

TECHNICAL AMENDMENT No. 1
to
MR No. B240-910-KA-MR-5010 Rev. B

Doc. No.
B240-910-80-42-TA1-5010

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TECHNICAL AMENDMENT NO: 1

ITEM DESCRIPTION : GAS TURBINE DRIVEN CENTRIFUGAL COMPRESSOR PACKAGE

BIDDING DOCUMENT NO. : SM/B240-910-KA-MR-5010/504

A	23.10.2019	ISSUED AS TECHNICAL AMENDMENT	AS	JSD	NK
Rev. No	Date	Purpose	Prepared by	Checked by	Approved by
			<i>AS</i>	<i>JSD</i>	<i>NK</i>

TECHNICAL AMENDMENT No. 1
to
MR No. B240-910-KA-MR-5010 Rev. B

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The terms, conditions and specifications of Bidding Document stand modified to the extent indicated under column "MODIFICATIONS/ADDITION/DELETION". All other terms & conditions, stipulations and specifications of bidding document shall remain unaltered.

Sl. No.	Part No/ Vol. No	Page No.	Section	Clause No /Line no.	Subject	Modifications / Additions / Deletion
A.0	MECHANICAL					
A.1	Doc. No. B240-910-80-42-SL-5010				List of Mandatory Spares	MODIFICATION: Doc. No. B240-910-80-42-SL-5010 Rev. C replaces & supersedes Doc. No. B240-910-80-42-SL-5010 Rev. B.
A.2	Doc. No. B240-910-80-42-SS-5010				Scope of Supply	MODIFICATION: Doc. No. B240-910-80-42-SS-5010 Rev. C replaces & supersedes Doc. No. B240-910-80-42-SS-5010 Rev. B.
A.3	Doc. No. B240-910-80-42-SP-5010				Job Specification	MODIFICATION: Doc. No. B240-910-80-42-SP-5010 Rev. C replaces & supersedes Doc. No. B240-910-80-42-SP-5010 Rev. B.
A.4	Doc. No. B240-910-80-42-VL-5010				Vendor List	ADDITION: Annexure-A to Job Specification No. B240-910-80-42-SP-5010 Rev. B deleted and Doc. No. B240-910-80-42-VL-5010 Rev. A added.
A.5	Doc. No. B240-910-80-42-DS-1001				Datasheet for Centrifugal Compressor	MODIFICATION: Doc. No. B240-910-80-42-DS-1001 Rev. C replaces & supersedes Doc. No. B240-910-80-42-DS-1001 Rev. B.
A.6	Doc. No. B240-910-80-42-DS-1002				Datasheet for Gas Turbine	MODIFICATION: Doc. No. B240-910-80-42-DS-1002 Rev. C replaces & supersedes Doc. No. B240-910-80-42-DS-1002 Rev. B.
A.7	Doc. No. B240-910-80-42-DS-1003				Datasheet for Gear-Unit	MODIFICATION: Doc. No. B240-910-80-42-DS-1003 Rev. B replaces & supersedes Doc. No. B240-910-80-42-DS-1003 Rev. A.
A.8	Doc. No. B240-910-80-42-DS-1004				Datasheet for Controls & Inst.	MODIFICATION: Doc. No. B240-910-80-42-DS-1004 Rev. B replaces & supersedes

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Sl. No.	Part No/ Vol. No	Page No.	Section	Clause No /Line no.	Subject	Modifications / Additions / Deletion
A.9	Doc. No. B240-910-80-42-DS-1007				Datasheet for Oil System (Special purpose)	<u>MODIFICATION:</u> Doc. No. B240-910-80-42-DS-1007 Rev. B replaces & supersedes Doc. No. B240-910-80-42-DS-1007 Rev. A.
A.10	Doc. No. B240-910-80-42-DS-1010				Datasheet for Special Purpose Coupling	<u>MODIFICATION:</u> Doc. No. B240-910-80-42-DS-1010 Rev. B replaces & supersedes Doc. No. B240-910-80-42-DS-1010 Rev. A
A.11	Doc. No. B240-910-80-42-DS-1011 B240-910-80-42-DS-1012				Datasheet for Low and High Speed Couplings	<u>DELETION:</u> Doc. No. B240-910-80-42-DS-1011 Rev. A & B240-910-80-42-DS-1012 are deleted.
B.0	ELECTRICAL					
B.1	Please refer Technical Amendment for Electrical attached.					
C.0	INSTRUMENTATION					
C.1	Please refer Technical Amendment for Instrumentation attached.					

Enclosures:

1. Electrical (Total 6 sheets): Technical Amendment (Doc. No. B240-910-16-50-TA-5010) & Doc. No. B240-910-16-50-SP-5010 Rev. B
2. Instrumentation (Total 3 sheets): Technical Amendment (Doc. No. B240-910-KA-MR-5010)
3. Rotating Equipment (Total 90 sheets): Documents (above)



MANDATORY SPARES (GAS TURBINE DRIVEN CENTRIFUGAL COMPRESSOR PACKAGE)

PROJECT : Installation of New GTC Compressor at Gandhar,
Gujarat,

OWNER : Gas Authority of India Limited

PMC : Engineers India Limited

JOB NO. : B240

C	23.10.2019	REVISED AND RE-ISSUED WITH TECHNICAL AMENDMENT	AS	JSD	NK
B	16.09.2019	REVISED AND REISSUED WITH MR	AS	JSD	NK
A	14.06.2019	ISSUED WITH MR	AS	NK	NK
Rev. No	Date	Purpose	Prepared by	Checked by	Approved by

GENERAL REQUIREMENTS

Bidder shall note the following and furnish the quotation for Mandatory Spares accordingly:

1. Mandatory spares shall consist of Spares as listed below. Bidder shall study the complete list below and submit a detailed list with bid. In case, if it is found that any mandatory spare has not been considered by the bidder but otherwise applicable, then the same shall be supplied by the bidder without any implication to the purchaser. Hence, it is in the bidder's own interest to carefully study the list of Mandatory spares and quote accordingly.
2. The word 'Set' means the quantity required for full and complete replacement of that part in the complete Gas Turbine driven Centrifugal Compressor package.
3. The bidder shall quote for all the mandatory spares as defined below & as applicable to the proposed design of the equipment. In case, any spare which is listed in the list but not applicable due to specific construction/design of the equipment, the same shall be highlighted as 'Not Applicable' against that spare supported with proper technical explanation.
4. Spare part shall be identical in all respects to the parts fitted on the main equipment, including dimensions, material of construction, and heat treatment.
5. The cost of these Mandatory Spares shall be added to the total cost for commercial evaluation of the offer.
6. The offers, not including the quotation for mandatory spare parts in the commercial section & the unpriced quotation for mandatory spare parts in the technical section shall be considered as incomplete offers and shall be liable for prima-facia rejection. The bidder is advised to furnish the above quotation alongwith the techno-commercial offer (i.e. both unpriced & priced copies).

SECTION-A: ROTATING EQUIPMENT

Sl. No.	Part Description	Unit	Quantity	Remarks
	ROTATING EQUIPMENT			
1.0	CENTRIFUGAL COMPRESSOR			
1.1	Spare Rotor (Dynamically Balanced)	Set	1	(See Note 1)
1.2	Dry Gas Seal (Drive end and Non-Drive end)	Set	1	
1.3	Bearings for Centrifugal Compressor			
	(a). Set of Radial Bearings	Set	1	
	(b). Set of Bearing Pads for radial bearings (in addition to above, if applicable)	Set	1	Not applicable for Sleeve type Bearings
	(c). Set of Thrust Bearings	Set	1	
	(d). Set of Bearing Pads for thrust bearings (in addition to above)	Set	1	
1.4	Instrumentation (as below) for Compressor Bearings			
1.4.1	Vibration Probes			
	(a). Radial vibration probes (non-contacting proximity) for Radial (journal) bearings	Set	1	
	(b). Axial vibration probes (non-contacting proximity) for Tilting pad thrust bearings	Set	1	
1.4.2	Temperature Probes			
	(a). RTD's for Radial (journal) bearings	Set	1	
	(b). RTD's for Tilting pad thrust bearings (Active/Inactive)	Set	1	
2.0	GAS TURBINE (Heavy Industrial, Light Industrial or Aero-derivative type)			
2.1	Spark Plugs	Set	1	
2.2	Fuel Nozzles for Gas Turbine	Set	1	

C

Sl. No.	Part Description	Unit	Quantity	Remarks
2.3	Fuel Control valve for Gas Turbine	Set	1	
2.4	Temperature probes for Combustion Chamber	%age / nos.	20% or 3 nos. (min.) whichever is higher	
3.0	SPECIAL PURPOSE GEAR-UNIT (If applicable)			
3.1	Set of Radial Bearings	Set	1	
3.2	Set of Bearing Pads for radial bearings (in addition to above, if applicable)	Set	1	Not applicable for Sleeve type Bearings
3.3	Set of Thrust Bearings	Set	1	
3.4	Set of Bearing Pads for thrust bearings (in addition to above)	Set	1	
3.5	Instrumentation (as below) for Bearings			
3.6	Vibration Probes			
	(a). Radial vibration probes (non-contacting proximity) for Radial (journal) bearings	Set	1	
	(b). Axial vibration probes (non-contacting proximity) for Tilting pad thrust bearings	Set	1	
	(c). Accelerometers for Gear-Box Casing	Set	1	
3.7	Temperature Probes			
	(a). RTD's for Radial (journal) bearings	Set	1	
	(b). RTD's for Tilting pad thrust bearings (Active/Inactive)	Set	1	
4.0	COUPLING(S)			
4.1	Complete Coupling assembly (including both driven and driver end hubs, spacer, flexible elements, nuts, bolts, bush etc.) in assembled condition with Pilot bore.	Set	1	In case of Gear-box drive, the quantity i.e. Set 1 will include both LS and HS coupling.
5.0	LUBE OIL PUMPS (Note-2) 			
5.1	Centrifugal Pump			
	Complete Pump assembly with drive motor in ready to install condition	Set	1	
5.2	Positive Displacement Pump Rotary			
	Complete Pump assembly with drive motor in ready to install condition	Set	1	
Remarks: 1. Spare Rotor shall be supplied duly dynamically balanced and Mechanical Run Tested. 2. Spares shall be quoted depending on the type of pump proposed for lube oil system. Incase of a between bearing pump, both Drive-end side and Non-drive end seals shall be considered.				

SECTION-B: ELECTRICAL

1.1.	MV induction motors 37 kW & above (one set of spare for each rating & type)		
a)	Set of bearings (NDE+DE)	Set	1
b)	Terminal/ bushing	Set	1
1.2.	VFD (one set of spare for each VFD)		
a)	Transistors/IGBT	Set of each rating & type	1
b)	Control cards	No. of each type	1
c)	Power supply cards	No of each rating & type	1
d)	Power fuses	Each rating & type, whichever is more	20 % or one no (min)
e)	control fuses/MCB	Each rating & type, whichever is more	10 no of each type and rating (min)
f)	Contactors	Each rating & type, whichever is more	10 % or one no (min)
g)	Indicating lamps	Each rating & type, whichever is more	20 % or one no (min)
h)	Indicating lamps covers	No. of each color	2 nos
i)	Blocker Diode	Each rating & type,	2 nos
1.3.	MV Switchboard (MCC)		one set of spare for each switchboard
a)	Closing Coil	Each rating & type,	1
b)	Trip Coil	Each rating & type,	1
c)	Control Fuses/MCB	Each rating & type,	10
d)	Indicating lamps covers	Each rating & type, whichever is more	5
e)	Indicating lamps	Each rating & type, whichever is more	20% or 3 Nos. (min.), whichever is more
1.4.	DC System		one set of spare for each DC System
a)	Power Thyristors / Transistors / IGBT /IGCT	Set of each rating & type	1
b)	Control cards	No. of each type	1
c)	Power supply cards	No of each rating & type	1
d)	Power fuses	Each rating & type, whichever is more	20 % or one no (min)
e)	Control fuses / MCB	Each rating & type, whichever is more	10 no of each type and rating (min)
f)	Indicating lamps	No. of each color	10 % or one no (min)
g)	Indicating lamps covers	No. of each color	20 % or one no (min)
h)	Blocker Diode	Each rating & type	2 nos

SECTION-C: INSTRUMENTATION

Mandatory Spares List (To be supplied loose)

To be read in conjunction with Doc. No. B240-910-16-51-SL-5010

Mandatory spares shall be quoted as per the following table:

Sl. No.	Part Description	Quantity Required
	Mandatory spares shall be quoted and included in base price as follows:	
1	Field Instruments	
	This includes all types of the following instruments excluding line-mounted instruments.	
I	Pressure gauges Temperature gauges	10%subject to minimum1No. of each type and size, range, rating and material wise whichever is higher.
II	Field transmitters for Pressure, Level, DP, Flow and Temperature etc.	10%subject to minimum1No. of each type and size, range, rating and material wise whichever is higher.
III	RTD/Thermocouple (with Thermowell), Thermowell etc.	10%subject to minimum1No. of each type and size, range, rating and material wise whichever is higher.
V	Gas detector, fire detector UV/IR Thermal/heat detectors with transmitter	10% subject to minimum 1 no of each type of sensor & transmitter, whichever is higher.
VI	Level gauge glasses	10% subject to minimum 1 no of glass of each size along with gasket set, whichever is higher.
VII	Instrument valve / 3-Way valve manifold / Tube fittings etc.	10% subject to minimum 1 no for each type/size, whichever is higher.
VIII	Speed transmitter probe	10% subject to minimum 1 no of each, which ever is higher.
IX	Beacons / Horns for gas detector	10% or minimum one number, whichever is higher.
2	Line mounted instruments	
I	Control valve, shutdown valve	a) 01No. seat plug assembly for each valve under cavitation and / or flashing and noise (for globe and angle valves). b) Grouping of balance valves with respect to size, rating, material & trim type and 10% subject to minimum 1 no. of plug & seat assembly of each group, whichever is higher (for globe & angle valves) c) Grouping of valves with respect to size, rating & material and 10% subject to min 1 no. ball & seat, for each group whichever is higher (for ball valves). d) Grouping of valves with respect to size, rating & material and 10% subject to min 1 no. of disk/rotary plug and seat of each group, whichever is higher (for rotary plug & butterfly valves).

Sl. No.	Part Description	Quantity Required
		e) Grouping of all valves with respect to size, rating, material & trim type and 10% subject to minimum 1 no. whichever is higher of the following items group wise: - I. Gland packing II. Actuator Diaphragm. III. Valve positioner IV. Bonnet gaskets (for all type of valves) V. Quick exhaust Valve (if any) VI. Solenoid valves VII. Limit switches. VIII. Smart Positioner. IX. Air filter regulators
II	Pressure Relief valve and pilot valve of pilot operated PRV	
	a) Spring, Nozzle, Seat	5% of total quantity of identical pressure relief valves or minimum one number which ever is higher.
	b) Gasket set, O-Ring set	20% of total quantity of identical pressure relief valves or minimum one number whichever is higher.
	c) Complete Pilot of Pilot operated pressure safety valves	5% of total quantity of identical pilot operated pressure relief valves or minimum one number whichever is higher
III	Self actuated regulators	a) Grouping of valves with respect to size, rating, material & trim type and 10% subject to minimum 1 no. of the following items of each group, whichever is higher : - I. Plug & Seat Assembly II. Gland packing III. Actuator Diaphragm. IV. Bonnet gaskets (for all type of valves)
3	PLC	
I	Each type of modules used in PLC like I/O cards, processor cards, power supply cards, communication cards, interface cards, etc. as being offered by the system	5% of the total installed quantity subject to minimum one number, whichever is higher of each type.
II	IS isolator barriers	
	a) Analog input	5 % of total quantity
	b) Analog output	5 % of total quantity
	c) Digital input	5 % of total quantity
	d) Thermocouple / RTD	5 % of total quantity
III	Isolator/signal multiplier	5% of total installed quantity subject to minimum one number, whichever is higher of each type.
IV	IS mV/I converter	5% of total installed quantity subject to minimum one number, whichever is higher of each type.
V	IS RTD/I converter	5% of total installed quantity subject to minimum one number, whichever is higher of each type.
VI	Prefabricated cable	4 set with connecting plug for each

Sl. No.	Part Description	Quantity Required
		type of peripheral and I/O hardware
VII	Keyboard	1 no of each type
VIII	Interposing relay	5% of total installed quantity subject to minimum one number, whichever is higher of each type.
IX	Push button	5% of total installed quantity subject to minimum one number, whichever is higher of each type.
X	Lamps	5% of total installed quantity subject to minimum one number, whichever is higher of each type.
XI	Selector switch	5% of total installed quantity subject to minimum one number, whichever is higher of each type.
XII	Switches	5% of total installed quantity subject to minimum one number, whichever is higher of each type.
XIII	Alarm cards (receiver switches)	5% of total installed quantity subject to minimum one number, whichever is higher of each type.
XIV	MCBs	5% of total installed quantity subject to minimum one number, whichever is higher of each type.
XV	System cabinet air filter	100%
XVI	Annunciator	
	- Power supply module	4 nos
	- Flasher module	4 nos
	- Tone generator card	2 nos
	- Lamps	5 dozen
	- Fuses	2 dozens
XVII	Termination panel/patch card, series resistor, isolator (for safe area signal)	5 % of total quantity
XX	Fuses (of each type)	100 %
4	Vibration and Temperature monitoring system	
I	Each type of module used in machine monitoring system like I/O cards, processor cards, power supply cards, communication card, interface card etc as being offered for system	5% of total installed quantity subject to minimum one number, whichever is higher of each type.
II	Probe of each type (vibration, temp, axial displacement keyphasor, etc)	Quantity shall be as mentioned in Rotating Equipment mandatory spares list attached elsewhere with the MR.
III	Fuses of each type	100%
VIII	Selector switches	5% of total installed quantity subject to minimum one number, whichever is higher of each type.
5	Compressor control system	
I	Anti-Surge Controller(If applicable)	01 No.
II	Master /Performance Controller(If applicable)	01 No.
III	Load Sharing Controller (If applicable)	01 No.

Notes:

- The word 'Type' means the make, model no., type, range, size/length, rating, material as applicable.

2. Whenever % is identified, contractor shall supply next rounded figure.
3. Mandatory spares shall include sub-package items also.
4. Mandatory spares shall be supplied loose for use by client in future.

Mandatory Spares for Fire Suppression system:

Mandatory Spares for Fire suppression system as per Clause No. 15 of EIL Std. Spec. STANDARD No. 6-66-0045 Rev. 3 shall be included.

Note: In Sl. No. 1.0 of table in clause no. 15, the clean agent gas may please be read as CO2 gas.



SCOPE OF SUPPLY (GAS TURBINE DRIVEN CENTRIFUGAL COMPRESSOR PACKAGE)

PROJECT : Installation of New GTC Compressor at Gandhar,
Gujarat,

OWNER : Gas Authority of India Limited

PMC : Engineers India Limited

JOB NO. : B240

C	23.10.2019	REVISED AND RE-ISSUED WITH TECHNICAL AMENDMENT	AS	JSD	NK
B	16.09.2019	REVISED AND RE-ISSUED WITH MR	AS	JSD	NK
A	14.06.2019	ISSUED WITH MR	AS	NK	NK
Rev. No	Date	Purpose	Prepared by	Checked by	Approved by

**SCOPE OF SUPPLY
FOR
GAS TURBINE DRIVEN CENTRIFUGAL COMPRESSOR PACKAGE**

Notes:

- (i) Bidder shall furnish all equipment, drivers, auxiliary systems, instruments and controls and safety devices as per the enquiry document. Anything required over and above what is specified, for safe and satisfactory operation of the equipment package shall be included by the vendor in his scope.
- (ii) Bidder's offer shall be completely inline with scope indicated. No deviation w.r.t. scope shall be accepted.
- (iii) Bidder's scope of supply shall include but not be limited to the following for the Gas turbine driven Centrifugal compressor package:

SECTION-A: ROTATING EQUIPMENT

SECTION-B: ELECTRICAL

SECTION-C: INSTRUMENTATION

SECTION-D: PIPING

SECTION-A: ROTATING EQUIPMENT			
Sl. No.	Description	Required (Yes/No)	Remarks
1.0	Compressor (Refer equipment data sheets and job specification for full details)		
1.1	Centrifugal Compressor as per Chapter-1 & 2 of API Standard 617, 7 th edn. & EIL Std. Specification 6-42-0005 Rev. 2 along with matching companion flanges, gaskets, fasteners etc. at all terminating points requiring owner's interface.	Yes	
1.2	Dry Gas Seals (Bi-directional Tandem Type with internal labyrinth)	Yes	
1.3	Gear Unit as per API Standard 613	Yes	If Required
1.4	Couplings (non-lubricated type) as per API 671 with spacers and non-spark guards	Yes	
1.5	All associated auxiliary piping/tubing etc. prefabricated and duly mounted on the equipment/base-plate.	Yes	
1.6	Fabricated Steel Base Plate: Compressor and Gear unit & Gas Turbine Driver.	Yes	Bolted & dowelled at site (if reqd.)
2.0	Gas Turbine and Associated System (Refer equipment data sheets and job specification for full details)		
2.1	Gas Turbine (GG & PT) as per API 616, 5 th edn. & EIL Std. Specification 6-43-0041 Rev. 2 complete with all necessary auxiliary equipments and control systems as per inquiry document	Yes	With DLE/DLN combustors (w/o water or steam injection)
2.2	Acoustic Enclosure to limit noise level within 85 dBA @ 1m alongwith ventilation system for Enclosure including ventilation fans (1W+1S), air inlet filter, inlet and exhaust ducting, silencers, Expansion joints, flanged connections and transition pieces with all supports and fixing arrangement etc. as required along with necessary instrumentation.	Yes	
2.3	Air intake system complete with suction weather-hood, bird screen, louvers, silencers, inlet air filter as per Job spec., filter housing, Pre-fabricated air inlet ducting, Expansion joints, flanged connections and transition pieces etc. as required along with necessary instrumentation.	Yes	

SECTION-A: ROTATING EQUIPMENT

Sl. No.	Description	Required (Yes/No)	Remarks
2.4	Turbine exhaust system including min. 30 meter high Stack/Chimney and complete with exhaust collector, exhaust silencer, expansion joints, flanged connections, transition pieces etc. as required along with necessary instrumentation.	Yes	
2.5	CO ₂ Fire suppression system for GT enclosure as per Job specification for fire suppression system	Yes	
2.6	Portable trolley mounted Gas Turbine washing and cleaning system complete with reservoir, driver, interconnecting flexible hose piping (10 m each at each port), hose-storage-wheel, valves, motor cable of approximately 30 m length & plug to suit the area classification & necessary instrumentation & controls.	Yes	If required for the quoted Gas Turbine model
3.0	Fuel Gas system (Refer equipment data sheets and job specification for full details)		
3.1	Fuel Gas system as per Clause no. 5.8 of 6-43-0041 Rev. 2 and Job Specification B240-910-80-42-SP-5010 attached with the inquiry document complete with the following:	Yes	
	- Twin Knock-out Pots with Demister pads.	Yes	
	- Twin strainers.	Yes	
	- Twin filters	Yes	
	- Continuous flow transfer valves.	Yes	
	- Twin fuel gas super heater(s), (one working & one standby).	Yes	
	- All Instrument and Controls duly mounted including all necessary control valves, safety valves, Gas & heater skin temperature controls, temperature and pressure gauges, fuel piping upto skid etc.	Yes	
	- All Stainless steel interconnecting, Pre-fabricated piping/tubing for fuel gas line duly installed.	Yes	
	- Fuel Gas Booster system	No	Bidder to comply with the fuel gas conditions at GTC package B/L without any booster system.
3.2	All Stainless Steel supply piping/tubing between Fuel Gas conditioning skid and GT duly fabricated.	Yes	
3.3	All Stainless Steel Vent/Flare piping/tubing from Fuel Gas conditioning skid to safe height or flare header.	Yes	
3.4	Matching companion flanges, gaskets, fastners etc. at all terminating points requiring Owner's interface.	Yes	
4.0	Lube Oil System for Compressor, Gear Box and Gas Turbine (GT) (Refer equipment data sheets and job specification for full details)		
4.1	Lube oil Console complete with the following:		
	- Stainless Steel Oil reservoir	Yes	
	- Shaft Driven/Electric motor (AC) driven Main oil pump with external pressure relief valve.	Yes	
	- Electric motor (AC) driven Standby oil pump with external pressure relief valve.	Yes	
	- Shaft Driven/Electric motor (AC) driven main Hydraulic	Yes	as applicable

C

SECTION-A: ROTATING EQUIPMENT

Sl. No.	Description	Required (Yes/No)	Remarks
	Oil Pump with external pressure relief valve.		
	- Electric motor (AC) driven Standby Hydraulic Oil Pump with external pressure relief valve.	Yes	as applicable
	- Electric motor (DC) driven Emergency-oil pump for coast-down/equipment cool-off.	Yes	
	- Twin Oil-filters.	Yes	
	- Continuous flow transfer valves.	Yes	
	- All instruments & controls duly mounted.	Yes	
	- Skid mounted Local Gauge Board with all instruments mounted on it.	Yes	
	- All Stainless Steel interconnecting, pre-fabricated piping/tubing duly installed	Yes	
4.2	Oil cooler (Air-cooled type) with adequate number of fans with 100% spare capacity, complete with interconnecting piping between Oil Cooler and the Oil Console.	Yes	
4.3	Emergency overhead Lube oil run down tank (sized for equipment coast down) along with all necessary piping, instrumentation and controls.	Yes	As applicable 
4.4	All Stainless Steel supply/return piping/tubing between lube oil console and Compressor/Gear Unit/GT.	Yes	
4.5	Matching companion flanges, gaskets, fasteners etc at all terminating points requiring Owner's interface/tie-in points.	Yes	
4.6	Necessary Instrumentation and Controls.	Yes	
4.7	Gas generator Lube Oil system as recommended by GT manufacturer.	Yes	If separate system is recommended by Gas Turbine manufacturer
4.8	One no. Portable trolley mounted emptying/Fill oil Pump for Lube Oil reservoir complete with Driver, flexible hose piping (10 m each at suction & discharge), hose-storage-wheel, valves, motor cable of approximately 30 m length & plug to suit the area classification.	Yes	
4.9	One no. Portable trolley mounted oil purifier complete with automatic self cleaning centrifuge separator, flexible hose piping (10 m each at suction & discharge), hose-storage-wheel, valves, motor cable of approximately 30 m length & plug to suit the area classification & necessary instrumentation and controls.	Yes	
5.0	Buffer Gas Supply System for Dry Gas Seals (Refer equipment data sheets and job specification for full details)		
5.1	Buffer/Seal Gas Skid complete with the following:	Yes	
	- All instruments & controls duly mounted	Yes	
	- All Stainless Steel interconnecting, pre-fabricated piping duly installed	Yes	
5.2	Seal Gas Booster	Yes	If required for the seal gas conditions
5.3	Seal Gas heater	Yes	
5.4	All Stainless Steel supply piping/tubing between buffer gas skid & compressor	Yes	
5.5	All Stainless Steel vent/flare piping/tubing from	Yes	

SECTION-A: ROTATING EQUIPMENT

Sl. No.	Description	Required (Yes/No)	Remarks
	compressor to safe height/flare header.		
5.6	Matching companion flanges, gaskets, fasteners etc. at all terminating points requiring Owner's interface.	Yes	
5.7	Provision of automatic change-over from normal to emergency Seal gas supply along with all the necessary instrumentation and controls. <i>Note: During start-up/Emergency external Seal Gas shall be made available by the Purchaser at the Vendor's battery limit for further distribution by vendor. Start-up/Emergency Seal gas Details are as given in Compressor datasheet.</i>	Yes	
6.0	Pressure Vessels and associated systems <i>(Refer equipment data sheets and job specification for full details)</i>		
6.1	Process Vessels	No	
6.2	Other vessels forming part of Auxilliary systems	Yes	
7.0	Heat Exchangers and Associated systems <i>(Refer equipment data sheets and job specification for full details)</i>		
7.1	Heat Exchangers forming part of Auxilliary systems (i.e. Air-Cooled Oil cooler same as Sl. No. 4.2 above). <i>Note: All coolers forming part of GTC package shall be air-cooled only</i>	Yes	Air-cooled heat exchangers
8.0	Piping <i>(Refer piping specification, PMS for details)</i>		
8.1	Permanent type Process Gas Suction Strainers at inlet of compressor along with spool piece(s).	Yes	
8.2	Temporary Process Gas Suction strainer for the commissioning of the Compressor package.	Yes	
8.3	Complete interconnecting piping within and between various skids (i.e. main equipment skid and various auxiliary skids such as L.O. Console Skid, Buffer Gas Skid and Fuel Gas conditioning Skid etc.)	Yes	
8.4	Complete inter-connecting piping from and/or to Purchaser's battery limit including Vent, Flare, Drain, Utility piping (i.e. Inst. Air, Plant Air, Inert Gas etc.)	Yes	
8.5	All other items as per Piping scope of supply in Section-D	Yes	
9.0	Electrical Equipment <i>(Refer electrical data sheet & specs. for full details)</i>		
9.1	All items as per Electrical scope of supply in Section-B & Electrical specifications	Yes	
10.0	Instrumentation and controls <i>(Refer instrumentation datasheets, related to specifications & P&IDs for full details)</i>		
10.1	All items as per Instrumentation scope of supply in Section-C & Instrumentation specifications	Yes	
11.0	Spares and Special Tools & Tackles <i>(Spares for the GTC package including Mechanical, Electrical, Instrumentation etc.)</i>		
11.1	Mandatory spares, as specified in Doc. No. B240-910-80-42-SL-5010 Rev. C	Yes	C
12.1	Commissioning spares as recommended by the	Yes	

SECTION-A: ROTATING EQUIPMENT

Sl. No.	Description	Required (Yes/No)	Remarks
	equipment manufacturer		
11.2	Quotation for vendor recommended spares for 2 year normal operation.	Yes	Including Mech./Elect./inst. Spares
11.3	Special tools and tackles required, if any, for erection, site assembly and maintenance of each equipment of compressor package as recommended by the equipment manufacturer including Hydraulic tightening device with low pressure and high pressure Pumps if required & GT manufacturer's recommended special tools including also Boroscope & Alignment tools. Also, refer Clause no. 13.3 of Job Specification for Centrifugal Compressor (Doc. No. B240-910-80-42-SP-5010) for Special tools and tackles to be mandatorily supplied.	Yes	
11.4	Spreader Bars/Slings/Shackles for lift of GTC skid for transportation/erection	Yes	
11.5	Torque Wrenches/Bolt Tensioners	Yes	
12.0	Inspection & testing:		
12.1	Shop inspection and Testing:		
	• Mechanical Run Test for Compressor with Main Rotor as per API Std. 617 & EIL Standard Spec. 6-42-0005 at Compressor manufacturer's works.	Yes	
	• Mechanical Run Test for Compressor with Spare Rotor as per API Std. 617 & EIL Standard Spec. 6-42-0005 at Compressor manufacturer's works.	Yes	
	• Performance Test for Compressor (with main rotor) as per Type 2 ASME Code PTC-10 at Compressor Manufacturer's works.	Yes	
	• Mechanical run test for the Gas Turbine with main rotor / main Gas generator as per API Std. 616 & EIL Standard Spec. 6-43-0041 at Gas Turbine Manufacturer's works.	Yes	Rotor or Gas Generator as per offered GT type
	• Performance Test for Gas Turbine main rotor / main Gas generator as per API Std. 616, ASME Code PTC 1 & 22 and EIL Standard Spec. 6-43-0041 at Gas Turbine Manufacturer's works.	Yes	Rotor or Gas Generator as per offered GT type
12.2	Performance Guarantee Test run (PGTR) of the GTC package at site	Yes	Refer Job specification
12.3	Other Shop inspection and Testing for all items under vendor's scope of supply, as specified in the datasheets, specifications etc. forming part of the inquiry document.	Yes	
13.0	Vendor Data & Drawings		
13.1	The Proposed layout(s) enclosed with the inquiry	Yes	

SECTION-A: ROTATING EQUIPMENT

Sl. No.	Description	Required (Yes/No)	Remarks
	document indicates tentative equipment layout. Bidder shall confirm that the Proposed equipment package is accommodated within the space allocated for the specified units. Bidder in his proposal shall include in his proposal suggested detailed equipment layout indicating main equipment as well as auxiliary equipment various consoles, local panels/local gauge board etc. along with their dimensions and levels at which the same are to be placed. The Bidder shall also indicate weights of equipment, maintenance space required, crane capacity (recommended) and crane hook approach from the grade level etc. The data/information shall be adequate for designing of the Compressor house (Shelter). General Arrangement Drawing(GAD)/Equipment layout of all equipment located inside compressor house including main equipment, auxiliaries heat exchangers and routing of piping etc. <i>(based on the indicative layout drawing provided in the inquiry)</i> shall be provided by the vendor along with the proposal.		
13.2	Detailed manufacturing, installation drawings & bill of material for self supporting exhaust steel stack with suitable ladder/ staircase for maintenance of the same & with connections/tappings for measuring emission levels.	Yes	Exhaust stack supply by Bidder. Assembly &, Installation by others under supervision of bidder
13.3	Detailed fabrication, installation drawings & bill of materials for structural supports, access/maintenance platforms, ladders for the Gas-Turbine Compressor skid and all the auxiliary systems forming part of GTC package like: - Inlet Air filters & Inlet Air Ducting - Ventilation Fans & Ventilation Air Ducting - Lube Oil Run Down Tanks (if applicable) - Exhaust Stack/Chimney/Exhaust ducting etc.	Yes	Fabrication, Supply, Installation of platform and ladders by others. Note: All foundation bolts of the complete GTC package and auxiliaries are in bidder's scope
13.4	All data & drawings as required per Vendor data requirements, data sheets, specifications and referenced codes and standards.	Yes	
14.0	Erection & Commissioning		
14.1	Supervision of Erection for Compressor package	Yes	Per diem rates as defined in commercial documents
14.2	Supervision of Commissioning for Compressor package	Yes	
15.0	Miscellaneous		
15.1	All Foundation/Anchor Bolts for the complete scope of supply of GTC package	Yes	To be supplied for all skids/chimney/supports
15.2	Chemical Cleaning, Pickling, Passivation etc. of vendor Supplied piping	Yes	
15.3	Surface Cleaning, environment primer etc. of all Pressure vessels & Heat Exchangers.	Yes	
15.4	Painting, Preparation of Shipment and export quality	Yes	

SECTION-A: ROTATING EQUIPMENT

Sl. No.	Description	Required (Yes/No)	Remarks
	packaging		
15.5	Customer Training (15 no. of persons x 02 Weeks=30 man weeks) at Bidder's/Sub-vendors's Works.	Yes	
15.6	Participation of Purchaser's personnel during assembly and other important activities	Yes	
15.7	Participation in HAZOP study of the GTC package	Yes	Per diem rates to be quoted
15.8	Train Torsional study	Yes	
15.9	Compressor Lateral study	Yes	
15.10	All other items not mentioned in this document but required as per P&IDs, datasheets, specifications etc. attached in the inquiry document .	Yes	
15.11	Additional items (including mechanical, electrical and instrumentation and controls) not specified by Purchaser but recommended by vendor for safe, smooth and efficient operation of complete Compressor Train.(Vendor to include separate list of such items in his proposal along with their unit prices)	Yes	

SECTION-B: ELECTRICAL

1.	Electrical Equipment			
1.1.	All MV motors IE2 efficiency class minimum (AC/DC Ex-de)/ heaters (Ex-de) as required for the auxiliary drives.	Yes		
1.2.	415V GTMCCs for feeding all the loads of package equipment envisaged at substation1.	Yes		
1.3.	VFD system if required (including input and output transformers, as applicable)	Yes		
1.4.	Flameproof Local control station/ local control panel for local operation of motors with Start, Stop push buttons, ammeter etc. It shall also contain other devices like selector switches, indications, etc as per operational/ process requirements. (Separate local control station (LCS) shall be provided for motors/ heaters located away from LCP)	Yes		
1.5.	Earthing for bidder supplied equipments within the skid and Earthing terminals for connection to main plant earth grid to be provided on Motor/Skid.	Yes		
1.6.	Cabling for skid mounted equipment including supply and termination within the skid.	Yes		
1.7.	Cable trays withing the skid (Refer Note-7)	Yes		
1.8.	Cable accessories / installation materials such as flameproof double compression cable glands, cable lugs etc., and all other associated accessories and hardware for all bidder supplied equipment.	Yes		

C

1.9.	Lighting of turbine enclosure and other skid mounted equipment.	Yes		
1.10.	Testing and commissioning of VFDs at site is included in vendor's scope & this work shall be executed/ carried out by VFD manufacturer, i.e. OEM only. Vendor shall certify readiness of system fit for commissioning. Vendor's scope shall also include supply of all specialised tools & tackles/ instruments and commissioning spares required for above service.	Yes		
1.11.	Heat tracing as required.	Yes		
1.12.	UPS (Refer Note-5)	No		Existing UPS 110V shall be utilised. Refer Instt part of MR.
1.13.	UPS Distribution Board	Yes		
1.14.	Battery, Battery Charger, DCDB, DC Motor starter panel and cell booster to cater load of Emergency Lube oil pump (As required and Emergency lighting of Turbine enclosure.	Yes		
1.15.	Electrics for any other equipment / items as specified elsewhere in the MR.	Yes		
1.16.	Special cables as applicable	Yes		
1.17.	All other electrical equipment, materials and work not explicitly mentioned but nevertheless required to fulfil the requirements shall be deemed to be included in the scope of the contractor with no additional cost and time implication to the owner/ EIL.	Yes		
1.18.	FLP Junction box (Ex-d) suitable for Gas group IIA/IIB, Temperature class: T3. If required in case of problem in termination of power cables	Yes		
1.19.	CCoE/PESO approval, Type test certificates, BIS Licence (applicable only for all Indigenous FLP items) for all bidder supplied equipment.	Yes		
1.20.	All data & drawings as required per Vendor data requirements, data sheets, specifications and referenced codes and standards.	Yes		
1.21.	Incoming 415V feeders for GTMCC	No		
1.22.	General Lighting within the compressor shed.	No		
1.23.	All power and control cables (other than cables within the skid).	No		
1.24.	Cable trays and accessories outside the skid	No		

Notes:

1. Commissioning spares shall be included in the Vendor's scope of supply. A list shall be attached with offer giving quantity of such spares.
2. The vendor shall supply special tools for operation and maintenance. A list shall be attached with offer giving quantity of such tools.
3. Vendor shall quote unit rates for 2 years operation and maintenance spares over and above mandatory spares already listed in this MR.
4. Cables glands shall be flameproof type, nickel plated brass, double compression for use in hazardous area shall conform to the requirements of latest IS/IEC 60079-0. Indigenous flameproof cable glands shall have valid BIS license as per the requirements of statutory authorities. Size of cables will be informed during detailed engineering and cable glands selected shall be appropriate to the size of cable
5. Bidder shall furnish number and rating of UPS feeders (110V AC) required alongwith offer.
6. For portable trolley mounted lube oil transfer pump and portable lube oil purifier, vendor shall supply and install 63A, TPN, 415V flameproof receptacles (socket) with plug within the skid. Purchaser shall feed 415V, 50Hz power to each socket.

7. For Power and Control cabling which are excluded from vendor's scope, cable laying provision including supply and installation of cable trays within the skid battery limit shall be provided by the vendor.

SECTION-C: INSTRUMENTATION

S.No.	DESCRIPTION	Bidder	Purchaser
1.0	Scope of Design & Engineering		
1.1	Design and detailed engineering including residual engineering (note-1) of instrumentation & controls of Gas turbine driven Centrifugal Compressor based on P&ID's and other technical requirements described in various documents attached with this MR. This shall include detailed engineering including preparation of engineering drawings/ documents, specification data sheets, sizing, selection of materials, review of vendor drawings / documents for all supply items and preparation of engineering drawings/ documents for UCP and PLC.	Yes	
1.1.1	All type of field instruments identified and marked as "*" on P&ID's on process gas suction & discharge, starting gas, fuel gas, seal gas, gas recycle and vent gas lines such as pressure, Flow(DP), temperature, differential pressure, temperature transmitters, pressure & temperature gauges, temperature elements and thermowells, all types of control valves & shutdown valves with accessories, pressure relief valves, anti surge control valves, suction flow elements, gas detectors etc. and any other instruments including skid mounted instruments, local gauge board mounted instruments, control panel mounted Instruments required to complete the job in all respect.	Yes	
1.1.2	Unit control panel with Programmable Logic Controller based control system to be located existing control room, for entire Gas turbine driven centrifugal compressor and associated auxiliaries and station control system as per P&ID's.	Yes	
1.1.3	All skid mounted instruments related to compressor package including Turbine, compressor, seal gas system, fuel gas system, starting gas systems, air intake system, gas after coolers, lube oil system and auxiliaries etc.	Yes	
1.1.4	All controls for entire gas turbine compressor train including process gas suction & discharge, starting gas, fuel gas conditioning skid with metering system , seal gas, gas recycle and vent gas lines instruments to be executed in dedicated PLC based control system of the compressor .	Yes	
1.1.5	Local Gauge boards	Yes	
1.1.6	Antisurge controllers, Performance/Master controller and load sharing controller (if required)	Yes	
1.1.7	Vibration, temperature and Displacement monitoring system including monitors.	Yes	
1.1.8	Integration of Compressor control systems with existing DCS/PLC systems.	Yes	

S.No.	DESCRIPTION	Bidder	Purchaser
2.0	Scope of procurement/ supply		
2.1	Supply of all items related to instrumentation & control system of Gas turbine driven centrifugal compressor and other station facilities as indicated in P&IDs and technical documents attached elsewhere in MR. The scope of supply shall include but not limited to following:	Yes	
2.1.1	All field mounted instruments including pressure, Flow(DP), temperature, differential pressure, temperature transmitters, temperature elements & thermowells, pressure & temperature gauges, all types of control valves & shutdown valves with accessories, pressure relief valves, anti surge control valves, suction flow elements, gas detectors etc. as marked “*” Gas turbine driven centrifugal compressor vendor scope and other station facilities as per P&ID's and compressor data sheets attached elsewhere in this MR and any other instruments required to complete the job in all respect.	Yes	
2.1.2	All controls system instruments for entire Gas turbine driven centrifugal compressor including process gas suction & discharge, starting gas, fuel gas, seal gas, gas recycle and associated other facilities. All instruments to be executed in dedicated PLC based control system	Yes	
2.1.3	Supply of Unit Control Panels for compressor and gas turbine controls and monitoring, including anti-surge, performance / master controllers, load sharing controller (if required) and panel mounted operator console (HMI) etc. These shall be located in control room.	Yes	
2.1.4	One no. HMI (Desk top PC with 21" TFT monitors) mounted in control room for control, monitoring and configuration of Integrated gas turbine compressor control system including all subsystems such as vibration, temperature, displacement, anti surge, performance / master controls. The HMI shall have operator cum engineering functionality with engineering facility password protected.	Yes	
2.1.5	One no Laptop computer with all necessary hardware and software and anti virus software for programming configuration of bidder supplied control system.	Yes	
2.1.6	Supply of AC and DC power supply distribution cabinets as required for as required for Centrifugal Compressor control systems, PLC, vibration monitoring system etc. in the control room and field instruments in the field.	Yes	
2.1.7	Local gauge boards with all instruments and accessories, duly mounted on them, if any.	Yes	
2.1.8	Any other skid mounted (Lube Oil System, dry gas seal system etc.) or panel mounted instruments required to complete the job in all respect for satisfactory operation of Compressor and Ancillary systems.	Yes	
2.1.9	Vibration, Temperature & Displacement Monitoring system including monitors.		
2.1.9.1	Vibration, axial displacement, key phaser and temperature probes etc as per compressor data sheets attached elsewhere in this MR.	Yes	
2.1.9.2	UCP mounted Monitors/ racks located in control Room.	Yes	

S.No.	DESCRIPTION	Bidder	Purchaser
	Vibration and temperature points shall also be configured in HMI including direct and GAP voltages and temperature indications.		
2.1.9.3	Panel/ cabinet for monitors/ rack in control room including terminals, barriers, I/O cards, and dual redundant power supplies etc., duly mounted on panel / cabinet.	Yes	
2.1.10	Antisurge controllers for compressor along with a dedicated Performance / master Controller, load sharing controller (if required) including terminals, barriers, I/O cards, and dual redundant power supplies etc., duly mounted & prewired in a Unit control panel located in control Room.	Yes	
2.1.11	Programmable Logic Controller (PLC) with dual redundant processor, communication and power supply and single I/O as per PLC data sheet no B240-910-YE-DS-5010 attached with this MR.	Yes	
2.1.12	Supply of Fire and Gas detectors including Detectors & Transmitters for Gas turbine enclosure. Fire and gas detection system shall be configured in the Centrifugal Compressor system PLC. On line data shall be displayed on HMI showing approximate locations of sensors	Yes	
2.1.13	Alarms, signals & power Junction boxes for following:		
2.1.13.1	For interconnection between skid mounted instruments in field and UCP in control room	Yes	
2.1.13.2	For interconnection between instruments supplied loose in field to be located on process gas compressor suction & discharge piping, Knock out drums, fuel gas /startup gas lines, gas vent lines, recycle gas lines as shown in P&ID and marked as “*” to Control Room and other associated facilities.		Yes
2.1.14	Cables (signal, alarm, thermocouple extension, RTD, power supply, serial communication) for following: (Note - 2)	Yes	
2.1.14.1	Between field instruments and skid mounted junction boxes	Yes	
2.1.14.2	Multi-pair cables between junction boxes and UCP in control room [6P or 12P 1.5mm ² , For RTD and Gas detectors 8T(1.5mm ²) cable to be used].Distance between field and control room to be considered as 500m approximately.	Yes	
2.1.14.3	Between field mounted sensors of vibration & temperature, displacement, key phasor monitoring system and monitors/ racks located in control room	Yes	
2.1.14.4	All system cables between various systems such as vibration & temperature monitoring system, antisurge controllers, performance/master controllers and UCP PLC and HMI.	Yes	
2.1.14.5	Special cable between speed sensor in field and Turbine Speed Controller in UCP in control room	Yes	
2.1.14.6	Any other special cables from field to UCP in existing control room for compressor control system.	Yes	
2.1.14.7	All Interconnection cables between instruments supplied		Yes

S.No.	DESCRIPTION	Bidder	Purchaser
	loose in field to be located on process gas compressor suction & discharge piping, fuel gas /startup gas lines, gas vent lines, recycle gas lines as shown in P&ID and marked as "*" to Control Room		
2.1.15	Installation & Erection Materials:		
2.1.15.1	All installation and erection materials such as impulse tubes, pipes, valves, fittings, manifolds etc. for installation of all bidder supplied instruments and junction boxes (on skid instruments and other off skid instruments) as per approved installation standards.	Yes	
2.1.15.2	Instrument stanchions, supports and all types of consumables and accessories for mounting all bidder supplied instruments and accessories, gauge boards etc.	Yes	
2.1.15.3	Cable glands, and PVC sleeves (cable shrouds) for different types of cables	Yes	
2.1.15.4	Cable trays along with supports from instruments to junction box for skid mounted instruments	Yes	
2.1.15.5	GI/ copper earthing strip & earthing cables for earthing of all instrumentation items including junction boxes, field instruments, etc.	Yes	
2.1.15.6	Supply & installation of all cable trays and accessories for routing the cables with the GTC skid.	Yes	
2.1.15.7	All piping and pipe fittings, tubes and tube fittings for instrument air supply distribution for instruments supplied by Bidder.	Yes	
2.1.15.8	Insulation and painting of instruments and impulse lines, as applicable, in line with insulation and painting specifications attached elsewhere in MR.	Yes	
2.1.15.9	Installation material for junction boxes and power distribution boards.	Yes	
2.1.15.10	Any other installation material required for installation and commissioning of various instruments and systems supplied by Bidder.	Yes	
2.1.16	Start-up and Commissioning spares	Yes	
2.1.17	Mandatory spares	Yes	
2.1.18	Supply of drawings and documents as listed in Vendor Data Requirement	Yes	
2.1.19	Any special tools or tackles for instrumentation	Yes	
2.1.20	Any additional instrument required in the opinion of bidder for meeting functional requirements, safe and efficient operation, which are not listed specifically in this document.	Yes	
2.1.21	One heavy-duty dot matrix type printer as per PLC data sheets as alarm cum log printer shall be supplied. And one no. laser jet colour printer A3 size shall be supplied.	Yes	
3.0	Factory testing & calibration		
3.1	Carrying out/ witnessing shop testing and calibration of all instruments and system oriented items as per approved Inspection Test Plan / FAT procedure.	Yes	Yes
4.0	Installation, field calibration/ testing and commissioning		
4.1	Installation of all instruments, junction boxes, and accessories and auxiliary systems (e.g. lube oil) on	Yes	

S.No.	DESCRIPTION	Bidder	Purchaser
	equipment skid.		
4.2	Installation of loose supply instruments on gas compressor process lines.		Yes
4.3	UCP in control room		Yes
4.4	HMI's in control room		Yes
4.5	Installation of local gauge board (mounted on bidder supplied skid)	Yes	
4.6	Laying & termination of all cables from bidder supplied instruments & junction boxes on skids to Bidder supplied UCP in control room.		Yes
4.7	Instrument air distribution for all bidder supplied instruments on skids	Yes	
4.8	Installation of all junction boxes and power distribution boards on skids.	Yes	
4.9	Supervision of installation, hookup, testing and commissioning of various instruments, local gauge board, antisurge controllers, performance controller, turbine speed controller, vibration and temperature monitoring system etc. supplied by Bidder.	Yes	
5.0	Coordination		
5.1	Coordination with - Purchaser, - Purchaser's Plant Control Station - Purchaser's station PLC contractor for loop checking, field testing of all items, calibration of all instruments for successful commissioning of the compressor package.	Yes	
6.0	Insulation and painting of instruments and impulse lines, as applicable, in line with insulation and painting specifications.	Yes	

Notes:

- Residual engineering includes instrument sizing, Thermowell Wake frequency calculation, utility consumption, specifying derived data in process data sheets, type and material selection of instruments wherever required. Residual engineering shall also include actual transfer/ implementation of the information provided in the form of notes in P&ID and instrument data sheets/ equipment data sheets and other documents provided in MR. Bidder to note that turbine control systems indicated in P&ID attached is indicative. Bidder shall develop the P&ID considering monitoring and controls from UCP PLC and its HMI and interface with Purchaser's Plant Control Station .
- Approximate cable routing distance between skid in field and Unit control panel located in existing Control room shall be considered as 500 meters for all interconnecting cable estimate as part of base quote of the Package. However bidder shall calculate the exact cable laying distance as per indicative
- Instruments not mounted on skid but to be located on process gas compressor suction & discharge piping, fuel gas /startup gas lines, gas vent lines, recycle gas lines shall be supplied loose along with all required installation materials as per approved installation standards finalized during detailed engineering.
- Installation & cabling between bidders supplied off skid loose instruments including supply of

cables, junction boxes, cable glands, trays etc shall be by purchaser.

5. EIL/Owner shall witness testing of any or all items at various stages during manufacture and/or final stage before shipment as per approved Inspection Test Plan. All system oriented items like Integrated Compressor & Turbine Control system, Anti Surge controllers, Vibration and Temperature Monitoring System, F&G system, performance/master controllers etc. shall undergo factory testing and integrated factory acceptance test. Testing shall be carried out as per approved procedure. No such item shall leave manufacturer's works without factory acceptance test.
6. For instruments and accessories outside skid, supervision of installation, erection & commissioning shall be in bidder's scope, on per diem basis.
7. All bidder supplied instruments and junction boxes on various skids of package shall be pre-installed including cabling & termination within the machine skid.
8. Bidder shall provide required assistance to Purchaser's instrumentation contractor during loop checking of all Compressor instruments (mounted within skid or outside skid).
9. Any activity specifically not listed in this document, does not absolve the vendor of their responsibility to include such activities in their scope of work, which otherwise is necessary, to complete instrumentation work for compressor.
10. All such activities shall be carried out by the vendor without any implication. Instrument Job Specification shall be read in conjunction with scope of work.
11. Any items not covered in this section, which form part of the vendor's standard package and are required for ease of operation, control safety and interlock requirement shall be supplied by Bidder without any implication.
12. In case compressor and turbine vendors are two different vendors then also all the engineering and engineering drawings/documents shall be prepared by the sole bidder for entire control system of turbine and compressor and also other system as per this requisition.
13. All indications, recording of instruments, status, control and alarms of Instruments **(which are NOT marked as * in attached P&IDs)** shall also be in common facility PLC supplied by GTC Package vendor. Vendor to size the PLC accordingly.

14. Following are excluded from bidder scope of work:

- Installation of bidder supplied off skid loose instruments & junction boxes.
- Laying & termination of single pair cables supplied by the bidder, from bidder supplied loose instruments to the bidder supplied junction boxes ~~(if any)~~.
- Laying & termination of the single pair., multi-pair cables & special cables, supplied by the bidder, from machine skid junction boxes to respective control room.
- Installation of all bidder supplied Unit control panels / cabinets in control rooms.
- Laying & termination of all interconnecting cables including power supply cables between bidders supplied unit control cabinets / panels with in the control room.
- These activities will be carried out by purchaser's field erection contractor and compressor package vendor shall coordinate with purchaser's field erection contractor

and provide them necessary specifications, data, documents and drawings and any other information & assistance required for the above activities to complete the job within the agreed time schedule. Further bidder shall be fully responsible for proper commissioning of the package along with all associated instruments and control systems.

SECTION-D: PIPING

BIDDER shall supply all Materials as per scope of work. The procurement and supply of all materials required shall be strictly in accordance with the requirements of P&ID's and PMS (B240-000-83-41-SP-0001) enclosed with the MR document. As a minimum, the following materials shall be supplied by BIDDER:-

- (i) All Piping materials (Pipes, fittings, flanges, valves, nuts, bolts, gaskets) for all systems mentioned in clause 2.1 & P & IDs.
- (ii) All Valves as indicated in P&IDs, including Direct Gas Actuated Ball Valves with Tag Nos. 910-AV-1107, 910-AV-1108, 910-AV-1109, 910-AV-1110, 910-AV-1111, 910-AV-1112, 910-AV-1113, 910-AV-1202, 910-AV-1301.
- (iii) Apart from the Valves included in (1) & (2) above, manually operated Full Bore Ball Valves to the Upstream & Downstream of PSVs with Tag Nos. 910-PSV1401A & 910-PSV-1401B.
- (iv) All companion flanges (including bolts, nuts, gaskets & adequate no. of Spare gaskets) at Battery Limits for process piping at all inlet/outlet connections of GTC, Fuel Gas Booster/ Conditioning Skid and Seal Gas Skid. Companion Flanges of all Valves in Bidder's scope of supply.
- (v) Strainers for Compressor & Fuel Gas Skid; including mating Flanges (with Nuts, Bolts, Gaskets & adequate no. of Spare gaskets).
- (vi) All Carbon Steel Ball valves (size 2" & above) shall be supplied as per Standard Specification for Pipeline Ball Valves (6-71-0014) and data sheets. All other valves shall be supplied as per Technical Notes for Valves (6-44- 0052).
- (vii) All supporting material for all Piping (including vents) in Bidder's scope of supply.
- (viii) All companion flanges (including bolts, nuts, gaskets & adequate no. of Spare gaskets) at Battery Limits for process piping at all inlet/outlet connections of GTC Skids and Fuel Gas Conditioning Skid.
- (ix) All other items as per Pipeline specifications attached in the inquiry document.



JOB SPECIFICATION (GAS TURBINE DRIVEN CENTRIFUGAL COMPRESSOR PACKAGE)

PROJECT : Installation of New GTC Compressor at Gandhar,
Gujarat,

OWNER : Gas Authority of India Limited

PMC : Engineers India Limited

JOB NO. : B240

C	23.10.2019	REVISED AND RE-ISSUED WITH TECHNICAL AMENDMENT # 1	AS	JSD	NK
B	16.09.2019	REVISED AND REISSUED WITH MR	AS	JSD	NK
A	26.06.2019	ISSUED WITH MR	AS	NK	NK
Rev. No	Date	Purpose	Prepared by	Checked by	Approved by

1.0 GENERAL

1.1 Scope

This specification describes the minimum requirements for design, engineering, manufacture, testing, supply & supervision of erection and commissioning of Gas Turbine Driven Centrifugal Compressor (GTC) package as described hereunder and in various attachments forming part of Inquiry document.

- 1.2 The intent of these requirements is to supplement, highlight and modify the requirements as given in the datasheets, specifications as listed under list of attachments forming part of the MR and other applicable standards and codes as specified therein.

1.3 Other General Requirements

- 1.3.1 The design, construction, manufacture, supply & testing and other general requirements of the Gas Turbine-Compressor package shall be strictly in accordance with the data sheets, this job specification, Drawings, standard specifications etc. as listed under "List of Attachments" as well as other referred codes, standards and recommended practices etc. which also form a part of this specification.

- 1.3.2 Along with compliance with this specification, bidder shall also have responsibilities of furnishing equipment and accessories of proper design, materials and workmanship to meet the specified start-up and operating conditions.

- 1.3.3 Compliance with this specification shall not relieve the Vendor of the responsibility of furnishing equipment and auxiliaries of proper design, materials and workmanship to meet specified operating conditions.

2.0 SITE & UTILITY DATA

- 2.1 Refer Doc. No. B240-910-80-42-SU-5010 forming part of inquiry document.

3.0 LOADING & PENALTY CRITERIA

- 3.1 Refer Doc. No. B240-910-80-42-LP-5010 forming part of inquiry document.

4.0 QUALIFICATION CRITERIA

- 4.1 Refer Bidder Qualification Criteria enclosed elsewhere with the RFQ. Bidder shall submit Proven Track Record Proforma duly filled-in alongwith supporting documents for Bidder Qualification attached with the RFQ.

4.2 QUALIFYING CRITERIA (QC) FOR AUXILIARIES:

QC for Dry Gas Seal/Dry Gas Seal skid and Gear-unit are as specified in the successive clauses.

- (i) The offers submitted by the bidders shall be evaluated based on the basis of offers meeting the QC of main equipment and the information required to satisfy the QC requirements of auxiliaries/bought-out shall be submitted post-order after finalizing the details of such bought-out equipment.
- (ii) Pumps coming in auxiliary systems such as Lube oil system etc. included in the package shall be of field proven design sourced from the approved vendors as listed in ANNEXURE-A to this job specification. The equipment sourced by the package vendor shall comply to the relevant standards indicated in the inquiry document. In case of an order, Bidder shall furnish details of all auxiliaries, as asked under vendor data requirements, during detailed engineering stage i.e. post order. Reference list for the auxiliaries shall be submitted during detailed engineering stage post-order.

5.0 SCOPE OF SUPPLY/ WORK & EXCLUSIONS

- 5.1 Bidder shall be the Single Point responsibility Vendor (SPRV) for the complete GTC package.

Single point responsibility vendor's scope of supply is described in data sheets, specifications, Process P&ID's, equipment layout and scope of supply doc. no. B240-910-80-42-SS-5010 forming part of the inquiry document.

However, it shall be the responsibility of the SPRV to furnish a safe operating unit. For this purpose, in case SPRV envisages additional equipment / instruments / control and safety

devices, the same shall be offered by the SPRV and included in his scope of supply. Such additional items shall be separately listed with reasons for their inclusion.

- 5.2** During detail engineering stage (in case of an order), the GTC package shall be studied for HAZOP review with the successful bidder at Owner's/EIL's office. Any suggestions/modifications raised during HAZOP review shall be implemented by the bidder without any cost/time implication to the purchaser.

Bidder shall indicate the cost of participation in HAZOP study on per diem basis. For the purpose of commercial comparison, 3 mandays shall be considered for participation in the HAZOP study of the GTC package. Per-diem rates as quoted by bidder shall be the basis of payment against participation in HAZOP study. However, the actual payment shall be based on actual mandays participated by the bidder.

5.3 Exclusions

Following are excluded from bidder's scope of supply:

- Foundation & civil works.
- Compressor shelter, other Civil & structural work.
- Erection & Commissioning (Except supervision).

6.0 GAS TURBINE AND COMPRESSOR SIZING

- 6.1** The enclosed Process Datasheet specifies two cases of operation i.e. Case-1 and Case-2. Case-1 represents while GANDHAR GPU is running condition (normal & most prevalent operating case). Case-2 represents while GANDHAR GPU is stopped condition.

- 6.2** GTC train shall be selected to suit all the operating cases as per Process Datasheet with the Rated/Guarantee case as indicated in Compressor Datasheet (Doc. No. B240-910-80-42-SP-5010).

The continuous base rating of Gas turbine at the specified site conditions of altitude, intake & exhaust losses, site rated temperature (47°C), humidity etc. shall not be less than:

- (i) **For Case-1:** 110% of maximum compressor power required among all cases/Guarantee case (*inclusive of all losses i.e. compressor mechanical losses, Gear-box losses, transmission losses etc.*).
- (ii) **For Case-2:** 100% of maximum compressor power required among all cases (*inclusive of all losses i.e. compressor mechanical losses, Gear-box losses, transmission losses etc.*).

Site conditions as indicated in Site & Utility data (Doc. No. B240-910-80-42-SU-5010) shall be considered for arriving at Gas Turbine site rating.

7.0 Piping termination and Vendor's battery limit

7.1 Process Gas Piping

The Compressor shall be supplied flange to flange. No process gas piping (inlet/discharge) is included in the bidder's scope of supply.

7.2 Utility Piping

- (i) The purchaser shall supply single point supply connection near the compressor package battery limit for each of the utilities like:

- Nitrogen.
- Instrument Air.
- Fuel Gas.
- Starting Gas.
- Seal Gas etc.

P&IDs as attached may please be referred for further details.

- (ii) Bidder shall furnish Utility consumption requirements for Nitrogen, Instrument Air, Fuel gas, Starting Gas, Seal Gas, electrical load requirements for auxiliary systems (i.e. lube oil pumps, portable lube oil purifier, portable oil filling & emptying Pump etc.) for the offered compressor package.

- (iii) All interconnecting distribution piping to various consumption points within bidder's Battery Limit, tubing, cabling, supports including isolation valves at the tie-up points of bidder's battery limit shall be engineered, designed and supplied by the bidder.
- (iv) All Piping shall be supplied prefabricated with minimum field joints and as a commercial length, where prefabrication is not possible due to general erection constraints. Refer Tentative Layout for compressor package enclosed in the inquiry document.
- (v) All vents pipes shall be supplied by the bidder with valves, fittings etc. and terminated to the safe elevation outside the compressor house.
- (vi) Bidder shall terminate all the drains at the grade level with isolation valves for further connection to purchaser's CBD/OWS system. Also, bidder shall terminate all the compressor-casing drains manifolded to single connection at the grade level for further connection to purchaser's CBD/OWS system. Further, any device if required to match with the operating and design conditions of existing CBD/OWS system shall be in bidder's scope. In case of any common drains e.g. from Compressor Casing, the same shall be provided with double-block valves.
- (vii) All flare lines required for the package shall be piped by the bidder up to purchaser's flare header and shall be free draining towards the flare header.

8.0 OPERATING & CONTROL PHILOSOPHY

8.1 The unit start-up shall be automatic with two button operation (as a minimum requirement) along with "Confirm operation Button". Pressing of the first button & "Confirm operation Button" shall initiate the sequential steps leading to a purged and pressurised compression system ready for start. Pressing of the second button & "Confirm operation Button" shall cause sequential start-up of gas turbine compressor train, bringing the unit to speed and loading it.

In the event of pressing the normal stop button, the shutdown sequence shall end with compressor trains in the pressurised mode ready for start. With the pressing of the second button, the system shall be completely depressurised and after completion of all the sequential steps, 'ventilated shut down' shall be displayed on the panels.

The unit shall be brought safely to a shutdown/ventilated shutdown in the event of activation of the emergency push button or in the event of a malfunction as part of the GTC protection and sequence control system. Detailed sequence block diagrams and logic diagrams for start-up / shutdown etc. shall be approved by the Purchaser.

The complete compressor-gas turbine train shall be capable of remote starting/stopping from Unit/Compressor control panel installed in the Main Control Room (MCR). However, Start clearance from the field will be provided. Monitoring & Control of the Compressor station shall be performed at two levels viz. Station PLC and Unit Control Panel (UCP)/Common facility panel (FCP).

Bidder shall refer Instrumentation specifications attached in the inquiry document which will be governing in this case.

8.2 Emergency shutdown of the compressor train shall be possible from Unit/Compressor control panel, Master control center as well as from local gauge board on the GTC skid regardless of mode selection.

8.3 Monitoring and control of the compressor station are envisaged to be performed as under.

System	Control and Monitoring from
Gas Turbine Compressor (GTC) Train, Fuel Gas Conditioning Skid, indication and alarms etc	1. Unit/Compressor control panel/PLC 2. Master Control Center/Station PLC (only key parameters)
Station Flow Computers/Repeat Signals to and from GTC Train PLC	1. Purchaser's Common Facility Panel/PLC for common facilities 2. Purchaser's Master Control Center/Station PLC (only key parameters)

Note: Refer Instrumentation System Configuration Schematic Nos. B240-910-16-52-SK-0001 and B240-

910-16-51-SK-0002 and Instrumentation specifications attached elsewhere.

9.0 SPECIAL REQUIREMENTS

9.1 COMPRESSOR

9.1.1 The Centrifugal compressor and associated equipment shall conform to Chapter 1 & 2 of API Std. 617, 7th edition together with EIL Standard specification no. 6-42-0005 Rev. 2 and other specifications as listed in the List of Attachments forming part of MR.

9.1.2 The compressor shall be selected so as to fully meet the requirements specified in data sheets (i.e. Process data sheets and Equipment datasheets) and specifications as well as referred codes and standards forming part of the inquiry document.

9.1.3 Compressor shall be driven by Gas Turbine (GT) through a Gear Unit (as applicable).

9.2 DRY GAS SHAFT SEALING SYSTEM

9.2.1 Compressor shall be equipped with dry gas shaft sealing system. All dry gas seal piping between auxiliary skids and compressor shall be included in bidder's scope.

The Proposed Dry-Gas Seals shall be bi-directional, interchangeable between drive end and non-drive end and of Tandem (with int. Labyrinths) & cartridge type design as per Fig. 1.C-9 of API 617, 7th edition.

The dry gas seal modules shall be on separate skid from the lube oil console comprising of all the necessary instruments like pressure reducing valves, pressure & temperature and differential pressure instruments etc.

9.2.2 Seal gas skid shall be compact, easy to operate/carry out maintenance and designed to ensure that there is no condensate ingress in dry gas seals.

9.2.3 The Dry gas seal (Primary Seal gas supply and vent) and seal gas system shall be designed for the supply/ return / mechanical design conditions of the proposed seal gases OR casing MAWP, whichever is higher.

9.2.4 The primary sealing medium shall be same as the gas handled by the compressor during normal running of compressor. Conditioning of seal gas to suit dry gas seal requirement shall be done by the vendor within dry gas seal skid.

9.2.5 During start-up of the Compressor package, start-up seal gas from upstream of Compressor shall be provided as indicated in P&ID No. B240-02-42-910-1111 attached in the MR.

Normal and emergency seal gas supply shall be from the compressor discharge also as indicated in the P&ID referred above. Compressor datasheet shall be referred for the B/L conditions of seal gas(es) under various conditions. If the B/L conditions (Normal/Emergency/Start-up gas/Nitrogen etc.) indicated in the site & utility data are not sufficient then bidder may include boosters in his scope.

9.2.6 The secondary sealing medium shall be Nitrogen. The provision for change over from normal to emergency seal gas supply is in bidder's scope. Bidder is advised to review the supply conditions of Nitrogen from Nitrogen Header as indicated in "Site & Utility data" and shall indicate their limitations, if any. Bidder shall furnish the quantity of Nitrogen required under various conditions.

9.2.7 Nitrogen as separation gas shall be provided between Secondary seal and Compressor Bearing to prevent flow of lube oil to seal area.

9.2.8 The Dry Gas Seals & Sealing system shall be designed for settle-out pressure attained after the Compressor trip. Bidder shall supply Seal system complete with all necessary pressure regulators, Control valve, Pressure safety valve, electric heaters, Pressure gauges, piping from Purchaser's battery limit to Compressor Seals along with fittings, other instruments and controls, stainless steel piping, Coalescing filters and Steel bodied transfer valves with Stainless Steel trim/internals. If required, based on Seal Gas



conditions, Stainless Steel piping shall be insulated and heat traced by the Vendor to prevent any condensation.

Bidder shall calculate the settle-out pressure and provide the same during detailed engineering (in case of an order). For this purpose, if required, necessary data required for calculation of settle-out pressure i.e. from major vessel upstream of Compressor to major vessel downstream of Compressor will be provided during detailed engineering (in case of an order).



- 9.2.9** If the Battery-limit pressure(s) of seal gas/nitrogen are not adequate, bidder shall provide Seal Gas Boosting System and associated auxiliaries along with necessary instrumentation & logics, as part of dry gas seal skid (&) Nitrogen Bottle Bank (as recommended and required by bidder) with auto-change-over valve(s) and associated auxiliaries along with necessary instrumentation & logics.



- 9.2.10** **Coalescing filters:** If required based on Seal Gas Conditions, Coalescing filters shall be equipped with stainless steel housing & shall have filtration efficiency of 98% on liquids (i.e. 1 micron or greater) & solids (i.e. 3 microns or greater). The collapse pressure of the filter elements shall be minimum 50 psi (3.5 kg/cm²) differential. Filters shall be twin filters each with an overdesign margin of 20%. The seal vents shall be routed to flare or safe disposal.

9.2.11 **QC for Dry Gas Seal:**

The offered model of Dry Gas Seal shall be field proven and similar in terms of specified process gas service, shaft diameters, speeds, sealing pressures and configuration as compared to at least TWO UNITS designed, manufactured, tested and supplied by the proposed manufacturer and at least ONE of these units shall have completed at least ONE year of satisfactory operation at site as on bid due date of main equipment. Bidder shall furnish past supply experience list of the seal manufacturer for the offered model of seal and justify meeting accepting criteria, during detailed engineering stage (post-order).

9.2.12 **QC for Dry Gas Seal Skid:**

The offered dry gas seal skid and panel shall be field proven and similar to the specified operating parameters as compared to at least TWO UNITS designed, manufactured, tested and supplied by the proposed manufacturer and at-least ONE of these units shall have completed at-least ONE year of satisfactory operation at site as on the bid due date of main equipment. Bidder shall furnish past supply experience list of the seal gas skid/panel manufacturer against the offered seal gas skid/panel and justify meeting accepting criteria, during detailed engineering stage.

- 9.2.13** Bidder shall indicate process gas & Nitrogen consumption requirements during normal, stand-still/settle-out & start-up conditions.

- 9.2.14** Bidder shall indicate the guaranteed seal leakage rate in compressor data sheet.

- 9.2.15** Operating and spare seals shall have the following shop tests:

- (i). Cleanliness (No discoloration or hard particles found on 20 mesh screen after module blown for 5 minutes with 100 psig (7.0 kg/cm² g) dry filtered gas).
- (ii). Gas Leak at a pressure equal to settling out pressure with a mol weight gas equal or less than the seal gas
- (iii). Functional run for minimum of one hour at operating pressure and speed. Following the test, the seal elements shall be examined for wear and general conditions.
- (iv). Other tests as per Annexure 1D of API 617.

- 9.2.16** The design & drawings of dry gas seal skid and panel shall be vetted by the dry gas seal manufacturer to ensure trouble free operation.

- 9.2.17** Dry Gas seal(s) shall preferably be of one of the makes as listed in the vendor list attached in ANNEXURE-A of this document.

Note: The Dry Gas seal panels shall be sourced from the Dry Gas Seal manufacturer.

9.3 ANTI-SURGE CONTROL SYSTEM

9.3.1 Anti-surge control system furnished for the compressor shall include all Instruments viz. (Flow, Pressure, Temperature, Speed) Transmitters, Indicators, control valve, surge controller with accessories as required for completeness of the surge control loop. The design/engineering, testing, supply and supervision of erection and commissioning of the complete system shall be in bidder's scope of supply. Details of the proposed system shall be furnished by the bidder along with the bid.

9.3.2 The surge controller shall be installed/integrated at a location as per Compressor manufacturer's standard proven design e.g. Compressor UCP in CCR.

9.3.3 Bidder shall be totally responsible for any coordination with controller supplier in realising the anti-surge control system for safe and reliable operation of the compressors.

9.3.4 Instrumentation specifications and process P&ID's as enclosed with the inquiry documents shall be referred for further requirements.

9.4 COMPRESSOR SUCTION STRAINERS

9.4.1 Bidder shall provide a suitable permanent "T" type strainer at gas inlet with spool piece arrangement. Suction pressure indicated in the data sheet is at the Suction flange of the Compressor. A pressure drop of 0.1 Kg/cm² has been considered across the strainer, to arrive at the compressor suction pressure. In case the pressure drop is more than the above value, bidder shall indicate the pressure drop and re-calculate the value of suction pressure at compressor flange. The revised value of suction pressure shall be indicated on compressor data sheet & shall be the basis of sizing/selection of the compressor. Strainer shall be mechanically suitable to withstand a pressure drop of 5 kg/cm². The open area shall be at-least 150%.

9.4.2 Bidder shall indicate the mesh size and the pressure drop across the strainer. A Differential pressure indicator with high differential pressure alarm & shutdown shall be provided for differential pressure across the suction strainer.

9.4.3 Bidder shall also provide a temporary strainer, which shall be housed in the same spool piece as provided for the permanent strainer. The temporary strainer in each case shall be used for commissioning of the compressor after which the same shall be removed and permanent "T" type strainer installed.

9.4.4 This strainer shall be installed as indicated in the enclosed P&ID. Strainers shall be of full line size.

9.4.5 All strainer materials shall confirm to Strainer Datasheet attached with the MR. Bidder shall furnish the details for the strainer in his bid/offer.

9.4.6 Piping specifications as attached elsewhere in tender may also be referred.

9.5 CASING DRAINS

9.5.1 All casing drains of the compressor shall be manifolded by the bidder and terminated at the package Battery-limit with double isolation valves. Drains shall be connected by the bidder to purchaser's nearest CBD/OWS point(s).

9.6 GEAR UNIT (AS APPLICABLE)

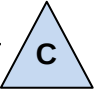
9.6.1 The Gear unit shall conform to API Std. 613, 5th edition 2003.

9.6.2 QUALIFYING CRITERIA (QC) FOR GEAR UNIT

The Gear unit shall be from a regular and established manufacturer of API 613 gear unit having requisite design, manufacturing and testing facilities.

The Gear-Unit model offered shall meet the following minimum service and manufacturing experience requirement:

Gear Unit model offered shall be identical or validly similar in terms of Power rating, Pinion



speeds, Gear ratio, Mechanical Design, Materials as compared to at least ONE UNIT designed, manufactured, tested and supplied from the proposed manufacturing plant in the last TWENTY years and the same shall have operated for one year at site as on the bid due date of main equipment.

Note: Provenness of the offered Gear-unit w.r.t. the qualification criteria shall not be reviewed during bid-evaluation stage. The same shall be reviewed during post-order stage upon placement of order. Duly filled in experience record proforma shall be submitted post-order to establish provenness of the offered Gear Unit model. However, if it is found during post-order stage that the offered gear-unit does not satisfy the QC as above, then bidder shall provide alternate make/model of gear-unit (meeting the QC as above) without any time/cost implication to the purchaser and without any increase in the "Guaranteed Compressor BKW".

9.7 GAS TURBINE

9.7.1 The Gas Turbine and associated equipment shall conform to API Std. 616, 5th edition together with EIL Standard specification no. 6-43-0041 Rev. 2 and other specifications as listed in the List of Attachments forming part of inquiry document.

9.7.2 The gas turbine shall be either of heavy-industrial, light-industrial or aero-derivative type and Single/Multiple Shaft design equipped with DLE/DLN combustors. All the components including gas generator shall be supplied with gas turbine which shall be newly manufactured against this order. *This shall be indicated from the manufacturing serial number.*

9.7.3 The Vendor shall furnish detailed time schedule of inspection/overhaul of various components. The design life of major components shall also be indicated. This information shall be indicated in the proposal.

9.7.4 Gas Turbine starting system:

(i). Gas Turbine driver can be with a gas starting (expansion turbine) system & the pipeline gas (start-up gas) as available shall be used for the purpose. The gas starter (gas based start motor) should be provided with speed monitoring system to measure the speed of the starter during startup & after the starter drop out to ensure the safety of starting system & clutch mechanism.

---OR---

Alternatively, the Gas Turbine starting system can be of soft starter based electric type i.e. VFD fed electric Motor Starter (Clutched) subject to the condition that the electric motor starting system shall be suitable for starting at full load with 500 kVA (Prime Rated Power) rating emergency DG set (in purchaser's scope) with GTC and all its auxiliaries (i.e. Air-cooled LO coolers, auxiliary motors etc.) on full load. The electric starting system shall be complete with all associated accessories, instrumentation & controls. **A categorical confirmation w.r.t. the above shall be provided in the bid with back-up calculation.**

(ii). Complete Gas starting system includes the equipment required for making the gas suitable for expander, interconnecting SS piping along with companion flanges from source to expander & vendor pipes shall be supplied by SPRV (Applicable PMS shall be referred for flanges and gaskets etc.) are included in bidder's scope.

(iii). Starting Gas used for starting the gas turbine shall be measured by installing a meter in starting gas line for the Gas turbine. Bidder to supply the metering system with flow computer suitable for compressibility correction as per AGA 8 detailed method.

(iv). Bidder shall refer the battery-limit conditions of start-up seal gas in Process Datasheet and Compressor datasheet.

Note: Start-up/Fuel Gas boosting system for the GTC package is not envisaged. Bidder shall comply to the B/L conditions of the Start-up/fuel gas indicated in the MR without any boosting system/compressor.



9.7.5 Air inlet system:

- (i) The air intake system shall be complete with silencer, plenum chamber, filter, filter housing, Pre-fabricated air inlet ducting, Expansion joints, flanged connections and transition pieces etc. as required along with necessary instruments and controls. The air intake shall be from safe area (as per Area classification drawing) and the air intake filter shall be at a height of minimum 6 meters from grade level. All parts coming into contact with inlet air shall be of Stainless Steel construction (SS) construction. The filter housing shall be of SS. 
- (ii) The air inlet system shall be equipped with a differential pressure transmitter and indicator in mm of water. Bidder shall provide arrangement of Alarm and Trip in case of increase in the pressure drop across filter with the alarm and trip set-points as per Gas Turbine OEM's recommendation. 
- (iii) The Air Intake System shall be suitable for the operating conditions specified by the Gas Turbine Manufacturer.
- (iv) Detailed fabrication, installation drawings & bill of materials for structural supports, access/maintenance platforms, ladders for the Inlet Air filters & Inlet Air Ducting shall be submitted for Purchaser's review/approval during detailed engineering.
- (v) Design of inlet ducting shall be made in such a way that it requires minimum time and effort to remove when the Gas Turbine has to be maintained/overhauled.
- (vi) Air filters shall be latest state of the art design such as synthetic type in place of conventional Cellulose type so as to ensure enhanced life. Air filtration capacity shall have an overdesign margin for keeping the provision for future as per Gas Turbine OEM recommendation. The type of offered Air-filtration system (i.e. Static or Pulse-Jet) shall be as per the Gas Turbine manufacturer's standard proven design practice suitable for the site/operating conditions in-line with clause no. 5.6.2.1.1 of API 616 5th edition. 
Filters shall be sourced from reputed manufacturers. Complete details of filter along with filter manufacturer's catalogues along with list of references shall be reviewed & approved by Purchaser during detailed engineering stage.
- (vii) The inlet air filter shall meet the mandatory requirements of the Gas Generator (GG)/Gas Turbine (GT) manufacturer in all respects.
- (viii) Inlet air filter shall be provided with a stainless steel weather hood/louvers and heavy mesh wire insect / bird screen.
- (ix) The inlet air pre-filter element shall be replaceable while the unit is in operation. Bidder shall furnish complete details of filter cleaning/replacement procedure and the expected time duration between each such operation and the expected life of filter elements (expected filter element change out period). The filters shall be provided with DPI, alarm & shutdown for high differential pressure. 

9.7.6 Exhaust system and Emission control:

- (i). The exhaust shall be routed to atmosphere through exhaust stack/chimney. The offered Gas Turbine shall mandatorily meet the emission norms/standards (latest in force) of "Central Pollution Control Board (CPCB)" of Government of India and the emission norms/standards of "Gujarat State Pollution Control Board (GPCB)" of Government of Gujarat state, whichever is stringent.

Bidder shall indicate the comparative data/table of the emission limits as per CPCB/GPCB and guaranteed emission data of the offered Gas Turbine in his bid/offer. The guaranteed exhaust gas emission datasheet (as in Gas Turbine Datasheet) shall be mandatorily filled-in and submitted with the bid/offer

It is reiterated that the use of water or steam to achieve emission limits of the offered Gas turbine equipped with DLE/DLN combustors shall not be permitted under any

circumstances.

A categorical confirmation of compliance to the above with back-up documents shall be furnished in the bid/offer of the bidder.

- (ii). The exhaust system for the Gas turbine shall include but not limited to:
- Exhaust collector
 - Exhaust silencer
 - Transition Pieces
 - Exhaust duct
 - Expansion joints
 - Exhaust stack/chimney (minimum 30 m height)
 - Instrumentation and controls as required
 - Necessary insulation for personnel protection. Surface temperature of cladding shall not exceed 60°C at any point of time.
 - Supports
- (iii). The exhaust stack/chimney shall be of self supporting type complete with suitable ladder/staircase for maintenance of the same as per the specifications attached elsewhere. The stack//chimney shall be provided with connections/ tapings for measuring emission levels with emission-measuring equipments for on line emission measurement equipment (Purchaser's supply) etc.
- (iv). The exhaust system shall be suitably located relative to the air inlet, ventilation inlet/exhaust and after cooling air, so that no recirculation of exhaust gas to inlet air filters, coolers is possible.
- (v). The exhaust stack shall be suitably insulated and jacketed so as to minimise heat contribution to other units and to provide personnel protection. Exhaust system shall be adequately supported.
- (vi). The exhaust shall be fitted with suitable silencer capable of reducing overall train noise levels to below the permissible noise level limit as specified in this specification.
- (vii). Provision shall be made for preventing the accumulation of monsoon rainwater in the exhaust system when the unit is not running. The purchaser shall approve the details of this provision.
- (viii). Design of exhaust ducting shall be made in such a way that it requires minimum time and effort to remove when the GT has to be maintained/overhauled.

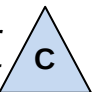
9.7.7 Fuel Gas System

- (i). The Fuel gas system shall be as per Clause 5.8 of EIL Standard 6-43-0041 Rev. 2 attached elsewhere in the inquiry document. In addition to what is specified in the EIL standard Specification as above, bidder shall also include all Instrumentation and valves, auto vent valve downstream of Shutdown valve (SDV) etc as indicated in Piping and Instrumentation diagrams (P&ID) forming part of the inquiry document.

Note: Fuel Gas boosting system for the GTC package is not envisaged. Bidder shall comply to the B/L conditions of the fuel gas indicated in the MR without any boosting system/compressor.

(ii). **Qualification Criteria for Fuel Gas Skid:**

The offered Fuel Gas skid shall be field proven and similar to the specified operating parameters (capacity and pressure) as compared to at least TWO UNITS designed, manufactured, tested and supplied by the proposed manufacturer and at-least ONE of these units shall have completed at-least ONE year of satisfactory operation at site as on the bid due date of main equipment. Bidder shall furnish past supply experience list of the fuel gas skid manufacturer against the offered fuel gas skid and justify meeting accepting criteria, during detailed engineering stage.



- (iii). Bidder shall obtain the detailed fuel gas specs from the Gas Turbine manufacturer and it shall be the responsibility of the bidder to engineer, design, manufacture, test the Fuel gas conditioning system so as to meet the specific fuel gas quality/requirements with the fuel gas for Gas Turbine offered by Purchaser. Bidder shall also take into account the possibility of cold starting of the unit during winter.
- (iv). All fuel gas piping downstream of the fine filters shall be stainless steel 304.
- (v). In case of tripping of compressor train (normal or emergency); gas supply to individual turbine compressor train shall be cut-off by SDV. Suitable arrangement for auto-venting of fuel gas downstream of SDV in such an event shall be provided.
- (vi). Fuel gas supply from conditioning skid to each train shall be provided with a PCV. Gas turbine fuel gas control / governing (complete with instrumentation, piping and valves etc.) shall be Gas Turbine manufacturer's standard proven system and shall satisfy the established safety means for such systems.
- (vii). Fuel Gas Conditioning skid shall be so designed that Proper maintenance space is provided around & within the Fuel Gas conditioning skid to take care of the bundle pulling arrangement for Fuel Gas Heater, filters etc. The local gauge board etc. should be located in such a manner so that accessibility/visibility is maintained. Gas conditioning skid shall be sourced from one of the vendors as listed in ANNEXURE-A of this job specification. Alternatively the same can be sourced/supplied from the main equipment OEM certified suppliers subject to availability of reference list for the intended application.
- (viii). Fuel Gas Skid shall be complete with the following:
 - Instrumentation, valves and controls as required.
 - Fuel gas piping between "fuel gas conditioning skid" and the Gas Turbine shall be in bidder's scope along with any Insulation/heat tracing as required.
 - Relief valves/thermal safety valves with block and bypass shall be provided as required. Discharge of all such PSV/PRV/TSVs shall be manifolded and terminated at skid edge with isolation valves.
 - All condensate drains shall be manifolded and terminated at skid edge with isolation valves. Drains shall be connected to purchaser's nearest OWS point(s)
 All vents shall be terminated at safe location.

9.7.8 Gas Turbine Washing System

The Gas Turbine shall be equipped with offline cleaning system along with crank/soak washing facility with all accessories, as required for internal turbine cleaning. Turbine shall have control for manual cranking and run up without firing. Gas Turbine manufacturer shall indicate recommended periods between cleaning under specified site and operation conditions. Liquid tank, piping and fitting etc. required for above purpose shall be of stainless steel. Instrument air (not gas generator air) shall be used for pressurisation of liquid tank, if required.

The Gas Turbine Washing/Cleaning System shall be portable trolley mounted complete with reservoir, driver, interconnecting flexible hose piping (10 m each at each port), hose-storage-wheel, valves, motor cable of approximately 30 m length & plug to suit the area classification & necessary instrumentation & controls.

9.7.9 Gas Turbine Enclosure

- (i) Weather proof sound attenuating enclosure shall be provided for the Gas turbine which shall meet all the requirements as per Clause no. 5.7.5 of EIL Std. Specification no. 6-43-0041 Rev. 2 attached in the inquiry document. Additionally, the following requirements shall also be complied with.
- (ii) The enclosure must be quickly detachable and equipped with lifting lugs for easy removal. Enclosure shall be constructed of easily handled sections to facilitate maintenance of and removal of the gas generator and power turbine

(as applicable). Access door(s) shall be provided for inspection, repair and maintenance of the turbine and its system. Turbine enclosure shall also have glass window with seal tight metallic covers. The enclosures shall be suitable for operation under conditions as specified and shall be rigid enough to withstand all static and dynamic loads.

- (iii) The enclosure shall be constructed with fire resistant materials. All enclosures shall be free of any depression or crevices where water or dust might collect.
- (iv) Provision shall be made for removal of rainwater, which might collect inside ventilation exhaust duct. Ventilation air intake and exhaust shall be provided with silencers having stainless steel splitters.
- (v) All instrument & electrical items, which are energised before start of pressurisation or remain energised after loss of pressurisation, shall be suitable for area classification as specified in Instrumentation and electrical specs attached elsewhere in the MR.
- (vi) The enclosure shall be provided with fire detection system including thermal detectors, flame detectors etc., gas detection system and fire suppression system using CO₂ as per the specifications enclosed elsewhere in the inquiry document.
- (vii) Detailed fabrication, installation drawings & bill of materials for structural supports, access/maintenance platforms, ladders for of the ventilation Fans & Ventilation Air Ducting shall be submitted during detailed engineering for the Purchaser's review.

9.8 LUBE OIL SYSTEM

9.8.1 General

- (i) The lube oil system to be supplied with the GTC package shall conform to API standard 614, 4th edition and attached data sheets and other specifications as listed in the List of Attachments forming part of inquiry document. Console type common lube oil system shall be supplied for Compressor, Gear Unit & Gas Turbine Driver.
- (ii) Gas Generator (GG) lube oil (LO) system may be independent if so recommended by the gas generator manufacturer. In such case GG LO system shall be as per GG manufacturer's standard. GG LO system shall comply with all the mandatory requirements of GG manufacturer.
- (iii) Bidder shall ensure that the design of the lube oil consoles from the point of view of easy accessibility. Sufficient free space for maintainability of the major pieces of equipments such as coolers, pumps, drivers, control valves, filters etc. shall be provided. Bidder to ensure easy personal movement and no criss crossing of piping in the consoles and shall not consider his standard congested consoles but shall design the layout in spread out manner. The layout shall be furnished for review and approval by the purchaser during detailed engineering.
- (iv) The LO system shall be complete and include oil reservoir, lube oil pumps (main & auxiliary), Emergency Oil Pump (EOP), hydraulic oil pumps (main & auxiliary oil pumps *as applicable*), twin filters, air-cooled Lube-oil cooler, and all necessary valves, fittings, gauges, an overhead emergency lube oil run-down tank (suitably sized so as to ensure supply of lube oil to compressor train for complete coast down time and cool off with separate accumulators shall for pump change over) etc.

Alternatively, in lieu of overhead emergency lube oil run-down tank, bidder may propose manufacturer's standard proven arrangement e.g. Shaft driven Main oil Pumps and Emergency Oil pumps to ensure uninterrupted supply of Lube-Oil to Gas Turbine-compressor train during coast-down time and equipment cool-off. The provenness of the offered alternative arrangement shall be substantiated with ample references of past supply and satisfactory operation at site. Details of offered Lube-oil system along with earlier supply references shall be provided in the bid/offer.

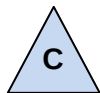
- (v) The material of construction of lube oil reservoir, lube oil supply and return piping, valve internals etc. shall be of Series 300 Stainless Steel.

Alternatively, Bidder may propose Lube-Oil reservoir of an alternate MOC as per his proven experience e.g. Epoxy coated Carbon Steel which can be accepted subject to availability of past supply records & satisfactory operation at site. However, as a minimum, all the items downstream of oil filters shall be of Series 300 Stainless Steel. Details of offered Lube-oil system along with earlier supply references shall be provided in the bid/offer.



(vi) Oil mist eliminator shall be provided in all lube oil vent lines to minimize the loss of lube oil due to vaporization. All the oil mist eliminator shall be mounted at suitable height by the bidder.

(vii) All inter-connecting lube oil piping from oil console to various consumption points in the equipment, including fittings, valves, instruments and supports shall be included in the bidder's scope of supply. Lube oil piping between compressor, oil console and lube oil run down tank (as applicable) shall also be in bidder's scope of supply. Bidder shall engineer the system and furnish detailed P&IDs as well as the piping drawings for the interconnecting piping for purchaser's review/ approval during detail engineering stage.



(viii) Reservoirs, pumps, coolers, filters and control valves shall be provided in an assembled console. Console shall have a steel baseplate with rim and drip lip for drainage.

Alternatively, Bidder may propose Lube-Oil reservoir integrated with the baseplate of main equipment which can be accepted subject to availability of past supply records & satisfactory operation at site. In such a case, other items forming part of Lube-Oil system such as Pumps, coolers, filters and control valves shall be suitably located within the GTC package Battery-limit with an easy accessibility for maintenance. Bidder shall also ensure that the Lube-Oil tank does not come into contact with the atmosphere. Details of offered Lube-oil system along with earlier supply references shall be provided in the bid/offer.



(ix) Matching companion flanges, gaskets, fasteners etc. at all terminating points requiring Owner's interface (Applicable PMS shall be referred for flanges and gaskets etc.) and all Stainless Steel supply & return piping/tubing between LO console & compressor/Gas Turbine are included in bidder's scope.

(x) Supply of First fill of lubricants for the machines is not included in the bidder's scope of supply. However, the bidder, in his proposal, shall indicate the Grade of Oil and the quantities required for flushing oil and for first fill of Lubricant for each machine forming part of the GTC package.

9.8.2 Drivers for Lube oil Pumps

Following Driving arrangement is envisaged for LO pumps.

Main Lube oil Pump	:	driven by Electric (AC) Motor/shaft-driven
Standby Lube oil Pump	:	driven by Electric (AC) Motor (Emergency AC feeder)
Emergency Oil Pump	:	driven by Electric (DC) Motor (DC battery bank)

For voltage and frequency levels electrical specifications may please be referred.

9.8.3 Lube-Oil Coolers

(i) Lube-Oil coolers shall be Air-Cooled and shall be supplied and manufactured according to the requirements API standard 614, 4th edition.

(ii) The cooler tubes shall be series 300 stainless steel. The header boxes shall be made of hardened stainless steel plate. The header plug material shall be selected to prevent galling. SS300 series tubes with aluminum fins are also acceptable.



(iii) The oil cooler shall be equipped with temperature-controlled bypass valves with a pre-determined temperature setting as per manufacturer's recommendation. For sizing purpose, bidder may consider a minimum temperature approach of 10 deg.C



to the maximum ambient air temperature.

- (iv) Oil cooler should be provided with adequate number of fans with 100% spare capacity. Cooling area shall be 200 % of the required surface area.
- (v) Electronic vibration switches shall be provided for each fan and shall alarm on high vibration.
- (vi) Each cooler shall be designed for 110 % of cooling capacity. 
- (vii) Cooler fans shall be electric motor driven directly (V Belt drives are not acceptable). Flexible metallic couplings shall be used for coupling motor & fan.
- (viii) Equipment furnished for Air-cooled exchangers shall include, but not limited to:
 - Coolers with fans and guards, electrical motor drivers.
 - Vibration cutout switches.
 - Pneumatically-actuated, opposed-action type louvers with Positioners for automatic control of oil temperature (controlled by temperature control system).
 - Access platform and ladders.
- (ix) Size and thickness of tubes, maximum number of fins per inch shall be as per relevant applicable functional specification and API code.
- (x) Motors shall be in accordance with functional specification of electrical motors, suitable for area classification.

Provisions shall be made in the Cooler design to facilitate ease of cleaning of the cooler.

9.8.4 Filling/Emptying out Pump

One portable trolley mounted pump with necessary hose piping, valves, connections etc. shall be provided for emptying out / filling the main oil reservoir. Pump capacity shall be 3 m³/hr (minimum) and it shall be electric motor driven, with a flexible motor cable of 30 m length and plug to suit the area classifications and motor rating. Ten metres of hose piping shall be provided both at inlet and outlet along with hose storage wheel by the Vendor.

9.8.5 Oil Purifier Unit

Bidder shall supply one portable trolley mounted oil purifier unit for the GTC package complete with automatic self cleaning centrifuge separator, flexible hose piping (10 m each at suction & discharge), hose-storage-wheel, valves, motor cable of approximately 30 m length & plug to suit the area classification/motor rating & necessary instrumentation and controls. The capacity of oil purifier shall be sufficient for total oil treatment in approximately 12 hours.

9.9 Couplings

- (i) The coupling(s) shall conform to API-671, 3rd Edition, October 1998 with a service factor of 1.75. While selecting the coupling, it shall be ensured by the bidder that the allowable shaft stresses of the Compressor train are not exceeded under any circumstances including any offset condition or conditions of maximum torque.
- (ii) In case of Compressor train having a gear-unit, the the coupling service factor shall not exceed the gear-box service factor.
- (iii) Coupling shall be non-lubricated flexible metallic element type.
- (iv) Coupling hubs and spacers shall be dynamically balanced at coupling manufacturer's works as one unit and all components shall be properly match marked.

9.10 Common Skid and Base-Plate

- (i) Gas Turbine Compressor (GTC) train shall be mounted on a common skid/base-plate designed to support the compressor, Gear unit and gas turbine. The skid/base-plate shall be suitable for 4/6 point lift. Bidder shall provide non-skid decking on the skid/base-plate.

- (ii) In case for transportation reasons from port/manufacturing works to site, splitting of this skid is required, the same shall be done by bidder. Splitting shall be done only with purchaser's prior approval. In case where splitting is essentially required, the skid/base-plate shall be designed so as to make a common skid/base-plate by bolting and dowelling at site and the complete skid/base-plate shall also be suitable for 4/6 point lift.
- (iii) Bidder shall also provide suitable spreader bars/spreader frames for transportation of common skid/base-plate or independent skids/base-plates.
- (iv) Auxilliary Skids (e.g. Fuel Gas Conditioning Skid, Buffer Gas Skid etc.) shall be so designed that Proper maintenance space is provided around & within the skids for maintenance purpose of individual skid components. Local gauge board etc. should be located in such a manner so that accessibility/visibility is maintained. All maintenance aspects of various skid components shall be reviewed by Purchaser and complied by the bidder.

9.11 Piping (Refer piping specification also)

Piping for lube oil and internal seal gas piping shall conform to API 614. Other piping requiring Purchaser's interface shall conform to enclosed specifications.

All piping, fittings, valves etc. specified in bidder's scope of supply shall conform to the technical requirements specified in the relevant codes and standards. However, all interfaces shall conform to purchaser's requirements specified in the P&ID's and respective Piping Material Specification (PMS) & piping specifications enclosed with the inquiry document.

9.12 Pressure Vessels

All pressure vessels, tanks required for lube oil system, buffer gas supply system, fuel gas system & starter gas system etc. shall be in accordance with the relevant API standards namely API Std. 617, API Std. 616, API Std. 614 & ASME Section VIII Div I.

9.13 Electricals

All electrical and lighting systems for the package shall be as per the electrical specification and data sheets as per list of attachments forming part of the inquiry document and other codes/Standards referred therein.

9.14 Instrumentation and Controls

Bidder shall supply all the necessary instrumentation and control system as described in Equipment and Instrument Data Sheets and Specifications, Process P&IDs and other specified instrumentation standards forming part of the inquiry document and other codes/Standards referred therein.

10.0 INSPECTION AND TESTING

10.1 General

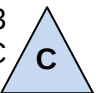
- (i) Inspection and test requirement have been detailed out in data sheets and/or specifications for various equipments.
- (ii) All tests which are marked as witness tests may be witnessed by Owner's and/or Consultant's Inspector.
- (iii) The successful bidder shall submit detailed Test Procedure for approval of the Purchaser at least four months in advance of the actual date of conducting each test.
- (iv) Complete details of all tests and inspection requirements must be consolidated by the successful bidder in a single document entitled "Inspection and Test Schedule for Gas Turbine driven Centrifugal Compressor Package".
- (v) For all witness tests, bidder shall give at least one month's notice and shall reconfirm the date of testing at least one week before the date of test.
- (vi) The following tests besides being witnessed by OWNER's/CONSULTANT's Inspector may also be witnessed by OWNER's/CONSULTANT's equipment specialists. The

successful bidder shall inform the Purchaser the scheduled test dates 6 weeks in advance and reconfirm the firm date of testing 1 week in advance.

- (a). Mechanical Run Test for Compressor with Main Rotor as per API Std. 617 & EIL Standard Spec. 6-42-0005 at Compressor manufacturer's works.
- (b). Mechanical Run Test for Compressor with Spare Rotor as per API Std. 617 & EIL Standard Spec. 6-42-0005 at Compressor manufacturer's works.
- (c). Performance Test for Compressor (with main rotor) as per Type 2 ASME Code PTC-10 at Compressor Manufacturer's works.
- (d). Mechanical run test for the Gas Turbine with main rotor / main Gas generator as per API Std. 616 & EIL Standard Spec. 6-43-0041 at Gas Turbine Manufacturer's works.
- (e). Performance Test for Gas Turbine main rotor / main Gas generator as per API Std. 616, ASME Code PTC 1 & 22 and EIL Standard Spec. 6-43-0041 at Gas Turbine Manufacturer's works.
- (f). Other tests as per respective datasheets.

10.2 Performance Guarantee test:

10.2.1 The GTC package shall be subjected to "**Performance Guarantee test (PGTR) at site**" within 3 months of commissioning of the GTC package. The PGTR at site shall be conducted inline with the requirements as per EIL Std. specification no. 7-76-0103 attached elsewhere in the inquiry document and all applicable codes i.e. ASME Code PTC 10 & 22, API 617 & 616 including the following requirements.



Bidder shall be informed regarding the site readiness for PGTR (post commissioning of GTC package) within the time frame as mentioned above. Bidder shall accordingly arrive at site with required manpower, tools, instruments etc. on the notified dates (as communicated by purchaser) to make necessary arrangement for carrying out PGTR at site.

10.2.2 The PGTR shall be done with the process gas (as per Process datasheets) and at full load for 72 (Seventy two) hours duration to establish satisfactory performance (in terms of performance guarantee parameters, pressure and temperature etc. as per inquiry document). Alongwith the guarantee parameters, safe & smooth, reliable operation, mechanical integrity and sound level of the complete package shall also be established during the PGTR at site.

Note: The duration of 72 (Seventy two) hours shall be on sustained basis i.e. process interruptions shall be allowed to cumulate, however machine related interruptions shall not be counted.

10.2.3 Bidder shall submit the detailed test procedure, guaranteed parameters to be measured at site and methods of computation of results for review by the Owner/EIL during detail engineering stage. The performance testing procedures shall be mutually decided after finalization of order.

Note: All utilities required during PGTR shall be provided by client as FREE ISSUE.

10.2.4 If required and with prior approval from the Owner/EIL; the guarantee parameters shall be adjusted to account for variation in ambient conditions prevailing at site during performance testing. Necessary calculations, correction curves shall have to be furnished by the bidder for this purpose during detail engineering. Owner/EIL's comments on these documents shall be final and binding on the bidder without any commercial implication to Owner.

Note: GT correction curves (or duly OEM signed and Stamped alternate technical document) to be submitted by bidder should be sufficient to estimate the deration w.r.t. off-design conditions & to correlate the GT output for various ambient conditions.



10.2.5 Modifications/additions/changes as required to resolve/correct any mechanical, electrical or Instrumentation related fault in the package, detected during PGTR shall be in bidder's scope without any cost implications to the purchaser. The above modifications/additions/changes etc. shall be carried out by the bidder within a reasonable time period mutually agreed upon.

10.2.6 If the GTC package fails to achieve the Guaranteed parameters at site, bidder shall carry out necessary modification at his own cost till the guaranteed parameters are achieved within a reasonable period (mutually agreed) from the date of failure of the first PGTR test and a second PGTR test shall be carried out by bidder at no extra cost implication to the purchaser.

Note: TECHNICAL PENALTY shall not be applicable to the PGTR at site. Commercial section of IFB shall be referred for further details.

10.2.7 If any additional equipments/instruments are necessary in addition to those in bidder's scope of supply for the purpose of testing & measurement, bidder shall bring them to site duly calibrated and shall take them back after successful completion. All utility and safety systems shall be operating during the test.

10.2.8 The cost for the "**Performance Guarantee test run at site**" shall be quoted as part of basic price.

10.3 Sound Level Test

(i) Sound pressure level of the complete unit operating at site at full load shall not exceed 85 dBA at any point when measured at 1 metre from the skid in any direction and the same shall be guaranteed at site.

(ii) In case specified noise level limit is not met at site, the bidder shall suggest and implement necessary modifications (without any time/cost implication to the purchaser) in the system to reduce the noise level to the specified noise level.

11.0 PARTICIPATION OF PURCHASER'S ENGINEERS DURING ASSEMBLY AND OTHER IMPORTANT ACTIVITIES:

Purchaser may depute his engineers at the Compressor/Gas turbine manufacturer's shop during the time of rotors assembly, balancing of rotor, main assembly of compressors and such other important activities which may be required to be performed during maintenance of the machines and the associated system. The Purchaser's engineers deputed in the Compressor/Gas turbine manufacturer's shop shall participate in the assembly operation and other activities and shall maintain record of all the final data like tolerances, clearances etc. Bidder shall have to provide all such data and records to the Purchaser's engineers and shall have to clarify all such data. Bidder shall submit along with the bid a list of activities in which such participation shall be useful for future maintenance work, along with the time period of each activities and the schedule when these activities are likely to be performed.

12.0 TRAINING

Bidder shall make arrangements for training of 15 persons x 02 weeks = 30 man weeks for the purchaser's operating and maintenance personnel at his/his sub-vendor's works to familiarize them with all aspects of operation and maintenance of mechanical, electrical, instrumentation & controls (inclusive of Compressor/Gear Box/Gas Turbine/ Anti-Surge Controller etc.) of these packages.

13.0 SPARE PARTS / SPECIAL TOOLS

13.1 Mandatory Spare Parts

Bidder shall include all the mandatory spare parts as specified in "**List of Mandatory Spares**" Doc. No. B240-910-80-42-SL-5010 as attached in the inquiry document.

13.2 Commissioning Spares

Bidder shall include in his proposal, sufficient spares required for commissioning of the GTC package as per his experience/recommendation & furnish a list for the same. If

however, any additional spare is consumed over and above the quoted commissioning spares, during commissioning, the same shall be provided free of cost, by the Vendor. Any leftover spares after commissioning shall be handed over to the owner.

13.3 Special Tools / Tackles

- (i) Special tools and tackles required, if any, for erection, site assembly & maintenance of each equipment of the GTC package as recommended by the equipment manufacturer shall be included in the bidder's proposal.
- (ii) Bidder shall supply the following minimum special tools & tackles alongwith the GTC package. If any specific item in the list below is not applicable, then the same shall be justified with suitable technical justification by the bidder.
 - Necessary power tools required for all bolts greater than 32 mm diameter.
 - One set of Hydraulic tightening devices, as required shall be supplied along with low pressure and high-pressure pumps.
 - One set alignment tools including fast align laser alignment tool for alignment purpose.
 - Industrial digital video scope/boroscope.
 - Torque Wrenches/Bolt Tensioners.
 - Coupling removal tools
 - Special tools for dismantling/assembly of GT
 - Special tools for dismantling/assembly of Compressor
 - Rotor lifting tools
 - Seals mounting tools.
 - Bearing tools
 - Transportation stand / container for the Gas generator for transporting the Gas Generator to the work of OEM for overhaul / major repair.

All special lifting tools/tackles including spreader bar etc. shall also be included in the bidder's scope of supply.

13.4 RECOMMENDED SPARES FOR TWO YEAR NORMAL OPERATION

Bidder shall include in his proposal, recommended spares for 2 years normal operation (Mechanical, Electrical and Instrumentation) as per manufacturer's recommendation over and above the mandatory spares, for the GTC package (Quote only) including compressor, driver, lube oil and seal gas, electrical, instrumentation etc. together with, part no., name of the parts, cost and recommended quantity of spare against the GTC train. Prices shall be firm for two years from the date of order.

14.0 SUPERVISION DURING ERECTION AND COMMISSIONING

14.1 The GTC package vendor shall provide his services for supervision during erection and commissioning of the GTC package. Electrical & Instrumentation engineers (as deemed necessary by the package vendor) shall also be present along with vendor's erection and commissioning engineer(s).

14.2 For supervision of erection and commissioning of the GTC package, a total of 200 mandays (maximum limit) have been envisaged alongwith pre-defined per diem rates (as defined in commercial document). Bidder shall categorically confirm compliance to the figure of 200 mandays and the pre-defined per diem rates (as defined in commercial documents) for supervision of erection and commissioning. Bidder may decide between days for Indian/Foreign supervisors and also discipline wise i.e. Mechanical, Electrical & Instrumentation etc., if required for supervision of erection and commissioning of GTC package, subject to the total of 200 mandays (maximum) as indicated above.

14.3 The cost for supervision of erection and commissioning shall NOT be considered for commercial comparison of bids.

15.0 EQUIPMENT LAYOUT

- (i) The main equipment i.e. Compressor, Gear Unit & Gas Turbine train is envisaged to be installed on foundations (at a certain height above grade level). Lube oil console

is also envisaged to be located at the Grade level below the main equipment.

- (ii) The proposed Equipment Layout (Drawing No. B240-910-83-41-11901) enclosed with the inquiry document indicates tentative Equipment layout alongwith the space available for the complete GTC package. Bidder shall ensure that the proposed equipment package is accommodated within the space allocated in the above mentioned layout drawing The main and auxiliary equipments shall be so arranged within this area such that enough space is available around each equipment for ease of operation and routine maintenance.

NOTE: Space given in the layout cannot be further increased and Bidder has to give his acceptability to overall space during proposal stage itself. Any upward change in the area requirement at a later date shall not be allowed.

- (iii) Bidder in his proposal shall include suggested detailed equipment layout indicating main equipment as well as auxiliary equipment various consoles, local panels/local gauge board etc. along with their dimensions and levels at which the same are to be placed.
- (iv) Bidder shall also indicate weights of equipment, maintenance space required, crane capacity (recommended) and crane hook approach from the grade level etc. The data/information shall be adequate for designing of compressor house (shelter).
- (v) General Arrangement Drawing (GAD)/ Equipment Layout of all equipment located inside compressor house as well as around the compressor house including main equipment, auxiliaries, and routing of piping etc. (based on the indicative layout drawing provided in the inquiry) shall be provided by the bidder along with the proposal.

16.0 VENDOR DATA AND DRAWING

16.1 General

- (i) Vendor Drawings and Data shall be furnished in conformity with the Vendor Data Requirements Forms attached with inquiry document.
- (ii) Vendor shall furnish all the information at the time of bidding as specified in the Vendor Data Requirement (VDR) and in this job specification.
- (iii) The Vendor Data Requirement after placement of Letter/Fax of Intent is indicated in the Vendor Data Requirement. Vendor shall confirm that all data as required shall be furnished by him within the agreed dates.
- (iv) After the placement of Letter/Fax of Intent, a conference (kick off meeting) will be held at such date and at such place, as may be mutually agreed upon between the Vendor and the purchaser. The intent of this conference shall be to discuss/clarify the various requirements and finalize the modus operandi of executing the order.
- (v) Vendor shall furnish the Drawings/Documents for purchaser's review/approval as per the Vendor Data Requirement. The review comments for major and critical drawings (such as system P&ID's General Arrangement Drawings, Foundation Drawings, Performance characteristics, Frequency analysis reports etc.) shall be discussed across the table at such date and place as may be mutually agreed between the Purchaser and the Vendor.
- (vi) Vendor shall also provide the operation and maintenance manuals as part of final documentation. The operation and maintenance must include Performance curves & characteristic curves for various operating conditions, Performance footprints at the time of shop testing. The operation and maintenance manual must clearly mention the schedule of all the overhauls along with detailed procedure for carrying out the same.

17.0 SUB-VENDOR LIST

- 17.1 Refer Doc. No. B240-910-80-42-VL-5010 Rev. A for vendor list of Pumps, Mechanical



Seal, Dry Gas Seal/Seal Skid, Fuel Gas Conditioning skid etc.

18.0 EQUIPMENT STORAGE

18.1 GTC package shall be packed for an outside storage period of 12 months.

18.2 The following shall be ensured before despatch of the GTC Package:

- (a) All the openings shall be plugged & in sealed condition during dispatch.
- (b) Instruments like gauges, probes, oiler etc shall be removed from the main equipment and dispatched separately to avoid the damage of these components during transportation handling and erection.
- (c) In addition to normal packing the equipment skids shall be separately covered with transparent polythene cover with opening for piping.

19.0 TRANSPORTATION OF THE PACKAGE

19.1 For transportation of the packages to the project site, number of pieces and size and weight limitations shall be mutually discussed between the purchaser and the Vendor.

19.2 Spare rotors shall be separately shipped with vertical storage box with suitable preservative measures.



VENDOR LIST FOR (GAS TURBINE DRIVEN CENTRIFUGAL COMPRESSOR PACKAGE)

PROJECT : Installation of New GTC Compressor at Gandhar,
Gujarat,

OWNER : Gas Authority of India Limited

PMC : Engineers India Limited

JOB NO. : B240

A	23.10.2019	ISSUED WITH TECHNICAL AMENDMENT # 1	AS	JSD	NK
Rev. No	Date	Purpose	Prepared by	Checked by	Approved by

GENERAL NOTES

- 1.0 BIDDER shall necessarily procure all the material / equipment forming permanent part of the unit / plant from OWNER / EIL approved vendors only. This shall include sub-ordered items / components also. The "Approved Vendors" shall be item specific.
- 2.0 OWNER / EIL approved vendor list for the various items is enclosed in this section.
- 3.0 ***BIDDER may procure material from any of OWNER / EIL approved vendors. However, current validity, holiday status and range of approval as per EIL enlistment letter, workload, stability and solvency need to be verified by the BIDDER with vendor before placement of order.*** BIDDER is also required to ensure that equipment qualification criteria, specified elsewhere in the bid document, are also simultaneously met.
- 4.0 Vendors on OWNER / EIL holiday list shall not be considered for ordering. BIDDER shall comply with this requirement without any time or cost implication to the OWNER. If a vendor is put on OWNER / EIL's holiday list subsequent to BIDDER placing an order, it shall be BIDDER's responsibility to ensure quality work and timely supply from the vendor.
- 5.0 For items not covered in the above list, the BIDDER shall approach OWNER / EIL for that list or the vendors list shall be approved by OWNER / EIL prior to placement or order by BIDDER. BIDDER shall list down the proposed suppliers / vendors for such items and submit the same for OWNER / EIL's review / approval along with necessary documents / credentials. "Approval status" documents / credentials to be furnished by the vendors in such cases shall solely be the responsibility of the BIDDER. OWNER / EIL's decision on above shall be final and non-negotiable. Acceptance or non-acceptance of a particular proposed vendor due to any reasons whatsoever shall not be a cause of schedule and cost implication.
- 6.0 BIDDER shall make an independent assessment of capability of all the vendors for timely deliveries of material / equipment. Any delays in deliveries by vendor(s) shall not be a cause of schedule and cost implication.
- 7.0 At any stage of the project, if it comes to the notice of OWNER / EIL that BIDDER has procured material / equipment, intentionally or unintentionally whatsoever, from an unapproved vendor and / or items not falling in approved range of vendor(s), the same shall be rejected forthwith and BIDDER shall be liable to replace such material / plant / machinery without any schedule and cost implication to the OWNER.
- 8.0 List of vendors appearing anywhere else in the contract document in case of duplication of the items at two or more places shall not be considered by BIDDER and shall be superseded by the vendor list enclosed herewith. And if in this vendor list also, items seems to be duplicated / repeated then BIDDER shall get clarified the issue by OWNER / EIL before proceeding ahead for procurement activity.
- 9.0 It is understood that should the name of vendor be changed due to change in their company or corporate shareholding. OWNER may accept such vendors under its new name with prior approval.

Any such approval shall however, not absolve the BIDDER from any of his obligations under the contract; neither shall any such approval signify nominations or instruction to use such a vendor. All approved vendors are deemed to have been freely chosen by the BIDDER at his own risk.

SL. NO.	DESCRIPTION	REMARKS
1.0	LUBE-OIL PUMPS-CENTRIFUGAL (SPECIAL PURPOSE PROCESS)	
1.1	Arai Pump Manufacturing Company Ltd.	
1.2	Clyde Union Ltd.	
1.3	DMW Corporation [Mishima]	
1.4	Ebara Corporation [Japan]	
1.5	Flowserve Corporation [Japan]	
1.6	Flowserve India Controls Pvt. Ltd.	
1.7	Flowserve (Thompsons Kelly & Lewis Pty Ltd.)	
1.8	Goulds Pumps Inc.	
1.9	Goulds Pumps Co. Ltd.	
1.10	Hyosung Goodsprings Inc.	
1.11	ITT Corporation India Pvt. Ltd. [Vadodara]	
1.12	Kirloskar Ebara Pumps Ltd. [Sangli]	
1.13	KSB Limited [Pune]	
1.14	KSB Pumps Ltd. (Poona) [Satara]	
1.15	Ruhrpumpen Gmbh [Germany]	
1.16	Ruhrpumpen India Pvt. Ltd.	
1.17	Shin Nippon Machinery Co. Ltd.	
1.18	Sulzer Pumps (US) Inc.	
1.19	Sulzer Pumpen Deutschland Gmbh [Bruchsal, Germany]	
1.20	Sulzer Pumps India Pvt. Ltd.	

SL. NO.	DESCRIPTION	REMARKS
1.21	Weir Minerals Netherlands BV	
2.0	LUBE-OIL PUMPS-ROTARY GEAR	
2.1	Allweiler India Private Limited	
2.2	DEL PD Pumps & Gears Pvt. Ltd.	
2.3	Flowserve Corporation	
2.4	MAAG Pumps Systems AG [Zurich]	
2.5	Shimadzu Corporation	
2.6	Viking Pump INC [USA]	
2.7	Witte Pumps & Technology GMBH	
3.0	LUBE-OIL PUMPS-ROTARY SCREW	
3.1	Alekton Engg. Industries Pvt. Ltd.	
3.2	Allweiler India Private Limited	
3.3	Flowserve Corporation	
3.4	Netzsch Technologies India Pvt. Ltd.	
3.5	Plenty Mirrless Pumps [England]	
3.6	Pompe Vergani SPA	
3.7	Robbins & Myers Inc	
3.8	ROTO Pumps Ltd.	
3.9	Seepex GMBH (Bottrop)	
3.10	UT Pumps & Systems Pvt. Ltd. (Borneman)	
3.11	Warren Pumps INC.	

SL. NO.	DESCRIPTION	REMARKS
4.0	MECHANICAL SEALS (for Lube-Oil Pumps)	
4.1	AESSEAL PLC [ROTHERHAM]	
4.2	Chetra Dichtungstechnik AG	
4.3	Eagle Burgmann India Pvt. Ltd.	
4.4	Flowserve Sanmar Limited (Chennai)	
4.5	John Crane Sealing Systems India Pvt. Ltd.	
4.6	Leak Proof Engg (I) Pvt. Ltd. (Banaskantha-Gujarat)	
5.0	DRY GAS SEAL (REFER QC)	
5.1	Eagle Burgmann	
5.2	Flowserve	
5.3	John Crane	
6.0	DRY GAS SEAL SKID (REFER QC)	
6.1	Eagle Burgmann	
6.2	Flowserve	
6.3	John Crane	
7.0	GAS CONDITIONING SKID	
7.1	Grand Prix Engineering Pvt. Ltd. [Faridabad]	
7.2	Multitex Filtration Engineers Ltd. [Noida UP]	
7.3	Nirmal Industrial Control Pvt. Ltd. [Thane]	
7.4	Premabargo Italiana SRL	

1	GENERAL										
2	Project:	INSTALLATION OF GTC AT GANDHAR				Job No.:	B240				
3	Owner:	GAIL (INDIA) LTD.				Site:	GPU GANDHAR				
4	Purchaser:					Unit:	NEW COMPRESSOR AREA		Unit No.: 910		
5	Item No.:	910-K-901				Service:	NATURAL GAS COMPRESSOR				
6	No. of Units:	ONE	Working:	ONE	Standby:	NONE	Driver:	Working:	GAS TURBINE	Standby:	NONE
7	Applicable to:	☒ Proposal ☐ Purchase				☐ As					
8	☒ Scope, Option & Information specified by Purchaser. ☐ Information reqd from and options left to vendor. Vendor to cross(☒) the selected Option.										
9	Manufacturer:	☐ Model				Driver Type:	☐ Elec. Motor ☒ GT ☐ ST				
10	Place of Mfrg.:	Drive Arrgmt.				☐ Direct ☒ Thru' gear box (as applicable)					
11	Duty:	☒ Continuous ☐ Intermittent				☐ Standby					
12	No. of stages: 01 (One) (Note-4)										
13	OPERATING CONDITIONS (Note-21)										
14	(ALL DATA ON PER UNIT BASIS)			Case-1				Case-2			
15				Case-1a	Case-1b	Case-1c	Case-1d	Case-2a	Case-2b	Case-2c	Case-2d
16	☒ Gas Handled (Also see Page 2 of 7)										
17	☐ Nm ³ /Hr (1.033 Kg/cm ² A, 0 °C Wet)										
18	☒ Weight Flow, kg/hr (Dry)	(Note-1)	110121	110121	110121	110121	----	----	----	----	----
19	☒ Weight Flow, kg/hr (Wet)		----	----	----	----	122794	122965	122424	122940	
20	Inlet Conditions: @ Compr. Suc. Flange										
21	☒ Pressure (kg/cm ² G)	(Note-2)	36	36	39	39	25	25	28	28	
22	☒ Temperature (°C)		40	55	40	55	15	35	15	35	
23	☐ Relative Humidity (%)										
24	☒ Avg. Molecular Weight (Dry basis)		17.8811	17.8811	17.8811	17.8811	----	----	----	----	
25	☒ Avg. Molecular Weight (Wet basis)		----	----	----	----	19.9163	19.9163	19.9163	19.9163	
26	☒ C _p / C _v (K ₁) or (K _{avg})	(Note-23)	1.3981	1.3731	1.4089	1.382	1.3849	1.3489	1.4022	1.3623	
27	☒ Compressibility (Z ₁) or (Z _{avg})		0.9242	0.936	0.9185	0.9313	0.9097	0.9282	0.8999	0.9202	
28	☐ Inlet Volume, (m ³ /hr) (Wet / Dry)										
29	☐ Inlet Volume, (m ³ /hr) (Wet / Dry)										
30	Discharge Conditions: @ Compr. Dis. Flange										
31	☒ Pressure (kg/cm ² G)	(Note-3)	92				92				
32	☒ Temperature (°C) (Estimated/Actual) (Note-4)										
33	☐ C _p / C _v (K ₁) or (K _{avg})										
34	☐ Compressibility (Z ₁) or (Z _{avg})										
35	Performance:										
36	☐ BKW Required (All losses Incl Rows 37 & 38) ^(#)										
37	☐ Mech. & Seal Losses Included in BKW										
38	☐ Gear-box losses Included in BKW										
39	☐ Speed (rpm)										
40	☐ Estimated Surge m ³ /hr (At above speed)										
41	☐ Polytropic Head (m)										
42	☐ Polytropic Efficiency (%)										
43	☒ Certified/Guarantee Point		----	Yes ^(#)	----	----	----	----	----	----	----
44	☐ Performance Curve Number										
45	Process Control Method										
46	☐ Suction Throttling From (kg/cm ² A) To (kg/cm ² A). (If required/ recommended)										
47	☐ Variable Inlet Guide Vanes										
48	☒ Speed Variation From	%	To	%.							
49	☐ Discharge Blow off To										
50	☒ Cooled Bypass From Discharge To Suction through Anti-Surge Valve										
51	Signal ☒ Source: (Refer Process P&ID)										
52	Type	☐ Electronic Manual from ☐ DCS ☐ Pneumatic ☒ Other : Master Controller									
53	Range	mA (Kg/cm ² A).									
54	Antisurge Bypass (Refer Job specification/P&IDs) ☒ Manual ☒ Automatic ☐ None										
55	REMARKS:										
56	(#) BKW against Guarantee/Certified point shall be with 0% +ve tolerance. The BKW reported shall include all Mechanical losses, Seal losses										
57	Gear-box losses, transmission losses etc.										
58											
59											
60											
61											
62											

OPERATING CONDITIONS (Continued)					
63					
64	Gas analysis		Case-1	Case-2	REMARKS
65	■ Mol % (Also refer Process Datasheet attached)				
66					Mechanical Data- Casing
67	Constituent	MW			Upstream Design Pressure kg/cm ² g
68	Air	28.966			95.6 (*)
69	Oxygen	32.000			Upstream Design Temperature °C
70	Nitrogen	28.016	0.23	0.16	75
71	Water	18.016		FULLY SAT.	Downstream Design Pressure kg/cm ² g
72	CO	28.010			95.6
73	CO ₂	44.010	2.36	2.47	Downstream Design Temperature °C
74	H ₂ S	34.076	0.00141	0.00141	Note-5
75	Hydrogen	2.016			(*) To be confirmed by vendor based on settle-out pressure. Also refer Note-10.
76	Methane	16.042	90.35	85.73	
77	Ethylene	28.052			
78	Ethane	30.068	5.93	5.06	
79	Propylene	42.078			
80	Propane	44.094	1.06	3.74	
81	i-butane	58.120			
82	n-butane	58.120	0.05	1.79	
83	i-pentane	72.146			
84	n-pentane	72.146		0.56	
85	n-Hexane				
86	C6+			0.48	
87	Pentylene				
88	Total				
89	Avg. Mol. Wt.		17.8811	19.9163	
90	Dew point (°C) @ Atm. Pressure		(-)103	(-)35	
91	Location:				Noise specifications:
92	☐ Indoor	☒ Outdoor	☒ Grade	■ Applicable to Machine: Max. 85 dBA @ 1 m.	
93	☐ Heated	☒ Under-roof	☐ Mezzanine	See Specification	
94	☒ Un-heated	☒ Partial Sides	☐	□ Applicable to Neighborhood: Max. dBA @ m.	
95	■ Elect. Area Classification (Note-6)				See Specification
96	☐ Winterization Reqd (2.1.8) ■ Tropicalization Reqd.				■ Acoustic Housing ☐ Yes (If Reqd) ■ No
97	Site data: (Note 7)				Applicable specifications:
98	☐ Elevation (m):		☐ Barometer (kg/cm ² A):		■ Chapter 1 & 2 of API Std. 617, 7 th edn. July 2002, EIL Std. Spec. 6-42-0005
99	☐ Range of Ambient Temps.		Dry Bulb	Wet Bulb	■ Vendor having Unit Responsibility: SPRV Vendor
100	Normal (°C):				■ Governing Specification: Job spec. No. B240-910-80-42-SP-5010
101	Max. (°C):				Painting:
102	Min. (°C):				■ Manufacturer's Standard
103	Site Rated(°C):				☐ Other
104	Unusual conditions:				Shipment:
105	■ Dust ■ Fumes				☐ Domestic ☒ Export ☒ Export Boxing Reqd
106	☐ Others :				■ Outdoor Storage More than 12 Months
107					■ Spare Rotor assembly packaged for:
108					☐ Horizontal Storage ☒ Vertical Storage (N2 purging)
109	REMARKS:				
110					
111					
112					
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123					

124	CONSTRUCTION FEATURES			
125	■ Speeds: [As per API 617]		Type (Open, Enclosed etc.): Enclosed	
126	Max. Continuous:	RPM Trip:	RPM	Type Fabrication:
127	Max. Tip Speeds @ Rated Speed (100% speed):		m/s	Material:
128	Max. Tip Speed @ Max. Continuous Speed:		m/s	Max. Yield Strength (Kg/cm ²):
129			Brinell Hardness: Max.:	Min.:
130	■ Lateral Critical Speeds (Damped): [As per API 617]		Smallest Tip Internal Width (mm):	
131	First Critical	RPM	Mode	Max. MACH Number @ Impeller Eye:
132	Second Critical	RPM	Mode	Max. Impeller Head @ Rated Speed (m):
133	Third Critical	RPM	Mode	■ Shaft:
134	Fourth Critical	RPM	Mode	Material:
135			Dia @ Impeller (mm):	Dia @ Coupling (mm):
136	■ Compressor Lateral Analysis Required		Shaft End: ☐ Tapered	☐ Cylindrical
137	■ Train Torsional Analysis Required		Max. Yield Strength (Kg/cm ²):	
138	(Turbine Driven Train)		Shaft Hardness (BHN) (R _c):	
139	■ Torsional Critical Speeds: [As per API 617]		Max. Torque Capability (kgm):	
140	First Critical	RPM	☐ Balance Piston:	
141	Second Critical	RPM	Material:	Area (mm ²):
142	Third Critical	RPM	Fixation Method:	
143	Fourth Critical	RPM	■ Shaft Sleeves:	
144	■ Vibration: Allowable Test Level (Peak To Peak) (mm):		At Intstg. Close Clearance Points:	Material: Stainless Steel
145	(including electrical & Mechanical Run-out)		At Shaft Seals:	Material: Stainless Steel
146	☐ Rotation Viewed From Driven End: ☐ CW ☐ CCW		☐ Accessible	
147	■ Materials Inspection Requirements		■ Labyrinths:	
148	☐ Special Charpy Testing		Interstage:	Type: Material: Aluminum Alloy or SS
149	■ Radiography Required for Casing and welds (100%)		Balance piston:	Type: Material: Aluminum Alloy or SS
150	■ Ultrasonic Required for Shaft, Major Forging			
151	■ Magnetic Particle Required for Impellers		■ Shaft seals: (Note-8 & 9)	
152	■ Liquid Penetrant Required for Impellers		■ Seal Type: Dry gas seal (Tandem with intermediate labyrinth)	
153	■ Casing:		■ Settling Out Pressure (Kg/cm ² G): (Note-10)	
154	Model:		☐ Special Operation:	
155	Casing Split:		☐ Supplemental Device Required for Contact Seals:	
156	Material:		Type:	
157	Thickness (mm):	Corrosion Allowance(mm):		■ Buffer Gas System Required: ☐ Manifold
158	Max. Working Pressure (Kg/cm ² G):		■ Buffer Gas Type: Primary: (Note-8 & 9) Secondary: (Note-8 & 9)	
159	Max. Design Pressure (Kg/cm ² G): ≥95.6 (Note-10)		■ Buffer Gas Control System (Schematic by vendor):	
160	Test Pressure (Kg/cm ² G): Helium: Hydro: 1.5xDesgn.Pr. Or More		☐ Pressurising Gas for Subatmospheric Seals:	
161	Max. Operating Temp. (°C):	Min. Operating Temp (°C):		■ Type Seal: Tandem (Refer Job specification)
162	Max. No. of Impellers For Casing:		☐ Inner Oil Leakage (Guaranteed)(m ³ /day/seal):	
163	Max. Casing Capacity (m ³ /hr):		Buffer Gas Required for:	
164	Radiograph Quality:	■ Yes ☐ No		☐ Air Run In ☐ Other
165	Casing Split Sealing:		☐ Buffer Gas Flow (Per Seal): ■ Separation Gas: Nitrogen	
166	■ System Relief Valve Set Point (Kg/cm ² G): 95.6 (Note-10)		Norm.:	Kg/min @ Kg/cm ² ; Diff. Pr.:
167	■ Diaphragms:		Max.:	Kg/min @ Kg/cm ² ; Diff. Pr.:
168	Material:			
169	■ Impellers:		☐ Bearing housing construction:	
170	No.:	Diameters:		Type (Separate/Integral) : Split:
171	No. Vanes EA. Impeller:		Material:	
172				
173				
174	REMARKS:			
175				
176				
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182				
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184				
185				

186	CONSTRUCTION FEATURES									
187	Bearings & Bearing Housings									
188	Radial	Inlet	Exhaust	Thrust (\$)	Active	In-active				
189	■ Type	Tilting Pad	Tilting Pad	■ Type	Tilting Pad	Tilting Pad				
190	□ Manufacturer			□ Manufacturer						
191	□ Length (mm)			□ Unit Load (Max.)						
192	□ Shaft Dia (mm)			□ Unit Load (Ult.)						
193	□ Unit Load (Actual/Allowable)			□ Area (mm ²)						
194	□ Base Material			□ No. Of Pads						
195	□ Babbit Thickness (mm)			□ Pivot Centre/ Offset, %						
196	□ No. Of Pads			□ Pad Base						
197	□ Load Between / On Pads			□						
198	□ Pivot Centre / Offset, %			Lubrication: □ Flooded □ Directed						
199	□			Thrust Collar: □ Integral □ Replaceable						
200	□ Bearing Span (mm)			Material:						
201	Bearing temperature devices: ■ Also refer API 670 (Note-11 & 12)			Vibration detectors: ■ Also refer API 670 (Note-11 & 12)						
202	□ Thermistors			■ Type: Non Contacting ■ Model:						
203	□ Type: +ve Temp. Coeff.: -ve Temp. Coeff.:			□ Manufacturer:						
204	□ Temp. Switch & Indicator By: Purchaser: Manuf.:			□ No. at Each Shaft Brg.: 2 Total No.: 4						
205	□ Thermocouples			■ Oscillator-Demodulators supplied By: Compressor Vendor						
206	□ Sel. Switch & Indicator By: Purchaser: Manuf.:			□ Mfr.: □ Model:						
207	■ Resistance Temp. Detectors			Monitor Supplied By: Compressor Vendor						
208	■ Resistance Material: Platinum ■ 100 Ohms			□ Location: □ Enclosure:						
209	■ Sel. Switch & Indicator By: Purchaser: Manuf.: Yes			□ Mfr.: □ Model:						
210	■ Location - Journal Bearing: (□)			□ Scale Range: Alarm; □ Set @ :m.						
211	No.: EA Pad: Every Other Pad: 2	Per Brg.		□ Shutdown □ Set @ :m. □ Time Delay Sec.						
212	Other:			Axial position detectors: ■ Also refer API 670 (Note-11 & 12)						
213	■ Location - Thrust Bearing: (□)			■ Type: Non Contacting □ Model:						
214	No.: EA Pad: Every Other Pad: 3	Per Brg.		□ Manufacturer: ■ No. Reqd.: 2						
215	Other:			■ Oscillator-Demodulators supplied By: Compressor Vendor						
216	No. (Inact): EA Pad: Every Other Pad: 2	Per Brg.		□ Mfr.: □ Model:						
217	Other:			Monitor Supplied By: Compressor Vendor						
218	■ Monitor Supplied By: Compressor Vendor			□ Location: □ Enclosure:						
219	□ Location: □ Enclosure:			□ Mfr.: □ Model:						
220	□ Mfr.: □ Model:			□ Scale Range: □ Alarm; □ Set @ :m.						
221	□ Scale Range: Alarm; □ Set @ °C.			□ Shutdown □ Set @ :m. □ Time Delay Sec.						
222	□ Shutdown ■ Set @ °C. □ Time Delay Sec.			□ Phase / Speed Detector: (At Shaft NDE)						
223	Casing connections:									
224	■ Design Approval Req'd. □ ASME □ API605 □ Other									
225	Connection	Rating	Size	Facing	Position	Flanged or Studded	Mating flange & Gasket by Vendor	Gas Velocity (m/s)	Remarks	
226										
227										
228										
229	Inlet	# 900 (min.)		RF	Top	Flanged	YES			
230	Discharge	# 900 (min.)		RF	Top	Flanged	YES		(Note-13)	
231										
232										
233										
234										
235										
236										
237	REMARKS:									
238										
239										
240	S: Max. Thrust Loading shall not exceed 50% of Design Load of Bearings.									
241	□: Each Journal Bearing shall have RTD's in no less than 50% of the Shoes.									
242	□: Each Thrust Bearing shall have RTD's in no less than 50% of Active Side & 2 in the Inactive Side.									
243	Legends: LCP <- Local Control Panel MCR <- Main Control Room. SRR: Satellite Rack Room									
244										
245										
246										

CONSTRUCTION FEATURES											
■ Other connections:					■ Allowable piping forces and moments(Note-14)						
Service	No.	Size	Type		Inlet		Discharge				
Lube-Oil Inlet					Force	Moment	Force	Moment	Force	Moment	
Lube-Oil Outlet					(Kg)	(Kg.m)	(Kg)	(Kg.m)	(Kg)	(Kg.m)	
Seal-Oil Inlet				Axial							
Seal-Oil Outlet				Vertical							
Seal-Gas Inlet				Horiz. 90°							
Seal-Gas Outlet					Force	Moment	Force	Moment	Force	Moment	
Casing Drains	Provide for Complete Drainage				(Kg)	(Kg.m)	(Kg)	(Kg.m)	(Kg)	(Kg.m)	
Stage Drains				Axial							
Vents				Vertical							
Cooling Water				Horiz. 90°							
Pressure					□ Casing Vibration Transducer						
Temperature					□ See Attached API 678 Data Sheet.						
Solvent Injection					□ Type □ Model:						
Purge For:					□ Mfr.: No. Reqd.:						
Bearing Housing					□ Location:						
Between Brg & Seal					□ Oscillator-Demodulators supplied By:						
Between Seal & Gas					□ Mfr.: □ Model:						
					□ Monitor Supplied By:						
					□ Location: Enclosure:						
					□ Mfr.: □ Model:						
■ Stage Drains Required (Double block Valves to be provided)					□ Scale Range: □ Alarm; □ Set @ mm/sec².						
□ Valved & Blinded.					□ Shutdown □ Set @ mm/sec². □ Time Delay Sec.						
■ Valved & Blinded & Manifold.					Key Phasor Required						
					□ Compressor ■ Gear (LS/HS Shaft) □ Driver						
ACCESSORIES											
Couplings and Guards: [As per API 671]											
Note: See Rotating Elements - SHAFT ENDS.											
□ See Attached API 671 Data Sheet. □ Keyless Hydraulic □ Keyed											
Coupling Furnished By: GTC Vendor											
Manufacturer: Type: Metallic Flexible Element (Diaphragm/Disc/ SS Flexible membrane) Model:											
Coupling Guard furnished by: GTC Vendor											
Type: ■ Fully Enclosed □ Semi Open ■ Other: Non Sparking											
Coupling Details:											
□ Max. O.D.: mm.					□ Vendor Mount Half Coupling □ Idling Adapter / Sole Plate Req'd. (3.2.4)						
□ Hub Weight:					Lubricating Requirements:						
□ Spacer Length: mm.					□ Non Lube □ Grease □ Cont. Oil Lube □ Other						
□ Spacer Weight:					Quantity per Hub (Kg or m³/hr).						
Mounting plates:											
□ Baseplates: Furnished by:					□ Soleplates: Furnished by: Compressor Vendor.						
□ Compressor Only □ Driver □ Gear					□ Thickness (mm):						
■ Other: Base plate for Compressor, Gearbox & GT(#)					□ Sub Sole Plates Req'd.						
■ Drip Rim ■ Leveling Pads					□ Leveling (Chock) Blocks Req'd..						
■ Column Mounting □ Perimeter					□ Stainless Steel Shim Thickness (mm):						
□ Sub Sole Plates Req'd.					□ Driver □ Gear □ Compressor						
■ Stainless Steel Shim Thickness (mm):					□ Primer for Epoxy Grout Req'd.						
Primer for EPOXY Grout Req'd.:					Type:						
Type:											
■ Base Plate will be on Concrete Foundation											
□ Machine Mounting Pads Required											
REMARKS:											
(#) Also refer scope of supply (Sl. No. 1.6)											

UTILITIES										
308	Utility conditions: (Note-7)					Total utility consumption: (Note-15)				
309	Steam	Drivers	Heating			Cooling Water:		m ³ /hr		
310	Inlet: Min.	kg/cm ² G	°C.	kg/cm ² G	°C.	Steam Normal:		Kg/hr		
311	Nor.	kg/cm ² G	°C.	kg/cm ² G	°C.	Steam Maximum:		Kg/hr		
312	Max.	kg/cm ² G	°C.	kg/cm ² G	°C.	Instrument Air:		Nm ³ /hr		
313	Exhaust: Min.	kg/cm ² G	°C.	kg/cm ² G	°C.	HP (Driver):		KW		
314	Nor.	kg/cm ² G	°C.	kg/cm ² G	°C.	HP (Auxiliaries):		kW		
315	Max.	kg/cm ² G	°C.	kg/cm ² G	°C.	Heaters:		kW		
316	Electricity: (Note-6)					Purge (Air or N ₂)		Nm ³ /hr		
317	Drivers	Heating	Control	Shutdown		Miscellaneous:				
318	Voltage					☒ Recommended Straight Run of Pipe Diameters				
319	Hertz					Before Suction:				
320	Phase					☐ Nomographs Reqd. for each Section				
321	Cooling Water: (Not available)					☒ Vendor's Review & Comments on Purch. Piping & Foundation				
322	Temp. Inlet:	°C.	Max. Return:	°C.		☐ Compressor to be suitable for Field Run in on Air				
323	Press. Norm.:	kg/cm ² G.	Design:	kg/cm ² G.		☐ Provision for Liquid Injection				
324	Min. Return:	kg/cm ² G.	Max. Allow.)P:	kg/cm ² .		☒ Vendor's Review & Comments on Purch. Control System				
325	Water Source:		Fouling Factor:			☒ Extent of Process Piping By Vendor as per Job Spec.				
326	Instrument air: (Note-6)					☐ Shop Fit Up of Vendor Process Piping				
327	Max. Press.	kg/cm ² G.	Min. Press.:	kg/cm ² G.		☐ Welding Hardness Testing				
328						☒ Aux. Eqpt. Monitors Explosion Proof (Note-6)				
329	SHOP INSPECTION & TESTS					☒ Provide spare rotor for each Compressor Casing				
330			Reqd.	Withn.	Obs.	☒ Optical Alignment flats reqd. for compressor & driver				
331	Shop Inspection		☒	☐	☐	Vendor's Representative shall				
332	Cleanliness		☒	☐	☐	☐ Observe Flange Parting				
333	Hydrostatic		☒	☒	☐	☒ Check Alignment at Temperature				
334	Impeller Overspeed		☒	☒	☐	☒ Be Present at Initial Alignment				
335	Mechanical Run (main & spare rotor)		☒	☒	☐	☐ Weights (kg):				
336	☒ Contract Coupling		☐ Idling Adaptor(s)			Compr.:		Gear:	Driver:	Base:
337	☒ Contract Probe		☐ Shop Probes			Rotors:		Compr:	Driver:	Gear:
338	Vary LO Pres. & Temp.		☒	☒	☐	Compr. Upper Case:				
339	Polar Form Vib Data		☒	☐	☐	Sour Seal Oil Traps:				
340	Tape Record Vib Data		☒	☐	☐	LO Console:		SO Console:		
341	Tape Data To Purch.		☒	☐	☐	Overhead Seal Oil Tanks:				
342	Shaft End Seal Insp.		☒	☒	☐	Max. Wt. For Maintenance:		(Pl. Identify)		
343	Gas Leak test Disch. Pressure		☒	☒	☐	Total Shipping Weight:				
344	☐ Before		☒ After Post Test Inspection			☐ Space requirements (m):				
345	Performance Test (Gas/Air) (Note-24)		☒	☒	☐	Complete Unit:		L:	W:	H:
346	Unitization of GTC @ SPRV shop (GTC train)		☒	☒	☐	LO Console:		L:	W:	H:
347	Torsional vib Measurement		☐	☐	☐	SO Console:		L:	W:	H:
348	Tandem Test		☐	☐	☐	Sour SO Traps:				
349	Seal Leakage Performance Test (@)		☒	☒	☐	Ovhd. Seal Oil Tanks:				
350	Dynamic Balancing of Rotor		☒	☐	☒	@:At Seal Vendor's works				
351	Helium Leak Test		☐	☐	☐	Bidder shall confirm the value of Guaranteed Seal leakage rate in his bid/offer.				
352	Sound Level test		☒	☒	☐					
353	Full Load/Speed/Pressure Test		☐	☐	☐					
354	Shop Verification of Unbalanced Response Analysis		☒	☒	☐					
355	Certf. Copies Of Test Data & Matrils		☒	☐	☐					
356	Residual Elect. & Mech. Run Out		☒	☒	☐					
357	Check Bearings & Seals after Test (\$)		☒	☒	☐					
358	Rotor insensitivity test		☒	☒	☐	(\$) Dis-assemble and Re-assemble after test shall be conducted only when any abnormality is observed during mechanical run test				
359	Dis-assemble & Re-assemble after Test (\$)		☒	☒	☐					
360	Gear Unit Tests (Refer Gear Unit Data sheet)		☒	☐	☐	In case dry gas seal are not used during mechanical run test, the same to be used during compressor performance test.				
361	REMARKS:									
362										
363										

364	Notes:														
365	1. Capacity indicated is rated capacity of the compressor i.e. corresponding to 3.5 MMSCMD.														
366	2. Suction Pressure indicated is at the Suction flange of the Compressor. Temporary Strainer shall be in suction line during start-up and same shall be replaced by permanent "T" type strainer subsequently. Pressure drop of 0.1 kg/cm2 has been considered to arrive at the Compressor suction pressure. Bidder shall provide the mesh size and the pressure drop across the permanent strainer in his bid/offer.														
367	3. Discharge pressure indicated is at the compressor discharge flange.														
368	4. Compressor is envisaged to be of SINGLE STAGE. The expected/actual discharge temperatures at the compressor discharge shall be indicated and by the bidder. However, the discharge temperature should not cross 165°C under any circumstances.														
369	5. The design temperature at the compressor discharge shall be confirmed by the bidder.														
370	6. Refer Electrical specifications forming part of inquiry document.														
371	7. Refer site and utility data Doc. No. B240-910-80-42-SU-5010 Rev. A														
372	8. Normal/Emergency gas supply shall be taken from Compressor discharge and the Seal gas supply for start-up shall be taken from upstream of Compressor (before Fuel/Gas conditioning skid inlet) as shown in P&ID No. B240-02-42-910-1111.														
373	9. The composition, avg. MW and dew-point of the normal/emergency seal gas in case of each individual case shall be as indicated in Page 2 of 7 of this datasheet. The Battery-limit (B/L)conditions of normal/emergency seal gas shall be as noted below:														
	<table><tr><td>Details</td><td>B/L Pressure (kg/cm2G) (\$)</td><td>B/L Temperature (°C)</td></tr><tr><td>Normal Seal Gas</td><td>92</td><td>55 (#)</td></tr><tr><td>Emergency Seal Gas</td><td>60 to 92 kg/cm2G</td><td>55 (#)</td></tr><tr><td>Start-up Seal Gas</td><td>(@)</td><td>(@)</td></tr></table>			Details	B/L Pressure (kg/cm2G) (\$)	B/L Temperature (°C)	Normal Seal Gas	92	55 (#)	Emergency Seal Gas	60 to 92 kg/cm2G	55 (#)	Start-up Seal Gas	(@)	(@)
Details	B/L Pressure (kg/cm2G) (\$)	B/L Temperature (°C)													
Normal Seal Gas	92	55 (#)													
Emergency Seal Gas	60 to 92 kg/cm2G	55 (#)													
Start-up Seal Gas	(@)	(@)													
	(\$)			Any pressure-let down (or boosting) device required shall form part of bidder's scope of supply.											
	#)			The B/L temperature shall not exceed the max. temperature at aftercooler exit as indicated in Page 2 of 6 and 4 of 6 of Compressor datasheet no. B240-910-02-42-DS-1501. Seal gas cooler (Air-cooled type), if required, shall be included in the bidder's scope of supply.											
	@)			Seal gas for start-up shall be either RLNG or SRG to be used as a fuel for Gas Turbine. For Battery-limit conditions and composition of fuel gas, Note-14 of Process Datasheet no. B240-910-02-42-DS-1501 Rev. 2 may please be referred.											
				Bidder shall provide necessary filter, electric heater, pressure regulator, control valves etc. for seal gas system. For more details, please refer Job specification.											
374	10.			Bidder shall confirm the design pressure and temperature at Compressor suction/discharge. Please also refer P&ID Nos. B240-02-42-910-1113 and B240-02-42-910-1114 wherein the set-pressures of PSVs on suction and discharge KODs have been indicated with HOLDS. Bidder to confirm the same in his bid/offer. Also, during detailed engineering, the Compressor vendor shall furnish Settle-out Pressure calculations and Blow-down calculations for review by the Purchaser.											
375	11.			The make and model of bearing temperature monitoring system, vibration and axial displacement monitoring system shall be as per Instrumentation specification forming part of inquiry document.											
376	12.			The location of bearing temperature monitoring system, vibration and axial displacement monitoring system shall be as per Instrumentation specification forming part of inquiry document.											
377	13.			The flange rating indicated is minimum required. The same shall be confirmed by the bidder in his bid/proposal.											
378	14.			The compressor shall be designed to withstand external forces and moments on each nozzles based on 1.85 times NEMA SM-23 values or values calculated as per Annexure 2E of API Std. 617, 7 th edition, whichever is higher.											
379	15.			Vendor shall furnish all utilities required for the complete package in a consolidated single document.											
380	16.			Vendor shall provide the performance curves for all cases of operation.											
381	17.			Vendor shall include in his scope of supply all normal instrumentation and control (including anti-surge control)/all essential auxiliaries for efficient operation, shutdown and safety requirements.											
382	18.			Apart from the vendors scope of supply as per P&IDs attached in the inquiry document, vendor shall supply additional instrumentation, control & shutdown logic devices for safe and efficient operation of machine.											
383	19.			Automatic spill back is considered for compressor.											
384	20.			Compressor will start from control panel located in main control room, however, start clearance from field will be provided. Monitoring & control of the compressor station shall be performed from DCS/PLC.											
385	21.			CASE-1: represents while GANDHAR GPU is running condition (normal operating case). CASE-2: represents while GANDHAR GPU is stopped condition. Compressor shall be running under CASE-1 for most of the time.											
386	22.			Vendor to provide max. Rate of depressurisation during compressor trip/ESD.											
387	23.			Cp/ Cv value is estimated for calculation purpose, Cp/ Cv value shall be confirmed by vendor.											
388	24.			Performance Test for Compressor shall be done as per Type 2 ASME PTC- 10-1997 at Compressor Manufacturer's Works.											
389	25.			In case of any mismatch of Process data in this datasheet with that in Compressor Process datasheet, data as per Process datasheet will govern.											

23.10.2019	C	AS	JSD/NK
16.09.2019	B	AS	JSD/NK
26.06.2019	A	AS	NK
DATE	REV	JOB ENGINEER	REV & APPROVED BY

GENERAL						
1						
2	Project:	INSTALLATION OF NEW GTC AT GANDHAR			Job No.:	B240
3	Owner:	GAIL (INDIA) LTD			Site:	GPU GANDHAR
4	Purchaser:				Unit:	NEW COMPRESSOR AREA
5	Item No. :	910-KT-901			Duty :	☒ Continuous ☐ Intermittent
6	No. of Units :	Working : ONE		Standby : NONE	Driven Equipment: Centrifugal Compressor	
7	Applicable to:	☒ Proposal		☐ Purchase	☐ As Built	
8	☒ : Scope, Option & Information specified by Purchaser. ☐ : Information required from and options left to vendor. Vendor to cross (:) the selected option.					
9	Cycle:	☐ Regen		☒ Simple	☐ Exhaust Heat recovery (Future)	
10	Type:	☒ Aero-Derivative --or-- ☒ Light industrial --or-- ☒ Heavy industrial		☒ Single Shaft or ☒ Two Shaft		
11	Driven Equipment : Normal Shaft Power (kW)			@	RPM	Rated Shaft Power (kW) @ RPM
12	Output Shaft Speed Range (RPM)	☐ Min.				☐ Max.
13	Desired Minimum Site Power (kW)			@	RPM	(See Note 1 & 2)
14	Manufacturer:			☐ Model	☐ ISO Rating	
15	Operation:	☐ Attended		☒ Unattended	☐ Potential Max. Power (kW)	
16	PERFORMANCE(Note-1,2,3)					
17	Gas Turbine Including All Losses			Site Rated	ISO Rated	Site Max. Temp.
18						Site Min. Temp.
19	☐ Dry Bulb Temp.	°C				
20	☐ Relative Humidity	(%)				
21	☐ Barometer	kg/cm ² a				
22	☐ Output @ Turbine Shaft	kW		(♠)		
23	☐ Heat Rate, LHV	Kcal/kW-Hr		(♣♣)		
24	☐ Output Shaft Speed	RPM				
25	☐ Exhaust Flow	Kg/Sec				
26	☐ Firing Temp.	°C				
27	☐ Gas Generator Exhaust Temp.	°C				
28	☐ Power Turbine Exhaust Temp.	°C				
29	☐ Certified Point					
30	(1) Incl. ☐ Steam ☐ Water Effects For					
31	☐ Emission Control	☐ Augmentation				
32	☐ Steam Flow	Kg/Sec				
33	☐ Water Flow	Kg/Sec				
34						
35	(♠) - Out Put KW guarantee;			(♣♣) - Heat rate guarantee;		
36	Location :			Noise specifications :		
37	☐ Indoor	☒ Outdoor	☒ Grade	☒ Applicable to Machine: Max. 85 dBA @ 1m.		
38	☐ Heated	☒ Under-roof	☐ Mezzanine	See Job Spec B240-910-80-42-SP-5010		
39	☒ Un-heated	☒ Partial Sides	☐	☐ Applicable to Neighbourhood: Max. dBA @ m.		
40	☒ Elect. Area Classification: (Ref. Elect. spec.)			See Specification		
41		Non-Hazardous	Zone/ Gr./ Temp.	☒ Acoustic Housing ☒ Yes ☐ No		
42	Gas Turbine Area	☐				
43	Gas Turbine Enclosure	☐		Applicable specifications :		
44	Control Panel	☐		☒ Job Specification No.:B240-910-80-42-SP-5010		
45	☐ Winterization Reqd (2.1.8)	☐	☒ Tropicalization Reqd	☒ API Standard 616, 5 th edn., EIL Std. Spec. 6-43-0041		
46	☐ Third Party Certification Reqd			☒ Vendor having Unit Responsibility : SPRV		
47	Site data : (Refer Site & utility data B240-910-80-42-SU-5010)			Painting :		
48	☐ Elevation (m):	☐ Barometer (kg/cm ² A):		☒ Manufacturer's Standard		
49	☐ Range of Ambient Temps. TempDry Bulb	Wet Bulb	Dry Bulb	☐ Other : Ref.Spec.:		
50	Normal (°C) :			Shipment :		
51	Max. (°C) :			☐ Domestic ☒ Export ☒ Export Boxing Reqd		
52	Min. (°C) :			☒ Outdoor Storage More than 12 Months		
53	Site Rated(°C) :			☐ Spare Rotor assembly packaged for :		
54	Unusual conditions :			☐ Domestic ☐ Export Shipment		
55	☒ Dust	☐ Fumes		☒ Lift Slings & Spreaders by Vendor/ Packager		
56	☐ Corrosive Agents					
57	☒ Other : Insulation for Heat conservation and Personnel protection.					
58	REMARKS :					



FUEL SYSTEM							
59							
60	Type	☒ Gas	☐ Liquid	☐ Dual: ☐ Gas/ Liquid ☐ Liquid/ Liquid			
61	Turbine Starting on:	☒ Gas	☐ Liquid	☐ Either of the Fuel			
62	Complete Fuel Receiving System	☐ Max. Time Allowed for Complete Transfer Seconds					
63	GAS FUELS Fuel Analysis - Mol%		LIQUID FUELS Not Applicable				
64							
65							
66	Composition	MW	Normal (Mole %)	Fuel Type:			
67	Please refer ANNEXURE-A to this datasheet for details of fuel gas for Gas Turbine			Liquid Fuel ☐ Yes ☐ No			
68				Air	28.96	Treatment ☐ Vendor ☐ Others	
69				Oxygen	32.000	Fuel Transfer ☐ Yes ☐ No	
70				Nitrogen	28.016	Heater Required ☐ Yes ☐ No	
71				Water Vap.	18.016	☐ Liquid Fuel Press. Req'd. Max. / Min. (kg/cm ² a): /	
72				CO	28.010	Fuel Storage ☐ Vendor ☐	
73				CO ₂	44.010	Fuel Unloading ☐ Vendor ☐	
74				Hydrogen	2.016	Fuel forwarding ☐ Vendor ☐	
75				Methane	16.042	FUEL ANALYSIS DATA	
76				Ethylene	28.052	PROPERTY ASTM Method Measured Value	
77	Ethane	30.068	Viscosity @ 38°C SSU D-445				
78	Propylene	42.078	Sulphur Content (%wt), Max.				
79	Propane	44.094	Bomb Method D-129				
80	i-Butane	58.120	Lamp Method D-1266				
81	N-Butane	58.120	High Temp. Method D-1552				
82	i-Pentane	72.146	Specific Gravity D-1298				
83	N-Pentane	72.146	Flash Point °C D-56				
84	Hexane Plus		Pour Point °C D-97				
85	Total		Water D-95				
86	Avg. Mol. Wt.		Filterable Dirt MG/100ml D-2276				
87	HC Dew point °C @ 30kg/cm ² g		Lower Heating Value, Kcal/Kg:				
88	Cors. Agts-PPM						
89	Contamints-PPM						
90	LHV, Kcal/Kg Kcal/Sm ³						
91	Supply Pressure . kg/cm ² g						
92	Supply Temp. °C						
93	Fuel Press.						
94	Req. Mx/Mn. kg/cm ² g						
95	Compression System Req'd.	☐ Yes ☐ No	C				
96	Compression System by (if req'd)	☐ Vendor ☐ Purchaser					
97	Heater Req'd. (Refer elect spec)	☒ Yes ☐ No					
98	Rate of Change of LHV						
99	Water / Steam Injection:						
100	☐ Water Pressure Req'd.:	kg/cm ² g					
101	☐ Steam Pressure Req'd.:	kg/cm ² g					
102	☐ Steam Temp. Req'd.:	°C					
103	☐ Water/ Steam Quantity	kg/hr					
104	☐ Water/ Steam Quality						
105							
106	FUEL SYSTEM PIPING (Also refer Job specification no: B240-910-80-42-SP-5010)						
107	☒ Bypass and Vent Valve		☒ Isolation Block valves	☒ ANSI Flange Rating			
108	☐ Twin Y-Type Strainer with cont. Flow Transfer Valve		☐ NACE Material Standards				
109	☒ Stainless steel fuel piping manifold.						
110							
111							
112	REMARKS :						
113							
114							
115							
116							
117							
118							

119 CONSTRUCTION FEATURES (♣♣♣)							
120 ■ Speeds				Materials of Construction:			
121 Max. Continuous : RPM ; Trip : RPM				Compressor Rotor Blades			
122 ■ Lateral Critical Speeds (Damped): [As per API 616]				Compressor Stator Vanes			
123	First Critical	RPM	Mode	Turbine Stage	Nozzles	Blades	Wheels or Discs
124	Second Critical	RPM	Mode	1			
125	Third Critical	RPM	Mode	2			
126	Fourth Critical	RPM	Mode	3			
127	☐ Above Critical Speed Test Proven Yes/ No			4			
128	■ Train Lateral Analysis Regd. ■ Undamped stiffness map regd.						
129	■ Train Torsional Analysis Required						
130	☐ Torsional Critical Speeds						
131	First Critical	RPM		Combustors			
132	Second Critical	RPM		Compressor Casing			
133	Third Critical	RPM		Combustor Casing			
134	Fourth Critical	RPM		Turbine Casing			
135	■ Vibration :						
136	Allowable Test Level : Shaft	Microns P/P					
137	Allowable Test Level : Case	mm/ Sec					
138	☐ Rotation, Viewed From Drive End : ☐ CW ☐ CCW			Gauge Boards And Control Panels			
139	Air Compressor :			Gauge Boards			
140	Stages	Max. Tip Speed	m/Sec	■ Location: GT Compressor skid			
141	Type	Pressure Ratio		Control Consoles	☐ On Skid	☐ Off Skid Local	
142	Casing Split	☐ Axial ☐ Radial		☐ Off Skid Remote (Central Control Room)			
143	Rotor	☐ Solid ☐ Built-up		Weather Protection (as per Inst. Spec.) ■ Yes ☐ No			
144	Turbine : GG/ PT			☐ Specification			
145	Stages	Max. Tip Speed	m/Sec	☐ Annunciation Required			
146	Casing Split	■ Axial ☐ Radial		☐ Visual Display Unit (VDU) ☐ Key Board			
147	Rotor	☐ Solid ☐ Built-up					
148	Combustors :			Control Systems (Refer Instrumentation Specifications)			
149	☐ Single ☐ Multiple, Number			Type	Method of Control: Speed variation(Ref.Job. Spec.)		
150	■ Gas ☐ Liquid ☐ Dual Fuel			Controlled Process variable : Compressor suction pressure			
151	Max. Allowable Temp. Variation (°C)			☐ Mech. ☐ Pneu. ☐ Hydraulic ☐ Electric ☐ Electronic			
152	Applicable Plane			☐ Microprocessor Based	☐ Combined		
153	Fuel Nozzles per Combustor			☐ Signal Source: Compressor dis. pressure(Refer Job Spec)			
154	☐ Wobbe Index No. Req'd. ☐ Max. ☐ Min.			☐ Sensitivity	☐ Range To		
155				☐ Time of AC Outage Protection	Min.		
156	Maintenance Intervals, Hours :			☐ Shut Off Valves for Shutdown Sensors			
157	■ Hot Gas Path Inspections			Starting System			
158	■ Major Overhauls			☐ Manual ☐ Semi Automatic ■ Automatic			
159	☐ Other			☐ Purge	Minutes		
160	Governor :			☐ Provision for Shutdown Valve Test During Operation			
161	■ Mfr's Std. ☐ Other ☐ Make: ☐ Model						
162	☐ Constant Speed ■ Variable Speed						
163	☐ Isochronous ☐ Droop						
164	Remote Shutdown Signal	■ Electric					
165	☐ Pneumatic ☐ Hydraulic ☐ None						
166	■ Manual Speed Changer, RPM	Max. Min.					
167	☐ Maintain Turbine Speed Upon Failure of Control Signal or Actuator						
168	■ Regulation, NEMA Class : 'D' (as applicable)						
169							
170							
171	REMARKS:						
172							
173	(♣♣♣) For Multiple-Shaft Turbine Vendor shall furnish all the information for each shaft.						
174							
175							
176							
177							
178							

CONSTRUCTION FEATURES (Continued) (♣♣♣)									
180 Bearings & Bearing Housings (♣♣♣♣)									
181 Radial	Inlet	Exhaust	Thrust	Active	In-active				
182 ☐ Type			☐ Type						
183 ☐ Manufacturer			☐ Manufacturer						
184 ☐ Length (mm)			☐ Unit Load (Ult.) (Kg/cm ²)						
185 ☐ Shaft Dia (mm)			☐ Unit Load (Site Rtd) (Kg/cm ²)						
186 ☐ Unit Load (Actual/Allowable)	/	/	☐ Unit Load (Max. Poten.)						
187 ☐ Base Material			☐ No. Of Pads/ Area, m ²	/	/				
188 ☐ Babbit Thickness (mm)			☐ Base Material						
189 ☐ No. Of Pads			☐ Babbit Thickness, mm						
190 ☐ Load Between / On Pads			☐ Pivot: Centre/ Offset, %						
191 ☐ Pivot Centre / Offset, %			Lubrication : ☐ Flooded ☐ Directed						
192 ☐ Damper Bearing			Thrust Collar : ☐ Integral ☐ Replaceable						
193			Material :						
194 Bearing temperature devices : ☒ As per API 670 (Note-5&6)			194 Vibration detectors : ☒ As per API 670 (Note-5&6)						
195 ☐ Thermocouples			195 ☒ Type: Proximity ☐ Model:						
196 ☐ Sel. Switch & Indicator By: Purchaser: Manuf.:			196 ☐ Manufacturer:						
197 ☒ Resistance Temp. Detectors			197 ☒ No. at EA Shaft Brq.: Two Total No.:						
198 ☐ Resistance Material : ☐ Ohms			198 ☒ Oscillator-Demodulators supplied By: Vendor						
199 ☐ Sel. Switch & Indicator By: Purchaser: Manuf.:			199 ☐ Mfr.: ☐ Model:						
200 ☒ Location - Journal Bearing : (Φ)			200 ☒ Monitor Supplied By : (Note-5&6)						
201 No.: EA Pad: One Every Other Pad: Per Brq.			201 ☐ Location: Enclosure:						
202 Other:			202 ☐ Mfr.: ☐ Model:						
203 ☒ Location - Thrust Bearing : (Ω)			203 ☐ Scale Range: Alarm; ☐ Set @ :m.						
204 No.: EA Pad: One Every Other Pad: Per Brq.			204 ☐ Shutdown ☐ Set @ :m. ☐ Time Delay Sec.						
205 Other:			205 Axial position detectors : ☒ As per API 670 (Note-5&6)						
206 No.(Inact): EA Pad: Every Other Pad: Two Per Brq.			206 ☒ Type: Proximity ☐ Model:						
207 Other:			207 ☐ Manufacturer: ☒ No.Regd.: 2						
208 ☒ Monitor Supplied By : (Note-5&6)			208 ☒ Oscillator-Demodulators supplied By: Vendor						
209 ☐ Location: Enclosure:			209 ☐ Mfr.: ☐ Model:						
210 ☐ Mfr.: ☐ Model:			210 ☒ Monitor Supplied By : (Note-5&6)						
211 ☐ Scale Range: Alarm; ☐ Set @ °C.			211 ☐ Location: Enclosure:						
212 ☐ Shutdown ☐ Set @ °C.; ☐ Time Delay Sec.			212 ☐ Mfr.: ☐ Model:						
213			213 ☐ Scale Range: ☐ Alarm ; ☐ Set @ :m.						
214 (Φ) Note-9 Datasheet No. B240-910-80-42-DS-1004			214 ☐ Shutdown ☐ Set @ :m. ☐ Time Delay Sec.						
215			215 Acceleration Transducers : ☐ As per API 670						
216			216 ☐ Mfr.: ☐ Model:						
217 (Ω) Note-9 Datasheet No. B240-910-80-42-DS-1004			217 ☐ Location: Number:						
218			218 ☐ Monitor Supplied By :						
219			219 ☐ Location: Enclosure:						
220			220 ☐ Mfr.: ☐ Model:						
221			221 ☐ Scale Range: ☐ Alarm ; ☐ Set @ :m.						
222			222 ☐ Shutdown ☐ Set @ :m. ☐ Time Delay Sec.						
223 Purchaser's Connections :									
224 ☒ Design Approval Req'd. ☐ ASME ☐ API605 ☐ Other									
225	Connection	Rating	Size	Facing	Position	Flanged Or Studded	Mating flange & Gasket by Vendor	Gas Velocity (m/s)	Remark
226									
227									
228									
229	Inlet								
230	Exhaust								
231	Fuel Supply								
232	Steam								
233	Water								
234									
235									
236 REMARKS :									
237									
238 (♣♣♣) For Multiple-Shaft Turbine Vendor shall furnish all the information for each shaft.									
239 (♣♣♣♣) For rolling element bearings if proposed please modify entry as required. Show L-10 Bearing life.									

240	ACCESSORIES SUPPLIED BY GAS TURBINE MANUFACTURER			
241	Starting And Helper Drivers (Note-7)		☐ Gears See API 613 Data Sheet	
242	☒ Starter Only	☐ Starter / Helper	☐ Driven Equipment See API Data Shts.	
243	Type ☐ Motor/ ☐ Electrohydraulic	☐ Steam Turbine	☒ Fire Protection Equipment	
244	☐ Gas Expander	☐ IC Engine ☐ Hydraulic	Type ☐ Clean Agent	☒ CO ₂ ☐ Others
245	☐ Gas Turbine	☒ Starter is Clutched	☐ Type of Sensor	☐ Number of Detectors
246	☐ Helper Rating, kW		☐ Ultra Violet	Number
247	☐ Starter Rating, kW		☐ Infra Red	Number
248	☒ Shaft Turning Device Required		☐ Additional Levels	
249	☐ Motor		Mounting Plates	
250	Type	Rating	kW	Type ☐ Soleplate ☒ Baseplate
251	Mfr.	Model		☐ Shimpack Thickness, mm
252	☐ Steam Turbine (See attached API DS)		Base Plate	
253	Mfr.	Model		☒ Furnished By Vendor
254	kW	Max. Steam Flow, kg/hr		☐ Gas Turbine Only ☒ Extended for Compr., Gear Unit
255	Total / Start, Kg		☐ Soleplates Required ☐ Drip Rim	
256	☐ Gas Expander	See Appl. Spec. No.:		☐ Column Mounting ☐ Levelling Pads
257	Mfr.	Model		☒ Decking : Non skid decking
258	kW	Max. Gas Flow, kg/hr		Remark:
259	Total / Start, Kg			
260	☐ Gas for Expansion Turbine			
261		Min.	Max.	Normal
262	Inlet Pressure, kPa			
263	Exhaust Press., kPa			
264	Gas Temp. Inlet, EC			
265	Gas temp. Exh., EC			
266	Molecular Wt.			
267	Speed Control	☐ Governor	☐ Pressure Regulator	
268		Yes	No	
269	Inlet Control Valve furnished	☐	☐	☒ Ventilation Fan 100% standby Reqd.
270	Stainless Steel Piping Manifold	☐	☐	☒ Positive Pressure Ventilation:
271	Carbon Steel Flanges	☐	☐	☒ Gas Turbine ☐ Gear ☐ Elec. Generator
272	Y-Strainer w/breakout Flanges	☐	☐	☐ Negative Pressure Ventilation: ☐ Gas Turbine
273	Low Speed Capability (for compr. cleaning)	☐	☐	☒ Ventilation Filter
274	Relief Valve Pressure Set Point, kg/cm ² g			☐ Type: ☐ No. of stages
275	Casing Material			☐ D.C. Fan Req'd.
276	Seal Type			☐ Others
277	☐ Internal Combustion Engine See Appl. Spec. No.:		Couplings And Guards See API-671 data sheet.	
278	Type	☐ Spark Ignited ☐ Diesel	☐ Mfr. ☒ Type: Metallic Flexible Element.	
279	Mfr.	Model		☐ Model
280	Speed, RPM	Power, kW		☐ Max. Outside Diameter, mm
281	☐ Combustion Gas Turbine See Appl. Spec. No.:		☐ Hub Weight, kg	
282	Mfr.	Model		☒ Spacer Length, mm ☐ Spacer Wt., kg
283	Speed, RPM	Power, kW		☐ Idling Adapter Req'd. ☐ Solo Plate Req'd.
284				☒ Guard supplied by Vendor
285	☐ Black Start Capability Required		Type ☒ Fully Enclosed ☐ Semi Open ☐ Other	
286	☐ Black Start Type:		☐ Lubricating Requirements	
287	☐ A.C. Power not Available		☒ Non Lube ☐ Grease ☐ Cont. Oil lube	
288	☐ C.W. not Available		Quantity per Hub, kg/m ³ /hr	
289	☐ Instrument Air not Available		Remarks:	
290	☐ D.G. Set reqd. to provide complete starting			
291	Elec. power requirements			
292	☐ Black Start on Gas/ Liquid/ Both fuel reqd.			
293				
294	Remarks:			
295				
296				
297				
298				
299				

300	ACCESSORIES SUPPLIED BY GAS TURBINE MANUFACTURER (Contd..)			
301	Air Inlet System(Refer Job spec: B240-910-80-42-SP-5010)		Exhaust System (Refer Job spec: B240-910-80-42-SP-5010)	
302	☐ Air Filter (Refer Job Specifications)		☐ Complete Exhaust System with stack/Chimney@min30 m ht	
303	☐ Complete Air Path Component Material : SS 304 (Internals)		☐ Extent of furnished Insulation	
304	☐ Internal Type Separator	☐ Media Filters	☐ (Relief) (Diversion) Valve (as applicable)	
305	☐ Pad Type Pre-filters	☐ Combination	☐ Exhaust Heat Recovery System:	
306	☐ Self Cleaning Pulse (Pulse Type)		☐ Emission Control System	
307	☐ Single Stage with provision for		☐ Exhaust Silencer Plate Element Matl.	
308	future Extra Stages	☐ Yes ☐ No	☐ Emissions Sampling System	
309	☐ Normal Dust Loading, kg/Nm ³ /hr		☐ Expn. Joint Mfr. Turbine Vendor Type	
310	☐ Wind Design Velocity, km/hr		☐ Ducting Gauge / Material: /	
311	☐ Snow Load, kg/m ³		☐ Silencer Mfr. Diff. Pr, mm H ₂ O	
312	☐ Seismic Zone		☐ Heat Recovery Device	
313	Location ☐ Ground level ☒ Elevated (Minimum 5 m)		Mfr. Type Diff.Pr, mm H ₂ O	
314	☐ Filtration Efficiency		Steam Gen. Pr.kPag Temp., °C	
315	☐ Maintenance Interval, months		Rate, kg/hr	
316	☐ Cleaning Frequency, months/days		☐ Manometer Mfr. ☐ Model	
317	☐ Implosion Door		Range, mm H ₂ O	
318	☐ Evaporative Cooler	☐ Anti-Icing	☐ Atmospheric Relief Device	
319	☐ Liquid to Air Exchanger		Type Mfr. Location	
320	☐ Walkway, Ladders, Handrails Req'd.		☐ External diff. Pr. by Others, mm H ₂ O :	
321	☐ Compr. Cleaning System, Type		☐ System Site Rated Pressure Drop, 100 mm H₂O	
322	☐ Silencer Plate Element Material: SS		☐ Disch. Flange Orientation:	
323	☐ Filter Mfr. ☐ Model		☐ Vertical ☐ Side Hzl. ☐ Side at an Angle ☐ Axial	
324	100% Rated Air flow diff. Pr.		Atmospheric Emissions (Note-8)	
325	Clean, mm H ₂ O Alarm, mm H ₂ O Changeover		☐ Emission Suppression System Req'd.	
326	☐ Cooler Mfr. ☐ Model Diff.Pr, mm H ₂ O		☐ NO _x Requirements:	
327	☐ Exchgr. Mfr. ☐ Model Diff.Pr, mm H ₂ O		☐ NO _x Emitted	
328	☐ Ducting Gauge / Material: SS		Emissions Reduction Method (if req'd.)	
329	☐ Expn. Joint Mfr. ☐ Type		☐ Water Injection ☐ SCR	
330	☐ Silencer Mfr. ☐ Model		☐ Steam ☐ Dry Combustor	
331	Diff. Pr, mm H ₂ O :		☐ Other ☐ SO _x Requirements	
332	☐ Manometer Mfr. ☐ Model		☐ Sulphur Content of Fuel	
333	Range, mm H ₂ O :		☐ SO _x Emitted (Based on stated sulphur content)	
334	☐ System Site Rated Pressure Drop, 100mm H ₂ O		☐ CO Requirements ☐ CO Emitted	
335	100% Rated Air Flow :		☐ Particulate Requirements:	
336	REMARKS :		☐ Unburned HC Requirements ☐ Unburned HC Emitted	
337			Applicable Emission Codes or Regulations	
338			☐ Refer Job Spec. (Rotating Eqpt.) Clause no. 9.7.6	
339	UTILITIES			
340	☐ Utility conditions : Refer spec no: B240-910-80-42-SU-5010		☐ Total utility consumption :	
341	Steam	Aux. Drivers	Heating	Cooling Water : m ³ /hr
342	Inlet: Min. /cm ² G °C.		kg/cm ² G °C.	Steam Normal : Kg/hr
343	Nor. kg/cm ² G °C.		kg/cm ² G °C.	Steam Maximum : Kg/hr
344	Max. kg/cm ² G °C.		kg/cm ² G °C.	Instrument Air : Nm ³ /hr
345	Exhaust :Min. kg/cm ² G °C.		kg/cm ² G °C.	HP (Aux.Driver) : kW
346	Nor. kg/cm ² G °C.		kg/cm ² G °C.	HP (Auxiliaries) : kW
347	Max. kg/cm ² G °C.		kg/cm ² G °C.	Battery Chargers/ Heaters : kW/ kW
348	Electricity : ☐ Pilot Light Indication			Purge (Air or N ₂) Nm ³ /hr
349	Motors Heating Control Shutdown			Miscellaneous :
350	Voltage			☐ Vendor's Review&Comments on Purch. Piping&Foundation
351	Hertz			☐ Final assembly clearance ☐ Welding hardness testing
352	Phase			☐ Speed –Torque curve ☐ Increase power for Steam / Water
353	Cooling Water :			☐ Effect of Amb. Cond. On exhaust flow
354	Temp. Inlet: °C. Max. Return: °C., Design °C			☐ Special Test procedure
355	Press. Norm.: kg/cm ² G. Design: kg/cm ² G.			☐ Purchaser's review of Comp. / Goodman Diagram
356	Min. Return: kg/cm ² G. Max. Allow. ΔP: kg/cm ² .			☐ Vendor witness alignment
357	Water Source: Fouling Factor :			☐ Technical Data manual
358	Instrument air :			☐ Recommended straight run of Pipe diameters before suction:
359	Pr.: Max. kg/cm ² G, Min. kg/cm ² G, Nor. kg/cm ² G			☐ Run down curves

INSPECTION AND TESTING				LUBRICATION & WEIGHTS			
360	SHOP INSPECTION & TESTS :			Lubrication Systems: ■ See LOS datasht. (B240-910-80-42-DS-1005/1006)			
362	Reqd.	Witn.	Obs.	☐ Lube oil Viscosity ISO Grade:			
363	Shop Inspection	■		Common to ☐ Gas Generator/ Single Shaft Turbine			
364	Cleanliness	■		■ Free Power Turbine ☐ Load Gear			
365	Hydrostatic	■	■	■ Driven Eqpt. ☐ Auxiliaries			
366	Mechanical Run	■	■	☐ Combined/ Separate Lube/Seal System			
367	☐ Contract Coupling	☐ Idling Adaptor(s)		☐ System Designed for Synthetic Lubricant			
368	■ Contract Probe	☐ Shop Probes		Lube Specification			
369	Vibration Plots	■		Common to ☐ Gas Generator ☐ Power Turbine			
370	Tape record Vib. Data	■		☐ Load Gear ☐ Driven Eqpt.			
371	Performance Test	■	■	☐ Auxiliaries			
372	PT spin test	☐	☐	■ Oil Requirements	Flow	Pr.	Heat Load
373	Load Gear Test			GG or SS Turbine			
374	Sound Level test	■	■	Driven Equipment			
375	Aux. Equipment Test	■	■	Gear			
376	Post Test Inspection	■	■	Couplings			
377	Hydraulic Coupling Inspection			Power Turbine			
378	Governor Response Test & emergency overspeed trip system (#)	■	■	Total			
379	Spare Parts	■	☐	■ Mounting Arrangement			
380	Fire Protection/Enclosure leak test	■	☐	☐ Console ☐ Column ■ Baseplate			
381	Other : PGTR at site	■	■				
382							
383	Material Inspection Requirements (Refer Job Specification)			■ Weights & Dimensions			
384	☐ Special Charpy Testing				Dry Inst.Wt kg	Shipp. wt.kg	L x W x
385	☐ Radiography Regd. for:			GG or SS Turbine			
386	☐ Magnetic Particle Regd. for:			SS Turbine Rotor			
387	☐ Liquid Penetrant Regd. for:			Power Turbine			
388	☐ Ultrasonic Regd. for:			P.T. Rotor			
389	☐ Weld Inspection			Lube System			
390	☐ Welding Hardness Testing			Driven Equipment			
391	Miscellaneous			Filter			
392	■ Vendor's review & Comments on Purch. Piping & Foundation			Inlet Silencer			
393	☐ Final Assembly Clearances			Exhaust Silencer			
394	☐ Coordination Meeting Site			Ducting			
395	■ Speed-Torque Curve						
396	☐ Increase Power for Steam/Water						
397	■ Effects of Ambient Cond. On Exh. Flow			Max. Erection wt.	Item No.		
398	☐ Run Down Curves			Max. Maintenance wt.	Item No.		
399	☐ Purch. review of Campbell/ Goodman Diag.						
400	■ Vendor Witness Alignment						
401	■ Technical Data Manual						
402	☐ No. of Proposal Copies						
403							
404	REMARKS :						
405							
406	(#) Overspeed trip can be demonstrated through electronic simulation, in case overspeed is considered unsafe as per GT OEM standard proven procedure.						
407							
408							
409							
410							
411							
412							
413							
414							
415							
416							

417	NOTES:
418	1. Both intake & exhaust losses shall be considered as 100mm WC for GT rating.
419	2. The continuous base rating of Gas turbine at the specified site conditions of altitude, intake & exhaust losses, site rated temperature, humidity shall not be less than: (a). For Case-1: 110% of maximum compressor power required among all cases/Guarantee case (inclusive of all losses i.e. compressor mechanical losses, Gear-box losses, transmission losses etc.). (b). For Case-2: 100% of maximum compressor power required among all cases (inclusive of all losses i.e. compressor mechanical losses, Gear-box losses, transmission losses etc.).
420	3. Performance data as per Page nos. 10 to 17 has to be filled-in for each of specified operating case of the Compressor against each specified LHV of fuel gas (RLNG and SRG).
421	4. In order to justify the site rating of the proposed Gas Turbine, bidder shall furnish all supporting data, deration curves/charts & calculations.
422	5. The make and model of bearing temperature monitoring system, vibration and axial displacement monitoring system shall be as per Instrumentation specification forming part of inquiry document. All items to be supplied shall have proven references.
C	6. For the proposed Gas Turbine model, bidder shall offer GT OEM recommended quantity and location of vibration and temperature probes as per OEM's standard proven design practice followed in earlier supplied GTC packages with suitable references.
424	7. Please refer Job Spec. Doc. No. B240-910-80-42-SP-5010 for details of Gas Turbine starting system.
425	8. No water/steam injection is permissible for emission reduction. Please refer Job specification (Doc. No. B240-910-80-42-SP-5010) for emission requirements.
426	9. Vendor shall provide Insulation for heat conservation & personal protection.
427	10. Vendor shall supply suitable Fuel Gas conditioning skid based on the specified Fuel Supply conditions.
428	11. The offered Gas Turbine shall be equipped with DLE/DLN combustors to control emissions. A write-up with the details of the offered combustion system (with DLE/DLN combustors) shall be submitted with the bid/offer.
429	12. In case of any mismatch of Process data in this datasheet with that in Compressor Process datasheet, data as per Process datasheet will govern.

ANNEXURE-A

1. Primary Fuel for GT: Re-gasified LNG (RLNG) from 18" Gandhar-Jhanore line.

Fuel gas properties for RLNG are as below:

Sl. No.	Component	RLNG Gas Composition (in Mol %)	
		Max. LHV	Min. LHV
1.	C1	93.32912	90.74001
2.	C2	5.62274	6.24112
3.	C3	0.27888	1.81558
4.	iC4	0.04775	0.32322
5.	nC4	0.05217	0.47376
6.	iC5	0.00333	0.01843
7.	nC5	0.00086	0.00487
8.	N2	0.66510	0.38304
	Total		
	Molecular Weight		
Fuel Gas Supply Conditions @ vendor's battery limit			
	Pressure (kg/cm ² G)	28-30	
	Temperature (°C)	18-35	
	LHV (kCal/Sm ³)	8834	8445
	HC Dew Point (°C)	(-)68.75°C @ 30 kg/cm ² G	

NOTE: Selection of Gas Turbine shall be based on Primary source of fuel i.e. RLNG

2. Secondary Fuel for GT: Semi-rich gas (SRG) from Compressor inlet common header (same as mentioned for Case-1 & Case-2 in Compressor Datasheet).

Fuel Gas Properties for SRG are as follows:

Sl. No.	Component	SRG Gas Composition (in Mol %)	
		Case-1	Case-2
1.	Nitrogen	0.23	0.16
2.	Carbondioxide	2.36	2.47
3.	Hydrogen Sulphide	0.00141	0.00141
4.	Methane	90.35	85.73
5.	Ethane	5.93	5.06
6.	Propane	1.06	3.74
7.	N-Butane	0.05	1.79
8.	N-Pentane	----	0.56
9.	Hexane Plus	----	0.48
	Total		
	Molecular Weight		
Fuel Gas Supply Conditions @ vendor's battery limit			
	Pressure (kg/cm ² G)	36-39	25-28
	Temperature (°C)	40-55	15-35
	LHV (kCal/Sm ³)	8396.761	9288.321
	HC Dew Point (°C)	(-)103 @ Atm. Pr.	(-)35 @ Atm. Pr.

PERFORMANCE DATASHEET (CASE-1): (REFER NOTE-3)

SL. NO.	DESCRIPTION	UNIT	PERFORMANCE DATA (CASE-1)			
			CASE-1A	CASE-1B	CASE-1C	CASE-1D
1.0	COMPRESSOR					
1.1	BKW required at compressor input shaft including all Mechanical, Seal & Gear-box losses (with 0% positive tolerance)	kW				
1.2	Rated Speed	RPM				
2.0	GEAR UNIT					
2.1	Gear Unit efficiency	%				
2.2	Gear Unit Rating	kW				
2.3	Input Speed/Output Speed	RPM				
3.0	GAS TURBINE					
3.1	Gas Turbine ISO Rating	kW				
3.2	GT Site Rating (See 3.9 Below)	kW				
3.3	Heat Rate at Site Conditions [While generating BKW at 1.0 above] GT Heat rate @ Site rated temp. °C	kJ/kWh I kcal/kWh				
3.4	GG Rated Speed	RPM				
3.5	PT Rated Speed	RPM				
3.6	GGT Inlet Temperature [While generating site rated power]	°C				
3.7	Expected TBO (Hot Section)	Hrs				
3.8	Expected TBO (Power Turbine)	Hrs				
3.9	SITE CONDITIONS (Please refer Doc. No. B240-910-80-42-SU-5010)					
	(i) Site Altitude	m				
	(ii) Max. Inlet Loss (At Site)	mm H ₂ O				
	(iii) Max. Exhaust Loss (At site)	mm H ₂ O				

SL. NO.	DESCRIPTION	UNIT	PERFORMANCE DATA (CASE-1)			
			CASE-1A	CASE-1B	CASE-1C	CASE-1D
	(iv) Site Rated/peak Temperature	°C				
	(v) Relative Humidity	%				
	(vi) LHV of fuel gas	kcal/kg kcal/Sm3				
	(vii) HC Dew point	°C @ kg/cm2G				
4.0	NOISE LEVEL					
4.1	Overall Compressor package Noise level @ 1 meter from the equipment Train (including compressor, turbine and other aux. Equipment & piping)	dBA				

PERFORMANCE DATASHEET (CASE-2): (REFER NOTE-3)

SL. NO.	DESCRIPTION	UNIT	PERFORMANCE DATA (CASE-2)			
			CASE-2A	CASE-2B	CASE-2C	CASE-2D
1.0	COMPRESSOR					
1.3	BKW required at compressor input shaft including all Mechanical, Seal & Gear-box losses (with 0% positive tolerance)	kW				
1.4	Rated Speed	RPM				
2.0	GEAR UNIT					
2.4	Gear Unit efficiency	%				
2.5	Gear Unit Rating	kW				
2.6	Input Speed/Output Speed	RPM				
3.0	GAS TURBINE					
3.10	Gas Turbine ISO Rating	kW				
3.11	GT Site Rating (See 3.9 Below)	kW				
3.12	Heat Rate at Site Conditions [While generating BKW at 1.0 above] GT Heat rate @ Site rated temp. °C	kJ/kWh I kcal/kWh				
3.13	GG Rated Speed	RPM				
3.14	PT Rated Speed	RPM				
3.15	GGT Inlet Temperature [While generating site rated power]	°C				
3.16	Expected TBO (Hot Section)	Hrs				
3.17	Expected TBO (Power Turbine)	Hrs				
3.18	SITE CONDITIONS (Please refer Doc. No. B240-910-80-42-SU-5010)					
	(i) Site Altitude	m				
	(ii) Max. Inlet Loss (At Site)	mm H ₂ O				
	(iii) Max. Exhaust Loss (At site)	mm H ₂ O				
	(iv) Site Rated/peak Temperature	°C				

SL. NO.	DESCRIPTION	UNIT	PERFORMANCE DATA (CASE-2)			
			CASE-2A	CASE-2B	CASE-2C	CASE-2D
	(v) Relative Humidity	%				
	(vi) LHV of fuel gas	kcal/kg kcal/Sm3				
	(vii) HC Dew point	°C @ kg/cm2G				
4.0	<u>NOISE LEVEL</u>					
4.2	Overall Compressor package Noise level @ 1 meter from the equipment Train (including compressor, turbine and other aux. Equipment & piping)	dBA				

PERFORMANCE TABLE CASE-1 (REFER NOTE-3)

SL NO	DESCRIPTION	UNITS	OPERATING CASE-1 (NORMAL OPERATING CASE)				REMARKS
			ISO	RATED	MAX	MIN	
1	Ambient temperature	°C					
2	Relative humidity	%					
3	LHV of Fuel gas	kcal/kg kcal/Sm ³					
4	Compressor BKW (including seal losses, transmission losses)	kW					
5	Rated Speed of the Compressor	rpm					
7	Mech. Losses of Gas Turbine (Power to all auxiliaries)	kW					
8	Power Turbine Shaft speed	rpm					
9	Power required on Power Turbine Shaft [= (4) + (7)]	kW					
10	Site efficiency	%					
11	H _R : Heat Rate corresponding to (9)	kJ/kWh kcal/kWh					
12	W _{max.} : Max. Power on PT Shaft at corresponding shaft speed Site Elevation = _____ m above MSL Max. Inlet pressure Losses = 100 mm H ₂ O Max. Exhaust Pressure Losses = 100 mm H ₂ O & Including all other losses	kW					
13	η _S corresponding to W _{max.}	%					
14	H _R corresponding to W _{max.}	kJ/kWh kcal/kWh					
15	T _S : PT Exhaust Temperature	°C					
16	GG Exhaust Temp	°C					
17	Firing Temp	°C					
18	Exhaust Flow	kg/sec					
19	Actual Margin available with offered GT [= {(12) – (9)}/(9)] * 100]	%					

PERFORMANCE TABLE CASE-2 (REFER NOTE-3)

SL NO	DESCRIPTION	UNITS	OPERATING CASE-2				REMARKS
			ISO	RATED	MAX	MIN	
1	Ambient temperature	°C					
2	Relative humidity	%					
3	LHV of Fuel gas	kcal/kg kcal/Sm ³					
4	Compressor BKW (including seal losses, transmission losses)	kW					
5	Rated Speed of the Compressor	rpm					
7	Mech. Losses of Gas Turbine (Power to all auxiliaries)	kW					
8	Power Turbine Shaft speed	rpm					
9	Power required on Power Turbine Shaft [= (4) + (7)]	kW					
10	Site efficiency	%					
11	H _R : Heat Rate corresponding to (9)	kJ/kWh kcal/kWh					
12	W _{max.} : Max. Power on PT Shaft at corresponding shaft speed Site Elevation = _____ m above MSL Max. Inlet pressure Losses = 100 mm H ₂ O Max. Exhaust Pressure Losses = 100 mm H ₂ O & Including all other losses	kW					
13	η _S corresponding to W _{max.}	%					
14	H _R corresponding to W _{max.}	kJ/kWh kcal/kWh					
15	T _S : PT Exhaust Temperature	°C					
16	GG Exhaust Temp	°C					
17	Firing Temp	°C					
18	Exhaust Flow	kg/sec					
19	Actual Margin available with offered GT [= {(12) – (9)}/(9)] * 100]	%					

GAS TURBINE EXHAUST GAS EMISSION DATASHEET (REFER NOTE-3)

GUARANTEED GASEOUS EMISSION DATA FOR GLC PREDICTION STUDIES									
SL. NO.	DESCRIPTION	UNITS	OPERATING CASE						REMARKS
			CASE-1			CASE-2			
			ISO	RATED	PEAK	ISO	RATED	PEAK	
	Reference Temperature for Gas Turbine	°C							
1.0	Fuel Gas, Calorific Value	kcal/kg kcal/Sm ³							
2.0	Fuel Flow Rate	kg/hr							
3.0	Physical Height of exhaust chimney from ground level	meters							Min. 30 metres
4.0	Diameter of exhaust chimney at tip	meters							
5.0	Exit Velocity (Min. / Nor. / Max.)	m/sec							
6.0	Exit Temperature (Min. / Nor. / Max.)	°C							
7.0	Volumetric Flow of Exhaust Gas (at _____ kg/cm²G & _____ °C)	m³/hr							
8.0	Mass flow rate of Exhaust Gas	kg/hr							
9.0	Avg. Molecular Weight of exhaust gas								
10.0	Composition of Exhaust Gas								
10.1	-CO ₂	Vol.% (dry/wet)							
10.2	-N ₂	Vol.% (dry/wet)							
10.3	-O ₂	Vol.% (dry/wet)							
10.4	-Moisture	Vol. %							
10.5	-SO ₂	Wt.% mg/Nm ³							

GUARANTEED GASEOUS EMISSION DATA FOR GLC PREDICTION STUDIES									
SL. NO.	DESCRIPTION	UNITS	OPERATING CASE						REMARKS
			CASE-1			CASE-2			
			ISO	RATED	PEAK	ISO	RATED	PEAK	
10.6	-NO _x	Wt.% mg/Nm ³							
10.7	-CO	Wt.% mg/Nm ³							
10.8	-HC	Wt.% mg/Nm ³							
10.9	-Any other composition from GT exhaust ** Component A □ □ Component B ** Component C	Wt.% mg/Nm ³							
11.0	Particulate matter : Size Distribution - < 10 : - > 10 :	mg/Nm ³							

23.10.2019	C	AS	JSD/NK
17.09.2019	B	AS	JSD/NK
26.06.2019	A	AS	NK
DATE	REV	JOB ENGINEER	REV & APPROVED BY

1	GENERAL									
2	Project: INSTALLATION OF GTC AT GANDHAR				Job No.: B240					
3	Owner: GAIL (INDIA) LIMITED				Site: GPU GANDHAR					
4	Purchaser:				Unit: NEW COMPR. AREA		Unit No.: 910			
5	Item No.: 910-GB-901				Service: Gear Unit between Centrifugal Comp. & Gas Turbine					
6	No. reqd.: One		Working: One		Standby: None		Driver Type: Gas Turbine		Driven Eqpt. Cent. Comp.	
7	Applicable ☒ Proposals				☐ Purchase		☐ As Built			
8	☒ Scope, Option & Information specified by Purchaser. ☐ Information required from and options left to vendor. Vendor to cross (X) the selected option.									
9	Manufacturer:				Model:					
10	☒ RATING REQUIREMENTS					☐ BASIC GEAR DATA				
11	Driven Eqpt. Power (kW):		Nor.:		Max.:		Mechanical rating:		kW @ rpm	
12	Driver Power (kW):		Rated:		Max.:		Full load power loss (kW):			
13	Gear rated power (kW):						Mechanical efficiency (%):			
14	Torque @ Max. Cont. Speed (kg-m):						Pitch line velocity (m/s):			
15	Max.		kg-m @		rpm		Tooth pitting index, "K":		Actual: Allowable:	
16	Rated speed (rpm):						Tangential load, "W _t " (kg):			
17	- Input		☐ Specified ☐ Nominal				Bending stress number S _t "W _t "		Pinion Gear	
18	- Output		☐ Specified ☐ Nominal				Actual:			
19	Allow variation in gear ratio:		V				Allowable:			
20	Max continuous speed (rpm):						Material index no.:			
21	Trip speed (rpm):						Anticipated SPL:		dBA @ m	
22	Gear service factor (Min.):		(1.6 as per API 613)				Journal static weight loads:			
23	Pinion Hardness:						Pinion: kg		Gear: g	
24	Shaft assembly designation:						WR ² referred to LS shaft (kg-mm ²):			
25	- HS shaft rot. Facing coupling end		☐ CW ☐ CCW				Breakaway Torque (kgf-m) @ LS shaft:			
26	- LS shaft rot. Facing coupling end		☐ CW ☐ CCW							
27	HS shaft ☐ Cylindrical ☐ Taper ☐ 1-Key						☐ CONSTRUCTION FEATURES			
28	☐ 2-Keys ☐ Hydraulic taper ☐ Integral flange						Type of Gear ☐ Reducer ☒ Increaser			
29	LS shaft ☐ Cylindrical ☐ Taper ☐ 1-Key						☒ Single stage ☐ Double stage			
30	☐ 2-Keys ☐ Hydraulic taper ☐ Integral flange						☐ Single helical ☐ Double helical			
31	External loads:						☐ Epicyclic ☐			
32	Other operating conditions:						Teeth			
33	☐ INSTALLATION DATA				Number of teeth: Pinion:		Gear:			
34	☒ Indoor ☐ Heated ☒ Under roof				Gear ratio		Centre Distance (mm):			
35	☐ Outdoor ☒ Unheated ☒ Partial sides				Pitch Dia: Pinion (mm)		Gear (mm):			
36	☒ Grade ☐ Mezzanine ☐				Finish (RA):					
37	☐ Winterisation Required ☒ Tropicalization Required				AGMA Geometry factor "J":					
38	Electrical Area Class:		Grp: Div.:		Pinion:		Gear:			
39	Max. allow. SPL: 85		dBA @ 1 m		Helix angle (°):					
40	Elevation (m):		Barometer (kg/cm ² A):		Normal pressure angle (°):					
41	Range of ambient temperatures:				Net face width, "Fw" (mm):		Pinion L/D:			
42			Dry Bulb Wet Bulb		Normal Diametrical Pitch:		Backlash (mm):			
43	Minimum		°C		Tooth plating: ☐ Recommended ☐ Not Recommended					
44	Normal		°C		MANUFACTURING METHODS					
45	Maximum		°C		Teeth generated by the:				Process	
46	Unusual Conditions ☒ Dust ☒ Fumes ☐ Refinery atm				Teeth finished by the:				Process	
47	☒ ADDITIONAL REQUIREMENTS				Teeth hardening method:					
48	MOUNTING PLATES				Gear to shaft: ☐ Integral ☐ Shrunk-on					
49	☒ Gear furnished with:				Rim attachment:					
50	☒ Baseplate ☐ Soleplate(s) ☐ Subplate(s)				☐ RADIAL BEARINGS					
51	☐ Mounting plate(s) furnished by:						Pinion		Gear	
52	☒ Equipment(s) on base plate: GT, GEAR UNIT & COMPRESSOR				Type					
53	☒ Baseplate with levelling pads:				Diameter mm					
54	☒ Baseplate suitable for column mounting:				Length mm					
55	☒ Grout type: ☒ Epoxy				Journal Velocity m/s					
56	☒ PAINTING: ☒ Mfr. Std. ☐				Loading kg/cm ²					
57	APPLICABLE SPECIFICATIONS				Clearance (min-max) mm					
58	☒ API Std. 613 ☐				Span mm					
59	☒ Other: Job spec. B240-910-80-42-SP-5010									
60										
61										

62	MISCELLANEOUS				☐ THRUST BEARING(S)			
63	☐ Undamped critical analysis report: ☐ Yes ☐ No						Pinion	Gear
64	☐ With damped rotor response analysis report				Location			
65	☒ Torsional analysis by ☐ Gear Vendor ☒ Other(Rem.7)				Manufacturer			
66	☐ Spare set of gear rotors				Type			
67	☐ Gear case furnished with inlet purge connection				Size			
68	☐ Orientation of oil inlet and drain connection				Area mm ²			
69					Loading kg/cm ²			
70	☒ VIBRATION DETECTORS				Rating kg/cm ²			
71	Radial:				Int. thrust load N (✓)			
72	☒ Manufacturer See Remark-3				Ext. thrust load N (✓)			
73	☒ No. at each shaft bearing 2		Total No.: 4		☒ COUPLING & GUARDS			
74	☒ Oscillator-Demodulators supplied by Comp. Mfr.						High Speed	Low Speed
75	☒ Manufacturer See Remark-3				Coupling Manufacturer			
76	☒ Monitor supplied by Comp. Vendor				Coupling Furnished by		Vendor	Vendor
77	☒ Location Remark-4 Enclosure				Coupling Type		(Remark-8)	(Remark-8)
78	☒ Manufacturer See Remark-3				Coupling Model			
79	☒ Alarm ☒ Shutdown				Coupling rating kW/100 rpm			
80	☒ Shutdown time delay seconds				Coupling Lubrication		Non Lube	Non Lube
81	Axial:				Taper mm/m			
82	☒ Manufacturer See Remark-3		No. reqd.:		Taper gauge furnished by			
83	☒ Location Remark-4				Limited end float		As Reqd.	As Reqd.
84	☒ Oscillator-Demodulators supplied by				Mount coupling halves		☒	☒
85	☒ Manufacturer See Remark-3				Cplg. gear pitch dia mm		☐	☐
86	☒ Monitor supplied by Compr. Mfr.				Cplg. pressure angle (°)		☐	☐
87	☒ Location Remark-4 Enclosure				Cylindrical / 1-key		☐	☐
88	☒ Manufacturer See Remark-3				Cylindrical / 2-keys		☐	☐
89	☒ Alarm ☒ Shutdown				Tapered / 1-key			
90	☒ Shutdown time delay seconds				Tapered / 2-keys			
91					Tapered / keyless			
92	Accelerometer:				☐ PIPING CONNECTIONS			
93	Manufacturer		No. Required			No.	Size	Type
94	Location				Service			
95	Monitor supplied by				Lube oil inlet			
96					Lube oil outlet			
97	☒ INSTRUMENTS				Casing drain			
98	☒ Other instruments as per DS no. B240-910-80-42-DS-1004				Vent			
99	☒ Bearing Temperature Monitoring System See Remark 3 & 4				Casing purge			
100	☐ CONTRACT DATA							
101	☒ Vendor's Representative at site							
102	☒ Test data prior to shipment				☒ LUBRICATION REQUIREMENTS			
103	☒ Progress reports				☒ Oil System Furnished by Compr. Vendor			
104	☒ SHIPMENTS				☐ Oil Visc.: cP @ 40°C cP @ 100°C			
105		Contract unit	Spares		Min. start-up oil temperature °C			
106	Export boxing	☒	☒		Unit oil flow(total) m ³ / hr			
107	Domestic boxing	☐	☐		Unit oil pressure kg/cm ² g			
108	Outdoor strg. over 6 months	☒	☒		Oil flow, Mesh m ³ / hr			
109					Oil flow, HS Bearings m ³ / hr			
110	MATERIALS				Oil flow, LS Bearings m ³ / hr			
111	Gear Casing		Oil Seals		Oil flow, Thrust Bearing(s) m ³ / hr			
112	Radial Bearings				Additional Requirements			
113	Thrust Bearing(s)				Filter breather location			
114	HS Shaft		LS Shaft					
115	Pinion(s)		Hardness					
116	Gear Rim(s)		Hardness					
117	Low Temp. Operation							
118	REMARKS:							
119								
120								
121								
122								

123	☐ INSPECTION AND TESTS				☐ GEAR DATA			
124	Reqd.	Observe	Witness	Test log				
125	Shop Inspection	■	■		Power loss each HS bearing			
126	Cleanliness inspection	☐	☐	☐	Power loss each LS bearing			
127	Hardness verification Insp	■	■	☐	Pinion Gear			
128	Dismantle-Reassembly Insp.	■	☐	■	Outside diameter mm			
129	Contact check	■	■	☐	Root Diameter mm			
130	Contact check tape lift (2.5.2.2)	☐	☐	☐	Center Groove Diameter mm			
131	Journal runout check	■	■	☐	Durability Power			
132	Axial stability check	☐	☐	☐	Strength Power			
133	Rotor balancing machine	☐	☐	☐	Face overlap ratio			
134	Sensitivity Check				Transverse contact ratio			
135	Residual Unbalance Check	☐	☐	☐	Length line of action mm			
136	Mech. run test	■	☐	■				
137	Mech. run test (Spare rotors)	☐	☐	☐	☐ WEIGHTS & DIMENSIONS			
138	Add'l mech. Test	☐	☐	☐	Net Weight:			
139	Part or full load and full speed test	☐	☐	☐	Gear Box: kg Auxiliaries: kg			
140	Full torque slow roll test	■	☐	■	Max. Maintenance Weight [Identify]: kg			
141	Full torque static test	☐	☐	☐	Total Shipping Weight: kg			
142	Back-to-back locked torque test	☐	☐	☐	Total Shipping Dimensions: L: m W: m H: m			
143	Sound level test	■	☐	■				
144	Add'l gear tooth test	☐	☐	☐				
145	Use shop lube system	■	☐	■				
146	Use job lube system	☐	☐	☐				
147	Use shop vibration probes, etc.	☐	☐	☐				
148	Use job vibration probes, etc.	■	☐	■				
149	Other:	☐	☐	☐				
150	Final assembly maintenance &	■	☐	■				
151	running clearance			☐				
152	Oil system cleanliness	■	■	☐				
153	Oil system casing joint tightness	■	■	☐				
154	Warning and protection devices	☐	☐	☐				
155								
156								
157								
158								
159								
160								
161	REMARKS:							
162	1. The gear unit rated power shall be, as a minimum, equal to the installed power of the driver i.e. Gas Turbine ISO Rating							
163	2. The oil system for gear unit shall be common with the main equipment i.e. Compressor and Gas turbine (if not separate).							
164	3. The make and model of bearing temperature monitoring system , vibration and axial displacement monitoring system shall be as per Instrumentation specification forming part of inquiry document.							
165								
166	4. The location of bearing temperature monitoring system , vibration and axial displacement monitoring system shall be as per Instrumentation specification forming part of inquiry document.							
167								
168	5. Vendor shall furnish all utilities required for the Gear Unit.							
169	6. The torsional analysis of the complete train comprising of Gas Turbine, gear unit and compressor shall be done by comp. vendor.							
170	7. Coupling type shall be Metallic Flexible Element (Diaphragm/Disc/ SS Flexible membrane).							
171								
172								
173								

23.10.2019	B	AS	JSD/NK
26.06.2019	A	AS	NK
Date	Rev	Job Engineer	Rev. & Approved By

1	CONTROLS & INSTRUMENTATION SYSTEM FOR GAS TURBINE DRIVEN CENTRIFUGAL COMPRESSOR					
2	Hazardous Electrical Area Classification	NEC:	Class	Div.	Group	
3		ISO:	Zone	Gas Group		
4						
5	Legends:					
6	LM: Local Mounted:	☐ By Vendor	☐ Others	H : Vendor's Supply and purchaser's remote Mount		
7	LGB: Local Gauge Board/Local HMI	☒ By Vendor	☐ Others	M : Mount by Vendor of Purchaser's items		
8	LCP: Local Control Panel:	☒ By Vendor	☐ Others	AV : Audio Visual		
9	UCP: Unit Control Panel:	☒ By Vendor	☐ Others	C :Cut out for Purchaser's item by vendor		
10	MP : Main Panel	☐ By Vendor	☐ Others	J :Vendor's supply and Mount on local control station		
11	PLC: Programmable Logic Control:	☒ By Vendor	☐ Others	S :Switches vendor's supply and purchaser local mount.		
12	DCS: Distributed Control System:	☐ By Vendor	☐ Others	Vendor to provide A/V (audio/visual) annunciation in LCP		
13	CCR : Central Control Room	For alarms and trips				
14	SRR : Satellite Rack Room	VP : Vendor's Loose Supply and Purchaser's Mount				
15	V : Vendor Supply and Mount	P :Signal / Contacts to be provided by vendor at vendor's				
16		Battery limit (further connection by purchaser)				
17	☒ Scope option & information supplied by Purchaser					
18	☐ Information required from & options left to vendor to cross ☒ the selected option					
19	REMARKS : 1. Flow element & Transmitter , 2. Standby Pump Start					
20						
21						
22						
23	DESCRIPTION	Location				
24		Loose Supply	Locally Mtd.	LGB Mtd.	LCP/LCS Mtd.	CCR / UCP
25						
26	I. GENERAL					
27	☒ Start counter					V
28	☒ Fired Hours Run Meter					V
29	- No. Status Counter					V
30	- Start Sequence Timer					V
31	☒ Gas Detection Summary					V
32	☒ Fire Detection Summary					V
33	II INDICATION LAMPS (STATUS INDICATIONS)					
34	☒ AC Power On/Off					V
35	☒ DC Power On/Off					V
36	☒ Control Power On/Off				V	V
37	☒ UPS Power On				V	V
38	☒ Main Lube oil Pumps RUN/STOP (Shaft driven)				V	V
39	☒ Stand-by Lube oil Pumps RUN/STOP (AC Motor driven)				V	V
40	☒ Emergency Lube oil Pump RUN/STOP (D/C Motor driven)				V	V
41	☒ Space Heater On/Off				V	V
42	☒ Lube OIL Heater(if electrical type) On/Off				V	V
43	☒ Ready to Run Light (Plant Ready light)				V	V
44	☒ Preparation Start in progress					V
45	☒ LO Shift Sealing System established					V
46	☒ Loading valve open					V
47	☒ Preparation start complete				V	V
48	☒ Start in progress				V	V
49	☒ Enclosure purged ready to start					V
50	☒ Lube Oil system established				V	V
51	☒ Running indication all auxiliaries (Individual)					V
52	☒ All auxiliaries healthy					V
53	☒ Gas Generator start initiated / Unit running					V
54	☒ Started Motor on					V
55	☒ Gas Generator Purging					V
56	☒ Igniters on					V
57	☒ Fuel on				V	V
58	☒ Gas Generator Lit					V
59	☒ Starter Motor Disengaged					V
60	☒ Power turbine running				V	V

61 62 63	DESCRIPTION	Location					
		Loose Supply	Locally Mtd.	LGB Mtd.	LCP/LCS Mtd.	CCR / UCP	PLC / DCS
64	■ Gas Generator above idling				V	V	
65	■ Ready to load					V	
66	■ Suction pressure control activated					V	
67	■ Shutdown in progress					V	
68	■ Blow down valve open					V	
69	■ By pass valve open					V	
70	■ GG Decelerating to idling					V	
71	■ Gas Generator Run Down Start Inhibited					V	
72	■ Ventilated shutdown				V	V	
73	■ Alarm system fault					V	
74	■ Valve open / closed indicated for - Shutdown valve on fuel gas supplier - Blow down valve					V	
75	■ Dry crank in progress					V	
76	III. SELECTOR SWITCHES FOR A/M OPERATIONS						
77	■ Master selector switch Compressor control panel/Remote/Crank/Off					V	
78	■ Compressor control panel/DCS Control mode selector switch					V	
79	■ Selector Switch Auto/Remote Manual/Local Manual for the following: - Main L.O. Pump - Standby L.O. Pump - Emergency L.O. Pump (D.C. pump) - Control oil/Hydraulic oil pumps (as applicable) - Ventilation Fan					V	
80	■ Auto/Manual Selector switch for selection of main and standby pump for each auxiliary					V	
81	■ Local/Remote Selector switch for each auxiliary system					V	
82	IV. PUSH BUTTONS						
83	■ Start/Stop Push Button For Standby LO Pump (A/C Motor Driven)				V		
84	■ Start/Stop Push Button Emergency Lube oil Pump (D/C Motor Driven)				V		
85	■ Lamp Test Push Button				V	V	
86	■ Alarm/Trip Acknowledge /Reset Push Button				V	V	
87	■ Start/Stop Lube Oil Heater (if electrical type) Push Button				V		
88	■ Dry Crank Start/Gas Generator Liquid Wash				V	V	
89	■ Manual Gas Generator Start				V		
90	■ Shelter Fan Start / Stop				V	V	
91	■ Preparation start				V	V	
92	■ Auto Sequential Start				V	V	
93	■ Normal shutdown				V	V	
94	■ Ventilated shutdown				V	V	
95	■ Emergency shutdown				V	V	
96	■ All auxiliaries Start / Stop				V		
97	V AMMETERS						
98	■ Ammeters for all auxiliary drive motors (rating >=5.5 kW)	V					
99							

CONTROLS AND INSTRUMENTATION															
DESCRIPTION	Indication					A/V Annun. & Pre-Alarm					Trip & A/V Alarm Annun.				
	Gauge- L M / Local	Gauge- LGB	Indicator -LCP	Indicator – CCR / UCP	Repeat Signal to MCC	Low - LCP	Low – CCR/UCP	High - LCP	High – CCR/UCP	Repeat Signal to MCC	Low Low - LCP	Low Low – UCP / CCR	High High - LCP	High High- UCP / CCR	Repeat Signal to MCC
100 1.0 COMPRESSOR															
101 1.1 PROCESS GAS															
102 ■Compressor Suction Pressure	VP			V			V					V			
103 ■Compressor Discharge Pressure)	VP			V					V					V	
104 ■Compressor Suction Temperature	VP			V											
105 ■Compressor Discharge Temperature	VP			V					V					V	
106 ■Pressure Balance line(s) / chamber(s) of compressor	V			V					V						
107 ■Differential pressure across inlet strainer (each)	VP			V					V						
108 ■Compressor balance line-Differential pressure	V			V											
109 □Compressor Suction Flow – First (section)															
110 ■Compressor Suction Flow – Second (section)	VP ¹			V											
111 ■Compressor Discharge Flow – First (section)	VP ¹			V											
112 ■Compressor Spillback Line Flow –each section	VP ¹			V											
113 ■Compressor Spillback Line pressure –each section	VP			V			V								
114															
115															
116 1.2 VIBRATION AND AXIAL DISPLACEMENT & BEARING TEMPERATURE MONITORING SYSTEM															
117 ■Radial shaft vibration (at each bearing) (Note-5)				V					V					V	
118 ■Axial displacement (Note-6)				V					V					V	
119 ■Key phasor (for each speed change)	V														
120 ■Journal bearing metal temp. (Each bearing) (Note-7,8)				V					V					V	
121 ■Thrust bearing metal temp. (Each bearing) (Note-7,8)				V					V					V	
122 ■Accelerometer for Casing vibration (X & Y)				V					V					V	
123 ■Display unit (For vibration , axial displacement , key phasor , bearing temperature and other diagnostics alarms and trips)															
124 □Connectivity to purchaser's DCS/PLC for all repeat indications															
125															
126															
127 1.3 SHAFT SEALING SYSTEM (DRY GAS SEAL)															
128 ■Primary seal gas Supply Pressure (each seal)		V		V			V					V			
129 ■Primary seal gas Delivery Pressure (each seal)		V		V			V					V			
130 ■Secondary seal gas Supply Pressure (each seal)		V		V			V					V			
131 ■Secondary seal gas Delivery Pressure (each seal)		V		V			V					V			
132 ■Separation gas Supply Pressure (each seal)		V		V			V					V			
133 ■Separation delivery Pressure (each seal)		V		V			V					V			
134 ■Seal Gas filters Differential Pressure		V		V					V						
135 ■Seal and operating gas differential pressure (each seal)		V		V			V								
136 ■Separation Gas and Secondary Vent Differential Pressure (each seal)		V		V			V								
137 ■Primary seal vent		V													
138 ■Secondary seal vent		V													
139 ■Primary Seal Gas Vent flow / Pressure (each seal)	V			V		V	V		V				V	V	
140 ■Secondary seal gas flow (inlet)	V			V					V						
141															
142															
143 1.4 ANTI SURGE CONTROLLER (ASC)															
144 ■Compressor Anti surge controller (as per Inst. Specs)				V											
145 ■Anti Surge, HIC with position indicator			V	V											
146 □Differential Pressure across compressor inlet and outlet – Each stage (section) In Case of ASC)															
147 ■All instruments associated with ASC	V														
148 ■Anti Surge Control valve	V														
149 □Emergency Surge Detector (ESD)															
150															
151															

CONTROLS AND INSTRUMENTATION														
DESCRIPTION	Indication					A/V Annun. & Pre-Alarm					Trip & A/V Alarm Annun.			
	Gauge- L M / Local	Gauge- LGB	Indicator -LCP	Indicator - CCR / UCP	Repeat Signal to MCC	Low - LCP	Low - CCR/UCP	High - LCP	High - CCR/UCP	Repeat Signal to MCC	Low Low - LCP	Low Low - UCP / CCR	High High - LCP	High High- UCP / CCR
152 1.5 PERFORMANCE CONTROLLER														
153 ☐ Compressor suction pressure (PIC)														
154														
155														
156 2. GEAR UNIT														
157 2.1 VIBRATION AND AXIAL DISPLACEMENT & BEARING TEMPERATURE MONITORING SYSTEM														
158 ☒ Radial shaft vibration (at each bearing) (Note-5)				V					V					V
159 ☒ Axial displacement (Note-6)				V					V					V
160 ☒ Key phasor (for each speed change)	V													
161 ☒ Journal bearing metal temp. (Each bearing) (Note-7,8)				V					V					V
162 ☒ Thrust bearing metal temp. (Each bearing) (Note-7,8)				V					V					V
163 ☒ Accelerometer for Casing vibration (X & Y)				V					V					V
164 ☒ Display unit (For vibration , axial displacement , key phasor, bearing temperature and other diagnostics alarms and trips)														
165 ☐ Connectivity to purchaser's DCS/PLC for all repeat indications														
166														
167														
168 3.0 GAS TURBINE														
169 3.1 COMBUSTION AIR INLET SYSTEM														
170 ☒ Inlet Air Filter differential pressure	V			V					V					V
171														
172														
173 3.2 TURBINE ENCLOSURE VENTILATION SYSTEM														
174 ☒ Enclosure Temperature (GG & PT)				V					V					V
175 ☒ Ventilation system filter Pressure Drop				V					V					
176 ☒ Enclosure Purging differential pressure (GG & PT)				V			V					V		
177 ☒ Enclosure Door unlocked Indicator				V										
178														
179														
180 3.3 TURBINE START SYSYEM														
181 ☒ Fail to Crank												V		
182 ☒ Starting Sequence Incomplete							V					V		
183 ☒ Auxiliary Sequence failure												V		
184														
185														
186 3.4 GAS FUEL SYSTEM														
187 ☒ Fuel Supply Temperature (Battery Limit)	V			V			V							
188 ☒ Fuel Supply Pressure (Battery Limit)														
189 ☒ Fuel supply pressure (downstream of conditioning skid)	V			V			V					V		
190 ☒ Fuel supply pressure (downstream of pressure regulator)	V			V			V					V		
191 ☒ Fuel gas filter differential pressure	V								V					V
192 ☒ Fuel governing valve position feed back														
193 ☒ Fuel System Malfunction							V					V		
194 ☒ Fuel Gas Flow indication Note-2				V										
195 ☒ Fail to Ignite												V		
196 ☒ Flame out												V		
197														
198														
199 3.5 GAS GENERATOR														
200 ☒ Air Compressor Inlet Air Temperature				V					V					
201 ☒ Air Compressor discharge Air Temperature				V					V					
202 ☒ Turbine firing temperature (Inlet to GG)				V					V					
203 ☒ GG compressor Discharge Pressure				V										
204 ☒ Speed Indicator				V					V					V
205 ☒ GG under speed							V					V		

CONTROLS AND INSTRUMENTATION														
DESCRIPTION	Indication					A/V Annun. & Pre-Alarm					Trip & A/V Alarm Annun.			
	Gauge- L / M / Local	Gauge- LGB	Indicator -LCP	Indicator - CCR / UCP	Repeat Signal to MCC	Low - LCP	Low - CCR/UCP	High - LCP	High - CCR/UCP	Repeat Signal to MCC	Low Low - LCP	Low Low - UCP / CCR	High High - LCP	High High- UCP / CCR
206 3.6 POWER TURBINE														
207 ■PT/Inlet temp. / GG Exhaust Temp.				V					V					
208 ■PT Locked Rotor (Under Speed)							V							
209 ■Speed				V					V					V
210 ■Speed Raise / Lower Control (Governor control)				V										
211 ■Turbine exhaust temperature (Mean of 8 points minimum)				V					V					V
212 ■Turbine exhaust pressure				V										
213 ■Failure Exhaust over-temperature S/D Device (Open Thermocouple Condition)									V					V
214 ■Running at Peak Load									V					
215														
216														
217 NOTE : 1 – Differential temperature protection														
218 NOTE : 2 – Pressure and temperature compensated														
219 NOTE –3 : Only if waste heat recovery unit is provided														
220														
221														
222 3.7 VIBRATION AND AXIAL DISPLACEMENT & BEARING TEMPERATURE MONITORING SYSTEM														
223 ■Radial shaft vibration (at each bearing) (Note-9)				V					V					V
224 ■Axial displacement (Note-9)				V					V					V
225 ■Key phasor (for each speed change) (Note-9)	V													
226 ■Journal bearing metal temp. (Note-9)				V					V					V
227 ■Thrust bearing metal temp. (Note-9)				V					V					V
228 ■Display unit (For vibration , axial displacement , key phasor , bearing temperature and other diagnostics alarms and trips)														
229 ■Connectivity to purchaser's DCS/PLC for all repeat indications														
230 ■Accelerometer for Casing vibration (X & Y) (Note-9)			V	V				V	V				V	V
231														
232														
233 3.8 FIRE & GAS EXTINGUISHING SYSTEM														
234 ■CO 2 released									V					V
235 ■CO2 leaked off									V					
236														
237														
238 4. LUBE OIL SYSTEM (Common for Compressor/Gear unit and Gas Turbine)														
239 ■Lube oil reservoir-Oil temp.	V	V												
240 ■Lube Oil Reservoir-Oil level	V	V					V							
241 ■Lube oil Reservoir purge (N2) flow (as applicable)	V			V										
242 ■Main Lube Oil pump suction pressure	V						V							
243 ■Main Lube Oil pump discharge pressure	V	V		V			V							
244 ■Standby Lube Oil pump suction pressure	V						V							
245 ■Standby Lube Oil pump discharge pressure	V	V		V			V							
246 ■Standby Lube oil pump –Start/Running	V			V										
247 ■Emergency Lube Oil pump suction pressure	V													
248 ■Emergency Lube Oil pump discharge pressure	V	V		V			V							
249 ■LO Cooler - Cooling Water Pressure at inlet	V													
250 ■LO Cooler - Cooling Water Pressure at outlet	V	V												
251 ■LO Cooler Cooling Water Temperature at inlet	V													
252 ■LO Cooler Cooling Water Temperature at outlet	V													
253 ■LO Cooler - Oil Temperature at inlet	V													
254 ■LO Cooler- Oil Temperature at outlet	V													
255 ■Lube oil cooler differential pressure	V													
256 ■Lube oil temperature after TIC	V		V	V					V					
257 ■Lube oil filters differential pressure (DP Indicator)	V		V	V										

CONTROLS AND INSTRUMENTATION														
DESCRIPTION	Indication					A/V Annun. & Pre-Alarm					Trip & A/V Alarm Annun.			
	Gauge- L / M / Local	Gauge- LGB	Indicator -LCP	Indicator - CCR / UCP	Repeat Signal to MCC	Low - LCP	Low - CCR/UCP	High - LCP	High - CCR/UCP	Repeat Signal to MCC	Low Low - LCP	Low Low - UCP / CCR	High High - LCP	High High- UCP / CCR
258 ■Lube Oil header pressure (each level) (Independent for lube oil to compressor and turbine bearings respectively)	V			V			V					V		
259 ■Accumulator (lube & control oil) pre-charge gas pressure (as applicable)	V			V					V					
260 ■Lube oil supply Pressure in each line from header				V			V					V		
261 ■Lube Oil Temp.at the outlet of each Journal/Radial bearing of GTC package (Note-9)	V								V				V	
262 ■Sight flow indicator - drains lines from each Journal bearing of GTC package	V													
263 ■Lube Oil Temp.at the outlet of each Thrust bearing of GTC package (Note-9)	V								V				V	
264 ■Sight flow indicator - drains lines from each Thrust bearing of compressor	V													
265 ■Lube Oil rundown tank (as applicable)-Oil level				V				V						
266 ■Sight flow indicator-Lube oil rundown tank (as applicable) outlet	V													
267 ■Sight flow indicator -Lube Oil circulation lines between filters, coolers to Tank	V													
268														
269														
270 5. MISCELLANEOUS														
271 ■Unit shutdown		V												
272 ■All permissive start switches (connected starting interlock)				V										
273 ■Common pre-alarm of all the machine alarms				V										
274 ■Common pre-alarm of all the process alarms				V										
275 ■Common trip alarm for all machine trips				V										
276 ■Common trip alarm for all process trips				V										

Electric Supply:						
Lamps	:	☐	V;	AC/DC;	☐	Hz.
Alaram Circuit	:	☐	V;	AC/DC;	☐	Hz.
Trip Circuit	:	☐	V;	AC/DC;	☐	Hz.
Control Circuit	:	☐	V;	AC/DC;	☐	Hz.
Solenoid Valves	:	☐	V;	AC/DC;	☐	Hz.

Notes

- (1). Pre-Alarms to proceed Trips.
- (2). Instruments to be connected to junction boxes on skid and consoles.
- (3). All Tubings, pipings, wiring between instruments and junction boxes, local gauge boards and local panels to be supplied by vendor.
- (4). Instrumentation, Controls & Annunciation indicated are minimum required. Vendor shall add any additional instruments, which in his view may be required as per OEM experience and recommendation to ensure safe & reliable operation of the machines or additionally required as per API 617/616 and other documents/standards referred in the inquiry document. The above instrumentation and controls shall be discussed upon during detailed engineering (with the successful bidder) with regards to applicability of any indication, alarm or trip.
- (5). Journal (Radial) bearings: Two numbers radial vibration probes (non-contacting proximity) per radial bearing.
- (6). Thrust bearings: Two numbers axial vibration probes (non-contacting proximity) per thrust bearing (active/inactive side).
- (7). Journal (Radial) bearings :
 - For tilting pad bearings, each bearing shall have RTD's in no less than 50% of the shoes.
 - For sleeve bearings, each bearing shall have two (2) RTD's located at two locations.
- (8). Thrust bearing:
 - For tilting pad bearings, each bearing shall have RTD's in no less than 50% of active side & 2 in the active side.
- (9). The requirements as per Notes 5,6,7 & 8 (above) shall not be applicable for Gas Turbine. For the proposed Gas Turbine model, bidder shall offer GT OEM recommended quantity and location of vibration and temperature probes as per OEM's standard proven design practice followed in earlier supplied GTC packages with suitable references.
- (10). All indications (not provided locally) and all alarms and trip (annunciations) against each parameter indicated above in this datasheet shall be also repeated to the Local Control panel (in bidder's scope). Bidder shall consider his scope accordingly. Please refer Instrumentation scope of work for further details.
- (11). Vendor shall also refer to P&ID's enclosed and any additional instruments required as per P&ID's shall be included by vendor in his scope of supply.
- (12). All switching devices (hardware/software) for prealarms, trips, trip alarm ,and interlocking shall be in the vendor's scope.
- (13). Separate ASC system shall be provided for each compressor stage/section as per the purchaser's specification and P & ID attached elsewhere.
- (14). Any additional instruments, indications, control valves, relief valves, alarm and trip switches etc. required for dry gas seal system shall also be included in the vendor's scope of supply and shall be added to the above listing by vendor during detailing and the same shall be subject to approval of the Purchaser/Owner.
- (15). For further details, instrumentation specifications may please be referred.

B

23.10.2019	B	AS	JSD/NK
26.06.2019	A	AS	NK
DATE	REV	JOB ENGINEER	REVIEWED & APPROVED BY

1	GENERAL										
2	Project:	INSTALLATION OF GTC AT GANDHAR					Job no. :	B240			
3	Owner:	GAIL (INDIA) LIMITED					Site:	GPU GANDHAR			
4	Purchaser:						Unit:	NEW COMPR. AREA	Unit No.:901		
5	Eqpt. Item No. for which oil system is reqd.:	910-K-901					Service:	Oil System for Comp., Gear unit & GT			
6	Oil System Item No.:	910-OS-901					Duty :	Continuous / Intermittent			
7	No. of units:	ONE	Working:	ONE	Standby:	NONE					
8	Applicable to:	☒ Proposal ☐ Purchase ☐ As Built									
9	☒ Scope, Option & Information specified by Purchaser. ☐ Information required from and options left to vendor. Vendor to cross (X) the selected option.										
10	Oil system(s) for: Centrifugal Compressor, Gear Unit and Gas Turbine										
11	Supplier:						Manufacturer:				
12	Overall System Typical Schematics						Fig. No.	Option No.	Comments		
13	☐ Combined lube, seal & control oil system										
14	☐ Separate seal-oil system										
15	☐ Seal Module at Equipment										
16	☒ Lube / Control System						2A-8				
17	☒ Basic Oil supply module						2A-10				
18	☒ Lube Module at Equipment						2A-11				
19	☐ Drawing requirements							☐ Component Review			
20	☒ Relief Valves to protect low pressure systems						☐ NO	☒ YES,	For:		
21	SUPPLY ARRANGEMENT		Lube Oil	Seal Oil	Combined	BASIC SYSTEM DETAILS					
22	☐ Separate Console		☒	☐	☐	☐ Compressor Block-In time:		Minutes			
23	☐ Multiple Package		☐	☐	☐	☐ Equipment Coast-Down time:		Minutes			
24	☐ Package No. 1					☐ Equipment Cool-Off time: Driver:		Minutes			
25	☐ Package No. 2					☐ Equipment Cool-Off time: Others:		Minutes			
26	☐ Package No. 3					☐ Minimum Start-up oil temperature		°C			
27	☐					☒ Settling Out Pressures		Ref. Comp. DS	kg/cm ² g		
28	BASEPLATES:					☐ Process Relief Valve settings		kg/cm ² g			
29	☐ Point Support		☐ Grout Hole/Vent Holes			☐ Shop Test Conditions					
30	☐ Epoxy Grout/ Precoat					☐ Field Start-up/Run-In Conditions					
31	COMPONENTS:					☐ Other Special Conditions					
32	Piping & Tubing:					☒ Welding & Special Fabrication Requirements					
33	☒ Material		SS304/SS316			☐ 100% Radiography					
34	☐ Double Block & Bleds					☐ Magnetic Particle					
35	☐ Tight Shut off					☒ Liquid Penetrant					
36	☐ Tube Fittings Mfr.: Model:					OIL CONDITIONERS					
37	☒ Slip-on Flanges					☐ Purchaser's Item No.		910-OC-901			
38	☐ Through Studs required					☒ Service Used in		Lube Oil System			
39	☐ Heat Tracing Req'd. by: ☐ Purchaser ☐ Vendor					☒ Type		Centrifuge			
40	☐ Special Requirements					☒ Portable, Or Mounted on		Portable			
41	☒ Utilities manifolded to common connections					☐ Rated flow (m ³ /hr) of Oil					
42	☒ Air					☒ Manufacturer		ALFA LAVAL or eqv.			
43	☐ Cooling Water					☐ Model					
44	☐ Other					☒ Driver (Electric Moto) for:		Main & Standby LOP	EOP		
45	☐ Instrument Test Valves required					☐ kW & Enclosure					
46	☐ Valve heads vented to Reservoir					☐ V / Ph. / Hz.					
47						☐ Water Removal Rate					
48						☒ Material of Construction		SS			
49	DEGASSING DRUM NOT APPLICABLE										
50	☐ Purchaser's Item No.					☐ Service Used in					
51	☐ As per Fig. No's or Other Specs.					☐ Flow Control		☐ Thermostat Control			
52	☐ Operating Temperature (°C)					☐ Material					
53	☐ Flow Rate: Normal Max. (m ³ /hr)					☐ Interior Coating		☐ Oversize Vent			
54	☐ Normal Retention Time (minutes)					☐ Vent Relief Device					
55	☐ Capacity: Normal Max. (m ³)					☐ Omit Breather					
56	☐ Purge Gas: Type					☐ Code: Constrn. Stamp					
57	☐ Required Flow (Nm ³ /hr)					☐ Other					
58	☐ Type Heating Device					☐ Other					
59	☐ Corrosion Allowance					☐ Other					
60	☐ Design / Test Pressure (kg/cm ² g)										
61	☐ Other:		☐ Other:								

RESERVOIR															
62															
63	Service Application			☒ Separate Lube/Ctrl			☐ Lube/Seal Combined			☐ Separate Seal					
64	☐ Purchaser's Item No.														
65	☒ Figure No.			2A-21											
66	☒ Include Options No.			a, b, c, d, f											
67	☒ Heater: Steam / Electric (S / E)			Electric											
68	☐ Heater in Sealed Tube														
69	☒ Material			SS 304-or- Epoxy coated CS											
70	☐ Normal Flow			m ³ /hr											
71	☐ Free Surface			m ²											
72	☒ Working Capacity			Minutes/Liters			5								
73	☒ Retention Capacity			Minutes/Liters			8								
74	☐ Rundown Capacity			Liters											
75	☐ Normal Operating Range			Liters											
76	☐ Charge Capacity			Liters											
77	☐ Insulation Clips			☐			☐			☐					
78	☒ Ladder with Hand-rail			☒			☐			☐					
79	☐ Hand-Rails on Top			☐			☐			☐					
80	☒ Non-skid Decking			☒			☐			☐					
81	☐ Flanged Vent														
82	☒ Oversize Flanged Vent			☒			☐								
83	☐ Pressure Relief Device: Type & Mtrl.														
84	☒ Siphon Breaker			☒			☐			☐					
85	☐ Top Mounted Components permitted			☐			☐			☐					
86	☐ Top Mounted Components are														
87	☒ Submerged Components and Materials			None											
88	Approx. Dimensions (Tank Only): L x W X H (m)														
89															
90	PUMPS AND DRIVERS														
91	Service Application			☒ Lube Oil/Ctrl			☐ Lube/Seal Oil			☐ Separate Seal Oil			☐ Boost Seal Oil		
92															
93	☒ Figure No's:			2A-19											
94	☒ Including Option No's.			a, b, c											
95	☐ Emergency Pump System														
96	Pump Service			Main	Stdby	Emerg.	Main	Stdby	Emerg.	Main	Stdby	Emerg.			
97															
98	☐ Pump Item No.														
99	☒ Pump Type (Centrifugal/Rotary)														
100	☐ Pump Data Sheet														
101	☒ Horiz. or Vertical (H / V)														
102	☐ Driver Item No.														
103	☐ Turbine Driver for														
104	☐ Turbine Data Sheet														
105	☒ Electric Motor Driver for			Yes	Yes	Yes									
106	☐ Electric Motor Data Sheet														
107	☐ Other Driver: Emergency AC Motor for														
108	☐ Other Driver: Data Sheet														
109	☒ Coupling Type (Flexible Metallic)			Yes	Yes	Yes									
110	☐ Booster Pumps Required														
111	☒ Autostart			Yes	Yes	Yes									
112	☐ Solenoid Trip Valve														
113	☒ Rotary Pump Relief Valve by Purchaser/Vendor (P / V)			V	V	V									
114															
115															
116															
117															
118															
119															
120															
121															
122															

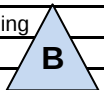
123	COOLERS:				
124	Service Application	☒ Lube/Ctrl	☐ Lube / Seal	☐ Sep. Seal Oil	
125	☐ Purchaser's Item No.				
126	☒ Twin Units/Air cooled Oil Cooler with Twin 100% Capacity fans	2A-17		☐	
127	☒ Include Option No's.	a, b, c			
128	☐ Water Side for Steam Heating	☐		☐	
129	☐ Details on Data Sheet				
130	☐ Water Side Corrosion Allowance				
131	☐ Manufacturer				
132	☐ Model				
133	☒ Applicable Code/Standard	API Std. 661 & Job Specs			
134	☐ Fouling Factor: Water Side Oil Side (hr m ² °C/kCal)				
135	☐ Heat Duty kcal/hr				
136	☐ Tube: L x OD x BWG.				
137	☐ Design Test Pressure: Shell Side kg/cm ² g				
138	☐ Design Test Pressure: Tube Side kg/cm ² g				
139	☐ Code: Construction Stamp	☐ ☐	☐ ☐	☐ ☐	☐ ☐
140	☐ Tube Water velocity Capacity: m/s m ³ /hr				
141	☐ Material: Shell				
142	☐ Material: Channel & Covers				
143	☐ Material: Tube Sheets Tubes				
144	☐ Removable Tube Bundle	☐		☐	
145	☐ U – Bend Tubes permitted	☐	☐	☐	
146	☐ Oil Temperature Control Valve	☐	☐	☐	
147	FILTERS				
148	Service Application	☒ Lube & Control Oil	☐ Separate Control Oil	☐ Separate Seal Oil	☐ Booster Pump Disch. Oil
149					☐ Separate Coupling Oil
150	☐ Purchaser's Item No.				
151	☒ Twin	☒		☐	☐
152	☐ Second filter for Control Oil	☐		☐	☐
153	☒ Include Option No's.	2A-17, a			
154	☒ Filtration Level Microns (Nominal)	10			
155	☐ Manufacturer				
156	☐ Model				
157	☐ Design Test Pressure kg/cm ² g				
158	☒ Code: Construction Stamp	☒ ☐	☐ ☐	☐ ☐	☐ ☐
159	☐ Clean / Fail ΔP kg/cm ²				
160	☒ Material: Case & Top	CS			
161	☐ Material: Cartridges				
162	☐ Furnish 4 Sets of Extra Cartridges:	☐ Per Service		☐ Per Filter (Extra over other spares)	
163	CONTINUOUS FLOW TRANSFER VALVES				
164	Service Application	☒ Lube & Control Oil	☐ Separate Control Oil	☐ Separate Seal Oil	☐ Booster Pump Disch. Oil
165					☐ Separate Coupling Oil
166	☒ Separate or Common for Coolers & Filters	Separate	☐	☐	☐
167	☒ Tight Shut-off Req'd.	☒	☐	☐	☐
168	☒ Type	Two way-6 Ported			
169	☐ Manufacturer				
170	☐ Model				
171	☐ With Lifting Jack	☐	☐	☐	☐
172	☐ Rating: kg/cm ² g				
173	☒ Materials: Body	CS			
174	☒ Materials: Plug or Ball	SS			
175	☒ Materials: Trim	SS			
176					
177					
178					
179					
180					
181					
182					
183					

184	ACCUMULATORS (As applicable)				
185	Service Application	Lube Oil	Control Oil	Seal Oil	Seal Oil Booster
186	☐ Purchaser's Item No.				
187	☐ Required: Yes or No & Quantity				
188	☒ Service combined with	Pump Switch Over			
189	☐ Direct contact type	☐		☐	☐
190	☒ Bladder Type	2 A-15		☐	☐
191	☐ Include Option No's.				
192	☐ Run-down minutes				
193	☐ Oil Temperature Control	☐		☐	☐
194	☐ Constant Pressure Regulator	☐		☐	☐
195	☐ Manufacturer				
196	☐ Model				
197	☐ Nominal Usable Capacity Liters				
198	☒ Material: Shell	SS	SS		
199	☐ Material: Bladder				
200	☐ Design Test Pressure kg/cm ² g				
201	☒ Code: Construction Stamp	☒	☒	☐	☐
202	☒ Include: Charge Pressure Gauge plus	☒	☒	☐	☐
203	☒ Manual Charge Valve or	☒	☒	☐	☐
204	☒ Gas Supply Regulator	☒	☒	☐	☐
205	OVERHEAD TANKS				
206	Service Application	Rundown Lube(As applicable)	Low Press. Seal	Med. Press. Seal	High Press. Seal
207	☒ Figure No.	2A-13 A			
208	☒ Required: Yes or No	Yes			
209	☐ Service combined with				
210	☐ Direct Contact Tank	☐	☐	☐	☐
211	☐ Bladder Type	☐	☐	☐	☐
212	☐ Include Option No's.				
213	☐ Capacity minutes / Liters				
214	☐ Blowdown Connection				
215	Rundown tanks (Fig. No.)	2A-13 A			
216	Overhead tanks (Fig. No.)				
217	☐ Corrosion Allowance				
218	☒ Material	SS			
219	☐ Total Capacity Liters				
220	☐ Design Test Pressure kg/cm ² g				
221	☒ Code: Construction Stamp	☒	☐	☐	☐
222	ACCUMULATOR UNITS				
223	☐ Purchaser's Item No.	Rundown Lube	Low Press. Seal	Med. Press. Seal	High Press. Seal
224	☐ Corrosion Allowance				
225	☐ Manufacturer & Quantity				
226	☐ Model				
227	☐ Material: Shell				
228	☐ Material: Bladder				
229	☐ Nominal Usable Capacity Litres				
230	☐ Design Test Pressure kg/cm ² g				
231	☐ Code: Construction Stamp	☐	☐	☐	☐
232	TRAPS FOR INNER SEAL OIL (Oil Seals)				
233	Service Application	Low Pressure Seal Oil	Med. Pressure Seal Oil	High Press. Seal Oil	
234	☐ Purchaser's Item No.				
235	☐ Seal - Gas Vent Piping Arrangement				
236	☐ Float Controlled	☐	☐	☐	
237	☐ Transmitter Controlled	☐	☐	☐	
238	☐ Pots only, For Manual Drain	☐	☐	☐	
239	☐ With: Valving	☐	☐	☐	
240	☐ Flush Level Glass	☐	☐	☐	
241	☐ High Level Switch	☐	☐	☐	
242	☐ Include Option No's.				
243	☐ Retention: Hours & Liters				
244					

245	FLOAT TRAP		Low Pressure Seal Oil		Med. Pressure Seal Oil		High Press. Seal Oil	
246	☐ Manufacturer Model							
247	☐ Pressure Rating kg/cm ² g							
248	☐ Material: Body							
249	☐ Material: Float Trim							
250	☐ Drain Line piped to:							
251	DRAIN POT							
252	☐ Corrosion Allowance							
253	☐ Material							
254	☐ Design Test Pressure Kg/cm ² g							
255	☐ Code: Construction Stamp		☐	☐	☐	☐	☐	☐
256	☐ Drain Line piped to:							
257	MIST ELIMINATOR							
258	☐ Corrosion Allowance							
259	☐ Material: Shell							
260	☐ Material: Demister Mesh							
261	☐ Design Test Pressure kg/cm ² g							
262	☐ Code: Construction Stamp		☐	☐	☐	☐	☐	☐
263	INSPECTION & TESTING							
264	SHOP TESTS:	Requir	Witnessed		SHOP INSPECTION:			
265	☒ Cleanliness	☒	☒		☐ Compliance with Inspector's Checklist			
266	☒ Four Hour Run	☒	☒		☒ Required for System Assemblies			
267	☒ Check Controls	☒	☒		☒ Cleanliness prior to closure			
268	☒ Changeovers: Coolers / Filters	☒	☒		☐ Required for Major Components			
269	☒ One & Two Pump Operations	☒	☒		☒ Material Certifications to be furnished			
270	☒ Sound Level	☒	☒		☐ Special Examinations			
271	☒ Hydrotest Assembled System	☒	☒		☒ Code Construction / Stamp ASME			
272	☐ Use for Complete Unit System Test	☐	☐		☒ Supply Certified copies of all Test Logs and Data			
273	☒ Certf. copies of all test logs & data	☒	☐		☐			
274	☐	☐	☐		☐			
275	☐	☐	☐		☐			
276	☐	☐	☐		☐			
277	☐	☐	☐		☐			
278	☐	☐	☐		☐			
279	REMARKS:							
280	1. The drivers for Main , Standby and Emergency Lube Oil Pump shall be suitable for auto-start.							
281	2. For instrumentation requirements also refer Datasheet No. B240-910-80-42-DS-1004.							
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23.10.2019	B	AS	JSD/NK
26.06.2019	A	AS	NK
DATE	REV	JOB ENGINEER	REVIEWED & APPROVED BY

1	GENERAL										
2	Project:	INSTALLATION OF GTC AT GANDHAR					Job No.:	B240			
3	Owner:	GAIL (INDIA) LIMITED					Site:	GPU, GANDHAR			
4	Purchaser:						Unit:	NEW COMPR. AREA	Unit No.:	910	
5	Item No.:	910-CP-101					Service:	Cent. Comp. thru' Gear unit & Gas Turbine			
6	No. of Units:	One	Working:	One	Standby:	None					
7	Applicable to:	☒ Proposal ☐ Purchase ☐ As Built									
8	☒ Scope, Option & Information specified by Purchaser. ☐ Information required from and options left to vendor. Vendor to cross (:) the selected option.										
9	Driver:	Type:	Gas Turbine				Manufacturer:				
10		Nameplate Power (kW):					Service Factor:	S.No.:	Tag No.:		
11	Driven Unit:	Gear Unit					Manufacturer:	Model:			
12		Serial No.:					Tag No.				
13	Coupling Type:	☒ Metallic Flex. Element (Diaphragm) ☐ Gear ☐ Quill Shaft ☐ Other:									
14	Manufacturer:					Model:			Size:	Assy. Dwg. No.:	
15											
16	☐ CONDITIONS CONSIDERED FOR COUPLING SELECTION						☐ RATINGS				
17	Conditions		Torque (kgf-m)		@ rpm	Torque (kgf-m)		@ rpm	Serv. Factor		
18	Normal					Normal					
19	Driven Rated Load					Peak					
20	Maximum Steady State					Momentary					
21	Maximum Transient					Shaft Juncture (Driving)					
22	Trip Condition					Shaft Juncture (Driven)					
23	Continuous Cyclic										
24	Other:										
25	☐ Frequency of Transients (Events/Time):					☐ Non-synchronous exciting frequency:					
26	☒ Coupling Minimum Required Service Factor, SF: 1.5 (Rem-3)						☐ Actual SF				
27	☒ Ambient Temperature (°C): (Rem-2)		Maximum:				Minimum:				
28	Environment:	☐ Hyd. Chloride ☐ Hyd. Sulphide ☒ Other: Dust, Fumes & Refinery Atmosphere									
29	LUBRICATION										
30	☐ Continuous ☐ Batch ☐ Non-Lubricated	☐ Viscosity:		cP @		°C					
31	☐ Filtration Microns:	☐ Pressure (kg/cm²g)		☐ Temp. (°C):							
32		☐ Flow (m³/hr)									
33	COUPLING DATA										
34	☐ Shaft Separation (including thermal growth) (mm B.S.E):										
35	@ Ambient Temp.:		@ Normal Operation:		@ Maximum Transient:						
36	☐ Motor Rotor Float (mm):		☐ Limited End Float (mm):								
37	☐ Marine Type Required		☐ Flex-Hub Type Required		☐ Electrically Insulated						
38	☐ Required Misalignment Capability:										
39	Steady State:	Angular (°):		Parallel Offset (mm):		Axial (mm):					
40	Transient:	Angular (°):		Parallel Offset (mm):		Axial (mm):					
41	☐ Maximum Allowable Misalignment:										
42	Steady State:	Angular (°):		Parallel Offset (mm):		Axial (mm):					
43	Transient:	Angular (°):		Parallel Offset (mm):		Axial (mm):					
44	☐ Component Balance		☐ Component Balance & Assembly Check Balance				☐ Component Balance with Assy. Balance				
45	☐ Residual Unbalance Check of Assembled Couplings						☐ Balance Repeatability Check				
46	☐ Max. Allowable Residual Unbalance		g-mm		Driver End:		Driven End:				
47	☐ Max. Actual Residual Unbalance		g-mm		Driver End:		Driven End:				
48	☐ Torsional Stiffness (kg-mm/Rad):										
49	☐ WR² (kg-m²):		Driver End:		Driven End:						
50	☐ Spacer Lateral Natural Frequency:					☐ Torque Capacity of Hub/Shaft Interface for keyless fits (kgf-m):					
51	Flexible-Element Coupling:										
52	☐ Initial Deflection (mm):		☐ Pre-Stretch		☐ Compression		☐ Max. Axial Deflection (mm):				
53	☐ Calculated Axial Natural Frequency:					☐ Test of ANF:		☐ Actual ANF:			
54	☐ Maximum Enclosure Temperature at Max. Continuous speed (°C):										
55	REMARKS:										
56	1. Coupling shall be of non-lubricated diaphragm type/SS flexible membrane type with spacer.										
57	2. Refer site & Utility Data enclosed elsewhere.										
58	3. Service factor shall be over the ISO rating for Gas turbine for the coupling between gas turbine and gearbox. Service factor shall be over the maximum power transmitted by the compressor for coupling between compressor and gearbox.										
59	4. This datasheet shall be used for both Low-speed and High-speed Couplings.										
60											
61											

62			
63	MATERIALS		
64	Component	Drive End Materials	Driven End Materials
65	Hub / Flange		
66	Spacer		
67	Sleeve		
68	Flexible-Element		
69	Flexible-Element Guard		
70	Bolts		
71	Nuts		
72	■ Protective Coating:	■ Vendor Standard	□ Other:
73	□ Internal Teeth Hardness: Rockwell C	Drive End Actual:	Driven End Actual:
74	□ External Teeth Hardness: Rockwell C	Drive End Actual:	Driven End Actual:
75	COUPLING HUB MACHINING		
76		Drive End	Driven End
77	□ Type (Integral / Cylindrical / Taper)		
78	■ Keyed or Hydraulically Fitted		
79	□ Taper		
80	□ Keyway Dimensions and Number		
81	□ Nominal Bore Diameter (mm)		
82	□ Interference Fit (mm): Max. Min.		
83	■ Puller Holes		
84	■ Trim Balance Holes		
85	COUPLING GUARD		
86	■ Co-ordinator: Compressor Vendor	□ Purge Gas:	□ Dry Air Purge:
87	■ Flanged Cylindrical:	□ Base Mount:	□ Purge Connection Size & Type:
88	□ Air Tight:	□ Oil Tight:	□ Purge m ³ /hr Required:
89	■ Spark Resistant	□ Oil Mist Cooling	□ Gas Cooling
90	□ Transparent Window for Each Oil Spray Point:	□ Contract Guard to be used during Shop Test	
91	□ Vent Connection:	□ Additional Guard Details:	
92	□ 1 inch NPT with Filter Breather		
93	□ 1 inch Flanged, Rating & Facing:		
94	ACCESSORIES		
95	■ Prime Eqpt. supplier to furnish one set of Plug & Ring Gauges (Appe. D)	■ Hydraulic Installation/Removal Tooling (To include Hand Pump(s), Pressure Gauge(s), Fittings & Hose(s)) By:	
96	□ Lapping Tools	■ Coupling Manufacturer	
97	□ Drill Template for Internal Flanged Hubs by:	□ Purchaser	
98	□ Coupling Manufacturer	■ Puller By Coupling Manufacturer	
99	□ Two-Piece Stop Rings by Coupling Manufacturer	□ Moment Simulator	□ Solo Plate
100	APPLICABLE SPECIFICATIONS		PREPARATION FOR SHIPMENT
101	■ API Std. 671 3 rd edition, October 1998		■ Outdoor Storage for more than 12 months
102	■ Others: Special Purpose Couplings, 3rd edition		□ Expected Storage Time (Months):
103	□	■ Shipping	□ Domestic
104	□ Coordination Meeting Attendance Required	■ Storage	□ Indoor
105			■ Export
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23.10.2019	B	AS	JSD/NK
26.06.2019	A	AS	NK
Date	Rev	Job Engineer	Rev. & Approved By

TECHNICAL AMENDMENT-1
(Doc. No. - B240-910-16-50-TA-5010)

TO

MATERIAL REQUISITION NO- B240-910-PA-MR-5010, Rev-A
(GAS TURBINE COMPRESSOR)

PROJECT : INSTALLATION OF GAS TURBINE COMPRESSOR AT GPU GANDHAR

OWNER : M/s GAIL

CONSULTANT : ENGINEERS INDIA LIMITED

JOB NO. : B240

			DK 18/10/19	SH 18/10/19	ANPS 18/10/19
0	18.10.19	Issued as Technical Amendment-1			
Rev. No.	Date	Purpose	Prepared By	Checked By	Approved By

ITEM : GAS TURBINE COMPRESSOR
MATERIAL REQUISITION NO. : B240-910-PA-MR-5010, Rev-A

The terms, conditions and specifications of Bidding Document as mentioned above stands modified to the extent indicated under column "MODIFICATIONS/ADDITION/DELETION". Corresponding implications of the same, else-where in the MR shall be taken care appropriately. All other terms & conditions, stipulations and specifications of bidding document shall remain unaltered.

S.No	Section No./ Document No.	Clause No./ Item No.	Subject	Modifications / Additions/Deletions
1.	Job Specification / B240-910-16-50-SP-5010 Rev. A	6.6.7	MV Motor	Modification: Combined test to be conducted at site.
2.	Job Specification / B240-910-16-50-SP-5010 Rev. A	6.11.6	Lighting Fixtures	Modification: Lighting fixtures shall be flameproof type suitable for area classification & ambient temperature.
3.	Job Specification / B240-910-16-50-SP-5010 Rev. A	6.11.15	Motor Starters	Modification : All hardware necessary for interfacing control system signals with Bidder's motors starters shall be in bidder's scope.
4.	Job Specification / B240-910-16-50-SP-5010 Rev. A	6.11.16	Cables	Modification : All Electrical cables (Power, Control-(MCC to field equipment, MCC to I/O rack/DCS/PLC) shall be in purchaser's scope. However all cables required within skid shall be in bidder's scope. For Instrumentation cables refer Instrumentation part of MR. All Cable glands and Lugs required for termination shall be supplied by bidder.

S.N o	Section No./ Document No.	Clause No./ Item No.	Subject	Modifications / Additions/Deletions
5.	Job Specification / B240-910-16- 50-SP-5010 Rev. A	6.11.16	Load Data, Dimension of panel	<u>Addition:</u> Load list and tentative dimension of MCC, DC system (including Batteries), VFD etc. shall be furnished along with the offer.

JOB SPECIFICATION (ELECTRICAL)

GAS TURBINE COMPRESSORS (MR No. – B240-910-KA-MR-5010)

PROJECT : INSTALLATION OF GAS TURBINE
COMPRESSOR AT GPU GANDHAR

OWNER : M/s GAIL

JOB NO. : B240

B	18.10.2019	Revised & Issued with Amendment	DK	SH	ANPS
A	08.04.2019	ISSUED WITH MR	DK	SH	ANPS
Rev. No	Date	Purpose	Prepared by	Checked by	Approved by

1. Site Conditions

Maximum Ambient Temp.	:	47 ⁰ C
Minimum Ambient Temp.	:	6 ⁰ C
Relative Humidity	:	90 %
Equipment design Temp.	:	40 ⁰ C

2. System voltage and frequency

2.1. Utilization voltage

1. 415V (nominal) 3 phase 4 wire solidly earthed neutral: This voltage shall be used for all motors above 0.37kW & upto and including 160KW as well as all other three phase loads.
2. 240V (nominal) 1 phase 3 wire 50Hz earthed: This voltage shall be used for low power single phase loads such as lighting, small power sockets, motors rated below 0.37KW etc.

2.1. Voltage and frequency variation

The following maximum variation shall be considered for equipment design:

- a) Voltage : Differing from its nominal value by not more than $\pm 10\%$.
- b) Frequency: Differing from its nominal value by not more than $\pm 5\%$.

3. Brief Description of Electrical system

- 3.1. Purchaser will provide 2 no power supply from Owner's EPMC for feeding the GTMCC supplied by bidder along with power cables.
- 3.2. Purchaser shall provide 110V AC UPS feeder for feeding the UPS distribution board at control room for feeding the Instrumentation loads (Refer elsewhere for load details).
- 3.3. Any other voltage required for the operation of GT system loads shall be derived by vendor.
- 3.4. Control cabling for local push button station/local control panel to MCC and MCC to PLC/DCS interface shall also be provided by Purchaser.
- 3.5. The system shall be complete in all respects with required interlocks for the desired sequence of operation and controls, selections, indications and alarms etc.

4. WORKS EXCLUDED

The following works / item are excluded from the scope of the bidder:

- 4.1. Supply of 415V feeders upstream of GT MCC.
- 4.2. Supply, laying and termination of power and control cables from the Owner's switchboards in Substation to the electrical loads installed at the Compressor skid.

- 4.3. Supply, laying and termination of interface cables (Electrical) between Bidder's switchboards in Substation and Instrumentation panels for DCS interface.
- 4.4. Supply, laying and termination of UPS power cables upto UPS Distribution board in control room.
- 4.5. All cable trays / trenches for owner's cables outside Skid.

5. AREA CLASSIFICATION & EQUIPMENT SELECTION

- 5.1. Area classification for the compressor shall be as under:

Sl. No	Equipment	Type of enclosure protection
1.	910-K-151	Ex-de , Zone-2, IIA/IIB, T3

- 5.2. The minimum enclosure protection shall be:

Sl. No	Equipment	Type of enclosure protection
1.	Auxiliaries for 10-K-151	
	i) MV Motors & Heaters	Flame proof, Ex-de, Gas group - IIA/IIB, Temp class T3
	ii) LCS/LCP	Flame proof, Ex-d, Gas group - IIA/IIB, Temp class T3
	iii) DC motors if any	
	iv) Lighting panel/ Fixtures as reqd.	

- 5.3 Flameproof Ex d equipment shall meet the requirement of IS/IEC: 60079-1. All indigenous flameproof equipment (Ex d type) shall be manufactured under BIS license.
- 5.4 All electrical equipment for use in hazardous areas shall be certified by CIMFR, PTB, Baseefa, UL, FM or equivalent independent testing agency for the service and the area in which it can be used and shall be approved by PESO/CCOE. Copies of Hazardous area test certificates & PESO/ CCOE approval shall be furnished. As per statutory requirement in India, the approval from PESO/CIMFR must be submitted for equipment to be installed in hazardous area.

6. ENGINEERING AND JOB SPECIFIC REQUIREMENTS

- 6.1. Bidder shall ensure that all electrical equipment comply to site and system conditions, rating and other technical requirement as specified in the MR.
- 6.2. Bidder shall use this specification, datasheet, and OWNER/ EIL's standard specifications for various equipment.
- 6.3. The equipment shall in general conform to latest revision of statutory regulations, Indian Standards, IEC / Other international standards applicable for the country of origin of the equipment.

6.4. All equipment shall be subjected to routine and acceptance tests as per applicable specifications.

6.5. Besides these, the following requirements as detailed out in respective clauses for the equipment shall also be considered:

6.6. MV MOTOR

6.6.1. MV motors (415 V) shall conform to EIL Specification for high efficiency motors 6-51-0064, relevant clauses of EIL specification for MV VFD, 6-51-0038 (VFD Driven only), as applicable, and MV Motor data sheet no. B240-010-16-50-DS-5010/11.

6.6.2. Motors in general shall be asynchronous squirrel cage type having synchronous speed of 1500 rpm.

6.6.3. All MV motors shall be of high energy efficiency type IE2 as per IS-12615.

6.6.4. All outdoor motors shall be provided with FRP canopy.

6.6.5. Exact cable sizes of power and control cables shall be finalized during detailed engineering. Provisions, as required in Vendor's equipment for termination of the same, shall be made accordingly without any cost & time implications to Owner. Vendor shall supply accessories such as cable glands, lugs, etc. for the furnished cable size. In case of limitation of cable size for termination of power cables, required Flameproof Junction box suitable for Gas group IIA/IIB, Temperature class: T3 shall be provided without any cost & time implications to Purchaser.

6.6.6. Variation / Clarifications against the standard specification of MV Motor 6-51-0064, shall be as per the MOU agreed with EIL by respective motor manufacturer. No further deviations shall be entertained.

6.6.7. The VFD controlled motors shall be designed considering cooling at lowest operating speed as defined in pump data sheet. Compliance with this aspect shall be established by the bidder during detailed engineering/drawing review stage. *Combined test on job VFD & motor shall be performed at site.*

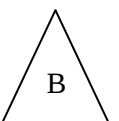
6.6.8. Motor frame size shall be selected based on the lowest operating speed as per process requirement.

6.7. MV SWITCHBOARD

6.7.1. MV switchboard/MCC supplied for feeding the various loads of Gas Turbine Compressor shall be located in MCC room/nearest Substation. The MV switchboard shall be compartmentalized and draw-out type.

6.7.2. Variation / Clarifications against the standard specification of MV Switchboard 6-51-0018, shall be as per the MOU agreed with EIL by respective motor manufacturer. No further deviations shall be entertained.

6.7.3. MV Switchboard shall have two incomers and 1 No. bus coupler. Ratings of outgoing feeders and their configuration shall be inline with the hardware datasheet document no. B240-910-16-50-DS-5014, Component datasheet document no. B240-910-16-50-DS-5015 and other EIL specifications attached.



- 6.7.4. Incomer at GT MCC shall be suitable for fault level of 50 kA (for 1 sec.). At least 20% spare outgoing feeders, subject to a minimum of 1 of each type shall be provided in GT MCC switchboard. For FVNR/FVR feeders, type and rating designation (e.g. FVNR-15, FVR-15, FVNR-15 HD etc. as per M.V. switchboard data sheet) shall be considered for working out number of spares. For switch fuse feeders, switch rating shall be considered for working out number of spares. Feeders in MCC shall be rated suitably considering 20% margin.
- 6.7.5. Bidder shall furnish a list of control cables to be provided by owner for signals exchanged between Bidder supplied equipment at substation and Bidder supplied field equipment as well as PLC along with Offer.
- 6.7.6. Bidder shall furnish the maximum operating power demand of GTC MCC for which owner's incoming cable has to be sized along with Offer.

6.8. DC SYSTEM

- 6.8.1. DC system envisaged shall meet the technical requirements of Datasheet no. B240-16-50-DS-5016 and EIL standard specification for DC System document no. 6-51-0019 and Inspection test plan 6-81-1019.
- 6.8.2. DC system shall be redundant system with 1 x 100% batteries as per Option-I of EIL specification for DC System document no.6-51-0019.
- 6.8.3. Batteries shall be Ni-Cd type with sufficient backup time. Backup time shall be decided by bidder based on the GT requirement. This time shall be adequately sufficient for Machine safety requirements.
- 6.8.4. All interconnecting cables among battery, Charger and DCDB shall be in bidder's scope.
- 6.8.5. DC System including DCDB shall be located in MCC room/ switchgear hall of nearest substation and their batteries shall be located in the battery room of nearest substation/ MCC Room. Distance between battery and charger shall be around 100m. Exact length shall be worked out during detailed engineering.

6.9. VARIABLE FREQUENCY DRIVE PANEL

- 6.9.1. The VFD system having converter input voltage rated 415V shall conform to EIL specification 6-51-0038 and datasheet no. B240-010-16-50-DS-5012.
- 6.9.2. Operator console on VFD (external port will be provided) shall have facility/port to connect external hardware such as Laptop etc. Console shall have facility for upload and download all parameter settings from one drive to another identical drive for start-up and operation. All the load parameters shall be visible at this operator console. In addition to that, manual alteration of load parameter can also be possible through this operator console.
- 6.9.3. Bidder shall ensure that, entire VFD module & its components (i.e. rectifier, inverter etc.) shall be procured from OEM only.
- 6.9.4. Following mentioned facilities/provision (min.) shall be provided in offered VFD panels:-

Interface with LCS

- Local start push button
- Local stop push button
- Local/remote selection switch with locking facility

- Run indication lamp
- Speed increase push button
- Speed decrease push button
- Trip indication lamp
- Ready to start indication lamp
- Ammeter (range: 0 to 150% of full load current of motor)

Interface with PLC/DCS

- Start/stop
- Start permissive.
- Speed setpoint.
- Current feedback.

Accordingly, control schematic of VFD panel shall be prepared.

6.9.5. Following indications/controls are to be provided in the facia panel of VFD

- a)Emergency STOP
- b)One no. emergency push button with locking arrangement to trip upstream feeding breaker
- c)Other control/metering/indication requirements as mentioned in EIL specification (6-51-0038)

6.9.6. For VFD panel, owner shall not provide any auxiliary power supply. Whatever is required shall be derived with in VFD only. Quantum of UPS control supply (110V) as required shall be furnished with Offer.

6.9.7. VFD shall be suitable for operation in non-air-conditioned environment at rated design ambient temperature. VFD shall be located in MCC Room/nearest substation. Distance between VFD to Motor shed shall be of the order of 250m approx.

6.9.8. Requirement of dedicated clean earth for VFD system (if any) and separate protective earthing is not envisaged. Vendor to confirm.

6.9.9. 240V, 1-Phase power supply to the motor space heater shall be derived from VFD. Necessary arrangement for these supplies shall be made available by vendor in VFD panels.

6.10. LOCAL CONTROL STATIONS

6.10.1. Flameproof control stations (IP-55) for all motors, emergency stop push buttons for motors as required for plant operation and safety etc., shall be provided by the vendor in accordance with standard specification no. 6-51-0006.

6.10.2. Outdoor area Local control stations shall have FRP canopies for additional weather protection.

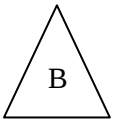
6.10.3. Following facilities shall be provided as a minimum on LCP/LCS:

- i). Start/Stop push buttons for all motors
- ii). Ammeters for motor above 5.5kW. Field ammeter shall be analogue type with mark of full load current (FLC) and 150% overload.

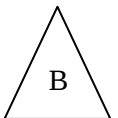
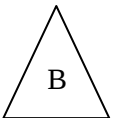
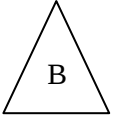
- iii). L-O-R (Local-Off-Remote) Selector switches as required Lockable type with key.
- iv). Field RPM meter shall be suitable for 0-110% of rated speed.

6.11. MISCELLANEOUS

- 6.11.1. Equipment like Lube oil filling pump, lubricating oil centrifuge, gas turbine washing system, trolley mounted pumps etc. shall be complete with flame proof motors and their flameproof starters suitable for use in Zone-2, Gas group (as applicable), Temp class T3, with armored copper conductor trailing cable. Motor starter shall have motor protections, other hardware such as switch, fuse, contactor and BMR etc.
- 6.11.2. Trolley mounted pumps shall be powered from a nearby 5 pin socket to be supplied by bidder.
- 6.11.3. Equipment earthing shall be done at 2 points and both earth connections shall be brought to an earth plate to be provided on the skid by the bidder. Further, Purchaser shall connect from skid earth plate to main plant earth grid.
- 6.11.4. All motors shall be earthed by two different connections using flexible braided GI wires with proper lugging as per Equipment earthing schedule.
- 6.11.5. All electrical equipment including cables, lighting fixtures etc. inside the turbine enclosure shall be suitable for the maximum temperature inside the turbine enclosure.
- 6.11.6. Gas turbine enclosure shall be provided with interior flameproof lighting fixtures wired to a switch mounted outside the enclosure. Flameproof 15A (SPN+E) power receptacles (Plug and socket) shall also be provided. *Lighting fixtures shall be flameproof type suitable for area classification & ambient temperature.* The fixtures shall be provided with mechanical protection and other accessories. Armoured cables shall be used inside the enclosure.
- 6.11.7. All imported equipment must be of reputed make and the equipment must have been operating satisfactorily for atleast 8000 hours and must have been supplied and in operation at minimum 2 installations.
- 6.11.8. Lux level for lighting design shall be as follows;
 - a. Instt and control faces: 300 Lux (Locally mounted on skid)
 - b. Turbine enclosure: 150 Lux.
- 6.11.9. Single point power supply (415V AC supply) shall be considered for oil filling pump, Lubrication oil centrifuge, gas turbine washing system. Further distribution to skid mounted electrical equipment shall be within the skids.
- 6.11.10. All material for aviation lights and lightning protection of all tall structures (stacks etc.) shall be included in bidder's scope.
- 6.11.11. Vendor shall supply Nickel plated brass double compression cable glands and tinned Cu crimping type lugs for equipment supplied by them. No cost / time implication shall be applicable on account of this). For outdoor equipment, double compression type Nickel plated brass flameproof cable glands shall be supplied. The size of cable glands supplied shall be appropriate to the size of cable.



- 6.11.12. All cable glands/ adapters/ blocking plugs for hazardous area equipment shall meet the requirements of IS/IEC: 60079-0.
- 6.11.13. All nuts and bolts shall be of stainless steel SS-304.
- 6.11.14. Prefabricated FRP canopy shall be provided for all outdoor equipment.
- 6.11.15. All hardware necessary for interfacing control system signals with *Bidder's* motors starters shall be in bidder's scope. Bidder shall furnish a sketch for the signals to be exchanged between Bidder's motor starters and bidder's local control panels (if any).
- 6.11.16. *All Electrical cables (Power, Control-(MCC to field equipment, MCC to I/O rack/DCS/PLC) shall be in purchaser's scope. However all cables required within skid shall be in bidder's scope. For Instrumentation cables refer Instrumentation part of MR. All Cable glands and Lugs required for termination shall be supplied by bidder.*
- 6.11.17. Bidder shall furnish a list of Power and control cables to be provided by Purchaser for signals exchanged between *Bidder's* motor starters and Bidder supplied field equipment and control room equipment. *Load list and tentative dimension of MCC, DC system (including Batteries), VFD etc. shall be furnished along with the offer.*
- 6.11.18. Exact cable sizes of power and control cables shall be finalized during detailed engineering. Provisions, as required in Vendor's equipment for termination of the same, shall be made accordingly without any cost & time implications to Owner.



7. INSPECTION AND TESTING AT MANUFACTURER'S WORKS

All major electrical equipment and material shall be subject to inspection by owner/ EIL/TPIA or authorized representative at manufacturers' works. Contractor/Vendor/ Sub-Vendor shall furnish all necessary information concerning the supply to owner/ EIL.

Type, routine and acceptance tests to be conducted on all equipment shall include all tests as specified in standard specifications, data sheets and ITPs enclosed with the MR.

All the equipment offered shall have valid type test certificates of recognized testing house such as CPRI, CMRI, BASEEFA or equivalent and valid CCOE approval.

8. Makes of Electrical Equipment/Component

The make of all electrical equipment shall be as below:-.

	Equipment	Acceptable makes
--	-----------	------------------

	Equipment	Acceptable makes
1	AC MV VFD	ABB Limited, Asea Brown Bovery Ltd (Abb Ltd), Baldor Electric Company Cg Power & Industrial Solutions Ltd. Danfoss Industries Pvt Ltd, Eurotherm Del India Pvt Ltd, Hitachi Hirel Power Electronics Pvt Ltd, Karl E Brinkmann Gmbh, L & T, Mediensa Corp, Nidec Asi Spa, Rockwell Automation India Pvt Ltd, Siemens Ag, Siemens Ltd Siemens Allis Energy Products, Toshiba Corp, Vacon Controls & Drives Pvt Ltd, Vacon Oyj
2	MV Motor (Indigenous)	ABB Limited, Bharat Bijlee Limited Crompton Greaves Ltd, Laxmi Hydraulics. Pvt Ltd, Kirloskar Electric Co Limited Marathon Electric Motor I Ltd
3	MV Motor (Imported)	Asea Brown Bovery Ltd (Abb Ltd), Nidec Asi Spa, Cemp Srl, Ge Power Conversion France Sas, Ge Canada Hitachi Ltd, Hyundai Heavy Industries Ltd Jeumont Sa / Framatone Anp, Lloyd Dynamowerke Gmbh & Co Ltd, Loher Gmbh. Siemens Ag, Toshiba Corporation, Toshiba Mitsubishi Electric Ind Co System, Weg Equipamentos Eletricos S.A, Weg Euro Idndustria Electrica Sa
4	Flameproof control stations/Junction box/Plugs/Sockets	Baliga Lighting Equipments (P) Limited. Flexpro Electricals Pvt Ltd. Flameproof Equipment pvt.Ltd. Fcg Power Industries Pvt Ltd. Fcg Flamproof Control Gears P. Ltd. Petroleum Safety Products Ind. Pvt. Ltd. Kaysons Techno Equipment P Ltd. Pepperl & Fuchs Manufacturing (India) Pvt Ltd Sudhir Switchgears Pvt Ltd.
5	MV Switchboard	ABB india Ltd, Controls & Schematics, GE Industrial Pvt Ltd. L & T Schneider Electric India Pvt Ltd. Siemens Ltd.

	Equipment	Acceptable makes
6.	DC System	Amara Raja Power Systems Borri Spa Chhabhi Electricals Pvt Ltd. Chloride Power Systems And Solutions Dubas Engineering Pvt Ltd. Hbl Power System Ltd Masstech Controls Pvt Ltd. Universal Instrument Mfg Co Pvt Ltd
.	Battery Ni-Cd	Amco SAFT India LTD HBL Power System Ltd
.	Flameproof Lighting Fixture	Baliga Lighting Equipments (P) Limited. Bajaj Electricals Ltd Flexpro Electricals Pvt Ltd. Flameproof Equipments Pvt.Ltd. Fcg Power Industries Pvt Ltd. Fcg Flameproof Control Gears P. Ltd. Petroleum Safety Products Ind. Pvt. Ltd. Kaysons Techno Equipment P Ltd. Pepperl & Fuchs Manufacturing (India) Pvt Ltd Sudhir Switchgears Pvt Ltd.

NOTES:

- Bidder may procure material from any of the Owner/EIL approved vendors. However, current validity and range of approval as per EIL enlistment letter, work-load, stability and solvency needs to be verified by the bidder before placement of order.
- Makes of items not covered above shall be subject to Owner/EIL's approval.
- Bidder may procure material from any of the Owner/ EIL approved vendors. However current validity and range of approval as per EIL enlistment letter, work load, stability and solvency needs to be verified by the bidder before placement of order. Intimation for the same shall be furnished along with PTR.
- Equipment shall be procured from OEM only. Channel partner/system house shall not be acceptable.**

9. LIST OF ATTACHMENTS:

SINo.	Title	Document No.	Rev.
1.	Data Sheet – MV Motors (DOL)	B240-910-16-50-DS-5010	A
2.	Data Sheet – MV Motors (VFD)	B240-910-16-50-DS-5011	A
3.	Data Sheet – MV VFD	B240-910-16-50-DS-5012	A
4.	Data Sheet – MV Switchboard	B240-910-16-50-DS-5013	A
5.	Data Sheet for MV Switchboard Hardware	B240-910-16-50-DS-5014	A

SINo.	Title	Document No.	Rev.
	Datasheet		
6.	Data Sheet – Load Data Format	B240-910-16-50-DS-5017	A
7.	Data Sheet Component Datasheet	B240-910-16-50-DS-5015	A
8.	Data Sheet Battery & Charger	B240-910-16-50-DS-5016	A
9.	Vendor Data Requirement	B240-910-16-50-VR-5010	A
10.	Specification for Flameproof Control stations	6-51-0006	5
11.	Specification for MV Switchboard	6-51-0018	5
12.	Specification for battery charger	6-51-0019	5
13.	Specification for MV Voltage Variable Frequency Drive System	6-51-0038	2
14.	Specification for stationary nickel cadmium batteries	6-51-0047	3
15.	Specification for MV Induction Motors	6-51-0064	1
16.	Specification for field inspection, testing and commissioning of electrical installations	6-51-0087	3
17.	Inspection & Test Plan for Flameproof Control stations	6-81-1006	3
18.	Inspection & Test Plan for MV Switchboard	6-81-1018	3
19.	Inspection & Test Plan for battery charger	6-81-1019	3
20.	Inspection & Test Plan for MV Motors	6-81-1032	5
21.	Inspection & Test Plan for MV Variable Frequency Drive System	6-81-1038	2
22.	Inspection & Test Plan for battery(Nickel Cadmium)	6-81-1047	2



TECHNICAL AMENDMENT NO. 01 -
INSTRUMENTATION
GAS TURBINE DRIVEN CENTRIFUGAL
COMPRESSOR PACKAGE
MR NO: B240-920-KA-MR-5010

DOCUMENT No.
B240-920-KA-MR-5010
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TECHNICAL AMENDMENT NO: 01
(INSTRUMENTATION)
TO
GAS TURBINE DRIVEN CENTRIFUGAL COMPRESSOR PACKAGE
MR NO:B240-920-KA-MR-5010
(PROJECT: GANDHAR COMPRESSOR M/S GAIL)

21.10.19	ISSUED AS AMENDMENT	PS	SR	PKS		
DATE	PURPOSE	BY	CHECKED	APPROVED	APPROVED	

SUBJECT : TECHNICAL AMENDMENT NO: 01 (INSTRUMENTATION)
BIDDING DOCUMENT NO. : GAS TURBINE DRIVEN CENTRIFUGAL COMPRESSOR
MR NO: B240-920-KA-MR-5010

The terms, conditions and specifications of Bidding Document stand modified to the extent indicated under column "MODIFICATIONS/ADDITION/DELETION". Corresponding implications of the same, else-where in the bid package/MR shall be taken care appropriately. All other terms & conditions, stipulations and specifications of Bidding Document shall remain unaltered.

S. no	Reference document	Item No./ Tag No.	Section	Clause No.	Subject	Modifications / Additions
1.	SCOPE OF WORK INSTRUMENTATION (Doc No: B240-910-16-51-SOW-5010)		Sheet 3 of 9	S.No 1.1.8		Addition: The following shall be added after " Integration Of Compressor.....systems": "Integration of Compressor control systems with existing DCS/PLC systems including up gradation (software and hardware) of existing DCS/PLC system for logics, graphics etc. and establishing all the serial links with existing DCS/PLC/SCADA (RTU). Compressor vendor to engage services GAIL's existing DCS/PLC vendor's services for integration activities and successful implementation of required logistics of GTC compressor with existing DCS/PLC. Existing DCS/PLC Make: Honeywell" Addition: The following shall be added as 4th Bullet point: Existing DCS/PLC vendor for integration activities, including establishing all the serial links with existing DCS/PLC/SCADA(RTU) and successful implementation of required logistics of GTC compressor"

TECHNICAL AMENDMENT NO. 01-
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2.	JOB SPECIFICATION INSTRUMENTATION (Doc No: B240-910-16- 51-SP-5010)	Sheet 21 of 22	S.No 11.9.4	Special Requirement	Modification: S. No 11.9.4 of Job Specification shall be read as: "Integration of Compressor control systems with existing DCS/PLC systems including up gradation (software and hardware) of existing DCS/PLC system for logics, graphics etc. and establishing all the serial links with existing DCS/PLC/SCADA(RTU). Compressor vendor to engage services GAIL's existing DCS/PLC vendor's services for integration activities and successful implementation of required logistics of GTC compressor with existing DCS/PLC. Existing DCS/PLC Make: Honeywell".