BHARAT HEAVY ELECTRICALS LIMITED

MATERIALS MANAGEMENT/BOUGHT OUT ITEMS

CORRIGENDUM

Date: 21.07.2025

TENDER REFERENCE: 1802500187

TENDER ID: 2025_BHEL_50535_2

Enquiry for Establishing a Rate Contract for Main Drives for Gravimetric Feeder

Following Corrigendum is issued

1. For Item SI NO. 2: Main Drives with Gear Ratio 200: 1 shall be as per Specification: GF-351/Rev06.

BHARAT HEAVY ELECTRICALS LIMITED

TIRUCHIRAPPALLI-620 014

Fuel Systems/PE (FB)

Rev. No.	Rev. Date	Description	Chd. & Appd.
06	26/08/2016	Updated for indicating reference to annexure-1 for project specific Energy Efficiency Class requirements	Arul Prabhu.R
05	31/12/2014	Updated for standard IS-12615/ IEC 60034-30,motor efficiency & Vibration clauses, location of earthing points, TTR requirements	Arul Prabhu.R
04	02/04/2011	In page No.04/15 Cl.No.5.4.0 Reduction ratio 80:1(Style-04) added.	J.V.V.A.K
03	05/10/2010	In page No.04/15 Cl.No.5.4.0 Reduction ratio 100:1 added.	J.V.V.A.K
02	24/08/2007	In page No.04/15 Cl.No.5.4.0 Reduction ratio 203:1 added	S.Selva
01	23/10/2006	In page 15/15, note 1 altered.	J.V.V.A.K.

	Name	Signature			Date
Prepared	JVVA / DVK / DMB				
Checked	JVVA / DVK / DMB				
Approved	SDB / KAK				

CONTENTS:

1.0 SCOPE OF WORK

1.1 This specification covers the requirements for the design, supply, manufacture, testing, marking and identification, packing for shipment and delivery of the items listed below.

- Feeder main drive AC motor with tacho generators.
- Gear box

1.2. The extent of supply stated herein is not necessarily exhaustive and shall not relieve the vendor from his responsibility to provide goods and services necessary to satisfy the performance criteria and guarantees specified.

2.0 APPLICATION

2.1 Feeder main drive AC motor and gear box used for driving the conveyor belt (loaded with coal) of 36" Gravimetric feeders at varied speeds.

3.0 AC INDUCTION MOTOR – (Suitable for variable frequency control application)

3.1	Motor rating	: 7.5 KW
3.2	Applicable standard	: IS-12615/ IEC 60034-30 (All routine & type test as per relevant standards shall be performed)
3.3	Type of mounting	: Vertical flange mounting
3.4	Type of motor	: Squirrel cage induction motor – Inverter duty
3.5	Enclosure protection	: IP-55
3.6	Power supply	: Refer to Annexure-A
3.7	Speed range required	: 0-1400 RPM corresponding to demand signal of 4-20 mA.
3.8	Allowable variation in speed	: ± 5 RPM
3.9	Duty cycle	: Continuous (S1)
3.10	Type of enclosure	: Totally enclosed fan cooled
3.11	Method of starting	: Direct on line
3.12	Class of insulation	: Class-F, Temperature rise limited to Class-B
3.13	Full load torque	: 3.8 Kg-m (minimum)

3.14 Starting torque : 200% full load torque (minimum)

3.15 Efficiency Clause : Motor shall be Energy Efficient motors, For applicable Efficiency class refer Anneuxure-1 for project specific requirements.

3.16 Vibration shall be limited within the limits prescribed in IS:12075 / IEC 60034-14.

3.17 Motor body shall have two earthing points on opposite sides.

3.18 Motor winding shall be VPI (vacuum pressure impregnation) treated.

3.19 Motors shall be suitable for variable frequency control and shall match with the drive in respect of over voltage / spikes generated by the controller.

3.20 The windings shall be VPI treated and two coat enamelled. These motors shall be sized to operate satisfactorily under lowest speed conditions.

4.0 TACHOGENERATOR:

4.1 Two numbers of Tacho generator shall be in-built at the drive end of AC motor to give redundant isolated output as given below :

4.2 Output into 10K Ohm load : 45 V AC ± 5% at 1000 RPM

4.3 Number of poles : 24

4.4 Output waveform : Sinusoidal

5.0 GEAR REDUCER:

5.1.0 Type : Large speed reduction, flange mounted compact gear reducer with one or two stages of spur or helical gears and last stage of worm gear reduction. The approximate centre distance of worm gearing is 184 mm (7 1/4").

5.2.0 Duty class : Continuous

5.3.0 Direction of rotation : Should be able to rotate in both directions

5.4.0 Reduction ratio :

5.4.1 Style 01 : 128:1

5.4.2 Style 02 : 203:1

5.4.3 Style 03 : 100:1

5.4.4 Style 04 : 80:1

Refer Annexure A for Project specific main drive gear ratio

5.5.0 Arrangement & Dims: Refer Sketch nos. 1, 2, 3 & 4.

5.6.0 Function : The gear reducer is used to drive the conveyor belt of gravimetric feeders.

Since gravimetric feeder is a variable slow speed equipment, VFD motor will be connected to the input side of gear reducer and the output shaft of the gear reducer will be coupled to the drive pulley of the feeder conveyor belt. The gravimetric feeder is a constant torque equipment.

.TECHNICAL REQUIREMENTS:

5.7.1 Output shaft and mating flange dimensions are strictly to be maintained as shown in the sketches 1, 2, 3 & 4 (page 11, 12, 13 & 14 of this specn.).

5.7.2 Dimensions with asterisk marks (*) should be strictly maintained. Other dimensions may be altered to suit the gear box design with the approval of BHEL.

5.7.3 In addition to dipstick arrangement, glass type oil level indicator must also be provided.

5.7.4 All gears, pinion, shafts are to be subjected to ultrasonic testing and MPI after machining.

5.7.5 Backlash of gear wheels and pinion and teeth contact before functional testing (no load run test) shall be checked.

5.7.6 Materials used shall be of tested quality and shall be correlated with test certificates for the mechanical and chemical properties.

5.7.7 Gear box shall be run tested till the bearing temperatures are stabilised and for a minimum of 4 hours and checks for smooth running, temperature rise, noise level etc. shall be carried out.

6.0 TESTING:

6.1.0 The total drive assembly with gear box should be trial run for minimum 8 hours continuously and observed for its smooth, noiseless and vibration-free running.

6.2.0 Test certificate for no load test for each assembly shall be furnished

6.3.0 Applicable QP for feeder drive Assy. QA:CI:STD:QP:21 (Latest revision)

7.0 DOCUMENTS:

7.1.0 The following documents shall be submitted in triplicate along with the offer.

7.1.1 Compliance for each clause of this specification & applicable Quality Plan.

7.1.2 Compliance for flange dimensions in the enclosed Sketch no.-05.

7.1.3 Catalogues for the offered drives.

7.1.4 Dimensional general arrangement drawing with bill of materials and total weight.

7.1.5 Exploded view of the gear box showing all the internals and spare parts with overall dimensions and bill of materials. The bill of materials shall also contain details of bought-out items like bearings, oil seals, circlips etc.

7.1.6 A list of spare parts for 3 years operation with details for ordering like part number, quantity and price.

7.2.0 The following documents shall be submitted in triplicate by the Successful Bidder, within 15 days from PO, for BHEL's review / approval.

7.2.1 Motor data sheet and characteristic curves in Annexure - A .

7.2.2 Tachogenerator data sheet and characteristic curves in Annexure - C.

7.2.3 Dimensional drawing for motor & Tachogenerator.

7.2.4 Type test certificate for applicable motor frame size. Type test certificates not earlier than 5 years from date of enquiry.

7.2.5 Dimensional general arrangement of total assembly drawing and cross sectional drawing with detailed bill of material as called for in clauses 7.1.4 and 7.1.5 and submitted by the bidder shall be modified inline with BHEL's comments and BHEL's approval shall be obtained before manufacture.

7.2.6 Twenty numbers of Operation and maintenance manuals covering all aspects of storage, preservation, installation, operation and maintenance shall form part of the supply.

8.0 OTHER INFORMATION REQUIRED:

8.1.0 Weight of motor.

8.2.0 Weight of gear box.

8.3.0 Lubrication details.

8.4.0 Painting details.

8.5.0 Mounting arrangement of tachogenerator on the output shaft of AC motor.

8.6.0 Recommended storage and preservation procedure prior to assembly and after assembly but prior to regular running.

9.0 PACKING:

The total drive assembly should be packed in such a way that it should not get damaged during transport. The total assembly should be properly covered with thick tear-proof polythene sheet and despatched in suitable moisture-proof and tamper proof wooden crates.

10.0 DATA SHEETS

PURCHASE ORDER No. & DATE :

10.1 ANNEXURE - A

10.1.0 Technical Data Sheet for AC motor suitable for VFD application

10.1.1 Application : Gravimetric Feeder main drive motor

10.1.2 Manufacturer :

10.1.3 Type, Frame size, Duty cycle :

10.1.4 Type of mounting : Vertical Flange Mounting

10.1.5 Degree of protection and method of cooling : IP-55 TEFC

10.1.6 Rated output in KW and speed in RPM :

10.1.7 Ambient Temperature : 50°C

10.1.8 Rated Voltage & Frequency : 415V, 3 Phase, 50HZ

10.1.9 Allowed variation in
Voltage : ± 10%
Frequency & : ± 5%
Combined variation : 10% Absolute sum

10.1.10 Full load current :

10.1.11 Rated torque :

10.1.12 Starting torque in % of FLT (FLT - Full Load Torque) :

10.1.13 Pull-up torque in % of FLT :

10.1.14 Pull-out torque in % of FLT :

10.1.15 No Load starting time :

10.1.16 Minimum permissible starting voltage : 80% of Rated Voltage

PURCHASE ORDER No. & DATE :

10.1.17 Power Factor at rated frequency & voltage
- a) 100% Load :
- b) 75% Load :
- c) 50% Load :
- d) No Load :

10.1.18 Efficiency at rated voltage & frequency

- a) 100% Load :
- b) 75% Load :
- c) 50% Load :
- d) No Load :

10.1.19 Starting current at
- 100% Rated voltage :
- 80% Rated voltage :

10.1.20 Starting time — 80% Voltage — 100% Voltage
- a) with driven eqpt.coupled :
- b) without driven eqpt. :

10.1.21 Safe stall time in seconds — Hot condition — Cold condition
- a) at 80% rated voltage :
- b) at 100% rated voltage :
- c) at 110% rated voltage :

10.1.22 Limiting rotor temperature to determine safe stall time :

10.1.23 Stator winding resistance per phase :

10.1.24 Moment of Inertia :

10.1.25 Method of starting :

10.1.26 Thermal time constant :

10.1.27 Number of starts/hour
- Equally spread :
- Successive hot :
- Successive cold :

10.1.28 Permissible running time at :

full load at 75% R.V

10.1.29 Permissible vibration limits :

10.1.30 Class of insulation :

10.1.31 Material and treatment of insulation :

10.1.32 Temperature rise by resistance method :

10.1.33 Stator winding connection :

10.1.34 No.of terminals brought out :

10.1.35 Terminal box location and angle of rotation :

10.1.36 Fault withstanding capability:

10.1.37 Bearings	Drive end	Non-drive end
a) Type of bearing :		
b) Manufacturer :		
c) Model number :		
d) Life in hours :		
e) Recommended lubricant :		

10.1.38 Method of coupling with driven equipment :

10.1.39 Weight of motor :

10.1.40 Documents enclosed (After P.O)

a) Speed - Torque curve at 110%, 100%, 90% & 80% Rated Voltage
b) Starting time Vs Speed curve
c) Current Vs Time curve
d) Speed Vs Current curve
e) Thermal withstand curve for hot and cold condition
f) Efficiency, power factor Vs Load curve
g) Dimensional drawing and terminal wiring drawing.

Signature of Vendor Representative

PURCHASE ORDER No. & DATE :

10.2 ANNEXURE - B

9.3.0 Technical Data Sheet for Tachogenerators

9.3.1 Make & type of Tachogenerator :

9.3.2 Model number :

9.3.3 Class of insulation :

9.3.4 Output voltage with variation in output voltage :

9.3.5 Output voltage waveform :

9.3.6 Frequency of output voltage :

9.3.7 Max. load resistance at output :

9.3.8 Stator resistance :

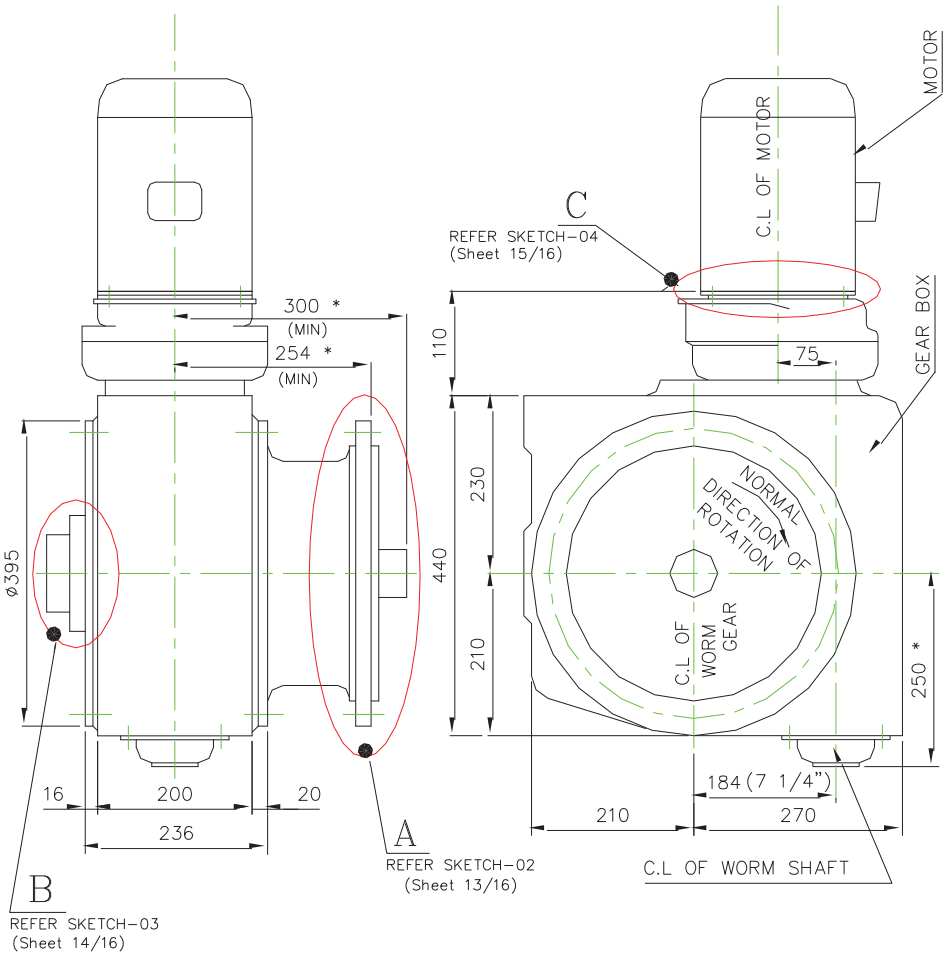
9.3.9 Linearity :

9.3.10 Documents (After P.O)

a) Dimensional drawing for the tachogenerator
b) Output voltage & frequency Vs Speed.

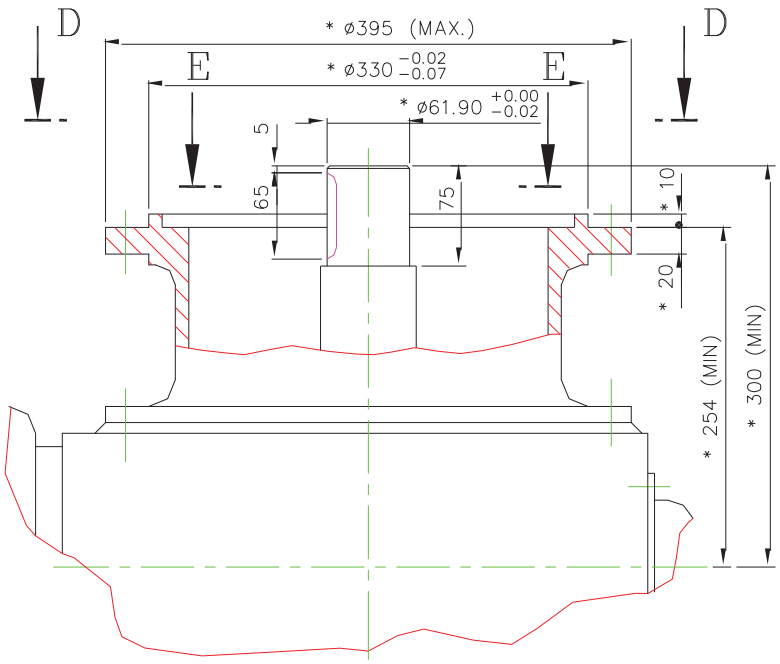
Signature of Vendor Representative with seal

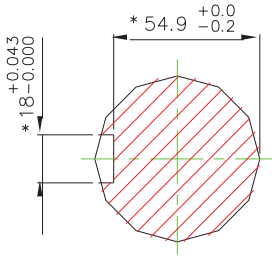
SKETCH NO: – 01



ALL DIMENSIONS ARE IN MM

SKETCH NO: – 02

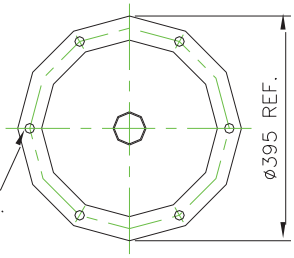




SECTION – EE

DETAIL – A

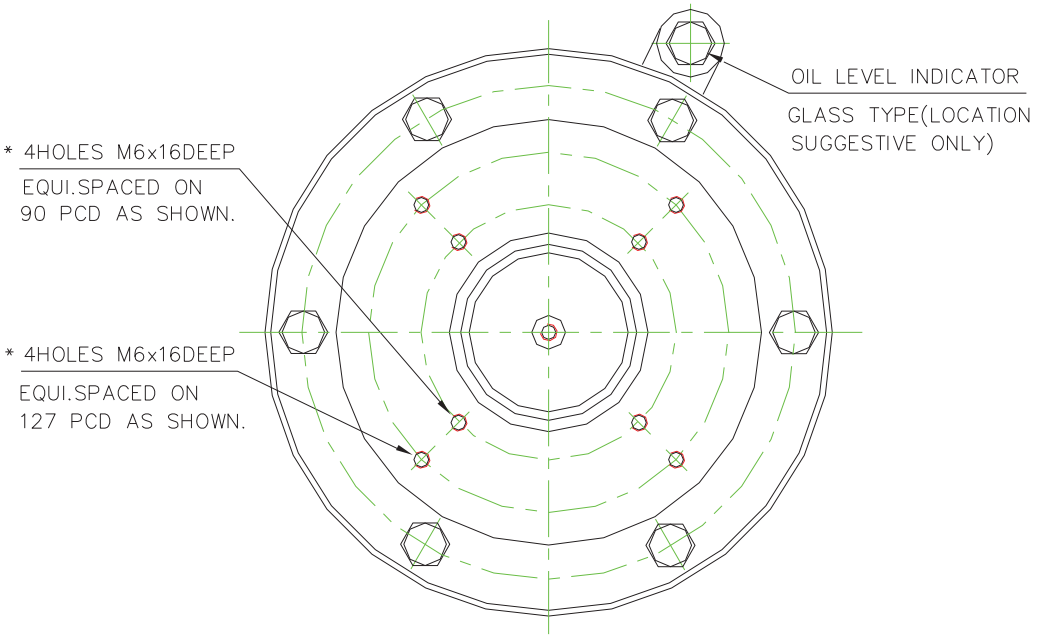
* 6HOLES ø18 ON 362 PCD EQUI SPACED AS SHOWN.

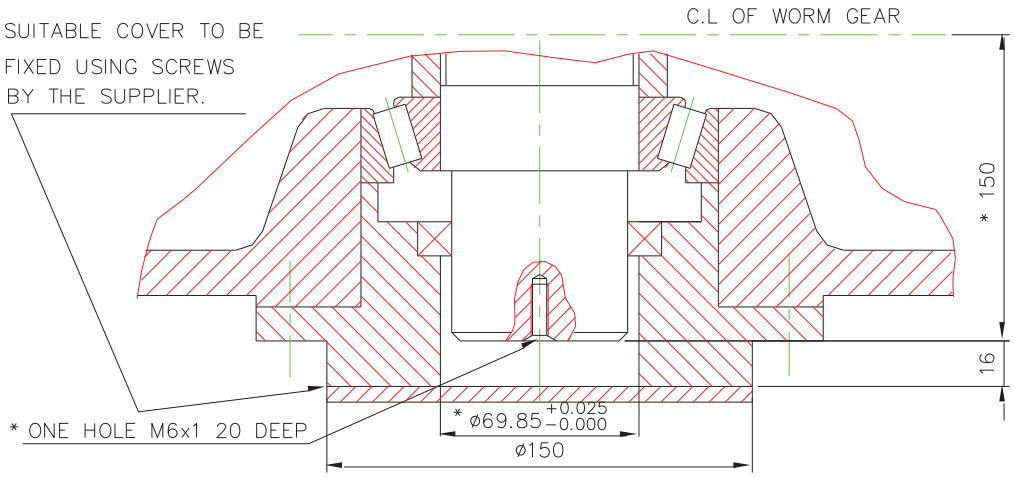


VIEW – DD

ALL DIMENSIONS ARE IN MM

SKETCH NO.–03



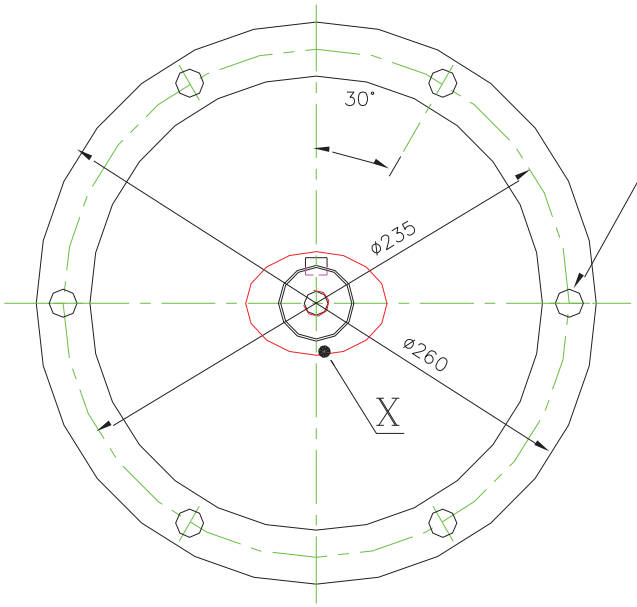


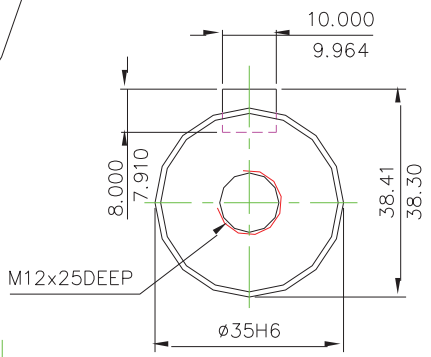
DETAIL–B

ALL DIMENSIONS ARE IN MM

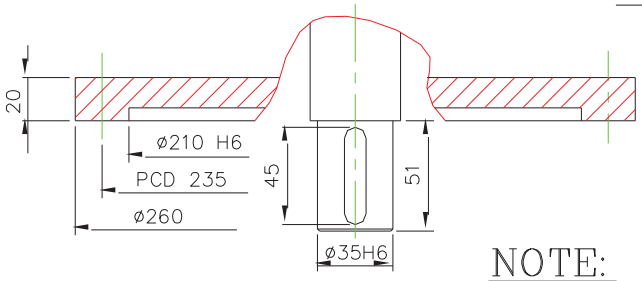
SKETCH NO.–04

MATING FLANGE AND SHAFT DETAIL (GEAR BOX INPUT SIDE)





DETAIL–X

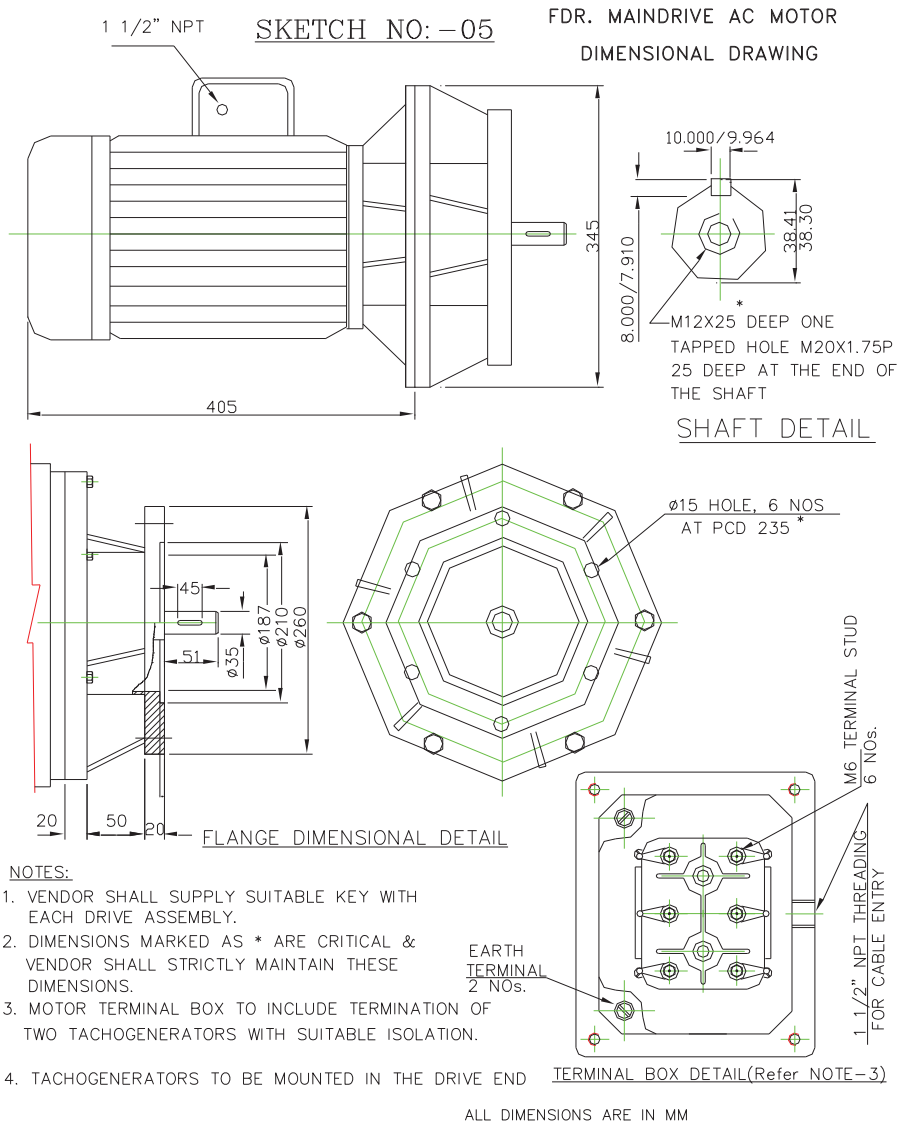


DETAIL–C

NOTE:

THE DIMENSIONS OF THE INPUT SIDE FLANGE AND PINION OF THE GEAR BOX SHALL MATCH WITH THE MATING DIMENSIONS OF VFD MOTOR AS SHOWN ABOVE.

ALL DIMENSIONS ARE IN MM



NOTES:

1. VENDOR SHALL SUPPLY SUITABLE KEY WITH EACH DRIVE ASSEMBLY.
2. DIMENSIONS MARKED AS * ARE CRITICAL & VENDOR SHALL STRICTLY MAINTAIN THESE DIMENSIONS.
3. MOTOR TERMINAL BOX TO INCLUDE TERMINATION OF TWO TACHOGENERATORS WITH SUITABLE ISOLATION.
4. TACHOGENERATORS TO BE MOUNTED IN THE DRIVE END

ALL DIMENSIONS ARE IN MM

BHARAT HEAVY ELECTRICALS LIMITED / TIRUCHIRAPPALLI
CONTROLS AND INSTRUMENTATION/QA/FB

STANDARD QUALITY PLAN
FOR
FEEDER DRIVE ASSEMBLY AND

CLEANOUT CONVEYOR ASSEMBLY

REV	DATE	PREPARED	REVIEWED	APPROVED	REVISION HISTORY
00	----	--- Sd ---	--- Sd ---	--- Sd ---	Initial release
01	----	--- Sd ---	--- Sd ---	--- Sd ---	Standards include
02	----	--- Sd ---	--- Sd ---	--- Sd ---	General Included
03	01.06.96	--- Sd ---	--- Sd ---	--- Sd ---	CHP included
04	16.06.97	--- Sd ---	--- Sd ---	--- Sd ---	Formet Revised
05	21.03.02	--- Sd ---	--- Sd ---	--- Sd ---	Department name changed, CTQ requirements added & General revision.
06	08.01.04	RM.VAIRAVAN	N.SRIDHAR	S.SOMASUNDARAM	Revised to include the comments /Feedback of internal discussion.

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS	TYPE OF CHECK	QUANTUM OF CHECK	REF.DOC. & ACCEPTANCE STANDARD	FORMAT OF RECORD	AGENCY	REMARKS
A.	**FINISHED PRODUCT INSPECTION**							
1.	Motor	Routine & type test as per IS 325	ELEC	100%	PO, Specification & IS 325	T.C.	MQCD	
2.	Clutch * routine test	a) Verification for provision of accessories like louver wire mesh , lifting eye bolt, PVC sheathed flex, conduit connector, etc.	VISU	- do -	Specification PO & Data Sheet	- do -	- do -	
	⇒	b) High Voltage test	ELEC	- do -	1.5 KV for 1 sec. No failure.	- do -	- do -	
	⇒	c) Insulation resistance measurement	ELEC		Specification , & Data Sheet Minimum, 50 mega ohm with 500V megger			
		d) Measurement of coil resistance	ELEC	- do -	+/- 5% of rated value.	- do -	- do -	
		e) No load test	ELEC	- do -	- do -	- do -	- do -	
3.	Tacho generator Routine test	a) Number of tacho generator	VISU	- do -	Specification & data sheet	- do -	- do -	

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS	TYPE OF CHECK	QUANTUM OF CHECK	REF.DOC. & ACCEPTANCE STANDARD	FORMAT OF RECORD	AGENCY	REMARKS
		b) Verification for number of poles.	VISU	100%	Specification & data sheet	T.C.	MQCD	
		c) Measurement of stator winding / coil resistance	ELEC.	- do -	- do -	- do -	- do -	
		d) Dimensional verification	MEAS	- do -	- do -	- do -	- do -	
		e) High Voltage test	ELEC.	- do -	1KV DC for 1sec. No Failure	- do -	- do -	
		f) Measurement of insulation resistance.	ELEC.	- do -	- do -	- do -	- do -	
	⇒	g) Speed Vs output voltage chart & output waveform (Performance test)	ELEC.	- do -	wave shall be sinusoidal linearity within +/- 1%	- do -	- do -	
4.	Motor-clutch tacho assembly testing * 1) Routine tests	a) Verification of name plate rating for motor clutch & tacho Generator.	VISU.	- do -	Specification & Data sheet	- do -	- do -	**C H P**
		b) Verification for provision of accessories like louver, wire mesh, lifting eyebolt etc.	VISU.	- do -	- do -	- do -	- do -	**C H P**

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS	TYPE OF CHECK	QUANTUM OF CHECK	REF.DOC. & ACCEPTANCE STANDARD	FORMAT OF RECORD	AGENCY	REMARKS
	⇒	c) Dimensional check for fixing hole dimensions & for output shaft diameter	MEAS.	100%	Specification & Data sheet	T.C.	MQCD	**C H P**
		d) Verification for wiring & provision of conduits with connectors for external connection.	VISU.	- do -	- do -	- do -	- do -	**C H P**
	⇒	e) Functional Check : Measurement of input voltage, current, power, output torque, rpm, efficiency, P.F at no load, 25%, 50%, 75%, 100% load and at 150% load	ELEC.	- do -	- do -	- do -	- do -	**C H P**
		f) Locked rotor test	ELEC	- do -	- do -	- do -	- do -	**C H P**
		g) Measurement of starting torque and current.	ELEC	- do -	- do -	- do -	- do -	**C H P**
	2. Type Tests	a) Temperature rise by resistance method at full load & at minimum speed.	ELEC.	One of design	- do -	- do -	MQCD/ LAB	**CHP** – Verification of TC

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS	TYPE OF CHECK	QUANTUM OF CHECK	REF.DOC. & ACCEPTANCE STANDARD	FORMAT OF RECORD	AGENCY	REMARKS
	⇒	b) Enclosure protection test	ENVI	One of design	Specification & Data sheet	T.C.	MQCD	
5.	Motor-clutch - Tacho gear box testing * Routine test	a) Functional check	VISU & ELEC	100 %	P.O Specification & Data sheet	- do -	- do -	**C H P**
		b) Verification of documents for all CTQ characters	ELEC	100 %	- do -	- do -	- do -	**C H P**
		c) All tests detailed under Sl.no: A. 04.1	ELEC	- do -	- do -	- do -	- do -	**C H P**

B. NOTES :

1. ELEC : ELECTRICAL; ENVI : ENVIRONMENTAL;
   VISU : VISUAL; MEAS : MEASUREMENT;
   TC : TEST CERTIFICATE; PO : PURCHASE ORDER;
   MQCD : MANUFACTURER'S QUALITY CONTROL DEPARTMENT;
   ⇒ : CRITICAL TO QUALITY POINTS;
   Lab : Govt. Approved / NABL Accredited.
   CHP : CUSTOMER HOLD POINT - INSPECTION BY BHEL.

2. All testing facilities shall be arranged by the vendor at their works. tests for which facilities are not available & those tests marked as test lab in agency column above are to be carried out at recognized national test houses like ETDC / CIL / NPL / ERTL / NABL accredited laboratories etc at vendor's cost.

3. Through log books/any other documents available at the vendor's works, it shall be possible to correlate the finished product with raw material & in process stage check / inspection carried out.

4. All measuring & testing instruments shall be periodically calibrated from recognized test houses & certificates made available during inspection for verification.

5. Test certificates for routine & type tests are to be furnished by the vendor. Type test certificate shall not be earlier than 5 years from the date of Purchase enquiry.

6. Vendor to give tentative inspection program in advance & confirm exact date two weeks in advance for arranging BHEL's inspection.

7. Packing shall be as per the ' PACKING PROCEDURE ' indicated in the Specification. Any loose supply items for the purpose of ' Safe transit ' shall be clearly indicated in the packing slip.

8. Item marked * are applicable only for feeder drive assembly and not for clean out conveyer.

C. REFERENCE STANDARDS (For The Indicated Standards Refer The Latest Version)

IS 325 : Specification for 3 phase induction motor

Pre-Qualification Requirement (PQR) for GEAR REDUCER DRIVE with VFD

1. The vendor shall be an established **gear reducer manufacturer** having adequate engineering, manufacturing and testing facilities and shall furnish technical backup documents and proof of above requirement.
2. The supplier shall have experience of having **supplied drive with gear reducer** of VFD enabled for dusty environment like power plant or application similar severity.
3. The **gear reducer** offered shall be from the existing regular manufacturing range of the supplier.
4. Proven track record is required. Minimum One end user certificate for the satisfactory operational performance of their product supplied meeting requirements specified in enquiry specification or greater.

   (or)

   Successfully executed two POs for same item meeting requirements specified in enquiry specification or greater.
5. In case of ordering, the Vendor shall have the responsibility for the following and same to be confirmed point wise.
   i) Vendor should have the component replacement responsibility in case of defect / failure.
   ii) Experts from Vendor's side shall associate in commissioning activities at site, if required.
   iii) Vendor should ensure the product performance during erection & commissioning and ensure performance guarantee.
6. Backup document checklist to meet PQR to the fullest satisfaction of BHEL:

Clause	Documents acceptable	Check list
1	i) ISO or Other third Party certification about the engineering, manufacturing, testing and servicing facilities in the name of vendor. The certificate shall be specific for the product quoted by the vendor. ii) List of manufacturing, testing and servicing facilities available (like machinery/equipment) in the letterhead of vendor	☐
2	Supply reference list with details of PO, PO date, customer name, application severity/type in the form of a table	☐
3	Product Catalogue in the name of vendor	☐
4	Min. one end user certificate (or) Two POs in the name of vendor	☐
5	Signed copy of this technical PQR document	☐

OEM signature and seal with Date

(If applicable)

Vendor signature and seal with Date