



Specification for
Main Drive with Gear Reducer for 36" Gravimetric Feeder
MPC System with Two Tacho generators and VFD motor

GF-351
Rev. 06

BHARAT HEAVY ELECTRICALS LIMITED

TIRUCHIRAPPALLI-620 014

Fuel Systems/PE (FB)

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.
Rev. No.	Rev. Date	Description	Chd. & Appd.

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



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1.0 SCOPE OF WORK

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- 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)

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- 3.14 Starting torque : 200% full load torque (minimum)
- 3.15 Efficiency Clause : Motor shall be Energy Efficient motors, For applicable Efficiency class refer Annexure-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 $\pm$ 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
- 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.



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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.



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- 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.



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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.



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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 : $\pm 10\%$
Frequency & : $\pm 5\%$
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 : 80% of Rated Voltage
voltage

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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 :

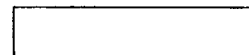
10.1.25 Method of starting :

10.1.26 Thermal time constant :

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

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10.1.28 Permissible running time at :





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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 resist-
ance 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
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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.

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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

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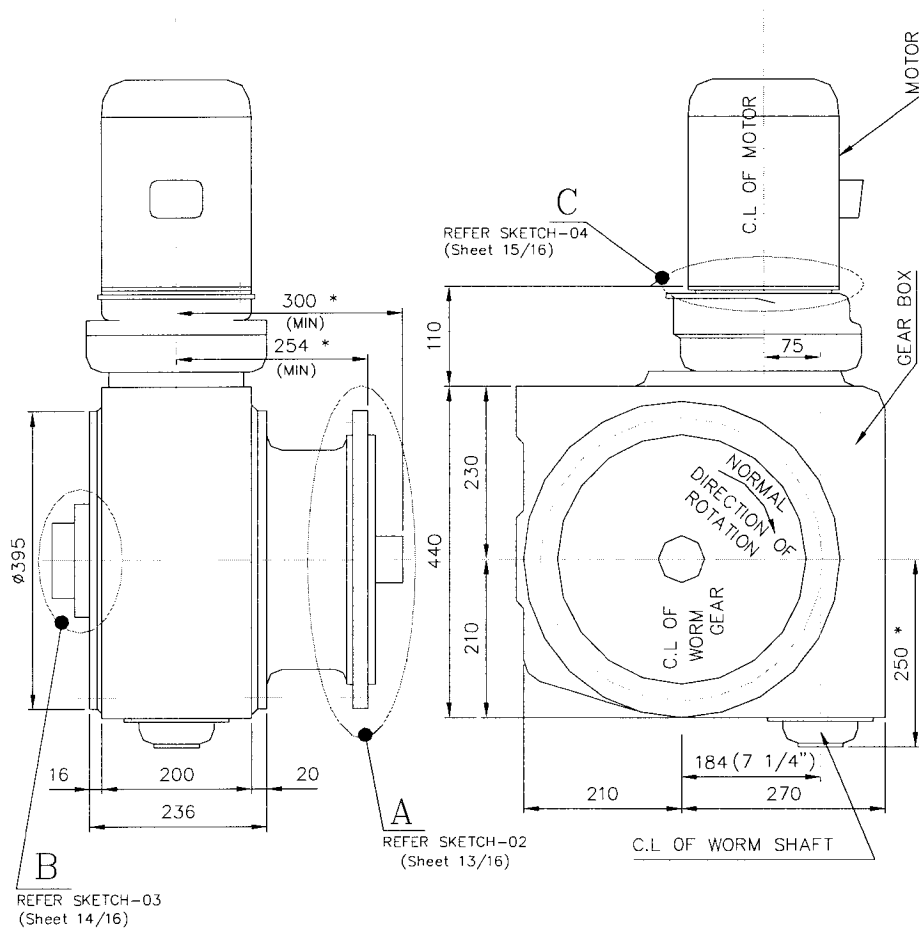
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SKETCH NO: -01



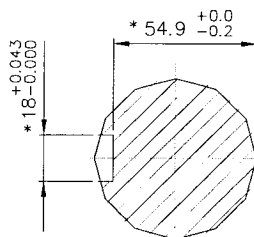
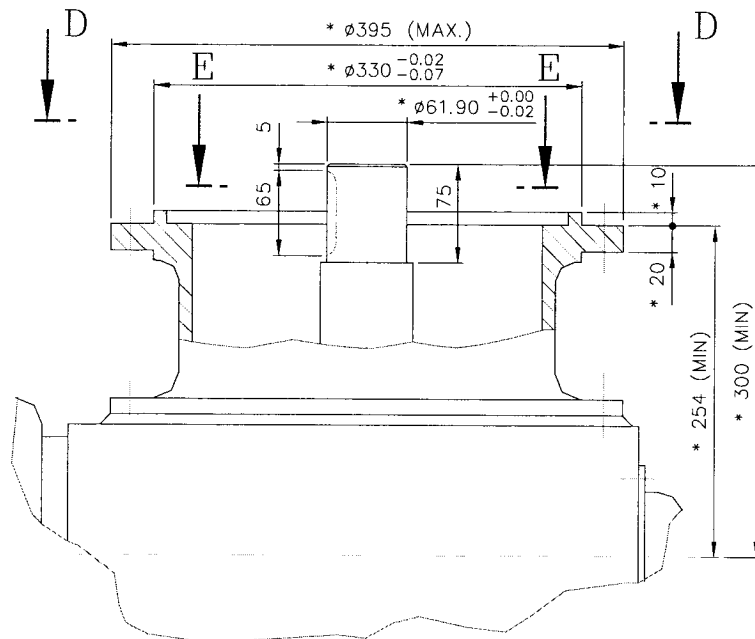
ALL DIMENSIONS ARE IN MM



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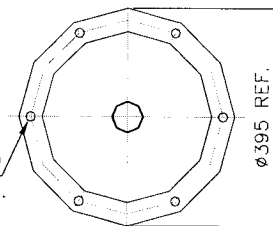
SKETCH NO: -02



SECTION-EE

DETAIL-A

6 HOLES $\phi 18$ ON 362 PCD
EQUI SPACED AS SHOWN.



VIEW-DD

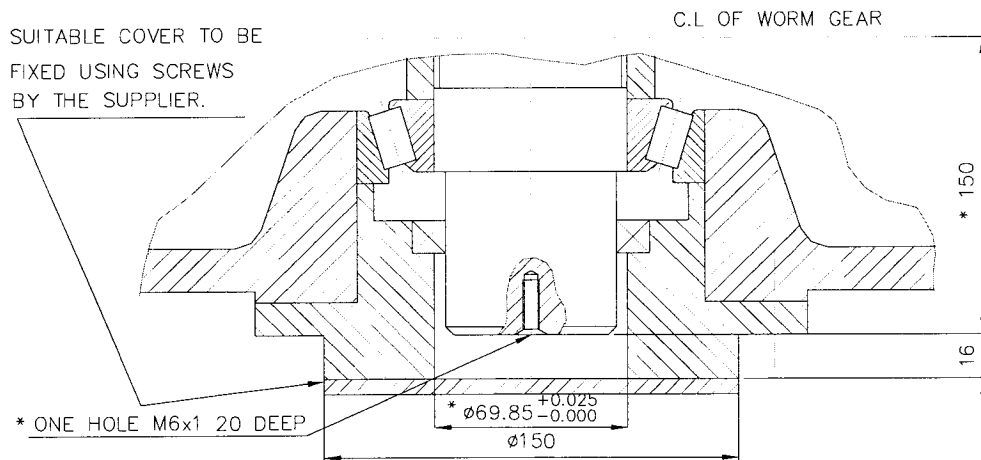
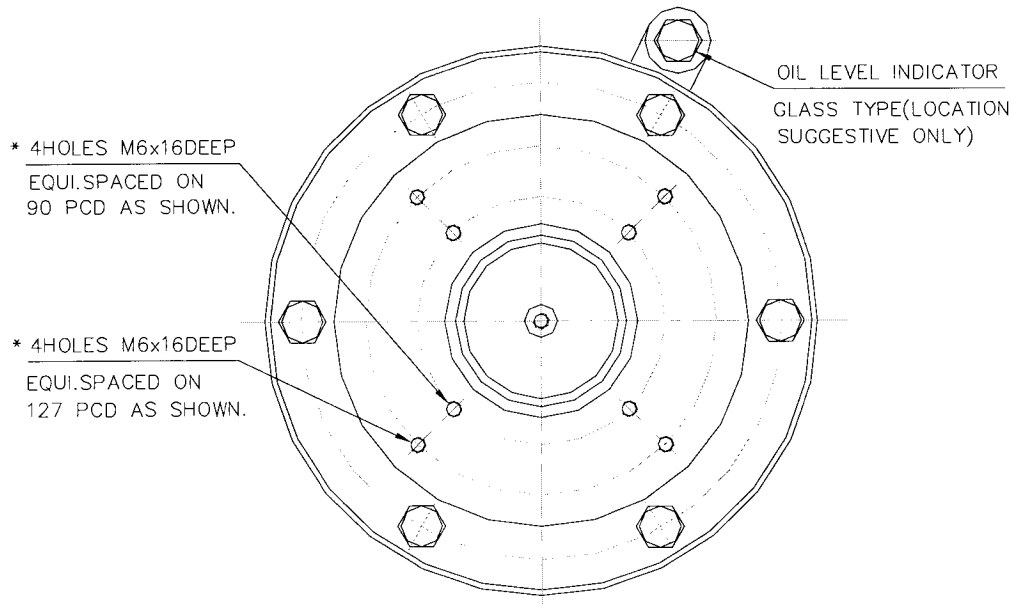
ALL DIMENSIONS ARE IN MM



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SKETCH NO.-03



DETAIL-B

ALL DIMENSIONS ARE IN MM

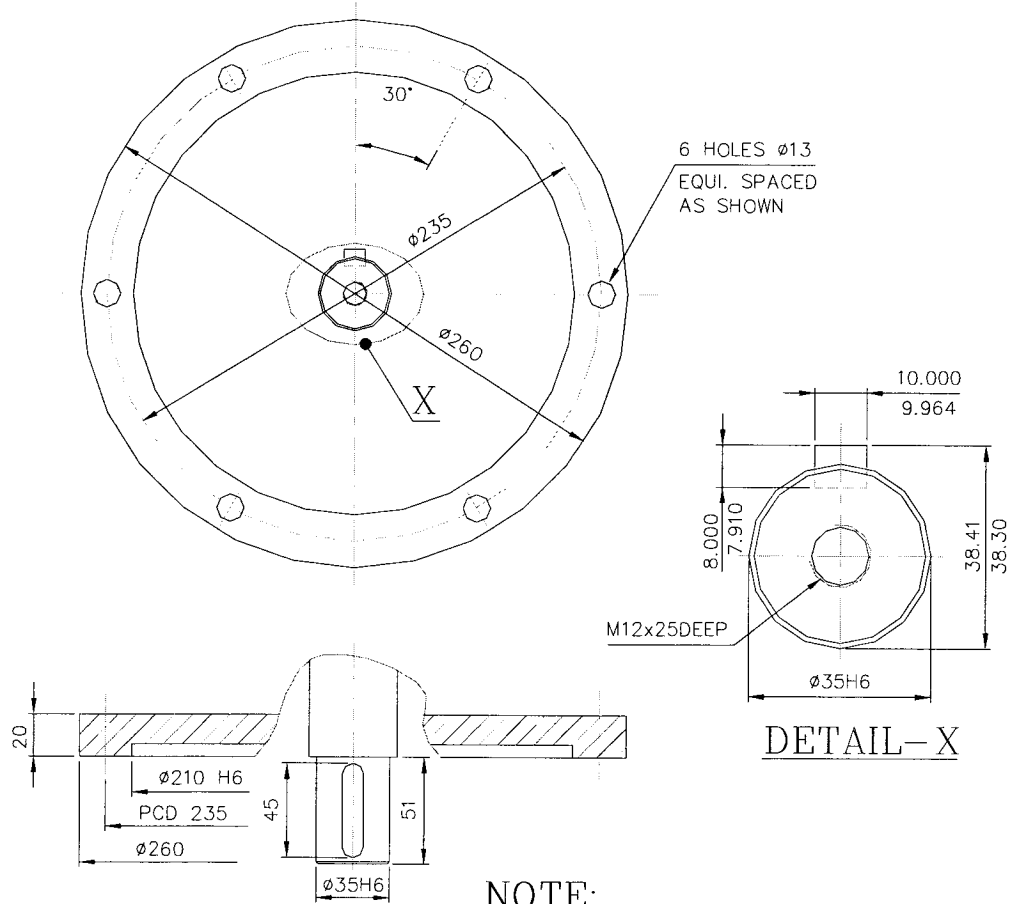


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SKETCH NO. - 04

MATING FLANGE AND SHAFT DETAIL (GEAR BOX INPUT SIDE)



NOTE:

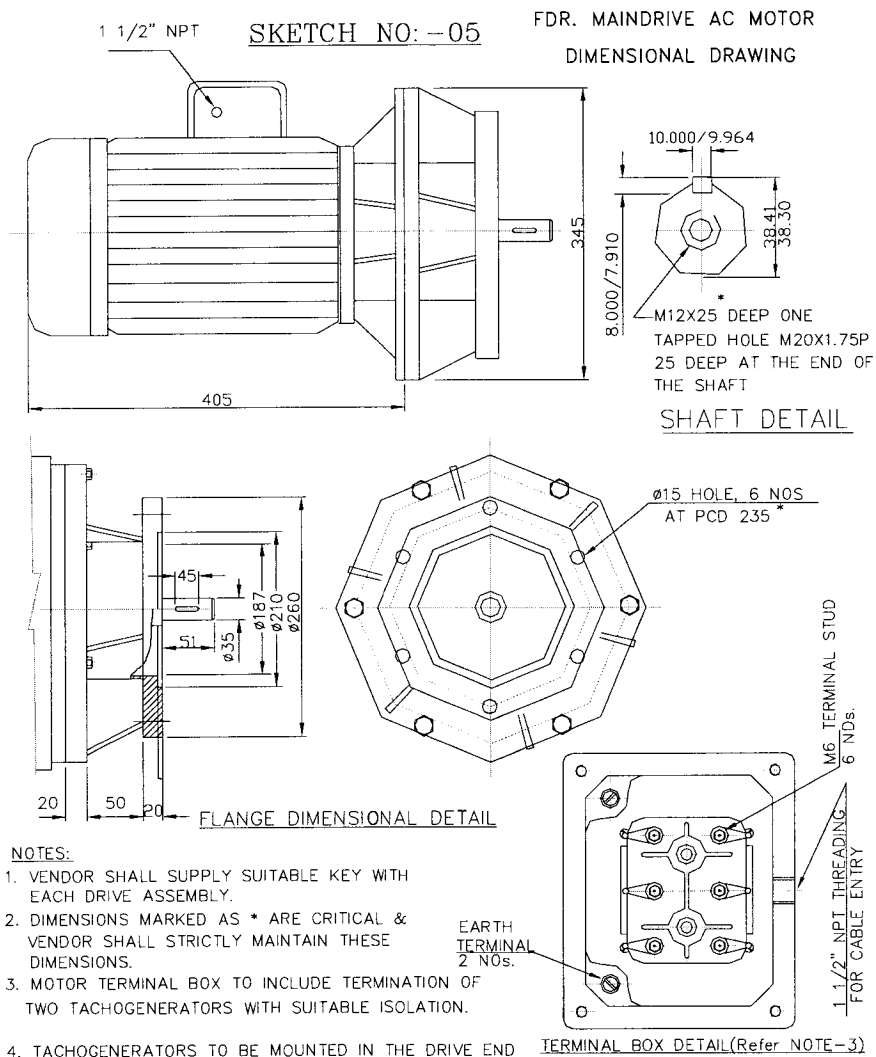
THE DIMENSIONS OF THE INPUT SIDE FLANGE
AND PINION OF THE GEAR BOX SHALL MATCH
WITH THE MATING DIMENSIONS OF VFD MOTOR
AS SHOWN ABOVE.

ALL DIMENSIONS ARE IN MM



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