This job specification shall be completely filled-in, duly signed by supplier and enclosed along with offer.

OFFER FOR SPEED INCREASING GEAR BOX

PROJECT: ONGC URAN LEAN GAS

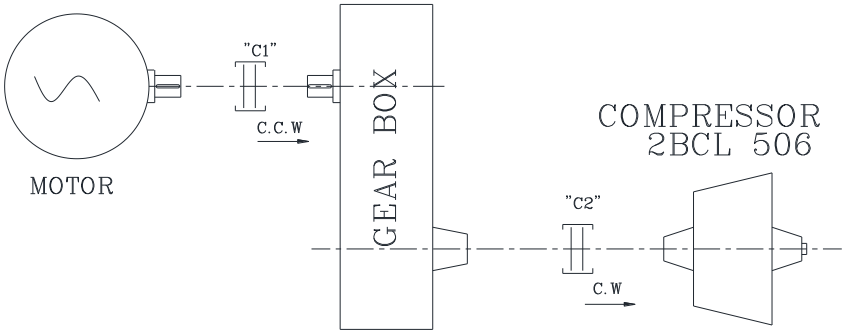
TYPE: _____

REF: _____

Technical Offer

MANUFACTURER: _____

"FIGURE 1"
CONFIGURATION



As shown in the above schematic the drive motor is provided with a Variable frequency drive (VFD) system to vary the output speed. The harmonics that may develop during startup, operation and shutdown of compressor due to VFD system shall be considered while designing the gearbox. These harmonics, gear box critical speeds and gear mesh frequencies shall not interfere with each other and shall be sufficiently away from operation speed range of the system.

TECHNICAL OFFER
OFFER FOR SPEED INCREASING GEAR BOX

1.0 Compressor train :
Enquiry / Indent No. : _____
Supplier : _____
Ref. No. of Supplier : _____

1.1.1 Gear Box Details

Configuration	:	Type-A of BHEL Spec TC 5 2203
Type of Driver	:	Electric Motor (With VFD)
Type of Driven Equipment	:	Centrifugal Compressor
Type of Gear	:	[✔] Speed Increaser [✔] Single Stage
Lay out (TC52203)	:	Type [✔] A [ ] B [ ] C [ ] D
Type of Gearing *	:	[ ] Single OR [ ] Double helical
Construction *	:	[ ] Cast OR [ ] Fabricated

1.1.2 Applicable Specifications: :
Gear Box : TC62646 / TC52203 / TC52204 / API613, 4th edition

1.1.3a) Design Parameters:

Driven Equipment Power	:	9372 KW
Driver Rating	:	10580 KW
Short Circuit Torque	:	Min [3] times of Nominal Torque
Gear Box Rating	:	11638 kW
Input Speed	:	1485 rpm
Output Speed	:	9989 rpm
MCS of Driven Equipment	:	10489 rpm
Nominal Torque (Gear)	:	7629 kgf-m (11638 KW @ 1485 rpm)
Gear Service Factor	:	1.7
Pinion Hardness (Case Hardened)	:	As Per API

Couplings- HS end dia. [Ø110] : Conical with 1:20 Taper (refer Notes below)

LS end dia. [Ø250] : [√] Cylindrical with [ ] one key [√] Two keys

: [ ] Conical with 1:20 taper (refer Notes below)

Notes

- Interference with shaft 2.5‰ (2.5 per thou)
- The shaft shall be machined for the applicable coupling size as per the dimensions provided in TC52204.
- The Taper Grinding of the shaft shall be carried out by using vendor's own shop gauges.

1.1.3b) Different operating conditions in case of VFD

S.no	Description	Compressor Power (kW)	Compressor Speed (rpm)
1	Max power and speed case	9372	9989
2	Min power and speed case	6392	9267

1.1.4 Installation : ☑ Out door ☐ Indoor

: ☑ Un heated

Max Allowable SPL. 85 dBa at 1m from the Machine
Ambient Temp. (Deg C) : Min: -10^{0}C Max: 38^{0}C
Relative Humidity : MAX : 85 MIN : 65

1.1.5 Gear sizing:

Mech Rating	KW	:	_*_____
Full Load Power Loss	KW	:	_*_____
Mech Efficiency	%	:	_*_____
Pitch Line Velocity	m/sec	:	_*_____
WR^2 referred to LSS	Kgm^2	:	_*_____
Starting torque required	Kgm	:	_*_____
GEAR Manufacture Method		:	_*_____
Gear Heat Treatment		:	Case Carburizing
Type of plating on Gear teeth (if Provided)		:	_*_____

1.1.6 Gear Data:

Power Loss		KW	:	_*_____
Heat to be removed		Kcal/hr	:	_*_____
Oil Supply	Bearings	L/m	:	_*_____
	Gear Mesh	L/m	:	_*_____
	Total	L/m	:	_*_____

1.1.7 Bearing details

Journal bearing (High Speed)
Type : Tilting Pad
Size : __*_____
Make : __*_____

Journal Bearing (Low Speed) :
Type : Tilting Pad/4 lobe/offset halves
Size : __*_____
Make : __*_____

Thrust Bearing (Low Speed) :
Type : Tilting pad with self-leveling features
Size : __*_____
Make : Kingsbury/eq.

Thrust Bearing (High Speed)# :
Type : Tilting pad with self-leveling features
Size : __*_____
Make : Kingsbury/eq.

- # Thrust bearing (High Speed) is applicable for Single helical Gear Box only.

1.1.8 Gear box connections:

LO inlet	Location	:	___*_____
	Size	:	___*_____
LO outlet	Location	:	___*_____
	Size	:	___*_____
Filter Breather	Location	:	Required
	Size	:	___*_____
Provision for coupling guard		:	Required

Remarks: * Furnish data required wherever "*" mark is indicated.

1.2 INSTRUMENTATION:

Area Classification (Tentative, will be confirmed at the time of order):
Ingress protection: **IP 65 min as per IEC 60529.**
Hazardous Area
IEC zone 1 Gas Gr IIA/B, T3
IEC zone 1 Gas Gr IIC, T3
IEC zone 2 Gas Gr IIA/B, T3
IEC zone 2 Gas Gr IIC, T3

☐
☐
☐
☑

a) RTD Material : Duplex RTD Platinum 100 Ω at 0°C 3 wire
Calibration : IEC 751

Quantity :

i) Journal Bearings — **2 RTDs per bearing**

ii) Thrust Brg. Low speed — **3 Shoes on active side & 2 Shoes on non-active side** should be provided with RTDs (Total 5 Nos for Double Helical ; 10 Nos for Single Helical)

b) Vibration Probes (provision) Qty **4** (2 on each Journal Bearing)

c) Axial Probes (provision) Qty **2** (1 at Thrust Bearing and ☐ on pinion shaft)

d) Key Phasor Probes (provision) Qty **2** (one each on high speed and low speed shaft)

e) Accelerometer (provision) Qty **2** (Refer ANNEXURE1)

Remarks: * Furnish data required wherever "*" mark is indicated.
(Refer Cl No.7 & 8 of standard specification for instrumentation details))

1.3 **MATERIAL CODES**

S.No	Description	Material Code
1	Gear Box	TC9762654013
2	Set of RTDs (Refer Note*)	TC9762654021
3	Set of High speed & Low speed Gears & Shaft Assembly(Refer Note**)	TC9762654030
4	Set of Radial Bearings	TC9762654048
5	Set of Thrust Bearings	TC9762654056
6	Set of Labyrinth Oil Seals	TC9762654064
7	Set of All Gaskets and O-Rings	TC9762654072

Note: The quantity for 01 (ONE) set is as follows:

* 01 (ONE) set contains total 06 (SIX) RTD's (03 nos RTD's for Journal Bearing and 03 nos RTD's for Thrust Bearing)

** LS and HS rotors can be supplied in single container, after considering respective coupling hub dimensions. Coupling hub dimensional details will be provided during detailed engineering after order placement. LS and HS rotors shall be supplied in N2 pressurized container.

1.4 INSPECTION & TESTING REQUIREMENTS

Gear box shall meet the Inspection/testing requirements as indicated below

	Required*	Observation	Third party witness	Test log
Shop Inspection (4.1.1.1)	✔	✔	✔	
Cleanliness Inspection (4.2.3.2)	✔			
Hardness Verification Inspection (4.2.3.3)	✔	✔	✔	✔
Dismantle - Reassembly Inspection (4.3.2.3.1)	✔		✔	
Contact Check (2.5.2.2)	✔	✔	✔	✔
Journal run out Check (2.5.2.1)	✔	✔		✔
Axial Stability Check (2.5.2.3) (for double helical Gear box)				
Rotor balancing machine sensitivity check (2.6.2.3)	✔		✔	
Residual unbalance check (2.6.6.2)	✔		✔	✔
Final assembly maintenance & running clearance (4.2.1.1.e)	✔		✔	✔
Mechanical run test (4.3.2)	✔		✔	✔
Mechanical run test (spare rotors) (4.3.2.4)				
Part or Full load & full speed Test (4.3.3.2)				
Full Torque, slow roll Test (4.3.3.2)				
Full torque static Test (4.3.3.3)				
Oil system cleanliness (4.3.2.1.3)	✔	✔		
Sound level test (4.3.3.5 item 5)	✔		✔	✔
Use shop lube system	✔			
Use shop vibration probes, etc	✔			
Oil system casing joint tightness (4.3.2.1.4)	✔	✔		

✔ To be Confirmed by Vendor
☐ Exception, if any to be indicated in the offer

Remarks: * Supplier shall carry out all the required tests and the data be recorded and **Submitted** to BHEL in approved vendor quality control system formats.

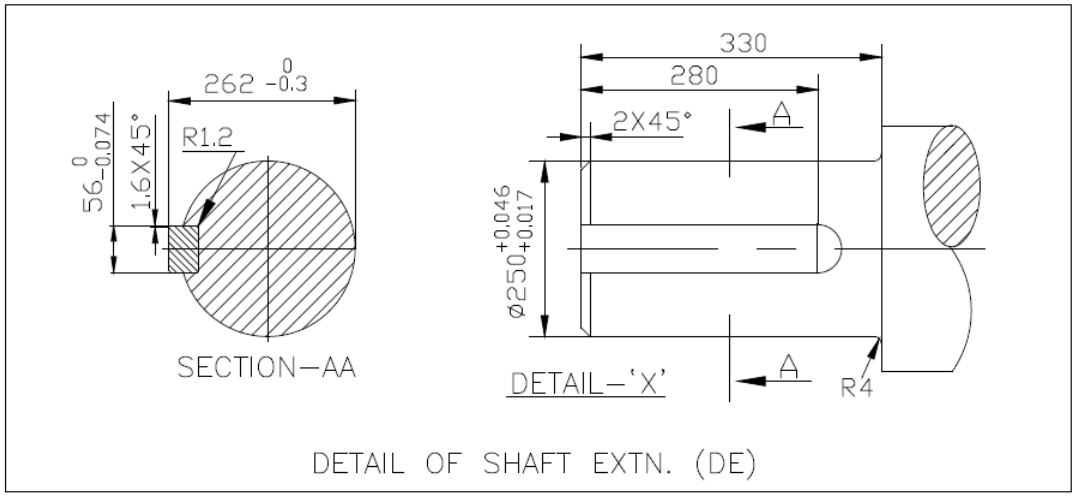
Wherever observation is indicated, the same shall be done by the End Customer

Note:

1. Clause Nos. mentioned above are referred to API 613

2. Third party Inspection shall be included in the offer.

1.5 Vendor shall note that following figure shows the shaft end detail for coupling between Motor and Gear Box



DETAIL OF SHAFT EXTN. (DE)

No of Keys On Gear Shaft is 2.

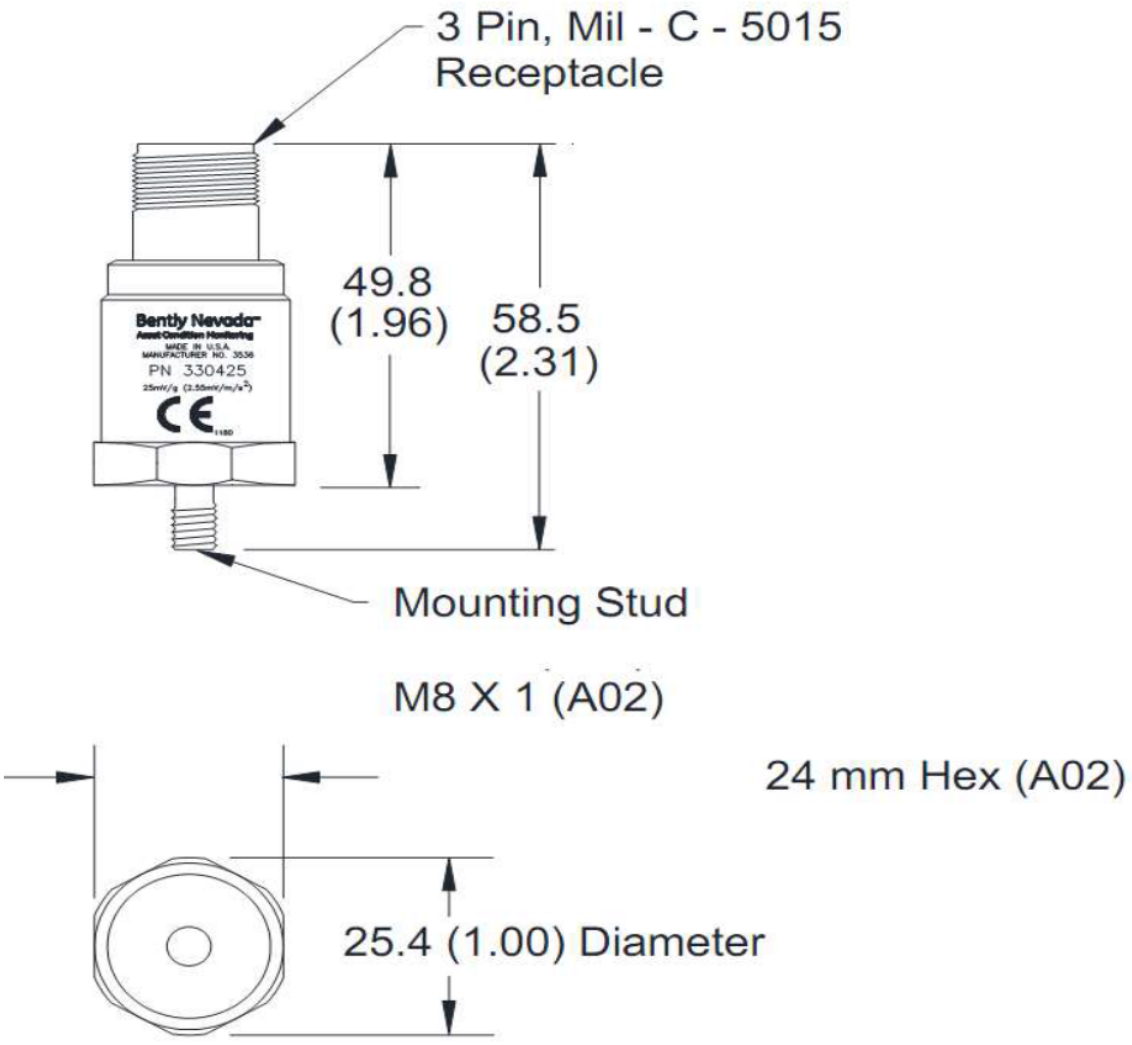
1.6 Special Notes

Clause 9 of TC52203 is replaced as follows:-

Acceptance Criteria for Gearbox the offered gearbox models shall be of proven design and shall be from the gear box manufacturer's existing regular production range. Each of the gear box model offered shall be identical or validly similar as compared to at least TWO UNITS designed, manufactured, tested and supplied by the vendor earlier from the proposed manufacturing plant, out of which at least one unit shall have been working under similar service conditions as required in this enquiry and must have completed 8000hrs of satisfactory operation on a continuous duty basis without any major over haul as on the date of issue of inquiry.

ANNEXURE-1

D	**Accelerometer (Gear Box)**			
1	Probe Type (330400 Series)		:	330400-02-05
2	Probe Qty / Tag No	[2] Nos.	:	TBA
3	Mounting		:	Standard
4	Unthreaded Length (mm)-A		:	NA
5	Case Length (mm)-B		:	NA
6	Case Threading		:	M8x1
7	Total Length (meter)-C		:	NA



RECORD OF REVISIONS

Rev. No.	Date	Revision details	Revised	Approved
00	01.12.2018	New standard prepared	RNR	YVRL