

TD-106-1
Rev.5

Form No.



**PRODUCT STANDARD
TURBINES & COMPRESSORS
HYDERABAD**

TC-6-2630

Rev.No. 01

SHT 1 OF 8

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

OFFER FOR SPEED INCREASING GEAR BOX

PROJECT: RCF THAL AMMONIA

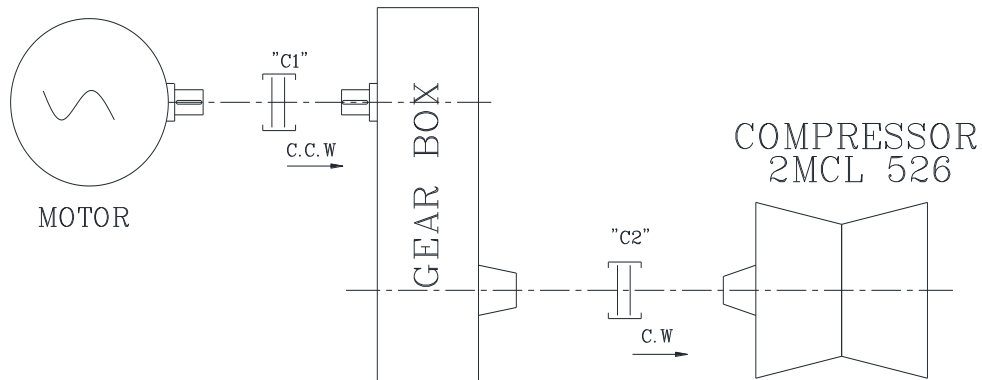
TYPE: _____

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.

COPYRIGHT AND CONFIDENTIAL

The information on this document is the property of BHARAAT HEAVY ELECTRICALS LIMITED
It must not be used directly or indirectly in any way detrimental to the interest of the company

Ref. Doc

Rev No.
00Revisions:
Refer to record of revisionsPrepared:
KVSApproved:
YVRLDate:
01.06.2018

RESTRICTED USE



Jun Wed 13 16:18 2018

Printed by : M SURENDAR REDDY-FM2639 / 6234194 on 02-07-18 12:55:36

This Drawing is printed from Engineering Digital Archive System (EDAS).
User login signature and password are required.



PRODUCT STANDARD TURBINES & COMPRESSORS HYDERABAD

TC-6-2630

Rev.No. 01

SHT 2 OF 8

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 : TC62630 / TC52203 / TC52204 / API613, 5th edition

1.1.3a) Design Parameters:

Driven Equipment Power : 3921 KW
 Driver Rating : 4800 KW
 Short Circuit Torque : Min times of Nominal Torque
 Gear Box Rating : 5280 KW
 Input Speed : 1485 rpm
 Output Speed : 9745 rpm
 MCS of Driven Equipment : 10232 rpm
 Nominal Torque (Gear) : 3461 kgf-m (5280KW @ 1485 rpm)
 Gear Service Factor : 1.6
 Pinion Hardness (Case Hardened) : As Per API

Couplings- HS end dia. : Conical with 1:20 Taper (refer Notes below)
 LS end dia. : ☒ 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.

COPYRIGHT AND CONFIDENTIAL
 The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED
 It must not be used directly or indirectly in any way detrimental to the interest of the company



PRODUCT STANDARD TURBINES & COMPRESSORS HYDERABAD

TC-6-2630

Rev.No. 01

SHT 3 OF 8

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	3921	9745
2	Min power and speed case	2616	9012

Speed variation from 80% to 105% of Rated speed (9745rpm)

1.1.4 Installation

: ☒ Out door ☐ Indoor: ☒ Un heated

Max Allowable SPL.

85 dBa at 1m from the Machine

Ambient Temp. (Deg C)

: Min: 11°C Max: 45°C

Relative Humidity

: 100 % @ 45°C & - % @ - °C

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		:	<u>Case Carburizing</u>
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.

COPYRIGHT AND CONFIDENTIAL
The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED
It must not be used directly or indirectly in any way detrimental to the interest of the company

Ref.Doc

RESTRICTED USE





PRODUCT STANDARD **TURBINES & COMPRESSORS** **HYDERABAD**

TC-6-2630

Rev.No. 01

SHT 4 OF 8

COPYRIGHT AND CONFIDENTIAL
The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED
It must not be used directly or indirectly in any way detrimental to the interest of the company

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 : Thermocouple ‘K’ Type
 Calibration : IEC 60584 & ANSI MC 96.1

Quantity :

- i) Journal Bearings **2 RTDs per bearing**
 Thrust Brg. Low speed **3 Shoes on active side &**
 ii) **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 CI No.7 & 8 of standard specification for instrumentation details))

1.3 MATERIAL CODES

Var No	Description	Material Code
01	Gear Box	TC9762630017
02	Set of Gear Box LS rotor in N2 pressurized container (Refer Note**-2)	TC9762630025
03	Set of Gear Box HS rotor in N2 pressurized container (Refer Note**-2)	TC9762630033
04	Set of radial bearings	TC9762630041
05	Set of Thrust bearings	TC9762630050
06	Set of RTDs for GB for spares (Refer Note**-1)	TC9762630068
07	Set of Oil Seals	TC9762630076



PRODUCT STANDARD TURBINES & COMPRESSORS HYDERABAD

TC-6-2630

Rev.No. 01

SHT 5 OF 8

**** Notes:**

- (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.
- MRT for spare rotors (LSS and HSS) is applicable.

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:

- Clause Nos. mentioned above are referred to API 613
- Third party Inspection shall be included in the offer.

COPYRIGHT AND CONFIDENTIAL
The information on this document is the property of BHARAAT HEAVY ELECTRICALS LIMITED
It must not be used directly or indirectly in any way detrimental to the interest of the company

Ref.Doc

RESTRICTED USE





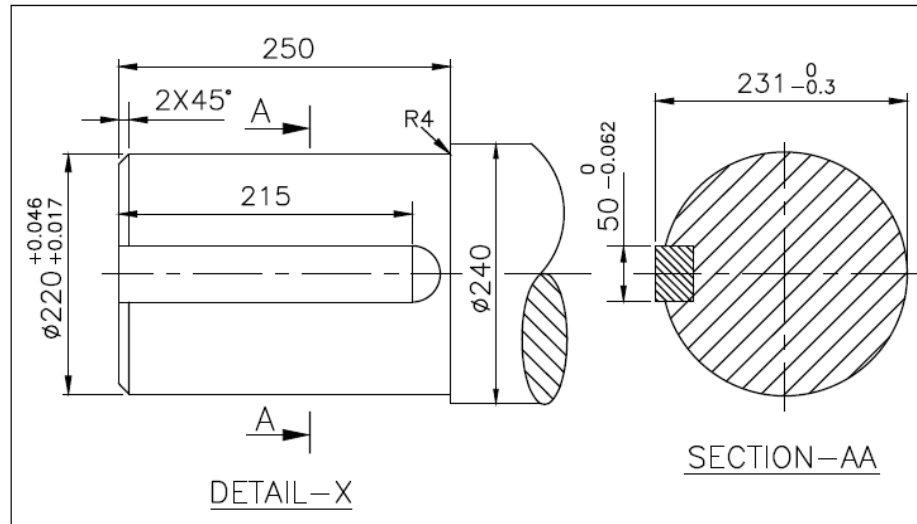
**PRODUCT STANDARD
TURBINES & COMPRESSORS
HYDERABAD**

TC-6-2630

Rev.No. 01

SHT 6 OF 8

- 1.5** Vendor shall note that following figure shows the shaft end detail for coupling between Motor and Gear Box. Gear Box side coupling hub shall have two keys



COPYRIGHT AND CONFIDENTIAL

The information on this document is the property of BHARAAT HEAVY ELECTRICALS LIMITED. It must not be used directly or indirectly in any way detrimental to the interest of the company.

Ref.Doc

RESTRICTED USE

**PRODUCT STANDARD**
TURBINES & COMPRESSORS
HYDERABAD

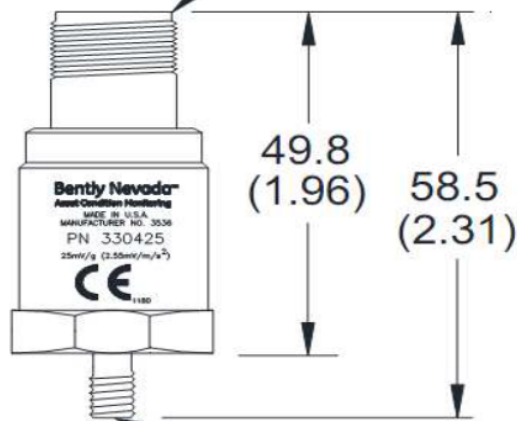
TC-6-2630

Rev.No. 01

SHT 7 OF 8

ANNEXURE-1**D Accelerometer (Gear Box)**

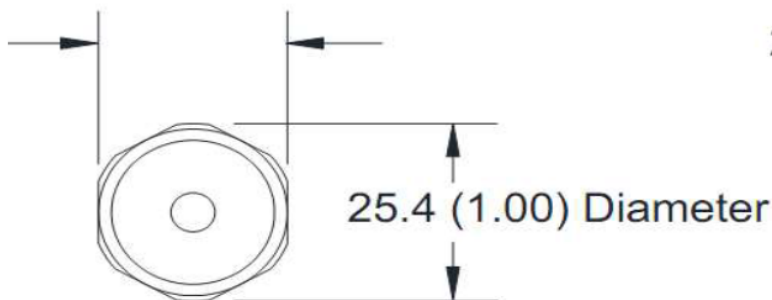
1	Probe Type (330400 Series)	:	330400-02-05
2	Probe Qty / Tag No	[2] Nos. :	TBA
3	Mounting	:	Standard
4	Unthreaded Length (mm)-A	:	NA
5	Case Length (mm)-B	:	NA
6	Case Threading	:	M8x1
7	Total Length (meter)-C	:	NA

3 Pin, Mil - C - 5015
Receptacle

Mounting Stud

M8 X 1 (A02)

24 mm Hex (A02)



COPYRIGHT AND CONFIDENTIAL

The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED
It must not be used directly or indirectly in any way detrimental to the interest of the company

Ref.Doc

RESTRICTED USE



TD-106-2
Rev.5

Form No.



PRODUCT STANDARD

TURBINES & COMPRESSORS

HYDERABAD

TC-6-2630

Rev.No. 01

SHT 8 OF 8

COPYRIGHT AND CONFIDENTIAL

The information on this document is the property of BHARAAT HEAVY ELECTRICALS LIMITED
It must not be used directly or indirectly in any way detrimental to the interest of the company

RECORD OF REVISIONS

Rev. No.	Date	Revision details	Revised	Approved
00	01.06.2018	New standard prepared	KVS	YVRL
01	13.06.2018	RTD material revised	KVS	YVRL

Ref.Doc

RESTRICTED USE

Printed by : M SURENDAR REDDY-FM2639 / 6234194 on 02-07-18 12:55:36

This Drawing is printed from Engineering Digital Archive System (EDAS).
Further signatures and approvals required.