of methods and also report making.			
3.9.2.3	Necessary interface cards, cables shall be provided for communication between computer and Micro GC			
3.9.2.4	RJ45 or USB 2.0/3.0 interface with GC shall be provided			
3.9.3	**Option-2**			
3.9.3.1	Interface can be on board with inbuilt instrument control (online and offline), acquisition, data processing and report making.			
3.9.3.2	Must have integrated touch display screen with GUI enabling to create & run methods, view run results and system status.			
3.9.3.3	Must have onboard data storage facility.			

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3.9.3.4	Shall be capable of connecting with laptop over WIFI/ RJ 45/USB to run methods, processing, analysing and printing results.			
3.9.4	Provison for printing of analyzed results and plots shall be avaialble with above both options			
3.9.5	**Ambient conditions:**			
3.9.5.1	Operating temperature range: 4 to 50 Deg C			
3.9.5.2	Relative humidity : 5 to 95% (non condensing)			
3.9.5.3	Usage: indoor or enclosed.			
4.0	**Documentation:**			
4.1	Test and calibration certificates & reports traceable to national standards must be supplied with Micro GC. Period of validity of calibration shall also be mentioned in the certificates.			
4.2	All applicable software's shall be supplied with the equipment in the form of CD's.			
4.3	Two sets of O & M, user and service manuals shall be provided.			
5.0	**Tools and other accessories**			
5.1	Installation kit with all necessary tools like spanners, screw drivers, any special tool required for operation,maintenance. Consumables required for installation shall be provided.			
5.2	All other items necessary for the full functioning of the complete unit but not mentioned in this specification shall be supplied along with the equipment.			
5.3	Fittings, regulators, matching male and female connectors from external carrier gas cylinders to Micro GC inlet shall be provided. Fittings and external pressure regulator required shall be provided. All piping works from external carrier gas cylinders to Micro GC inlet shall be done by supplier.			
6.0	**Documents during offer submission:**			
6.1	The offer shall be accompanied by the detailed technical data, supporting technical documents and dimensional drawings.			
7.0	**Optional Accessories**			
7.1	List and prices of critical spares for 5 years of trouble free operation shall be submitted with the offer. BHEL reserves right to order spares along with main equipment or separately.			

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8.0	**Documentation Approval:**			
8.1	Data sheets shall be submitted for BHEL approval before manufacturing within 3 weeks after receiving firm order.			
9.0	**Test Certificates:**			
9.1	Vendor shall perform all applicable tests as per releavant standard and furnish all test certificates and calibration certificates of the equipment to BHEL for review before despatch. Applicable tests shall be enclosed along with offer for customer reference.			
10.0	**Packing and forwarding:**			
10.1	Dispatch shall be done in closed packing boxes consistent with requirements of safe transit. It shall be the suppliers responsibility to determine that the package done is adequate to preserve integration of the unit after being met the satisfactory visual check and such that the complete unit shall arrive at its destination in an undamaged condition (No mechanical damages, distortions dust and rain water entry etc.) and the unit should be ready for its intended use.			
10.2	Packing slips containing full information about the contents of the packing case should accompany the consignment			
11.0	**Installation and Commissioning**			
11.1	Installation of equipment shall be done by the supplier at BHEL, Hyderabad with all fittings, regulators, matching male & females connectors from external carrier gas cylinders to G.C inlet. Piping required for full functional of Micro GC shall be done by the supplier.			
11.2	Applicable GC software installation and configuration shall be done. Operation and control of MGC with software shall be established.			
11.3	Demonstration of fully functional Micro GC shall be done after commissioning at BHEL works.			
11.4	After Installation and commissioning, equipment functionality has to be proved by the supplier with different standard calibration mixtures to ensure Micro GC functionality, software functionality and limit of repeatability, accuracy, speed of analysis as mentioned in specification.			
11.5	Vendor shall quote lump sum amount for installation , commissioning and training of Micro GC in the main offer.			

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12.0	**Training**			
12.1	Training in operation, analysis and maintenance with necessary hands-on experience shall be provided for at least 2 BHEL executives at BHEL works.			
13.0	**Pre Qualification criteria for Vendors**			
13.1	References of similar systems supplied earlier in India or outside India in the last five years shall be furnished with the offer.			
13.2	Vendor shall submit acceptance letter to provide after sales services and spares support to supplied Micro GC for atleast 5 years.			
14.0	**Delivery**			
14.1	As per BHEL commercial terms and conditions.			
14.2	Penalty clause is applicable as per BHEL purchase policy if equipment is not delivered within the specified period mentioned in Purchase order.			
15.0	**Other conditions**			
15.1	Offers with complete system required as per specification will only be considered for evaluation.			
15.2	In case the quoting agency for this system is not OEM, then it is mandatory that the supplier shall furnish a letter from the respective OEM stating that, they will provide technical support, service and spares for at least five years.			
15.3	The complete system engineering is the responsibility of supplier. Incomplete offers will be disqualified.			
15.4	The system, any unit or parts there in, if found defective during commissioning or in warranty period shall be replaced within 2 weeks of detection of such defects.			
15.5	Equipment will not be accepted if any deviations from specification are found during commissioning and functional testing.			
15.6	Vendor is advised to visit BHEL plant to get complete knowledge of the BHEL requirement before submitting the offer.			
15.7	In case of any clarification required, the party taking part in tender shall contact BHEL and obtain written clarification regarding this tender.			

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Table1: GAS Samples details

S.no	GAS combinations	Range of gas percentages		Remarks
1	N2 + AIR	90 +10%	99+1%	
2	CO2+N2	80+20%	99+1%	
3	FREON 22+N2	80+20%	99+1%	
4	Freon 22 +CO2+AIR	60+38+2%	80+19+1%	
5	FREON22+N2	60+40%	80+20%	
6	R134a+N2	80+20%	99+1%	
7	R134A+CO2+AIR	60+38+2%	80+19+1%	
8	R134A+N2	60+40%	80+20%	
9	CO2+N2	60+40%	80+20%	
10	He+N2	95+5%	99.5+0.5	
11	HE+N2	60+40%	80+20%	
12	R134A+He+AIR	60+38+2%	80+19+1%	
13	Carrier gas used	argon		