HYDRO GENERATOR MANUFACTURING

PI-220341030 (Machining of Bottom shaft)

Annexure-I

Scope of work-

1) Complete Machining of bottom shaft as per machining drawing No. 02540112701.

2) Assembly of Bottom Oil Retaining Sleeve on Bottom shaft as per drawing 12540112704 Rev 00 and clamping & machining of Oil retaining sleeve as per drawing no. 12635212711.

3) Packing and Painting of Shaft/Oil Retaining Sleeve: Packing to be done as per drawing No.12545112711, packing standard HG07003 Rev.03 & painting standard HG12007.

Note-

- Following material will be issued by BHEL Bhopal-

1) Bottom shaft forging as per drawing no. 32540112701.
2) Machined bottom oil retaining sleeves as per drawing no-12570112710.
3) Clamping arrangement items (common items which will be used for clamping) as per drawing 12635212711 item no 01 to 07. All these items will be issued on returnable basis only.
4) Bottom shaft shipping stand as per drawing 12545112710.

- Scrap generated during machining work will be retained by vendor and scrap cost @ Rs40.80 per kg plus extra GST charges on scrap cost will be adjusted in bill payment.
- Transportation and insurance will be in BHEL Bhopal scope.

विशाल शर्मा / VISHAL SHARMA
वरि. उप महाप्रबंधक / Sr. Dy. General Manager
एच. जी. एम. प्रभाग / HGM Division
बी.एच.ई.एल., भोपाल / BHEL, BHOPAL

Sameer Kumar
Mgr (HGM Planning)

(Ajay K.S. Yadav)

BHOPAL	TECHNICAL PRE-QUALIFICATION REQUIREMENTS (TPQR) HYDRO GENERATOR ENGINEERING DIVISION	**DOC. NO.**: HGG-2303 **DATE**: 15-06-2023 **REV**.: 00 **PAGE** 01 OF 01

The bids are invited for fully finished (machined) shaft from forging provided by BHEL as per BHEL drawing:

Following are the Technical Pre-Qualification Requirements (TPQR):

Sr. No.	Description of pre-qualification requirement	Vendor Response	
		Complied/ Not complied	**Supporting Documents required to accept compliance**
1)	Machining facilities available for machining of shaft forging at vendor's work.		Document/Data of machines available at vendor's works.
2)	Experience of machining of steel shaft forging during last 10 years (see note-3) having following criteria: a) Minimum 2 Nos. shaft machined of weight above 30000 kgs. OR b) Minimum 1 No. shaft machined of weight above 50000 kgs.		- Purchase order and invoice - Dimension records
3)	Compliance to machining of steel shaft as per drawing no. 02540112701 Rev.00 (Forged weight:-61661 Kg).		Self-certification of having the capability.
4)	Company shall be certified with ISO 9001.		Valid certificate to be submitted.
5)	Quality plan to be submitted to BHEL for approval along with the offer.		Quality plan to be submitted for approval.

Note:

1. Compliance to above Technical Pre-Qualification Requirements are mandatory. In absence of compliance of above requirements vendor TPQ application is liable to be rejected.
2. BHEL has the right to verify information / confirmation furnished, by asking additional documents, proofs, visit of vendor's works etc.
3. The reference date will be the date of enquiry.

Prepared & Checked by

(Amit Kumar Verma)
Manager/HGE

Approved by

(Ritesh Gajbhiye)
Sr.DGM/HGE

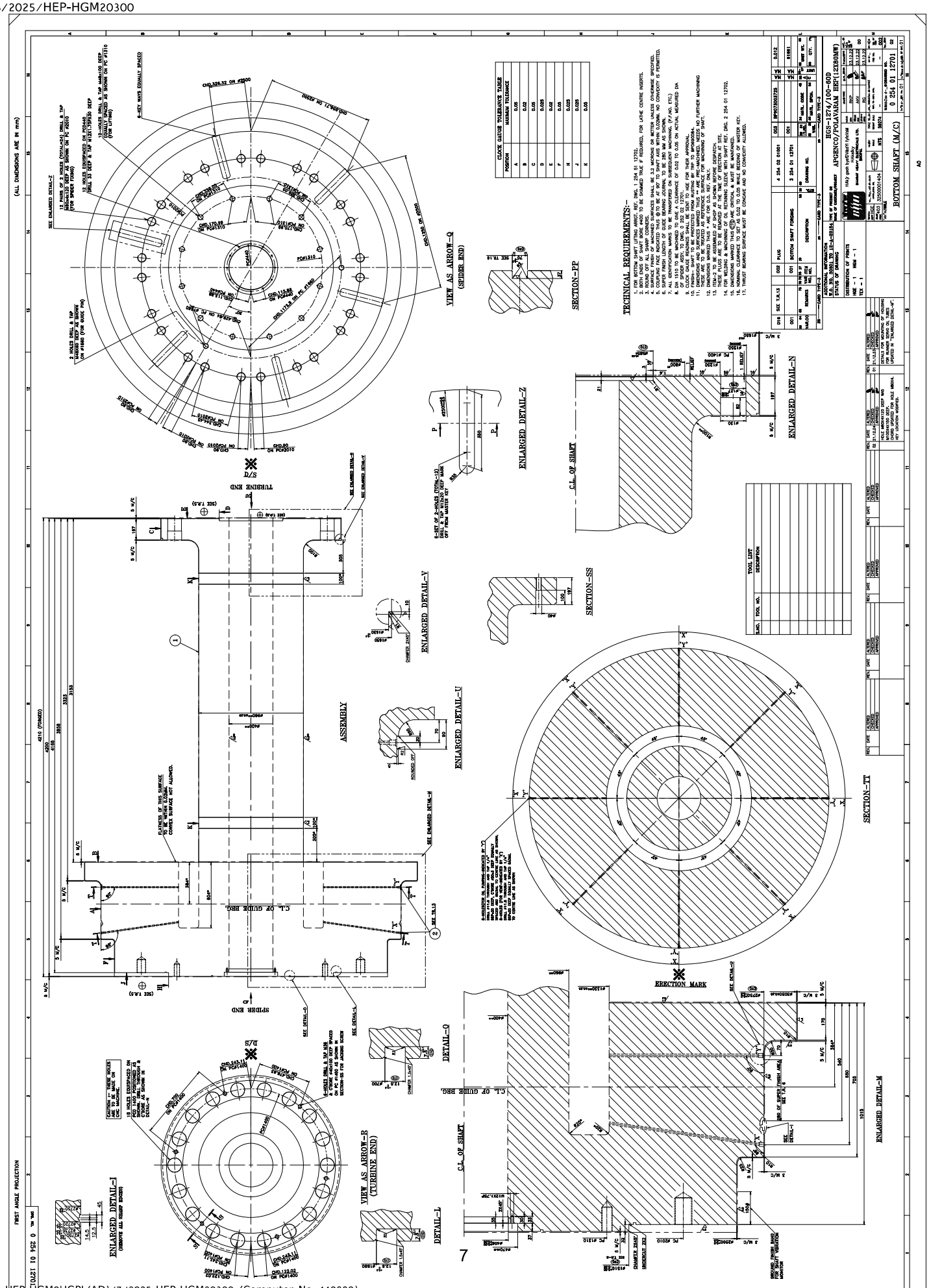
	MANUFACTURER'S NAME AND ADDRESS	MANUFACTURING QUALITY PLAN	PROJ: MEIL POLAVARAM HEP (12X 80 MW)
भेएइएल BHEL	BHARAT HEAVY ELECTRICALS LIMITED, BHOPAL	ITEM(S): GENERATOR PACKAGE QAP NO.: QA/HG/662 REV. NO.: 03 DATE: 13.01.2023 PAGE: PAGE 4 OF 5	PACKAGE: ELECTROMECHANICAL CONTRACT NO.: :(3139)POLAVARAM /MEIL /BHEL-TURBINE/20-21/LOI/01 DATED-10.09.202

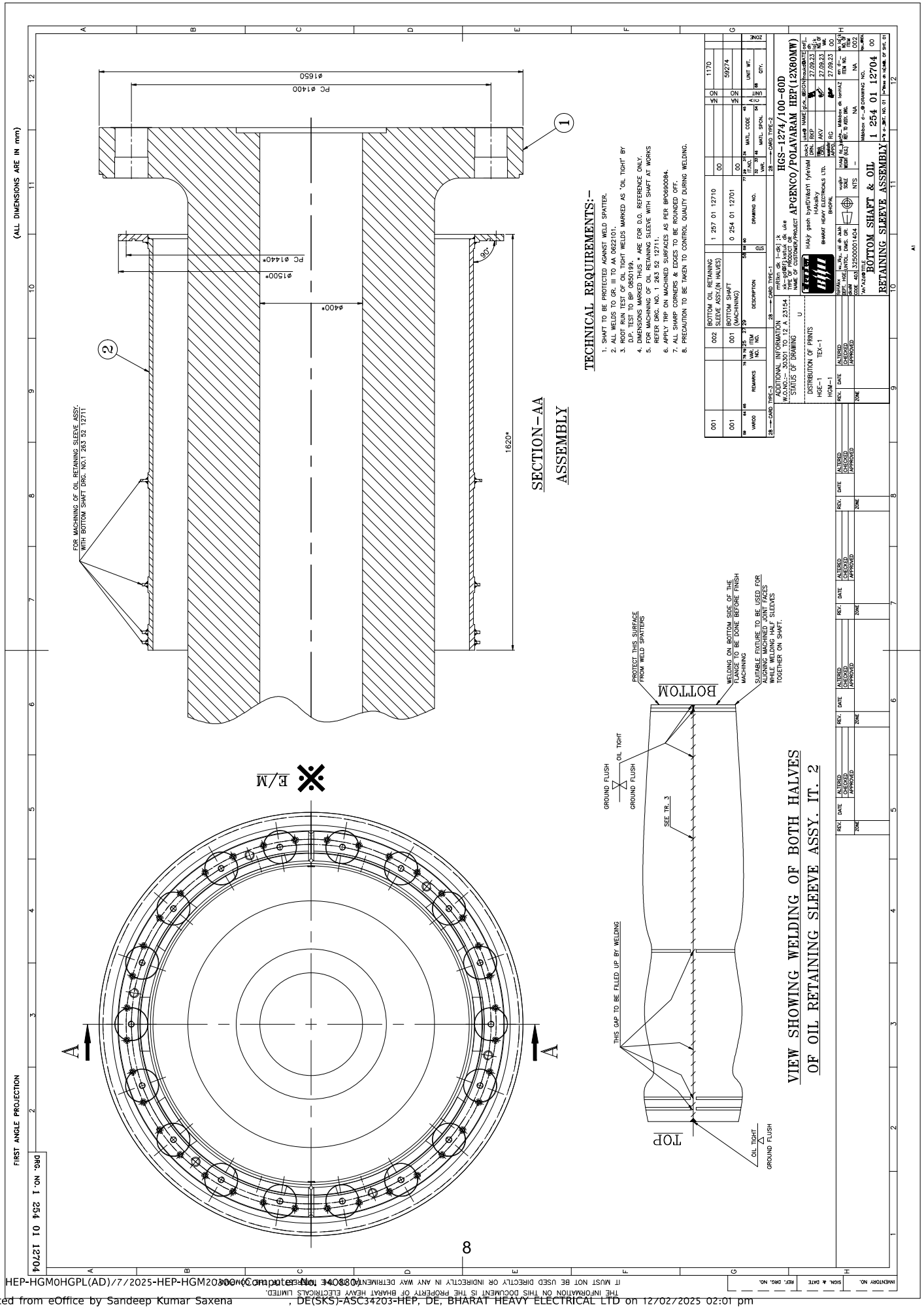
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK(**)		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
					M	C / A					M	C	A	
1	2	3	4	5	6		7	8	9	D*	10			11
2.26	Wound pole	Dimension check	Major	M	100%	100%	Drawing		QCR	✓	P	W	R	
2.27		DC resistance, IR & HV test	Critical	ET	100%	100%	-do-		JIR	✓	P	W	W	CHP(W) for any one unit & review for other units
2.28		Impedance test	Critical	ET	100%	100%	-do-		JIR	✓	P	W	W	
2.29	Generator shaft	Dimensional checks after machining	Major	M	100%	100%	-do-		QCR	✓	P	W	R	
2.30		Measurement of roughness of bearing surfaces	Major	M	100%	100%	-do-		QCR	✓	P	W	R	
2.31		Run out check	Major	M	100%	100%	-do-		QCR	✓	P	W	R	
2.32	Thrust & guide pads	Dimensional checks	Major	M	100%	100%	-do-		QCR	✓	P	W	R	
		DPT and UT	Major	NDT	100%	100%	-do-		QCR	✓	P	W	R	
2.33	Upper & Lower bearing bracket assembly	Dimension check after fabrication	Major	M	100%	100%	-do-		JIR	✓	P	W	W	AS PER REV.02
2.34		DPT / MPI after fabrication	Major	NDT	100%	100%	-do-		QCR	✓	P	W	R	
2.35		Water leakage test after fabrication	Major	Test	100%	100%	-do-		QCR	✓	P	W	R	
2.36		Dimension check after machining	Major	M	100%	100%	-do-		QCR	✓	P	W	R	
2.37	Air & oil coolers	Dimension check after assembly	Major	M	100%	100%	-do-		QCR	✓	P	W	R	
2.38		Hydraulic pressure test	Major	Test	100%	100%	-do-		QCR	✓	P	W	R	

APG/05/QC1-GENERATOR/QA/HG/662

MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER	LEGEND:
AADHAR RAWTANIA Dy. Manager CMT Division BHOPAL		* D: RECORDS, IDENTIFIED WITH "TICK" (√) SHALL BE ESSENTIALLY SUBMITTED BY SUPPLIER IN QA DOCUMENTATION. M: MANUFACTURER/SUB-SUPPLIER, C: MAIN SUPPLIER, A: OWNER/OWNER'S AUTHORISED REPRESENTATIVE, P: PERFORM W: WITNESS AND V: VERIFICATION AS APPROPRIATE, CHP: CUSTOMER HOLD POINT TC: TEST CERTIFICATE, QCR: QUALITY CONTROL REPORT, JIR: JOINT INSPECTION REPORT, ET- ELECTRICAL TEST, M- MEASUREMENT, CT-CHEMICAL TEST, MT-MECHANICAL TEST, VIS-VISUAL CHECK

FOR APGENCO USE	DOC. NO.:	REV..... CAT.....	
	REVIEWED BY	APPROVED BY	APPROVAL SEAL
	EE/QC1	SE/QC	APGENCO Vidyut Soudha Q.C Approved

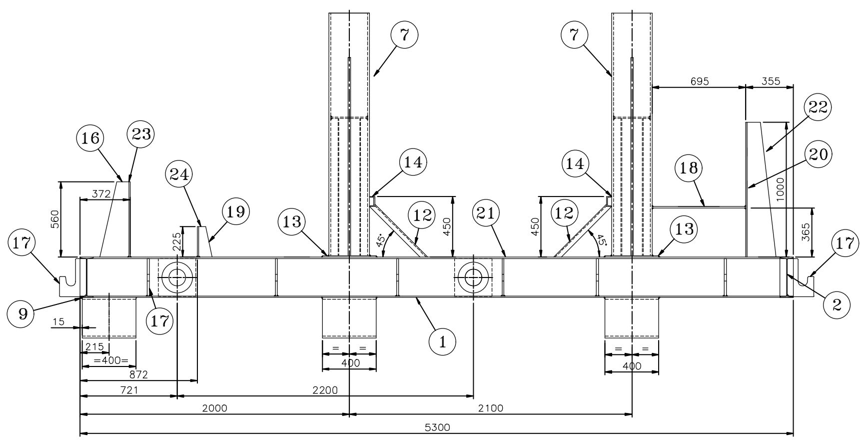


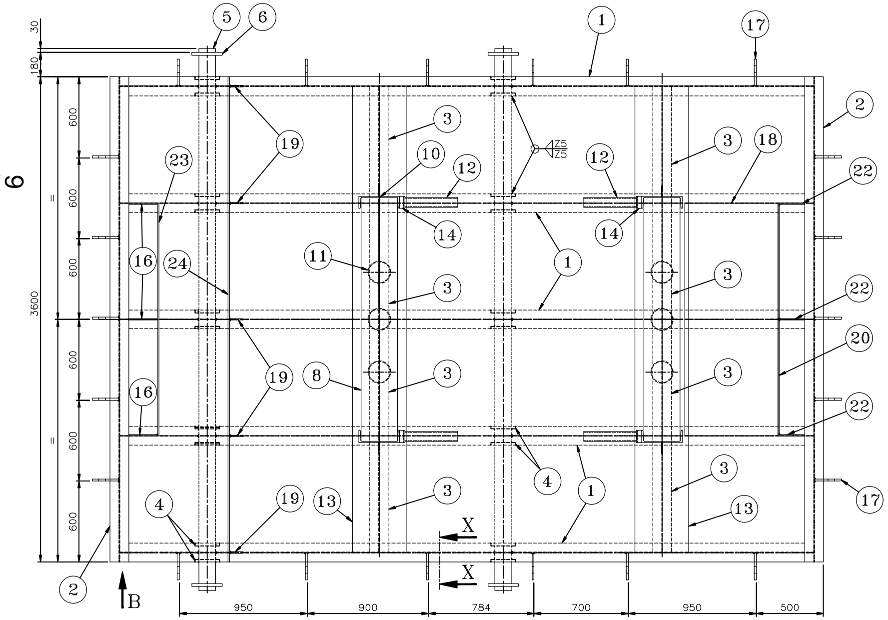


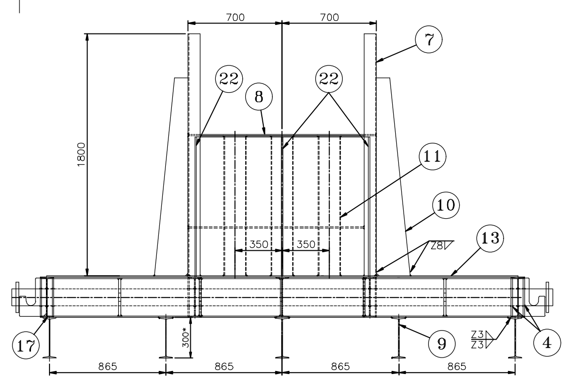
FIRST ANGLE PROJECTION

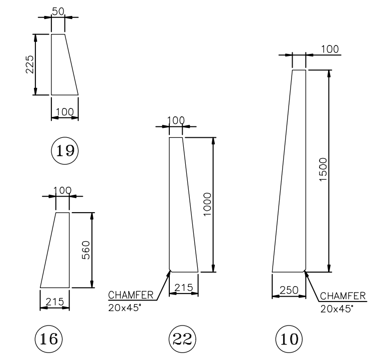
(ALL DIMENSIONS ARE IN mm)

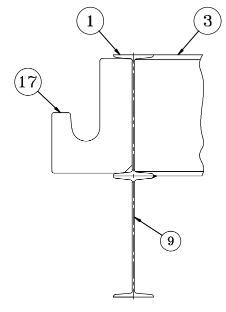
DRG. NO. 1 254 51 12710

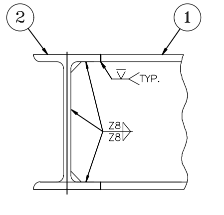




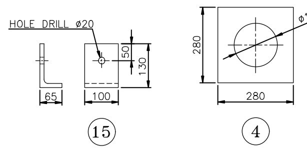


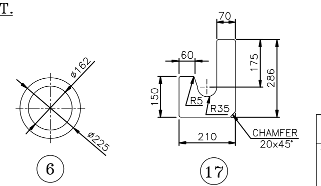



SECTION-XX


VIEW AS ARROW-B
(SEE TR-9)

ARRGT.





QTY VAR00	REMARKS	VAR. NO.	ITEM NO.	DESCRIPTION	STD	DRAWING NO.	IT.NO. / VAR.	MATL. CODE / MATL. SPCN.	A	C	UNIT WT. / QTY.
001			024	PLATE 10TK.x225x3600LG. S.S.S.Q.PLATE	1			AA1011808072 / AA10108	NA	NO	63.59
001			023	RIB 10TK.x560x1730LG. S.S.S.Q.PLATE	1			AA1011808072 / AA10108	NA	NO	76.05
003			022	RIB 10TK.x215x1000LG. S.S.S.Q.PLATE	1			AA1011808072 / AA10108	NA	NA	12.35
001	SEE TR 6		021	COVER PLATE 1.6TK.x3600x5300LG. S.S.S.Q.PLATE	1			AA1011715090 / AA10115	NA	NO	239.64
001			020	PLATE 10TK.x1000x1730LG. S.S.S.Q.PLATE	1			AA1011808072 / AA10108	NA	NO	135.81
005			019	RIB 10TK.x100x225LG. S.S.S.Q.PLATE	1			AA1011808072 / AA10108	NA	NA	1.32
001			018	PLATE 10TK.x695x1730LG. S.S.S.Q.PLATE	1			AA1011808072 / AA10108	NA	NO	94.38
022			017	HOOK 16TK.x210x286LG. S.S.S.Q. PLATE	1			AA1011808110 / AA10108	NA	NO	4.48
003			016	RIB 10TK.x215x560LG. S.S.S.Q.PLATE	1			AA1011808072 / AA10108	NA	NO	6.9
024	SEE TR 8		015	130x130x12x100LG. S.S.S.Q.EQUAL ANGLE	1			AA1012808093 / AA10108	NA	NO	2.35
004			014	ISMC 75x40x4.8x7.5x90LG. S.S.S.Q. CHANNEL	1			AA1012708020 / AA10108	NA	NO	0.6
002			013	PLATE 10TK.x400x3500LG. S.S.S.Q. PLATE	1			AA1011808072 / AA10108	NA	NO	109.90
004			012	ISMC 75x40x4.8x7.5x575LG. S.S.S.Q. CHANNEL	1			AA1012708020 / AA10108	NA	NO	4.10
006			011	PIPE O/D166.5x4.85TK.x1000LG. MS. TUBE	1			AA1011052393 / AA10152	NA	NO	19.70
004			010	RIB 10TK.x250x1500LG. S.S.S.Q. PLATE	1			AA1011808072 / AA10108	NA	NO	20.59
015			009	ISMB 300x140x7.7x13.1x400LG. S.S.S.Q. BEAM	1			AA1012808122 / AA10108	NA	NO	18.44
002			008	PLATE 10TK.x270x1384LG. S.S.S.Q. PLATE	1			AA1011808072 / AA10108	NA	NO	29.33
004			007	ISMC 300x90x7.8x13.6x1800LG. S.S.S.Q. CHANNEL	1			AA1012708179 / AA10108	NA	NO	65.34
004			006	RING 20TK. S.S.S.Q. PLATE	1			AA1011808137 / AA10108	NA	NO	3.01
002			005	LIFTING BAR ø160x4020LG. S.S.S.Q. BAR	1			AA1010208306 / AA10108	NA	NO	633.27
020			004	LIFTING BAR STIFFENER 20TK.x280x280LG. S.S.S.Q. PLATE	1			AA1011808137 / AA10108	NA	NO	9.07
008			003	ISMB 300x140x7.7x13.1x857LG. S.S.S.Q. BEAM	1			AA1012808122 / AA10108	NA	NO	39.51
002			002	ISMB 300x140x7.7x13.1x3600LG. S.S.S.Q. BEAM	1			AA1012808122 / AA10108	NA	NO	165.96
005			001	ISMB 300x140x7.7x13.1x5152LG. S.S.S.Q. BEAM	1			AA1012808122 / AA10108	NA	NO	237.51

28 — CARD TYPE-3   28 — CARD TYPE-1   28 — CARD TYPE-2

TECHNICAL REQUIREMENTS:-

1. ITEMS 1 TO 11 & 13, 16 & 18 TO 24 ARE TO BE PRE-ASSEMBLED IN FWM. OTHER ITEMS TO BE SUPPLIED LOOSE TO HGM TO BE ASSEMBLED DURING PACKING.
2. ALL WELDS ARE CONTINUOUS EXCEPT WHERE OTHERWISE STATED.
3. ALL WELDS ARE 8MM. FILLET TO GR. IV STD. OF AA0622101.
4. PAINT SHIPPING STAND WITH RED-OXIDE PRIMER TO AA56101.
5. DIMENSIONS MARKED THUS * ARE FOR D.O. REF. ONLY.
6. IT. 21 CUT TO SUIT TO OVER LAP EACH OTHER THEN TACK WELD TO SUIT.
7. FOR PACKING REFER SPECIFICATION NO. HG 07003.
8. ANGLE IT.15 TO BE WELDED ON OUTER BEAM OF SHIPPING STAND FOR SUPPORTING THE WOODEN BLOCK TO SUIT PACKING.
9. ALL BEAM TO BEAM WELDING TO BE DONE AS PER "VIEW AS ARROW-B".

ADDITIONAL INFORMATION
WO. 30301 TO 12-A-23154
STATUS OF DRAWING: U

DISTRIBUTION OF PRINTS
HGE – 1   HGE – 1
FWM – 1   TEX – 1

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: HGS-1274/100-60D APGENCO/POLAVARAM HEP(12X80MW)

भारत हैवी इलेक्ट्रिकल्स लिमिटेड भोपाल
BHARAT HEAVY ELECTRICALS LTD. BHOPAL

	NAME	SIGN	DATE
DRN.	RKP		14.08.24
CKD.	AKV		14.08.24
APPD.	RG		14.08.24

NO. OF VAR.: 00

DEPT. HGE | CODE 403 | UNTOL. DIMS. GR. 3 253 02 01001 | SCALE NTS | WEIGHT (KG.) 5160 | REF. TO ASSY. DRG. NA | ITEM NO. NA | NO. OF ITEM 024

TITLE: BOTTOM SHAFT SHIPPING STAND

DRAWING NO. 1 254 51 12710 | REV. 00
SHT. NO. 01 | NO. OF SHT. 01

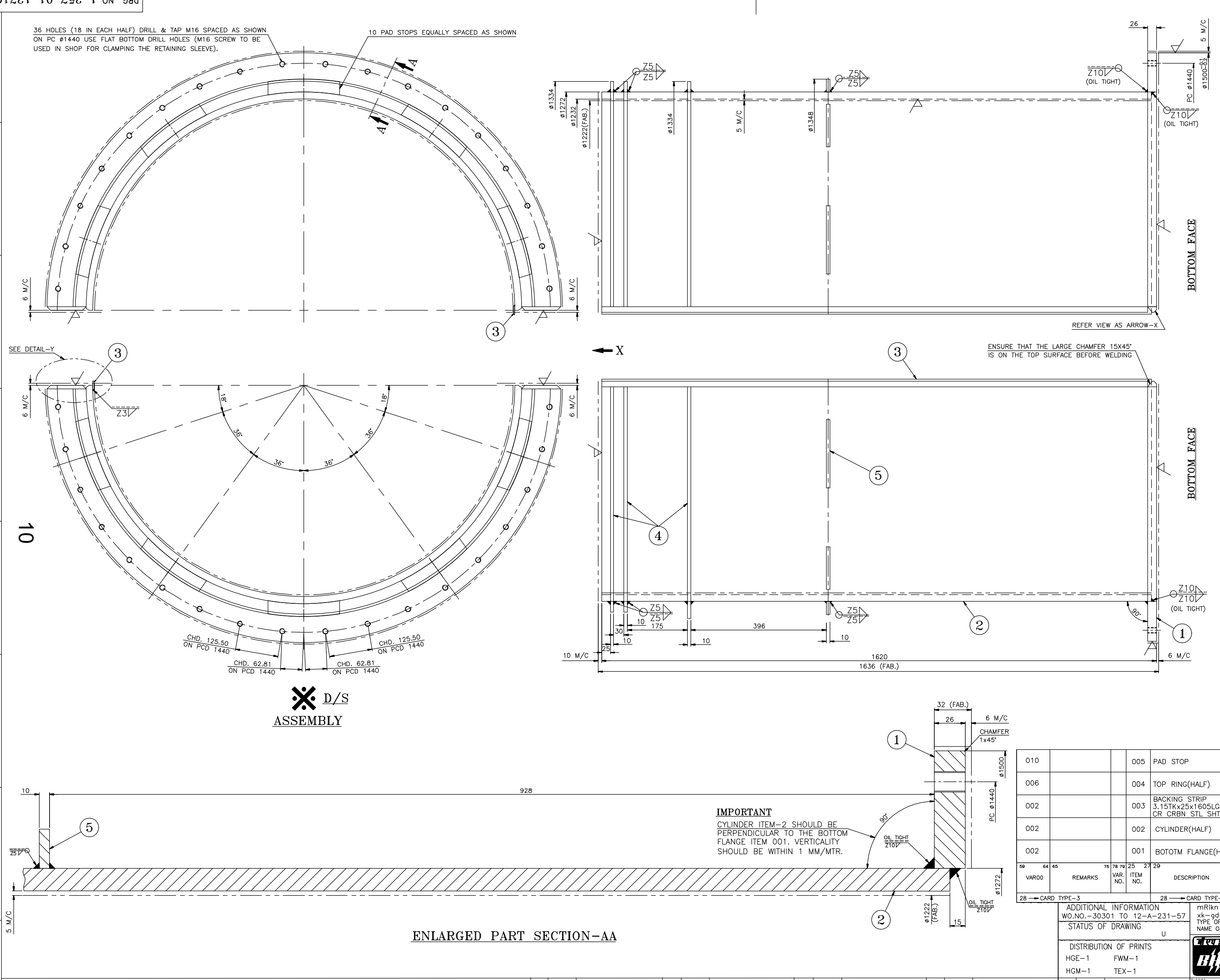
A1

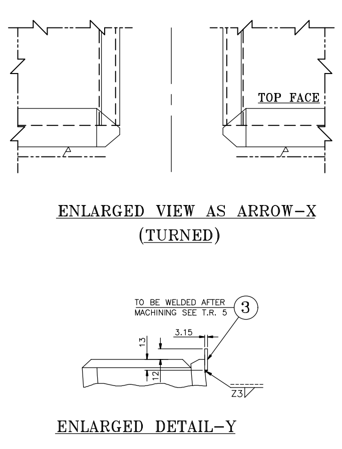
THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY.

REF. DRG. NO. | SIGN. & DATE | INVENTORY NO.

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)





FABRICATION WEIGHT = 1451KG

TOOL LIST

ITEM NO	TOOL NO.	DESCRIPTION
001	–	–

TECHNICAL REQUIREMENTS:-

1. ALL WELDS TO GR III TO AA0622101.
2. ROOT RUN TEST OF OIL TIGHT WELDS TO BE D.P. TESTED TO BP0850199 AND FINALLY WELD PORTION TO BE PAINTED.
3. SURFACE FINISH OF THE MACHINED SURFACES SHALL BE 3.2 MICRONS OR BETTER.
4. FOR WELDING AROUND THE SHAFT OF OIL RETAINING SLEEVE ASSY. REFER DRG.NO. 1 254 01 12704.
5. ITEM-3 TO BE WELDED IN POSITION AFTER MACHINING OF JOINT FACE & I.D.
6. DIMENSION MARKED THUS * ARE FOR D.O. REFERENCE ONLY.
7. STRESS RELIEVE ASSY. TO BP 0640299 BEFORE MACHINING.
8. PAINTING SHALL CARRIED OUT AS PER PRODUCT SATANDARD HG 12007. FOR OUTER SURFACES : REFER CLAUSE 6.4(CATEGORY OF PART-B). FOR INNER SURFACES : REFER CLAUSE 6.4(CATEGORY OF PART-A).

VAR00	REMARKS	VAR. NO.	ITEM NO.	DESCRIPTION	STD	DRAWING NO.	IT.NO. / VAR.	MATL. CODE / MATL. SPCN.	C	UNIT	UNIT WT. / QTY.
010			005	PAD STOP		2 257 01 12704	004		NA	NO	0.60
006			004	TOP RING(HALF)		2 257 01 12704	003		NA	NO	4.93
002			003	BACKING STRIP 3.15TKx25x1605LG. CR CRBN STL SHT				BP1011715996 AA10115	NA	NO	0.99
002			002	CYLINDER(HALF)		2 257 01 12704	002		NA	NO	620.40
002			001	BOTOTM FLANGE(HALF)		2 257 01 12704	001		NA	NO	65.50

28 —CARD TYPE-3 · 28 —CARD TYPE-1 · 28 —CARD TYPE-2

ADDITIONAL INFORMATION
WO.NO.-30301 TO 12-A-231-57
STATUS OF DRAWING U

DISTRIBUTION OF PRINTS
HGE-1 FWM-1
HGM-1 TEX-1

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: HGS-1274/100-60D
APGENCO/POLAVARAM HEP(12X80MW)

BHARAT HEAVY ELECTRICALS LTD.
BHOPAL

	NAME	SIGN	DATE
DRN.	RKP		27.09.23
CHD.	AKV		27.09.23
APPD.	RG		27.09.23

NO. OF VAR.: 00

DEPT. HGE · UNTOL. DIMS. GR. · CODE 403 · 32500001404 · SCALE 1:5 · WEIGHT (KG.) 1170M/C · REF. TO ASSY. DRG. NA · ITEM NO. NA · NO. OF ITEM 005

BOTTOM OIL RETAINING SLEEVE ASSY.

DRAWING NO. 1 257 01 12710 · REV. 00 · SHT. NO. 01 · NO. OF SHT. 01

DRG. NO. 1 257 01 12710

A1

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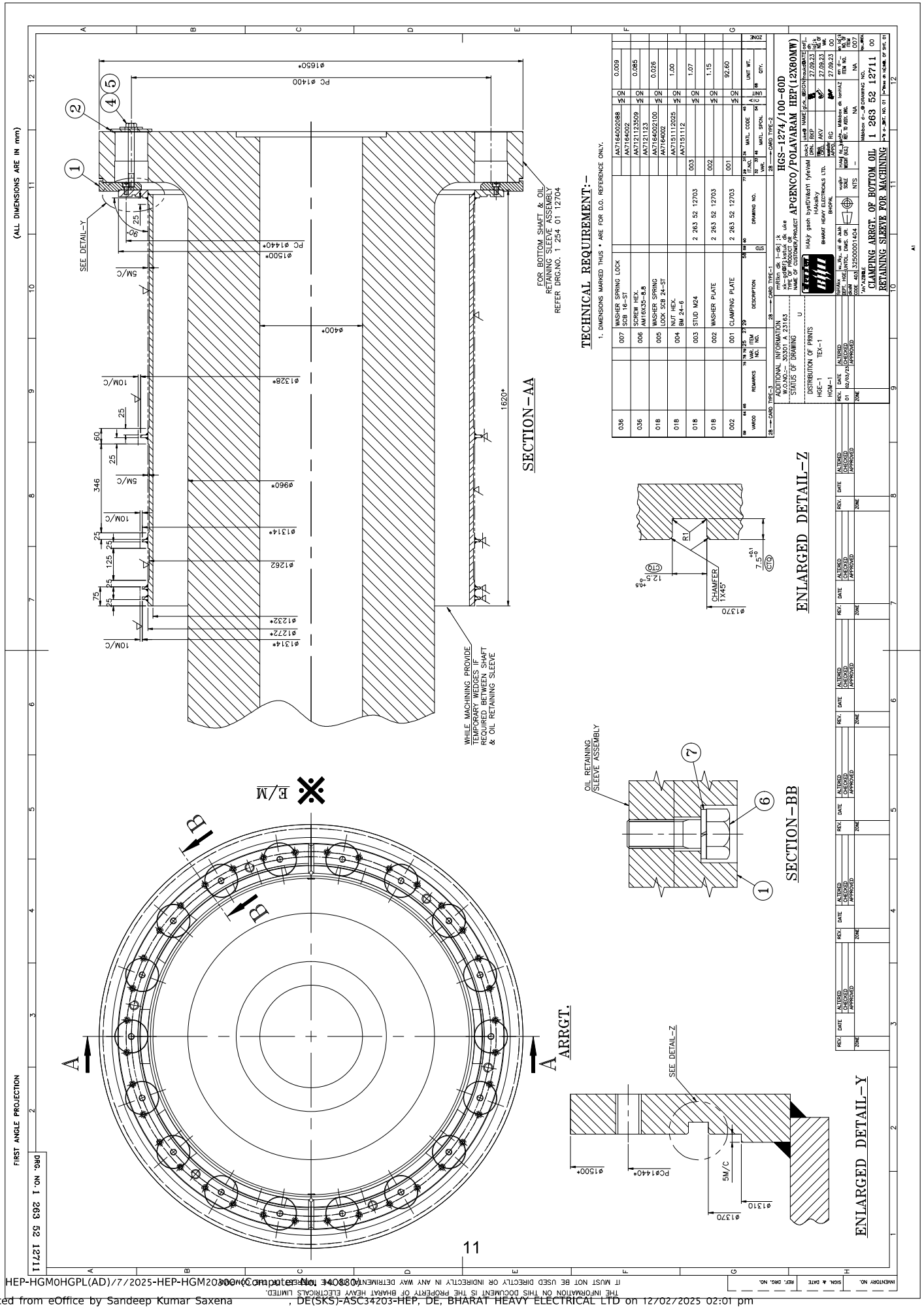

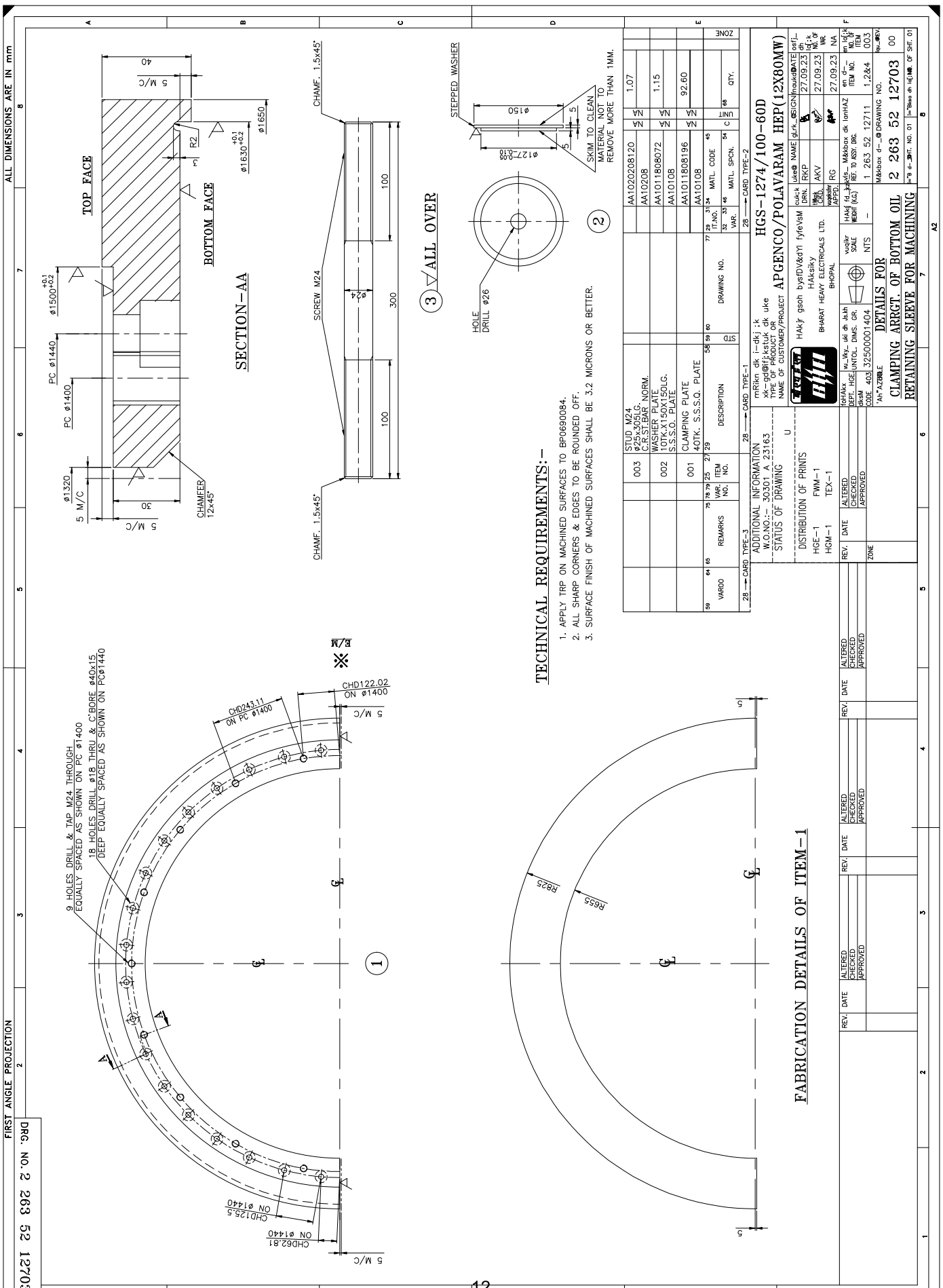

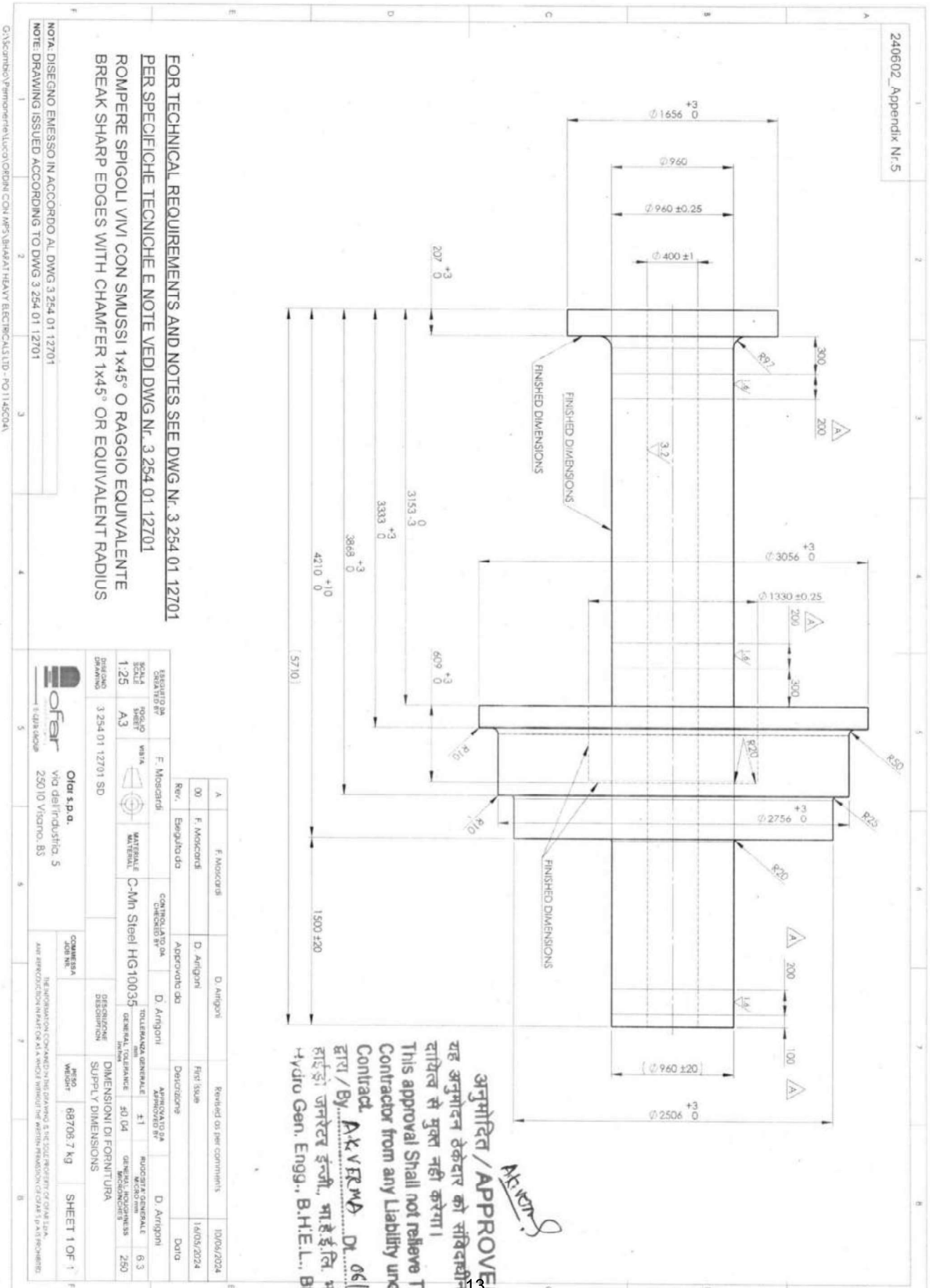

अनुमोदित / APPROVED

यह अनुमोदन ठेकेदार को संविदात्मक किसी दायित्व से मुक्त नहीं करेगा।

This approval Shall not relieve The Contractor from any Liability under the Contract.

द्वारा / By.....Dt. 06/07/24

हाईड्रो जनरेटर इन्जी., भा.हे.इ.लि. भोपाल

Hydro Gen. Engg., B.H.E.L., Bhopal

BHEL	**PRODUCT STANDARD** **HYDRO GENERATOR ENGINEERING**	**HG 12007** **Rev. 00**
		Page 1 of 8

PAINTING SPECIFICATION OF HYDRO GENERATOR COMPONENTS

1. GENERAL:

This standard gives the materials & processes to be used to provide protective coating by spraying/brushing on machined as well as unmachined surfaces of hydro generator components.

2. MATERIALS:

2.1	High build black coal tar epoxide paint	- AA 56135
2.2	Oil resistant air drying synthetic enamel	- AA 56132 (Jasmine Yellow ISC 397 of IS:5) *
2.3	Chemical resistant epoxide priming paint	- AA 56105 (Red)
2.4	Chemical resistant epoxide finishing paint	- AA 56131 (Light Grey ISC 631 of IS:5) *
2.5	White spirit Gr. 145 / 205	- AA 56701
2.6	Special thinner for AA 56135	- AA 56709
2.7	Thinner for AA 56105 & AA 56131	- AA 56708
2.8	Rust preventive hard film black (TRP)	- AA 55154
2.9	Latex emulsion for cement wash manufacturers	- Standard product of reputed paint
2.10	Polyvinyl acetate based adhesive (Fevicol)	- AA 55302

Note: * Colour shade may change as per specific requirement of customer otherwise as stated.

3. PREPARATION OF THE PAINTS:

3.1 Removal of the skin from the paint

Before application, any skin formed on the paint in the tin shall be carefully removed. Any settled pigment broken up and loosened, and the paint thoroughly stirred to ensure complete and uniform mixing of the constituents. Care shall be taken to avoid entraining air in to the paint while stirring. The paint shall be strained through a muslin cloth or 60 mesh sieve before use.

Rev. No.	Date of Rev.	Remarks	**Approved**		
			A.Biswas, AGM –HGE		
			Prepared	**Checked**	**Date of issue (Rev 00)**
			Amit Kumar Verma Dy. Manager-HGE	Ritesh Gajbhiye Sr. Manager-HGE	06/03/2018

3.2 Preparation of the paint AA 56135

This paint has a short pot life of 4 hours only. Hence it is important to note that only sufficient paint be mixed for immediate requirements and the paints be used within 4 hours from the completion of mixing of base and accelerator. Shortly before mixing and use, these shall be thoroughly stirred. The base and accelerator shall then be accurately mixed together in the following proportions.

Supplier	Base (by volume)	Accelerator
Asian Paints	4	1
Bombay Paints	4	1
Berger Paints	3	1
Shalimar Paints	1	1

The accelerator shall be added to the base slowly with continuous stirring. After the addition of all the accelerator, contents shall be stirred continuously until a uniform consistency is obtained. The mixing of paint can be done by hand or mechanical stirring.

3.3 Preparation of the paints to AA 56105 & AA 56131

Both these paints as supplied, consist of two separate ingredients; namely base and accelerator. Shortly before mixing and use, these shall be thoroughly stirred. The base and the accelerator shall be accurately mixed together in the proportions as given below for material supplied by different suppliers.

Supplier's Name	Paint Specification	Mixing Ratio in parts by Volume	
		Base	Accelerator
Shalimar Paints	AA 56131	3	1
Berger Paints	AA 56131	3	1
	AA 56105	3	1
Alkali & Chemicals	AA 56131	4	1
	AA 56105	6	1
Goodlass Nerolac	AA 56131	3	1
	AA 56105	3	1
Garware Paints	AA 56131	3	2
	AA 56105	5	1
Asian Paints	AA 56131	4	1
	AA 56105	3	1

Accelerator should be added to the base and not the base to the accelerator. The paints shall be mixed with continuous stirring until a uniform consistency is obtained.

Note: After mixing, these paints shall be used within 4 hours.

3.4 Consistencies of the paint

The paints shall be used at the following consistencies measured in ford cup No. 4 (IS:3944) under the normal shop temperature.

Sl.no.	Paint	Consistency	
		Spraying	Brushing
i)	Chemical resistant epoxide priming paint to AA 56105	30 ± 2 secs	40 to 60 secs
ii)	Chemical resistant epoxide finishing paint to AA 56131	30 ± 2 secs	40 to 60 secs
iii)	Oil resistant air drying synthetic enamel to AA 56132	45 ± 5 secs	60 ± 5 secs
iv)	High build black coal tar epoxide paint to AA 56135 (HE 5043)	See note-1 below	See note-1 below

Note: 1) For AA 56135 the maturing time for mixture of base and accelerator before actual use shall be 30 minutes. Thinning of AA 56135 (HE 5043) is not recommended. If there is problem in application of paint, TSD should be consulted.
The mixed paint shall be used within 4 hours.
2)Thinning of AA 56132 to be done by white spirit to AA 56701.
3)Thinning of AA 56131 & AA 56105 is to be done by its special thinner AA 56708.

4. METHODS OF PAINT APPLICATION:

For methods of paint application refer BHEL standard AA 0674123.

5. SURFACE PREPARATION:

5.1 For machined ferrous Surfaces

All machined surfaces shall be cleaned and degreased with white spirit to AA 56701, any rust or staining being carefully removed by abrasive paper of 220 No. and again cleaned with white spirit to AA 56701.

The surface shall then be thoroughly dried by a blast of air or dry cloth.

5.2 For other ferrous Surfaces

It is necessary that surfaces to be painted is free from loose dust, mill scale, rust, grease, oil, old paint etc. For surface cleaning and preparation refer BHEL standard AA 0674101.
Note: The shot blasted surface shall conform to Grade SA 2.5 of Swedish standard SIS 055900.

5.3 For concrete embedded surfaces

All concrete embedded surfaces shall be treated with cement wash as below.

5.3.1 Oil and grease shall be removed by using white spirit to AA 56701. Thereafter all dust, loose scales, rust etc. shall be removed by sand/ shot blasting to Swedish Standard SIS 055900 Gr SA 2.5.

5.3.2 Cement wash shall be prepared by mixing 15 to 20 Kg of latex emulsion (2.11) or 30 Kg of polyvinyl acetate based adhesive/ Fevicol (2.12) with 100 Kg of dry cement. In order to make the process easier cement shall be made into slurry by adding 40-50 litres of water and then latex emulsion or polyvinyl acetate base adhesive is added. This shall be applied to the surface by brush.

5.3.3 After 8 hours of application, water shall be sprinkled on the coated surface to facilitate curing of cement. Setting time for the cement wash is 24 hours.

6. APPLICATION OF PAINTS:

6.1 The paints prepared as per clause 3.2 and 3.3 shall be applied as shown in the schedule in clause 6.4.

In case of machined surfaces, TRP shall be applied immediately after the surface preparation as per clause 5.1 while in case of unmachined surfaces the paint shall be applied within 6 hours of preparation of surfaces as per clause 5.2. For unmachined surfaces in the event of more than six hours elapsing, before application of paint is done, the preparation as detailed in clause 5.2 above shall be repeated in full.

6.2 Drying time

The following drying schedule should be followed after the application of the paints.

Sl.No.	Paints	Drying Time
i)	High build black coal tar epoxide paint to AA 56135	18 hours
ii)	Oil resistant, air drying synthetic enamel to AA 56132	16 hours
iii)	Chemical resistant epoxide priming paint to AA 56105	16 hours
iv)	Chemical resistant epoxide finishing paint to AA 56131	16 hours

6.3 Sanding

Between any two successive coatings, immediately after the former coat of painting is dried as per clause 6.2 sanding to be done on this coat by using water proof abrasive paper 220. The loose dust shall now be wiped off by a blast of air or dry clean cloth and then the later coat of paint be applied.

6.4 Schedule of paint application

Description of surface	Category of paint	Typical example	Preparation	Painting or treatment
Exposed unmachined surfaces to atmosphere	A	Stator frame, spider, lower bracket, upper bracket, generator flooring, brush gear casing, fan, outside air/oil/water piping, exposed surfaces of shaft after final erection at site, inside surface of concrete barrel etc.	As detailed in para 5.2	Apply two coats of AA 56105 & 2 coats of AA 56131.
Surfaces coming in contact with oil	B	Lower bracket, upper bracket, oil piping of H.S. lubrication, oil retaining sleeves, oil retainer etc.	As detailed in para 5.2	Apply two coats of AA 56132 (Jasmine yellow)
Surfaces coming in contact with water	C	Cooling water piping	As detailed in para 5.2	Apply two coats of AA 56105 followed by 2 coats of AA 56135
All machined surfaces	D	Journal faces & thrust faces of shaft & thrust collar, spider, stator frame, lower bracket, upper bracket, fasteners, shims etc.	As detailed in para 5.1	To be coated with liberal coat of rust preventive to AA 55154 to get jet black finish.
Surfaces coming in contact with cement concrete	E	Lower bracket sole plate, stator sole plate etc	As detailed in para 5.3	Liberal application of cement wash

Note 1: Complete painting of the machines as per clause 6 shall be done in the factory only. An extra coat of finishing paint can be applied at site if felt necessary.

Note 2: After receipt of machines at site, patch repair on any damaged area shall be done immediately with paint, temporary rust preventive as the case may be.

Note 3: In case of machines to be stored for prolonged period, a schedule of checking for paint damage after every six months shall be carried out and damaged area if any shall be repainted.

Note 4: During dispatch of a machine, suitable protection such as tarred felt, water proof paper or polythene sheet must be provided between machined surface and packing wood to avoid corrosion.

Note 5: Customers be advised to repaint the machinery as soon as they notice that top coat of the paint has been damaged to avoid surface getting corroded. Repainting on corroded surface does not afford any protection unless rust is again thoroughly removed before repainting.

6.5 Thickness of finished paint film

The dried film thickness (DFT) shall be as below, when measured by using a suitable instrument for non-destructive measurements of coats as detailed in IS: 6012 - 1992.

Category of paint	Thickness of finished paint film (Micron)
A	90 to 140 (At local points 200 max)
B	25 to 60 (At local points 100 max)
C	225 to 275

Note: In case specified thickness of paint film is not achieved then additional coats of finishing paint shall be applied.

6.6 Thickness of cement wash

Average built up thickness (Dry film thickness) - 200 Micron Min.

Note: At some isolated areas lower thickness up to 15 % of average built up is allowed.

7. QUALITY CHECKS & INSPECTION:

7.1 Following points shall be ensured to achieve overall quality of the job:

(a) Compressed air used for spray application shall be free from oil, moisture and other contaminants.

(b) Steel surfaces to be painted shall be free from burrs, sharp edges, lamination, surface imperfections and any other contamination detrimental to paint adhesion finish or appearance.

(c) All surfaces to be coated have been cleaned in accordance with the requirements of clause 5 of this specification.

(d) All surfaces to be coated shall be completely dry before paint application.

(e) Paint components shall be mixed as prescribed / recommended and mixed paint shall be consumed with in specified pot life.

(f) Drying / curing requirements shall be fully satisfied.

(g) Damaged paint coating shall be properly touched up before another coating application.

7.2 Inspection

7.2.1 Visual

The painted surfaces shall be free from spacks of iron, salt or dust. It shall be smooth and uniform and there will be no visible porosity, pot holes, or any other paint coating defects. If runs and sags dry spray and over spray are present these defects shall not be more than 5% in any given area (sq. feet) and cumulatively not more than 2% of total surface area unless otherwise specified.

7.2.2 Dry film thickness (DFT)

Dry film thickness should be measured with an appropriate measurement gauge calibrated as per clause 6.5 & 6.6. Unless otherwise specified.

7.2.3 Adhesion by tape test (For A, B & C category of paint)

This test is carried out by applying & removing pressure sensitive adhesive tape over cuts made in the paint film to ensure that adhesion of paint film to metallic substrate is adequate.
This test shall be carried out generally in line with ASTM D 3359 except that Transparent Pressure Sensitive Adhesive Tape of 25 mm width, shall conform to IS : 2880 or should bear ISI mark.
Method A of ASTM D 3359 shall be followed in case thickness of film is greater than 125 microns & acceptance criterion shall be "4A" Viz trace peeling or removal along incisions, and method B of ASTM D 3359 shall be followed when thickness of paint film is between 50 to 125 microns and acceptance shall be "4B", viz small flakes of coating are detached at intersections, less than 5 % of the area is affected.

8. REPAIR OF DAMAGED PAINT WORK:

8.1 Local damage without rust:

Where local damage to the paint work has occurred without subsequent rusting, the damaged area shall be cleaned with white spirit. The number of paint coats shall be applied which are sufficient to provide a dry film thickness, not less than that of the surrounding paint.

8.2 Local damage with rust:

Where local damage to the paint work with subsequent rusting has occurred, the rust shall be removed by mechanical cleaning as per clause 4 and followed by subsequent procedure laid down in clause 8.1

8.3 Extensive damage:

In case of extensive damage, entire old film shall be removed and surface prepared as per clause 5 and subsequently painted as per clause 6 to the required thickness.

NOTE: This product standard is applicable for "EXPORT" projects also.

BHOPAL	PRODUCT STANDARD	NO. : HG07003
	PACKING INSTRUCTIONS FOR ROTOR SHAFT AND THRUST COLLAR.	REV NO : 03 REV. DT : 04-09-18
	DEPARTMENT : HGE	PAGE 1 OF 4

Procedure for Inspection of wooden packing materials & Packing of Rotor Shaft and Thrust Collar

Scope : This procedure covers the Inspection of wooden packing materials and method of packing of the rotor shaft and thrust collar.

Objective : To establish a rust proof safe packing procedure of rotor shaft and thrust collar.

Responsibility : Section Incharge (Q.C.) and Section Incharge (Logistics).

Packing Methodology: -

1) The incoming wooden packing boxes / wooden raw material must have details which shall consists of vendor's name, PO/WO number, box supply date, box serial number for identification and traceability.

Wooden packing boxes and packing materials received by the stores shall be inspected by Quality Control (QC) department as per the respective standards & specifications as per contract / work order. Dimensions of the wooden packing boxes with the availability of suitable gaps inside the wooden packing box for ease of mounting of items inside the box with suitable supports shall be checked by QC. Moisture content in the wooden packing boxes / wooden raw material shall be checked by QC, by using a Moisture Analyser or any suitable alternate method and record of the same shall be maintained. One sample per 5 boxes of each challan shall be compulsorily chosen for analysing the moisture content. Effort shall be made to select a sample from a box suspected to be the wet after a thorough visual inspection (the boxes may also be hand touched for a feel of wetness). At least, one sample is to be chosen, even if the quantity of boxes of a particular challan is less than 5No's.

The non-conforming boxes / raw materials to be rejected and returned to the vendor of wooden packing boxes / wooden raw material for replacement.

2) All items to be packed are to be marked by QC with "OK" stickers only need to be packed.

3) The packing of rotor shaft and thrust collar should be done in a covered shed.

4) Items to be packed are to be arranged and aligned properly inside the wooden packing boxes of specific size.

	Prepared By	Checked By	Approved By
Signature :			
Name :	Jayesh Janardhanan	Ritesh Gajbhiye	A Biswas
Revision:	Rev03: Clause no. 17 added.		

5) **Packing Procedure for Rotor Shaft:**

Vacuum packing material (aluminium barrier foil / suitable alternate material).

5.1) The rotor shaft shall be coated with 1st layer of TRP.
5.2) Tapped holes are to be filled with grease and closed with plastic grub screw. The plain holes are to be closed with rubber plug. The above two operation to be ensured by HGM.
5.3) Wrap the shaft with oil paper / VCI paper.
5.4) Now wrap the shaft with a layer of 4 mm thick foam sheet, join the foam sheet with adhesive tape and further cover the whole shaft with VCI paper.
5.5) Place the metal / wooden support structure with 2 layers of 5 mm thick plastic PVC sheet over the shaft seating faces.
5.6) Place the half part of vacuum packing material on the shaft seating face of support structure in such a way that it covers the whole shaft from lower side and over it place the packed shaft.
5.7) Put other half part of vacuum packing material in such a way that it covers the whole shaft from upper side and seal both the vacuum packing materials with hot sealing machine with an opening for vacuum packing.
5.8) For vacuum packing suck all the inside air from the sealed vacuum packing material and closed the opening by heat sealing machine. Alternate method for vacuum packing may be adopted.
5.9) Additionally wrap the entire shaft with 4 mm thick foam sheet and close the joints with adhesive tape.
5.10) At bearing location, surfaces are to be covered with 5 mm thick PVC sheet and binding with endless lashing belt.
5.11) After this, cover the packed shaft with a layer of tarpaulin / silpaulin sheet.
5.12) Mount the fixing clamps at support structure and fix it with bolting. Now fix the four side walls made of wooden pallets (with tarpaulin / silpaulin sheets lining on inside face).
5.13) Secure the packed shaft firmly to arrest relative movement of the component inside the box. This can be achieved by using beams, battens etc. to be nailed or bolted without damaging the packed shaft.
5.14) All the inside faces of wooden pallets should have tarpaulin / silpaulin lining and the tarpaulin / silpaulin sheet lining on inside face of top cover should be placed in such a way that it projects (about 150mm on all side) outside the case. Nail securely the top cover and tarpaulin / silpaulin round the case.

6) **Packing Procedure for Thrust Collar:**

6.1) The thrust collar shall be coated with 1st layer of TRP.
6.2) Tapped holes are to be filled with grease and closed with plastic grub screw. The plain holes are to be closed with rubber plug. The above two operation to be ensured by HGM.
6.3) Apply wool felt on thrust and journal faces and wrap it with cotton tape.

6.4) Wrap the thrust collar with oil paper / VCI paper.
6.5) Now wrap it with a layer of 4 mm thick foam sheet, join the foam sheet with adhesive tape and further with VCI paper.
6.6) Place the wooden packing box with a lining of tarpaulin / silpaulin sheet and place 2 layers of 5 mm thick plastic PVC sheet at the bottom face.
6.7) Place the vacuum packing material over it.
6.8) Carefully lower the packed thrust collar in to the wooden packing box with thrust face downwards and rest it on the soft wood or cushioning material such as rubberised coir, foam rubber etc.
6.9) Put another part of vacuum packing material all around the thrust collar and seal both the vacuum packing materials with hot sealing machine with an opening for vacuum packing.
6.10) For vacuum packing suck all the inside air from the sealed vacuum packing material and closed the opening by heat sealing machine. Alternate method for vacuum packing may be adopted.
6.11) After this, cover the packed thrust collar with a layer of tarpaulin / silpaulin sheet.
6.12) Secure the packed thrust collar firmly to arrest relative movement of the component inside the box. This can be achieved by using beams, battens etc. to be nailed or bolted without damaging the packed thrust collar.
6.13) All the inside faces of wooden pallets should have tarpaulin / silpaulin lining and the tarpaulin / silpaulin sheet lining on inside face of top cover should be placed in such a way that it projects (about 150mm on all side) outside the case. Nail securely the top cover and tarpaulin / silpaulin round the case.

7) The VCI paper must be secured properly with adhesive tape. It has to be ensured that all the packing materials used should not get damaged / punctured during the packing process.

8) Silica gel packets are to be placed and uniformly distributed inside the boxes to remove/prevent moisture. In order to cover the maximum space inside the box, small quantity packets should be used.

Note: Thumb rule be used for calculating the weight of silica gel w.r.t. container volume is: $1m^3$ of container size require 1.0kg of silica gel.

9) The top covers of boxes shall be sealed only after final clearance from QC for confirmation of above.

10) The dispatch clearance to be given after joint inspection by QC and Logistics. A register is to be maintained by logistics section as per Annexure- I for record of the same.

11) All boxes should be covered by GI sheet on all four sides and over top in such a way that it should project about 150-200mm on all sides. All gaps and joints should be secured properly.

12) Steel strap of 20/25mm wide to IS 5872:1990 should be strapped around the case, tensioned and crimped. There should be at least two straps per case. These straps should be across the top cover. Use 20/25mm wide/corner straps to IS 5872:1990 wherever necessary.

13) For transportation the packed items are to be mounted properly on the truck/trailer and additional supports to be welded and lashed on vehicle as per the transportation scheme.

14) Packing list should be placed in polythene bag and to be placed inside and outside of each box with following details : -

i). Box No., PO No., Product name, Project Name, Quantity, Customer/Consignee, Dimension of box, Weight of the box etc.

ii). Instructions for transportation to be mentioned on box :

a) Water proofing (Umbrella Stencilling).

b) Upside direction.

c) Sling position indicator.

iii). Following recommendations for storage conditions also to be mentioned on each box :

a) All our products are packed in accordance with our standard packing or as per customer requirements, which are agreed in orders.

b) Our products should be stored indoors, protected from rain, snow, dust, moisture & corroding agents (smoke, steam, acid & oil vapours, chlorine, ammonia etc.)

c) Warehouses should be protected against temperature & humidity changes. The minimum & maximum temperatures should be + 5 deg °C and 40 deg °C respectively, while relative humidity inside should preferably be kept below 40%.

d) Once after opening the packing, the material should be consumed at the earliest, since the protection given by the packing material is no longer effective.

15) Nailing of boxes after the complete packing and loaded on trailer for dispatch is strictly prohibited.

16) The vehicle containing these wooden packed boxes should be covered by suitable tarpaulin / silpaulin during transportation. A register as per Annexure- II shall be maintained by Section Incharge (Logistics) at factory exit to record the compliance.

17) References:

Corporate Standard

a) AA0490004 – Seaworthy packing.
b) AA0490009 – Export packing.
c) AA0490010 – Domestic packing.

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Rev00: Dated 01-11-14.
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