Bharat Heavy Electricals Limited

Heavy Equipment Repair Plant

Tarna Shivpur Varanasi-221003
website: https://herp.bhel.com

Enquiry Number : **E-304-25-0058-61-1** Date : **07/May/2025**

Enquiry For Material :-

Sl No	Material Description	Material Code	Quantity	Unit
1	MODULAR SPRING ASSLY (HY 1105.00) AS PER DRG. NO. 26130403010 REV-00	RV1019600004	2.0	NOS

Remarks

(A)SUPPLY CONDITION
1. ITEMS ARE TO BE SUPPLIED AT BHEL HERP STORES.
2. PRE-DESPATCH INSPECTION WILL BE CARRIED OUT BY BHEL REPRESENTATIVE AT PARTY'S WORKS AS PER QUALITY PLAN NO. RV/FAB&MCD/58 REV-00.

(B)TECHNICAL DELIVERY CONDITION
1. MATERIAL SHOULD BE AS PER SPECN MENTIONED IN DRAWINGS.
2. DIMENSIONS AND TOLERANCES TO BE MAINTAINED AS PER DRG/SPECN.
3. BHEL SHALL ISSUE JOURNAL PRESSURE SPRING (ITEM NO. 02 OF ASSLY DRG.26130403010), QTY 1 NO. PER ASSLY TO PARTY AS FREE ISSUE MATERIAL. REST OF THE ITEMS ARE IN PARTY'S SCOPE OF SUPPLY.
4. FREE ISSUE MATERIAL SHALL BE ISSUED TO THE PARTY AT LEAST ONE MONTH PRIOR TO LOT WISE DELIVERY SCHEDULE OF MODULAR SPRING ASSLY.
5. MATERIAL SHOULD BE PROCURED ONLY FROM APPROVED SOURCES (WHEREVER SPECIFIED IN QA PLAN). FOR APPROVED SOURCES, ANNEXURE PKG-07/SOURCE REV 01 SHOULD BE REFERRED .
6. ALL M.S. PLATES > 25 THK. SHOULD BE OF UST QUALITY ONLY.

(C) TEST CERTIFICATE : REQUIRED AS PER QUALITY CHECKS MENTIONED IN QUALITY PLAN.

(D) GUARANTEE CERTIFICATE :REQUIRED FOR 24 MONTHS AGAINST ANY MANUFACTURING DEFECTS FROM THE DATE OF RECIPT AT BHEL HERP.

(E) PACKING AND PRESERVATION INSTRUCTION:
1. PAINTING AND PRESERVATION SHALL BE AS MENTIONED IN QUALITY PLAN.
2. ITEM TO BE SUPPLIED IN WOODEN BOXES OF 1" THICK PLANKS AND 1.5" BRACKETS AFTER WRAPPING IN 90 GSM THICK POLYTHENE SHEET. WOODEN BOX SHOULD BE COMPACT SO THAT PACKED ASSLY IS NOT DAMAGED DURING TRANSIT. SINGLE WOODEN BOX SHOULD NOT CONTAIN MORE THAN ONE ASSLY.

(F)THE COST OF FREE ISSUE MATERIAL IS 61834.75/-APPROX.PER PIECE WHICH WILL BE SUPPLIED BY BHEL.

(G)DELIVERY IS REQUIRED WITHIN 04 MONTHS FROM PO DATE.HOWEVER, EARLY DELIVERY IS ACCEPTABLE.

(H) THE VALIDITY OF PURCHASE ORDER (PO) FOR SENDING BHEL FREE ISSUE MATERIAL (FIM) SHALL BE 1.5 YEARS FROM THE DATE OF PO i.e. BHEL CAN ISSUE FIM TO THE PARTY UPTO 1.5 YEARS ONLY FROM PO DATE.

(I) BANK GUARANTEE:
(i) THE COST OF BHEL FREE ISSUE MATERIALS FOR THE ITEM WILL BE AS MENTIONED ABOVE, PARTY WILL HAVE TO SUBMIT EQUAL AMOUNT OF SECURITY DEPOSIT (IN THE FORM OF 10% BG/FDR/DD/CHEQUE/BANK TRANSFER AND 90% INDEMNITY BOND) TOWARDS THE COST OF BHEL MATERIALS TO BE ISSUED TO THEM BEFORE THE ISSUE OF BHEL MATERIALS TO THEM.

(ii). BHEL MAY ASK THE SUPPLIER FOR SUBMISSION OF FULL SECURITY DEPOSIT AMOUNT OR PART DEPENDING UPON THE AVAILABILITY OF FREE ISSUE MATERAILS AT OUR END. AT ANY POINT OF TIME, PROPORTIONAL SECURITY DEPOSIT OF TOTAL/CUMMULATIVE MATERIAL VALUE SHOULD BE MAINTENED.

(iii). PARTY MUST HAVE TO SUBMIT THE SAME WITHIN 02 WEEK TIME FROM THE DATE OF WRITTEN INTIMATION BY BHEL

WITHOUT FAIL OTHERWISE IT WOULD TREATED AS FAILURE OF HONOURING PO TERMS AND ACCORDINGLY BHEL MAY CANCEL THE PURCHASE ORDER AND INITIATE ALTERNATE PROCUREMENT ACTION AT SUPPLIER RISK & COST.

(iv). IN CASE OF ABSENCE OF DESIRED SECURITY DEPOSIT AT BHEL END AND ALSO NON-RESPONSE OF POINT NO. 03 AS ABOVE,
a. BHEL MAY HOLD THE PENDING PAYMENTS OF SUPPLIER AVAILABLE AT BHEL ON THEIR CONSENT.
b. IF NO PAYMENT IS PENDING AT BHEL END, ACTION FOR ALTERNATE PROCUREMENT ACTION MAY BE INITIATED.

(J) TRANSPORTATION CHARGES FOR SENDING THE FREE ISSUE MATERIALS FROM BHEL STORES VARANASI TO PARTY'S WORKS TO BE BORNE BY BHEL (NOT APPLICABLE FOR LOCAL VENDORS) AND TRANSPORTATION CHARGES FOR SENDING THE FINISHED COMPONENTS FROM PARTY'S WORKS TO BHEL STORES VARANASI WILL BE BORNE BY THE PARTY. FOR LOCAL VENDORS TO & FRO FREIGHT CHARGES TO BE BORNE BY PARTY ITSELF.

(K) IMPORTANT NOTES REGARDING TERMS& CONDITIONS:
1. ALL OTHER TERMS AND CONDITIONS SHALL BE AS PER THE ATTACHED GTC (PARTY HAS TO STRICTLY ADHERE THESE TERMS & CONDITIONS).
2. SPLITTING CLAUSE FOR THIS ENQUIRY ARE NOT APPLICABLE.
3. PARTY MUST QUOTE CONSIDERING SCRAP RATE OF BHEL FREE ISSUE MATL AS SCRAP IS TO BE KEPT BY PARTY.

PQR for Crirical Regular Direct Mill items

PQR Ref No: PQR/24-25/ Crirical Regular Direct Mill items	**Date: 23.08.2024**
Rev No: 00	**Review Date: 23.08.2024**
PQR Revision Date:	

Sl. No.	BHEL Terms	Supplier's ComplianceYES/NO
1	**Offers are accepted from:**	
1.a	Only Manufacturer's Offers shall be considered for the Tender Enquiry.	
2	**Supplier shall give list of In-House Facilities:**	
2.a	Vendor shall have in-House necessary Manufacturing facilities required for manufacturing and supply of item/s as per drawing/specification.	
2.b	BHEL reserves right to visit the Works of the Manufacturer for Physical verification of the Manufacturing facilities (as declared by them) and assessment of their Quality systems during Technical Evaluation of the Offers.	
2.c	Bidders shall submit detailed Manufacturing process Plan along with the Technical Offer.	
3	**Experience:**	
3.a	Bidders shall submit the necessary documents proving their Experience in Supplying same or similar items to any Power Plant equipment Manufacturer (worldwide or within India) in last three years from the date of Enquiry. Documentary evidances to be submitted in the form of Customer's Purchase Order copies / Material Acceptance Report and item drawings/specifications. Documentary evidences submitted shall strictly meet all the technical requirement of the NIT.	
3.b	BHEL reserves right to verify the details from the Bidder's customers based on Documents submitted as a part of past experience. BHEL may ask for other relevant documents in line with above to review the capacity and capability of vendor with respect to enquired items.	
4	**Financial Capability:**	
4.a	**Turn Over:-** Turn over of Non-MSe vendors should be 100% of tender value. Relaxation for MSe vendors/ Notified Start-Ups on turn over will be as per MSME guidelines. UDYAM Certificate required for Mse status.	
4.b	Applicable only for Non-Mse vendors: Audited balance Sheet and Profit and Loss account Statement of last three consecutive year (with UDIN) required along with part-1 bid. Or A CA Certified Consolidated summary (with UDIN) for last 3 consecutive years having annual turn over and Profit and Loss to be enclosed along with Part-1 bid . For Vendors having Turn over less than 1 crore in any of the financial year, CA certified Financial Turn over and Profit Loss (with UDIN) may be accepted for that year only.	

Note-1: Non Submission of the above requested documents/non compliance to the above points will result in rejection of the Offers without further Notice/Intimation to the Bidder and no correspondance will be entertained at later date.

Note-2: "Similar items" means items having same/similar manufacturing process,similar nature of use of item as that of enquired items etc.

On Bidder's office letter pad

Make in India (Model Certificate) Annexure-I

Self-Declaration

Enquiry No.	
Enquiry Date	

In line with Government public procurement order Number P-45021/2/2017-B.E-II dated 15.06.2017, and further modified order dt. 28.05.2018, 29.05-2019, 04.06.2020 and 19.07.2024.

I / We hereby declare that I / We are a "Local Supplier" meeting the requirement of minimum local content (…….%) defined in the above government notification for the goods against above mentioned enquiry Number.

Details of location at which local value addition will be made is as follows:

Door No.	
Street / Address 1	
Street / Address 2	
District	
State	
Country	
PIN Code	

We also understand that the false declarations will be considered as breach of Integrity and liable for action.

For Company Name:
Seal:

Signature:

Date:
Place :

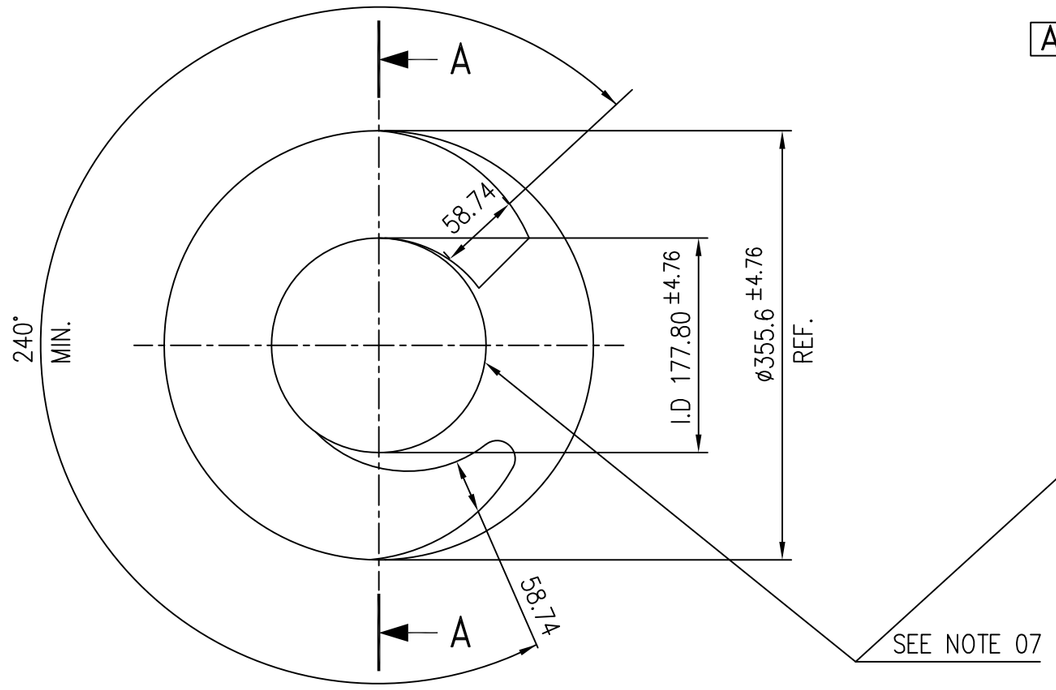
(Please fill all Yellow color field)

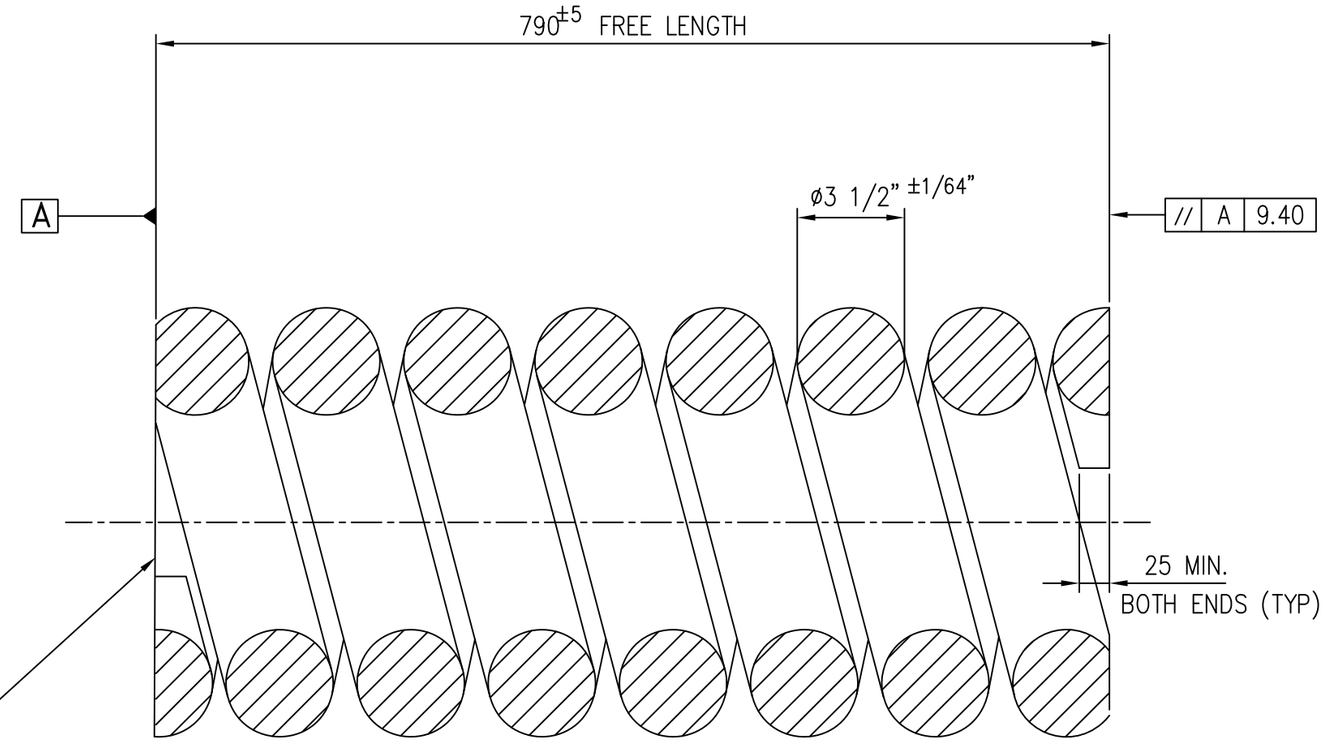
FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DJC

DRG.NO. 2-61-300-00776





SECTION–AA

NOTES:–

1. SPRING TO HAVE SQUARED AND GROUND ENDS
2. HEAT TREATMENT & TOLERANCES IN ACCORDANCE WITH ASTM. A–125 UNLESS OTHERWISE SPECIFIED.
3. MAGNETIC PARTICLE INSEPECTION PER ASTM E–709 IS REQUIRED SURFACE DISCONTINUOUS GREATER THAN 1/16" LONG ARE CAUSE FOR REJECTION FLAWS MAY BE WET GROUND OUT TO A DEPTH OF 1/16" MAX.
4. SHOT PEENING REQUIRED INTENSITY–5 TO 7C; MEASURED WITH ALMEN STRIP SHOT SIZE 550 HARD 100% VISUAL INSPECTION.
5. STRESS RELIEVE AFTER GRINDING
6. SPRING TO BE COATED WITH PERSESRVATIVE OIL FOR SHIPPING
7. REMOVE ALL SHARP EDGES FROM GROUND ENDS W / 1/8" RAD.
8. CUSTOMER APPROVED QUALITY PLAN TO BE FOLLOWED.
9. REFER PROD.STD.BA75019 FOR TDC
10. INSPECT SPRING RATE PER ASTM A–125, SECTION S6. TOLERANCE ±10% UNLESS OTHERWISE SPECIFIED.
11. BOTH ENDS OF THE BAR STOCK ARE TO BE HOT TEMPERED BEFORE COILING. BLUNT END CONSTRUCTION IS NOT PERMITTED.

SPRING COILING SPECIFICATIONS:–

FREE LEANGTH = 790.6±5
SOLID LENGTH = 663.6 ±6.4
SPRING RATE = 535.745 kgs/mm ±10%.
ACTIVE COILS = 6.16 REF.
TOTAL COILS = 7.46 REF.
WEIGHT = 303.91
BAR STOCK CENTRELESS GROUND.

MATL:–

LOW ALLOY ASTM A–322 GR. 4161 H.F QUENCHED AND TEMPERED TO 429 TO 477 BHN.

ITEM NO	DESCRIPTION	DRAWING NO.	VAR. NO.	RAW MATERIAL SIZE OR CASTING DRG.NO. OR FORGING DRG.NO.	BA9717552037	303.91
					BA75019	
					MATERIAL CODE	UNIT WT.
					MATERIAL SPECN.	QUANTITY

REV.	DATE	ALTERED	CHECKED	APPD.
04	21.03.12	TOL. ON SOLID LENGTH WAS ±7%. TOL. ±10%. ADDED ON SPRING RATE.		
03	14.03.11	NOTE 10,11 ADDED		
02	04.06.03	NOTE 9 ADDED		
01	08.10.98	DRAWING REDRAWN ON CAD NOTE 8 ADDED		

ZONE: 04 — —; 03 —; 02 E2; 01 —

THE FOLLOWING CONDITIONS APPLY EXCEPT OTHERWISE STATED...

1. REF.TO HY0230261 FOR UNSPECIFIED TOLERANCES.
2. CHAMFER M/CD SHARP EDGES 1.2 TO 1.0 AT 45°.
3. INTERNAL M/CD CORNER RADII 1 TO 0.7.
4. THE SURFACE ROUGHNESS WHEREVER NOT SHOWN SHALL BE TAKEN FROM THE SURFACE ROUGHNESS SHOWN OUT SIDE BACK SLASHES GIVEN AT THE TOP MOST RIGHT CORNER OF THE DRG.

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: 1003 XRP BOWL MILL

BHEL BHARAT HEAVY ELECTRICALS LTD. HYDERABAD

	NAME	SIGN.	DATE	NO.OF VAR.
DRN.	N.D.S		5.10.98	–
CHD.	S.G		5.10.98	
APPD.	K.M.RAO		5.1098	

DEPT.	GRADE OF TOL. DIM.	SCALE	WEIGHT(Kg)	REF. TO ASSY DRG.	ITEM No.	NO.OF ITEMS
PULV. ENGG. CODE 446	E/M/F	N.T.S	303.91	C–101–01297 REV. 2	–	–

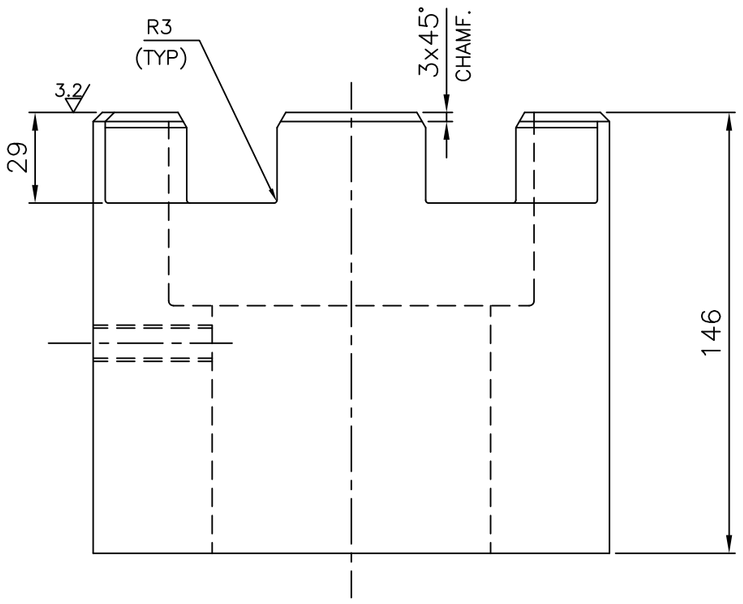
TITLE: JOURNAL PRESSURE SPRINGS

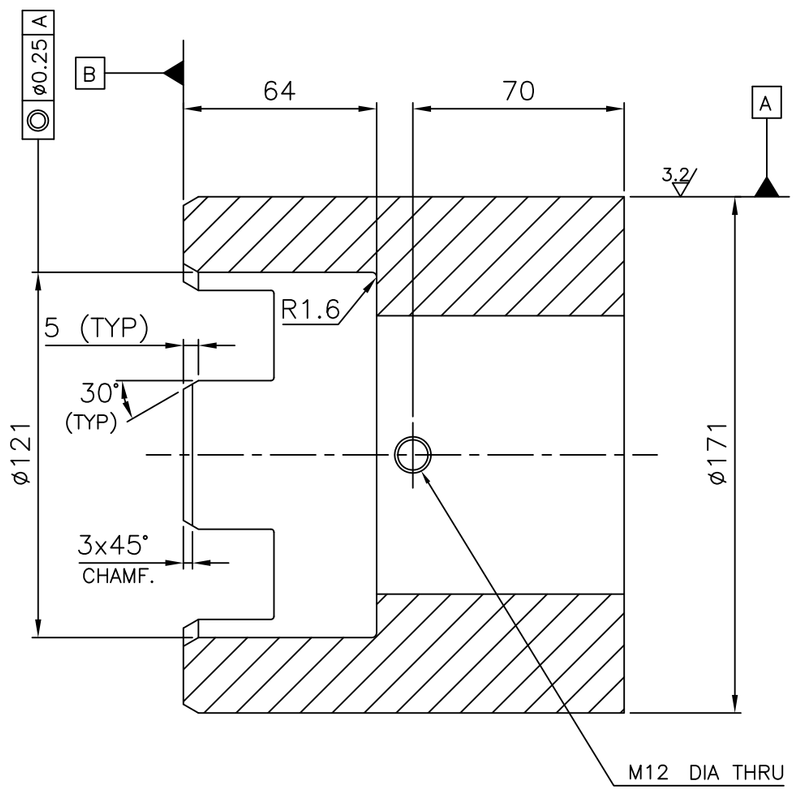
DRAWING No.. 2-61-300-00776 REV. 04

SHEET No. — No. OF SHEETS —

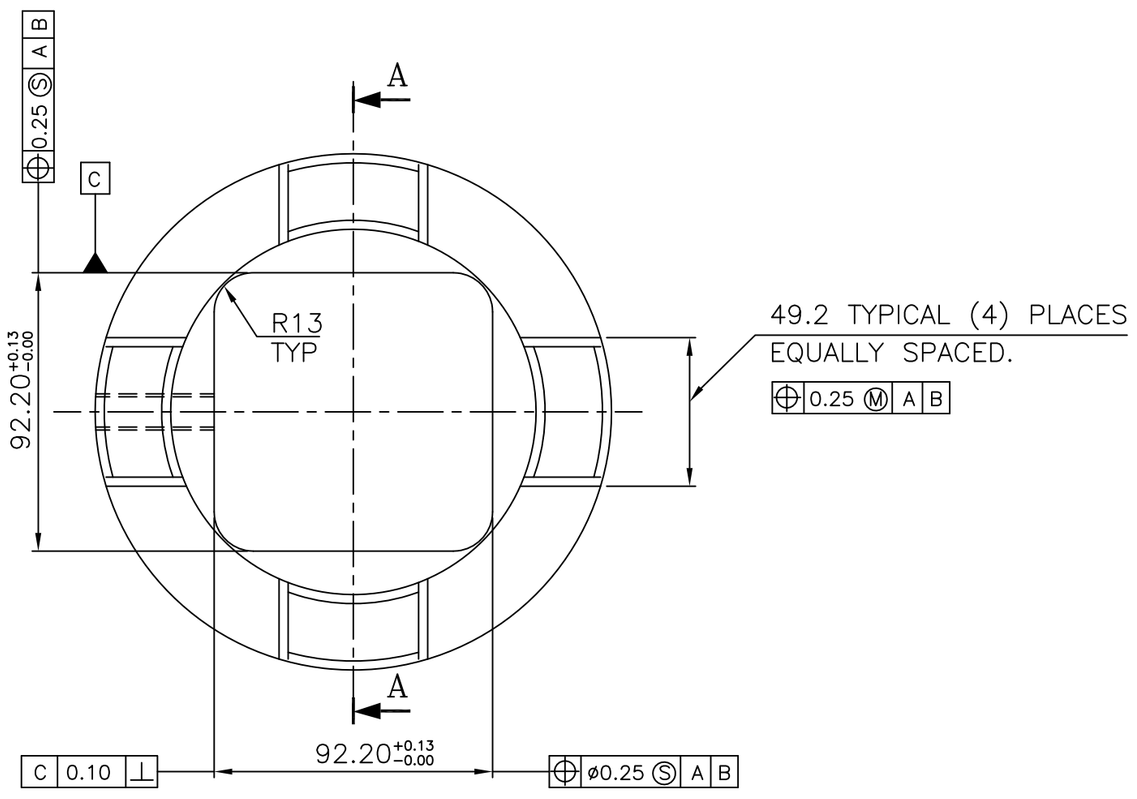
COMP. FILE NAME 26100776.DWG | REF.DRG.NO. | INVENTORY NO.

TD–150/REV.NO.03 SIZE A2





SECTION–AA



6.3 3.2

NOTES:–

1. ALL SURFACES TO BE 6.3 UNLESS OTHERWISE NOTED.
2. BREAK ALL SHARP EDGES AND CORNERS UNLESS OTHERWISE NOTED,
3. ~~VAR–01 WITH, INCH THREADING VAR–02 WITH METRIC THREADING~~.
4. FORGING TO BE SUPPLIED WITH 5mm M/C ALLOWANCE ON DIMENSION 146 & ø 171 OTHER FEATURES TO BE FULLY FINISHED EXCEPT THREADING.
5. CUSTOMER APPROVED QUALITY PLAN TO BE FOLLOWED.

ITEM NO	DESCRIPTION	DRAWING NO.	VAR. NO.	RAW MATERIAL SIZE OR CASTING DRG.NO. OR FORGING DRG.NO.	MATERIAL CODE	NET WT.	GROSS WT.
	FORGING				BA9517030002	25	00
					HY19370	1	
					MATERIAL SPECN.	QUANTITY	

THE FOLLOWING CONDITIONS APPLY EXCEPT OTHERWISE STATED...

1. REF.TO HY0230261 FOR UNSPECIFIED TOLERANCES.
2. CHAMFER M/CD SHARP EDGES 1.2 TO 1.0 AT 45°.
3. INTERNAL M/CD CORNER RADII 1 TO 0.7.
4. THE SURFACE ROUGHNESS WHEREVER NOT SHOWN SHALL BE TAKEN FROM THE SURFACE ROUGHNESS SHOWN OUT SIDE BACK SLASHES GIVEN AT THE TOP MOST RIGHT CORNER OF THE DRG.

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: 1003 XRP BM

BHARAT HEAVY ELECTRICALS LTD. HYDERABAD

	NAME	SIGN.	DATE	NO.OF VAR.
DRN.	N.D.S.		17.9.98	–NA–
CHD.	S.G		17.9.98	
APPD.	K.M.R		17.9.98	

DEPT. PULV.ENGG	UNTOL. DIMS. GR.		SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO.OF ITEMS
CODE 446	℄/M/Y		1:2	13.50	C–101–01303–4	–NA–	–NA–

TITLE: SPRING STUD LOCKNUT KEEPER

DRAWING NO. 2–61–300–00778 REV. 04

SHT. No 01 NO. OF SHT. 01

REV.	DATE	ALTERED	CHD/APPD	ZONE
04	29.11.05			NOTE.03 DELETED. VARIANTS REMOVED.
03	18.8.01			TOLERANCE ON DIM 92.2 ADDED. DIM 90.20 DELETED. SUFACE C AND POSITIONAL TOLERANCE ON 92.2 ADDED.
02	17.9.98			NOTES 3&4 ADDED DRAWING REDRAWN. INCARPORATING PREVIOUS REVISION. NOTE 5 ADDED

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

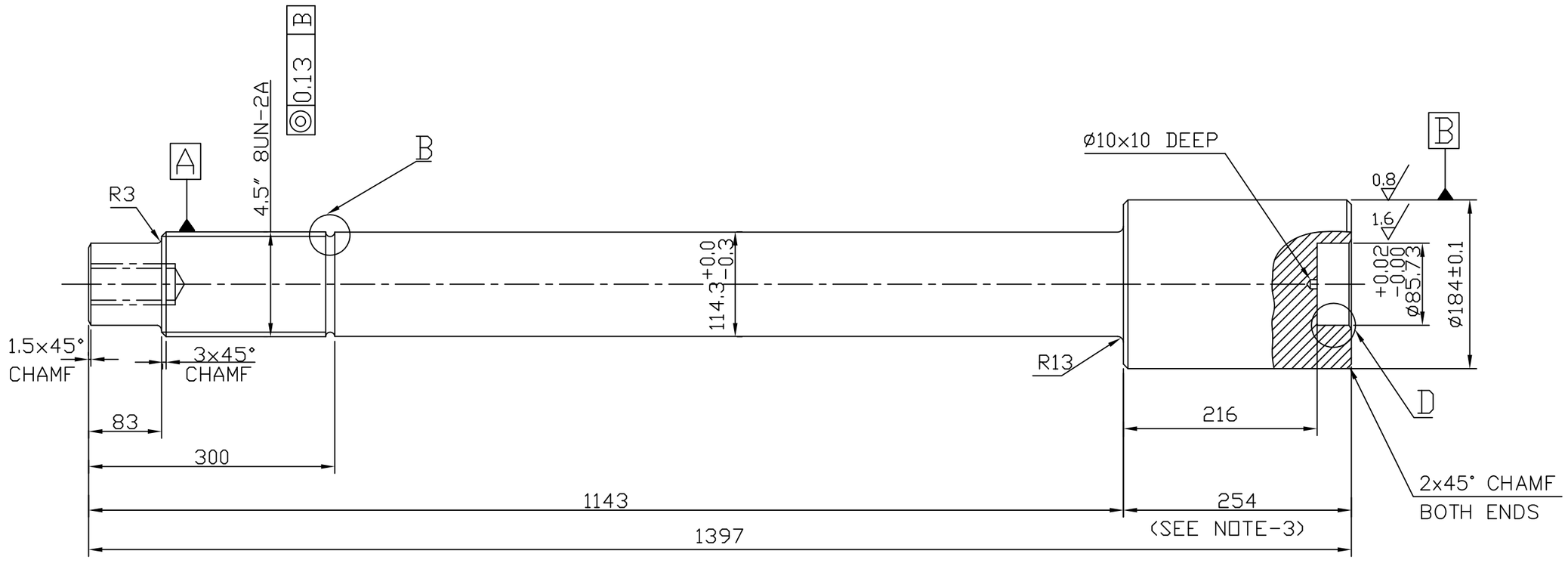
BSES

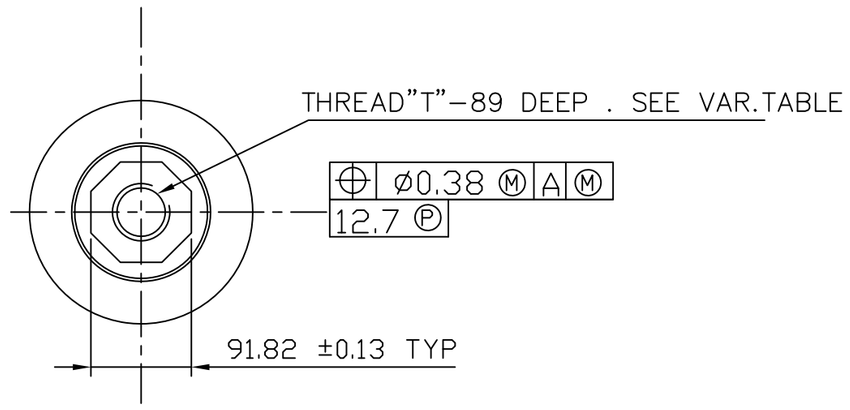
DRG.NO. 3-61-300-00779

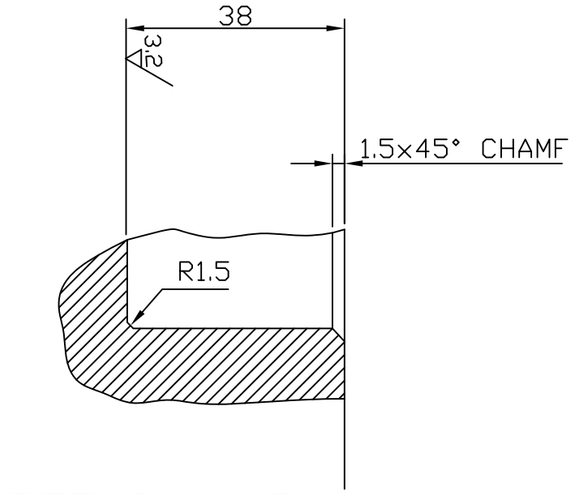
COMP. FILE NAME 26100779.DWG

REF.DRG.NO. C-101-1681

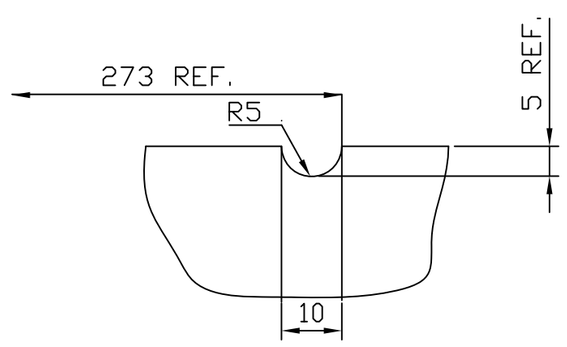
INVENTORY NO. 2-61-300-00779







DETAIL - D



DETAIL - B

NOTES: –

1. ALL FILLETS, UNDERCUTS AND GROOVES TO HAVE A 3.2 FINISH
2. BREAK ALL SHARP EDGES
3. HARD CHROME PLATE THE SURFACE INDICATED 58–62 RC 0.10 TO 0.15 RADIALLY.
4. ALL DIAMETERS TO BE ◎ Ø0.25A B UNLESS OTHERWISE SPECIFIED.

VAR NO.	THREAD "T"
01	2"-4.5UNC-2B
02	M52X5

REV.	DATE	ALTERED / CHECKED / APPD.	ZONE	
09	19.12.07	B.KRISHNA / G.M.R /		Ø114.3 +0/-0.3 WAS Ø114.3±0.38.
08	24-10-03	B.KRISHNA / G.M.R /		NOTE 5 DELETED & CONVERTED TO VARIANT TABLE.
07	06.03.02	E.M.ASHOK / /	D2	DIM 86 REF. DELETED.
06	20/025/99	E.M.ASHOK / /		DRG. REDRAWN INCORPORATING ALL THE PREVIOUS REVISIONS. NOTE 5 ADDED. 184± 0.1 WAS 184
11		MANIVAS / AMAN / SG		THREADING LENGTH INCREASED TO 300 FROM 273
10	12/09/13	BGK / AMAN / SG		NOTE TO FORGING SUPPLIER DELETED GROSS WEIGHT ADDED.

ITEM NO	DESCRIPTION	DRAWING NO.	VAR. NO.	RAW MATERIAL SIZE OR CASTING DRG.NO. OR FORGING DRG.NO.	MATERIAL CODE	NET WT.	GROSS WT.
1.	FORGING				BA9516953514	135.00	171.00
					HY19369	QUANTITY: 1	

THE FOLLOWING CONDITIONS APPLY EXCEPT OTHERWISE STATED...

1. REF.TO HY0230261 FOR UNSPECIFIED TOLERANCES.
2. CHAMFER M/CD SHARP EDGES 1.2 TO 1.0 AT 45°.
3. INTERNAL M/CD CORNER RADII 1 TO 0.7.
4. THE SURFACE ROUGHNESS WHEREVER NOT SHOWN SHALL BE TAKEN FROM THE SURFACE ROUGHNESS SHOWN OUT SIDE BACK SLASHES GIVEN AT THE TOP MOST RIGHT CORNER OF THE DRG.

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT

BHEL BHARAT HEAVY ELECTRICALS LTD. HYDERABAD

	NAME	SIGN.	DATE
DRN.	E.M.ASHOK		13/2/86
CHD.	S.GHATGE		13/2/86
APPD.	K.M.RAO		13/2/86

NO.OF VAR.

DEPT.	SCALE	WEIGHT(Kg)	REF. TO ASSY DRG.	ITEM NO.	NO.OF ITEMS
PULV. ENGG.	1:5 1:1	135	1-61-388-01055	7	30
CODE 446					

TITLE: JOURNAL PRESSURE SPRING PRELOAD STUD

DRAWING NO. 2-61-300-00779 REV. 11

SHEET NO. 01 NO OF SHEETS 01

TD-150/REV.NO.03 SIZE A2

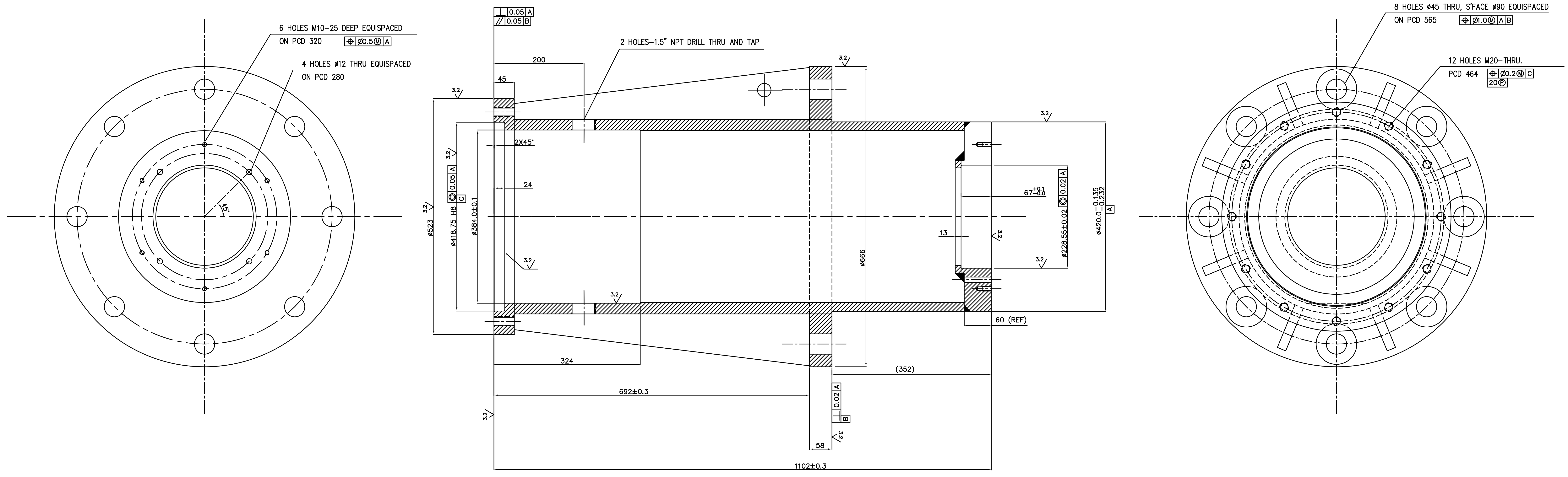
FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRG. NO. 2-61-300-03008 | SH. 01 OF 01

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

GENERAL DIMENSIONAL LIMITS,FITS & TOLERANCES AS PER HY0230261



VAR. NO.	ITEM NO.	DESCRIPTION	DRAWING NO./RAW MAT.	ITEM NO. / VAR. NO.	MATL. CODE / MATL. SPECN.	UNIT WT. / QTY.
	01	PRESURE SPRING HSG (FAB)	2-61-304-03009			453.43 / 522.0

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT	100" BOWL MILL
BHARAT HEAVY ELECTRICALS LTD. HYDERABAD	

	NAME	SIGN.	DATE	NO.OF VAR.
DRN.	R. RANJAN		22.11.10	
CHD.	AMAN SURIN		22.11.10	
APPD.	S.GHATGE		22.11.10	

DEPT.	UNTOL. DIMS.	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO.OF ITEMS
BULU ENGG. DEPT. CODE 446		1:1	453.43	0-61-300-00	-N.A.-	-N.A.-

TITLE HOUSING-SPRING (MACHINING)

DRAWING NO. 2-61-304-03008 REV. 01

SHT. No 01 NO. OF SHT. 01

REV.	DATE	ALTERED CHD/APPD
01	20.3.13	AMAN/SG DIM 200 WAS 150.

INVENTORY NO	SIGN. AND DATE	REF. DRG. NO.	COMPUTER FILE NAME
			1630000 .DWG

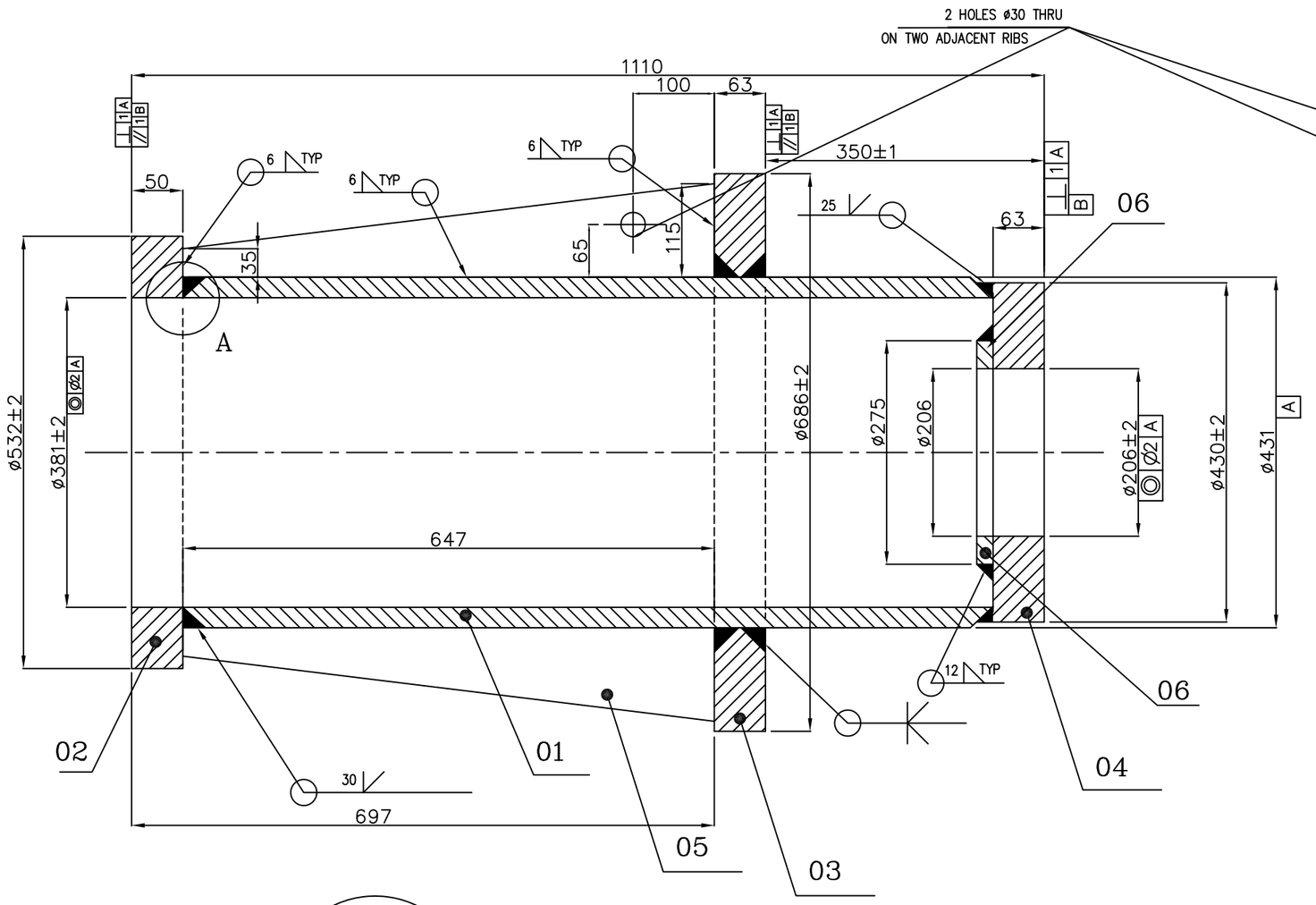
FIRST ANGLE PROJECTION

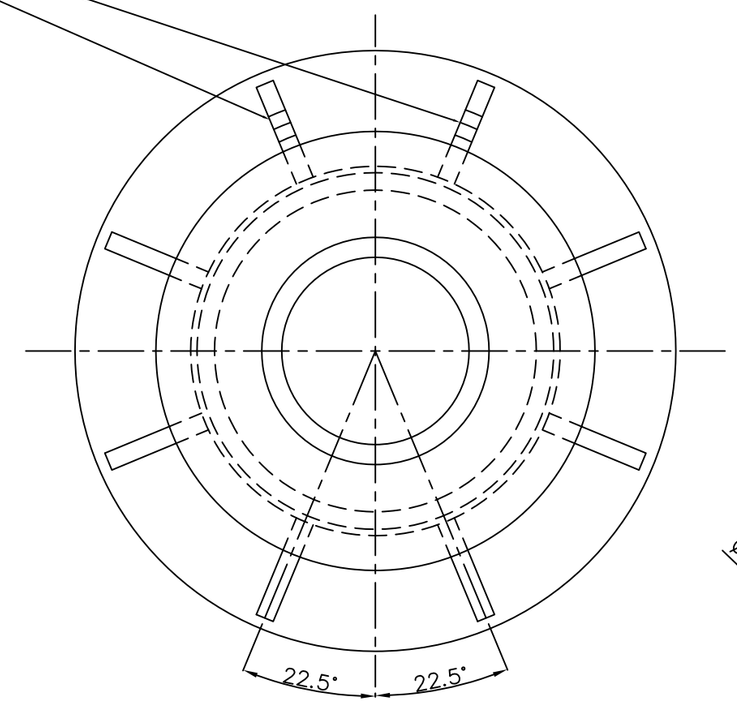
(ALL DIMENSIONS ARE IN mm)

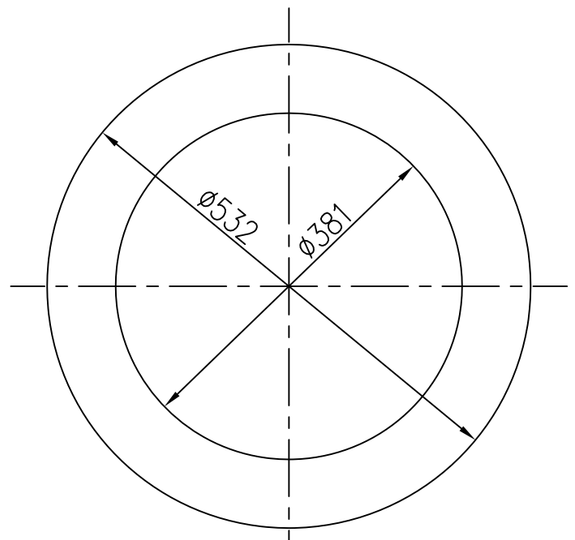
DJC

DRG.NO. 2-61-304-03009

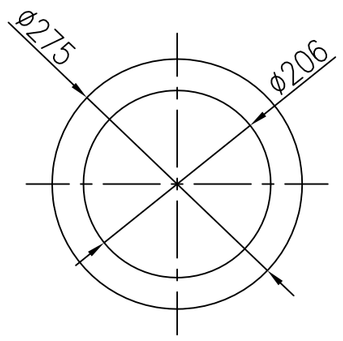
COMP. FILE NAME 2610.DWG | REF.DRG.NO. | INVENTORY NO.





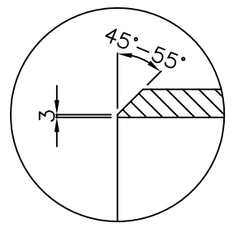


ITEM 02

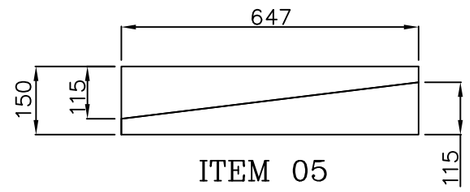


ITEM 06

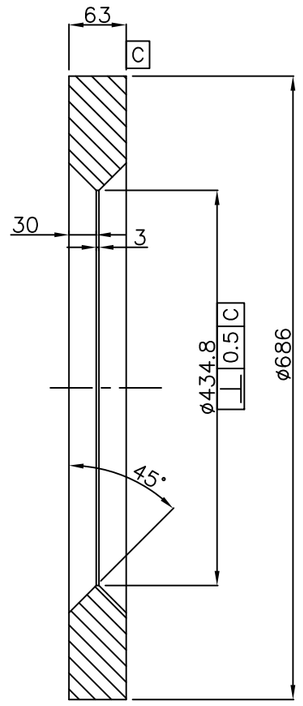
WPS:WE001

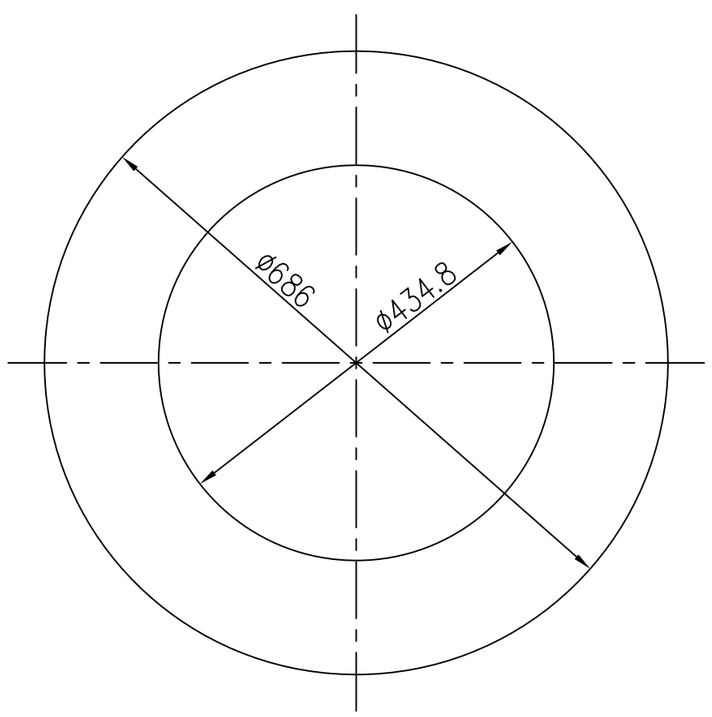


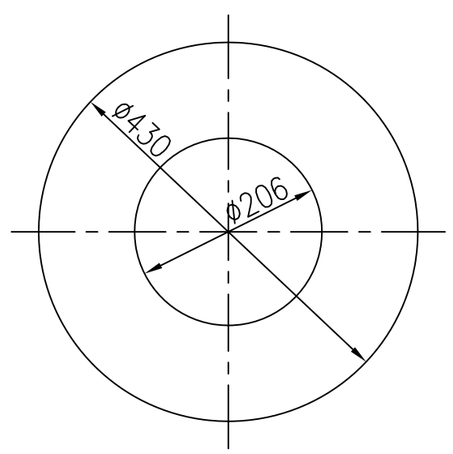
DETAIL A



ITEM 05
CUT TO 2 PIECES







ITEM 04

ITEM 03

ITEM NO	DESCRIPTION	DRAWING NO.	VAR. NO.	RAW MATERIAL SIZE OR CASTING DRG.NO. OR FORGING DRG.NO.	MATERIAL CODE	UNIT WT.	
					MATERIAL SPECN.	QUANTITY	
06	PLATE			PL.20 X ID 200 X OD 280	AA1011819139	4.1	4.74
					AA10119	1	
05	PLATE			PL.20 X 650 X 155	AA1011819139	15.20	15.82
					AA10119	4	
04	PLATE			PL.63 X ID 200 X OD 430	AA1011819236	55.34	57.96
					AA10119	1	
03	PLATE			PL.63 X ID 430 X OD 690	AA1011819236	109.3	113.10
					AA10119	1	
02	PLATE			PL.50 X ID 378 X OD 535	AA1011819210	42.50	44.20
					AA10119	1	
01	PIPE	4-61-304-03335				250.0	254.0
						1	

THE FOLLOWING CONDITIONS APPLY EXCEPT OTHERWISE STATED...

1. REF.TO HY0230261 FOR UNSPECIFIED TOLERANCES.
2. CHAMFER M/CD SHARP EDGES 1.2 TO 1.0 AT 45°.
3. INTERNAL M/CD CORNER RADII 1 TO 0.7.
4. THE SURFACE ROUGHNESS WHEREVER NOT SHOWN SHALL BE TAKEN FROM THE SURFACE ROUGHNESS SHOWN OUT SIDE BACK SLASHES GIVEN AT THE TOP MOST RIGHT CORNER OF THE DRG.

REV.	DATE	ALTERED	CHECKED	APPD.	ZONE
01	20.3.12	2 HOLES ø30 THRU FOR LIFTING PURPOSE ADDED.	CHECKED AMAN	APPD. SG	

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: 1003 XRP BOWL MILL

BHARAT HEAVY ELECTRICALS LTD. HYDERABAD

	NAME	SIGN.	DATE	NO.OF VAR.
DRN.	SHARIFF		27.11.10	–
CHD.	AMAN SURIN		27.11.10	
APPD.	S.GHATGE		27.11.10	

DEPT.	GRADE OF TOL. DIM.	SCALE	WEIGHT(Kg)	REF. TO ASSY DRG.	ITEM No.	NO.OF ITEMS
PULV. ENGG. CODE 446	℄/M/F	N.T.S	522.0	C-101-01297 REV. 2	–	–

TITLE: PRESSURE SPRING HOUSING (FABRICATION)

DRAWING No.. 2-61-304-03009 REV. 01

SHEET No. | No. OF SHEETS

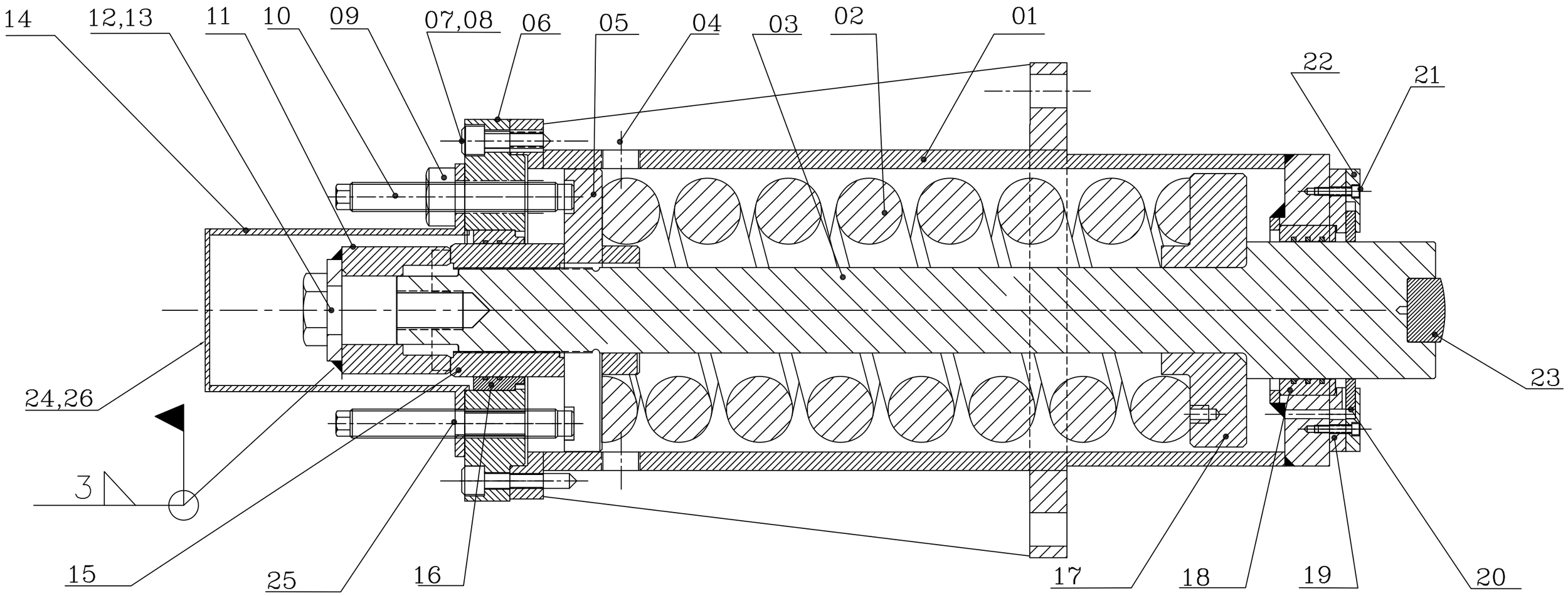
TD-150/REV.NO.03 SIZE A2

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRG. NO. 2-61-304-03010

SH. 01 OF 01



ITEM NO.	DESCRIPTION	DRAWING NO./RAW MAT.	MATL. CODE / MATL. SPECN.	NET.WT. / QTY.	GR. WT.
26	HAMMER SCREW		HY7126938624 / HY7126938	0.001 / 4	
25	M20 STUD X 225 LG. WITH 2 NUTS		HY7142198273 / HY7142198	0.75 / 1	
24	WARNING PLATE	BA9715674291		0.16 / 1	
23	SPRING STUD INSERT	3-61-300-00694		2.2 / 1	
22	AIR SEAL CAP	3-61-300-03284		8.6 / 1	
21	M10X45 HEX.SOC.HD CAP SCR		AA7123123182 / AA7123123	0.01 / 6	
20	SPRING ORIFICE PLATE	4-61-300-00983		3.7 / 1	
19	RETAINER PLATE	3-61-300-03285		13.0 / 1	
18	SPRING STUD BRNG (WEAR SLEEVE)	3-61-300-00693	BA9610273009	7.8 / 1	
17	SPRING STUD ADAPTOR	3-61-300-00689		69.0 / 1	
16	COVER WEAR SLEEVE	3-61-300-00688	BA9617333066	6.1 / 1	
15	SPRING STUD LOCK NUT	3-61-300-00692		14.5 / 1	
14	STUD EXTENSION CAP	3-61-300-00691		21.70 / 1	
13	KEEPER WASHER	4-61-300-00782		1.6 / 1	
12	M52X5 HEX HD CAP SCR X 125 LG		BA9717034117	3.2 / 1	
11	STUD LOCK NUT KEEPER	2-61-300-00778	AA7121123	13.5 / 1	
10	HI TENSILE STUD M39	4-61-300-02303		3.2 / 6	
09	HEX. NUT M39		BA9614872012	0.40 / 6	
08	D21 MACHINED WASHER TYPE "B"(N)		AA7161001099 / AA7161001	0.017 / 12	
07	M20 HEX.SOC.HD.CAP SCR. X 75 LG		AA7123123352 / AA7123123	0.25 / 12	
06	COVER SPRING HOUSING	2-61-304-03011		102.0 / 1	
05	SPRING GUIDE	36130000695		50.3 / 1	
04	1 1/2" SQ. HD. PIPE PLUG – SOLID		HY7242574080 / HY7242574	0.14 / 2	
03	SPRING PRELOAD STUD	2-61-300-00779		135.0 / 1	
02	JOURNAL PRESSURE SPRING	2-61-300-00776		304 / 1	
01	HOUSING– SPRING	2-61-304-03008		440.0 / 1	

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

GENERAL DIMENSIONAL LIMITS,FITS & TOLERANCES AS PER HY0230261

COMPUTER FILE NAME 1630000 .DWG

REF. DRG. NO.

SIGN. AND DATE

INVENTORY NO

ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED
CHD/APPD			CHD/APPD			CHD/APPD			CHD/APPD			CHD/APPD			CHD/APPD			CHD/APPD			CHD/APPD			CHD/APPD
	ZONE			ZONE			ZONE			ZONE			ZONE			ZONE			ZONE			ZONE		

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: 104" BOWL MILL

BHARAT HEAVY ELECTRICALS LTD. HYDERABAD

	NAME	SIGN.	DATE
DRN.	R. RANJAN		30.7.09
CHD.	AMAN SURIN		30.7.09
APPD.	S.GHATGE		30.7.09

NO.OF VAR.

DEPT. PULU ENGG. / DEPT. CODE 446	UNTOL. DIMS.	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO.OF ITEMS
		1:1	1220.0	0-61-300-00	-N.A.-	-N.A.-

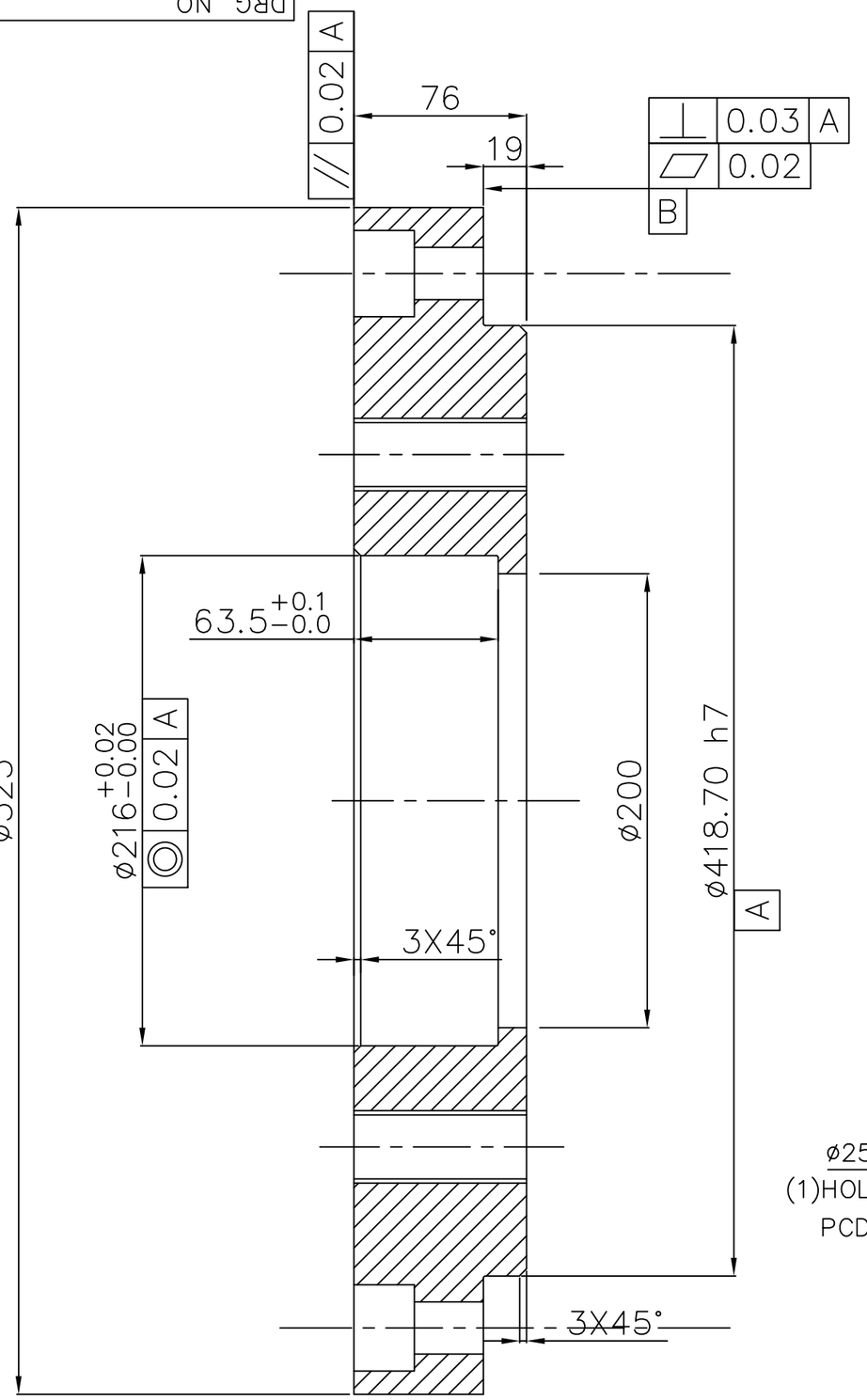
TITLE: SPRING ASSEMBLY (MODULAR)

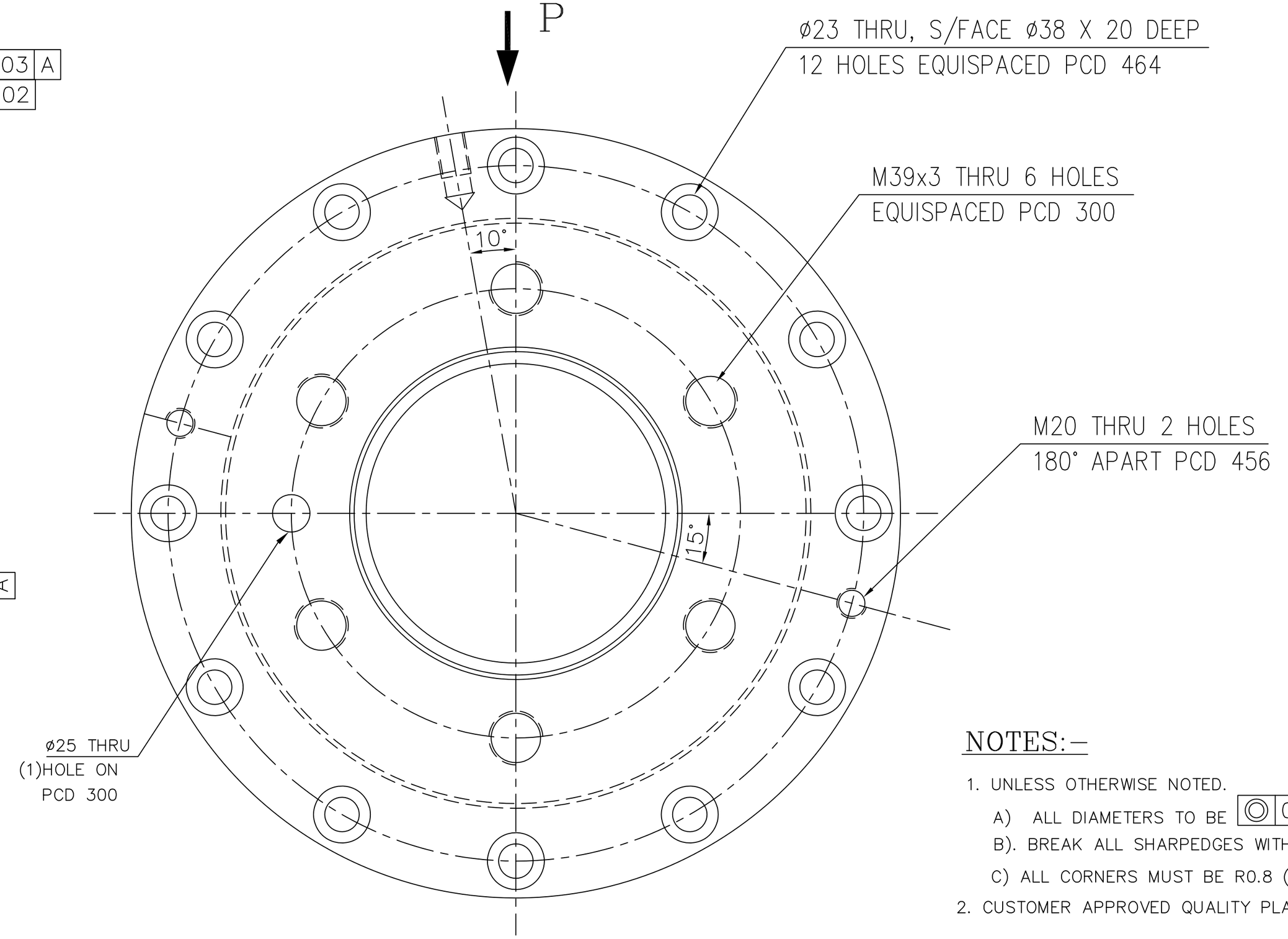
DRAWING NO. 2-61-304-03010 REV. 00

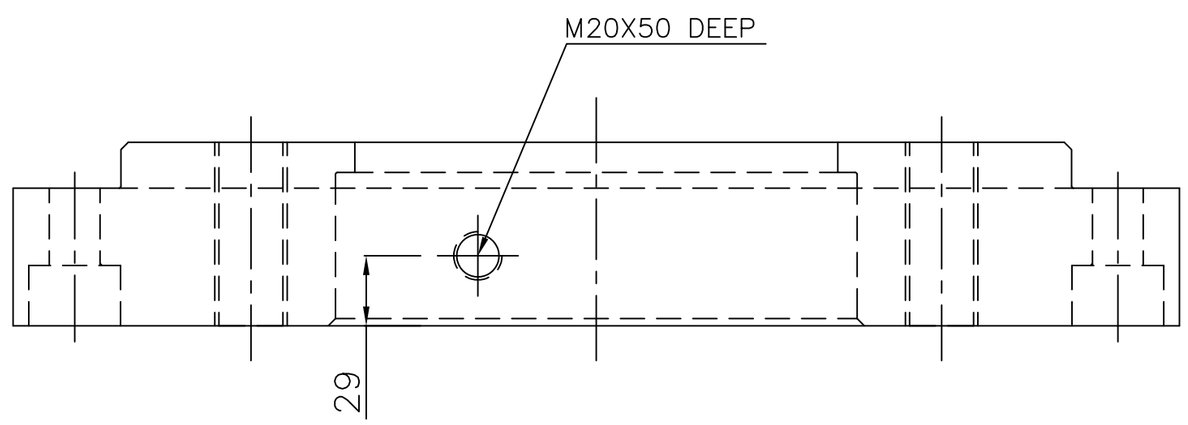
SHT. No 01 NO. OF SHT. 01

FIRST ANGLE PROJECTION | (ALL DIMENSIONS ARE IN mm) | POORNIMA CAD

DRG. NO. 2-61-304-03011 | SHT. 01 OF 01







VIEW–P

3.2

NOTES:–

1. UNLESS OTHERWISE NOTED.
   A) ALL DIAMETERS TO BE ◎ 0.25 B
   B). BREAK ALL SHARPEDGES WITH 1X 45°
   C) ALL CORNERS MUST BE R0.8 (MAX)
2. CUSTOMER APPROVED QUALITY PLAN TO BE FOLLOWED

ITEM NO	DESCRIPTION	DRAWING NO.	VAR. NO.	RAW MATERIAL SIZE OR CASTING DRG.NO. OR FORGING DRG.NO.	MATERIAL CODE	NET WT.	GROSS WT.
01	CASTING	0D530xID180x90THK			AA 19511	90.00	137.55
					MATERIAL SPECN.	QUANTITY	

THE FOLLOWING CONDITIONS APPLY EXCEPT OTHERWISE STATED...

1. REF.TO HY0230261 FOR UNSPECIFIED TOLERANCES.
2. CHAMFER M/CD SHARP EDGES 1.2 TO 1.0 AT 45°.
3. INTERNAL M/CD CORNER RADII 1 TO 0.7.
4. THE SURFACE ROUGHNESS WHEREVER NOT SHOWN SHALL BE TAKEN FROM THE SURFACE ROUGHNESS SHOWN OUT SIDE BACK SLASHES GIVEN AT THE TOP MOST RIGHT CORNER OF THE DRG.

TYPE OF PRODUCT
OR
NAME OF CUSTOMER/PROJECT

BHARAT HEAVY ELECTRICALS LTD.
HYDERABAD

	NAME	SIGN.	DATE	NO.OF VAR.
DRN.	R. RANJAN		24.11.10	–NA–
CHD.	AMAN SURIN		24.11.10	
APPD.	S.GHATGE		24.11.10	

DEPT. PULV.ENGG	UNTOL. DIMS. GR.		SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO.OF ITEMS
CODE 446	℄/M/F		1:1	90.00		–NA–	–NA–

TITLE: COVER – SPRING HOUSING

DRAWING NO. 2-61-304-03011 REV. 00

SHT. No 01 NO. OF SHT. 01

REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED
		CHD/APPD			CHD/APPD			CHD/APPD			CHD/APPD
ZONE			ZONE						ZONE		

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COMPUTER FILE NAME 26100 .DWG | REF. DRG. NO. | SIGN. AND DATE | INVENTORY NO

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

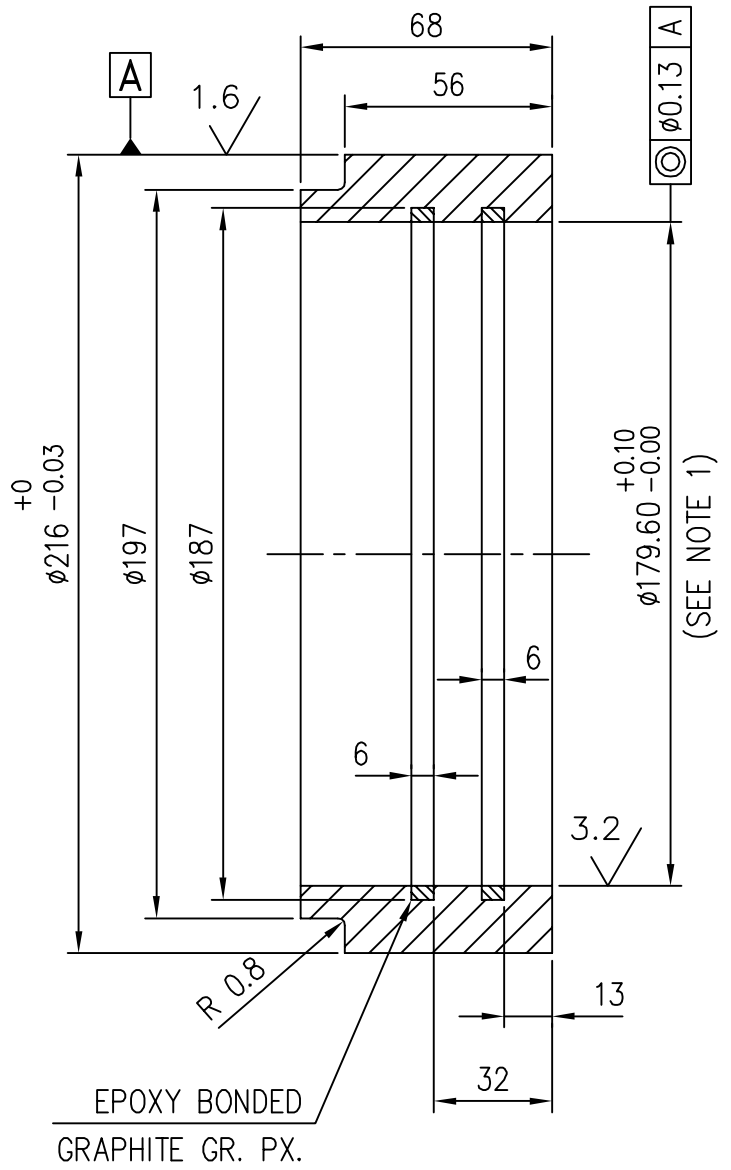
DJC

DRG.NO. 3-61-300-00688

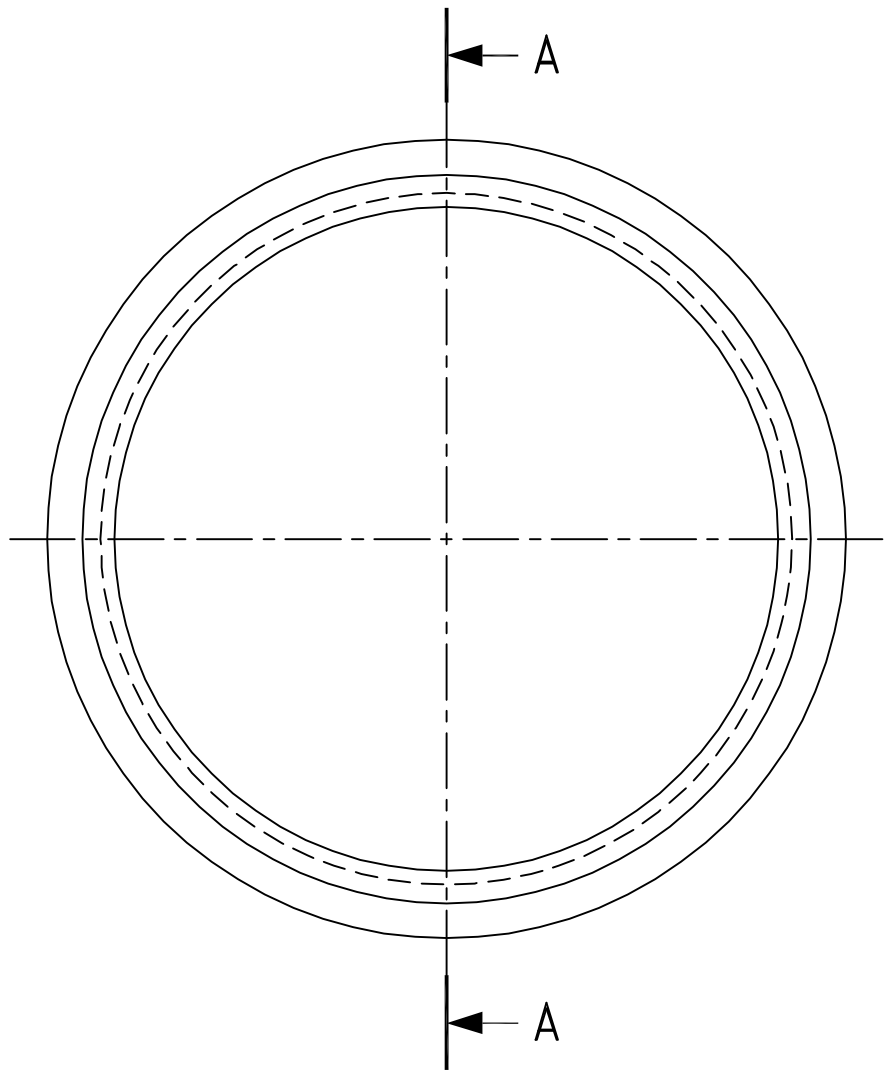
COMP. FILE NAME 36100688.DWG

REF.DRG.NO. B-101-01429-2

INVENTORY NO.



SECTION A-A



3.2 1.6

NOTES:-

1. BORE TO BE FINISH MACHINED AFTER BONDING GRAPHITE.

MATERIAL:

ASTM B271 ALLOY 86300 BRONZE OR ASTM B 584 ALLOY 86300 BRONZE AND EPOXY BONDED GRAPHITE GR. PX

ITEM No	DESCRIPTION	DRAWING No.	VAR. No.	RAW MATERIAL SIZE OR CASTING DRG.No. OR FORGING DRG. No.	MATERIAL CODE	NET WT.	GROSS WT.
01					BA9617333066	6.049	
					MATERIAL SPECN.	QUANTITY	1

REV.	DATE	ALTERED ACAD / CHECKED	APPD.	
03	8.9.03	N.D.S		ø179.60+0.1 WAS 179.58 ±0.13
02	08.10.98	N.D.S		DRAWING REDRAWN ON CAD INCORPORATING ALL THE PREVIOUS REVISIONS.

THE FOLLOWING CONDITIONS APPLY EXCEPT OTHERWISE STATED...

1. REF.TO HY0230261 FOR UNSPECIFIED TOLERANCES.
2. CHAMFER M/CD SHARP EDGES 1.2 TO 1.0 AT 45°.
3. INTERNAL M/CD CORNER RADII 1 TO 0.7.
4. THE SURFACE ROUGHNESS WHEREVER NOT SHOWN SHALL BE TAKEN FROM THE SURFACE ROUGHNESS SHOWN OUT SIDE BACK SLASHES GIVEN AT THE TOP MOST RIGHT CORNER OF THE DRG.

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: 883/1003 XRP BOWL MILL

BHARAT HEAVY ELECTRICALS LTD. HYDERABAD

	NAME	SIGN.	DATE
DRN.	ACAD		10.08.98
CHD.	N.D.SAEMUL		10.08.98
APPD.	S.GHATGE		10.08.98

No.OF VAR. –

DEPT.	GRADE OF TOL. DIM.	SCALE	WEIGHT (KG)	REF. TO ASSY DRG.	ITEM No.	No.OF ITEMS
PULV. ENGG. CODE 446	¢/M/f	1:2	6.049	1.61.388.01055	14	30

TITLE: HOUSING COVER WEAR SLEEVE

DRAWING No. 3-61-300-00688 REV. 03

SHEET No. 1 No. OF SHEETS 1

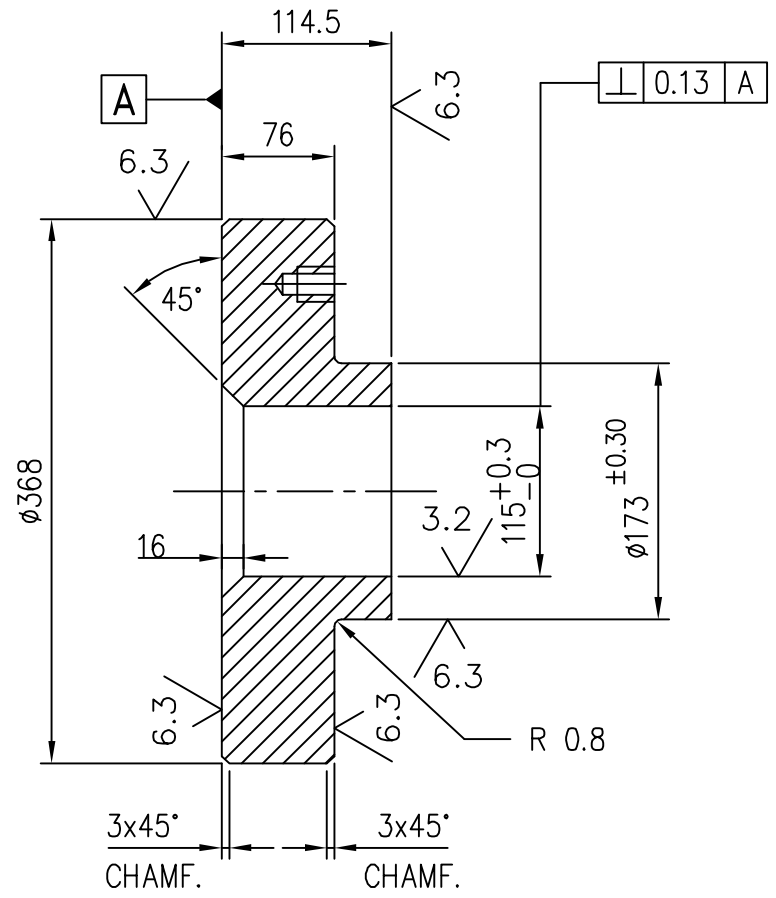
TD-151/REV. 03 SIZE A3

FIRST ANGLE PROJECTION

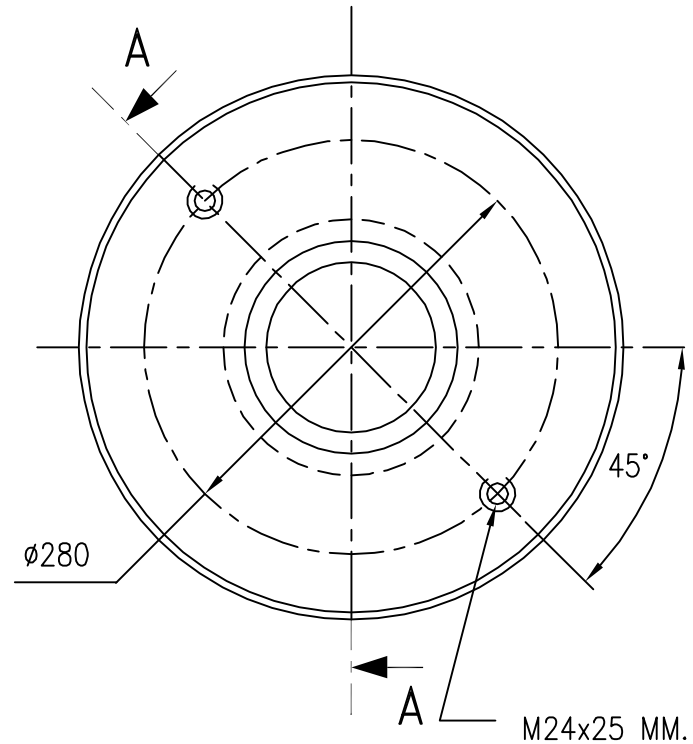
(ALL DIMENSIONS ARE IN mm)

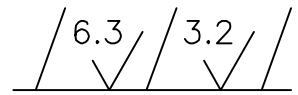
DJC

DRG.NO. 3-61-300-00689



SECTION A-A





NOTE:-

1. BREAK ALL SHARP EDGES AND CORNERS UNLESS OTHERWISE NOTED.
2. CUSTOMER APPROVED QUALITY PLANTO BE FOLLOWED.

ITEM No	DESCRIPTION	DRAWING No.	VAR. No.	RAW MATERIAL SIZE OR CASTING DRG.No. OR FORGING DRG. No.	MATERIAL CODE / MATERIAL SPECN.	NET WT. / QUANTITY	GROSS WT.
	PLATE		02	PL 130xOD380xID100	AA1011819783 / AA10119	61.00 / 1	
	CASTING		01		BA9211100011 / AA19511	61.00 / 1	

THE FOLLOWING CONDITIONS APPLY EXCEPT OTHERWISE STATED...

1. REF.TO HY0230261 FOR UNSPECIFIED TOLERANCES.
2. CHAMFER M/CD SHARP EDGES 1.2 TO 1.0 AT 45°.
3. INTERNAL M/CD CORNER RADII 1 TO 0.7.
4. THE SURFACE ROUGHNESS WHEREVER NOT SHOWN SHALL BE TAKEN FROM THE SURFACE ROUGHNESS SHOWN OUT SIDE BACK SLASHES GIVEN AT THE TOP MOST RIGHT CORNER OF THE DRG.

REV.	DATE	ALTERED	CHECKED	APPD.
04		ø115.0 +0.3/−0 WAS ø115.0±0.38.		
03	08.10.98	DRAWING REDRAWN ON CAD INCORPORATING ALL THE PREVIOUS REVISIONS.		

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT

BHARAT HEAVY ELECTRICALS LTD. HYDERABAD

	NAME	SIGN.	DATE	No.OF VAR.
DRN.	N.D.S		08.70.98	–
CHD.	S.G		08.10.98	
APPD.	K.M.R.		08.10.98	

DEPT.	GRADE OF TOL. DIM.	SCALE	WEIGHT (KG)	REF. TO ASSY DRG.	ITEM No.	No.OF ITEMS
PULV. ENGG. CODE 446	¢/M/f	1:5	61.00	B-101-01683-2	–	–

TITLE

SPRING STUD ADAPTER

DRAWING No. 3-61-300-00689 REV. 04

SHEET No. 1 No. OF SHEETS 1

TD-151/REV. 03 SIZE A3

COMP. FILE NAME 36100689.DWG

REF.DRG.NO.

INVENTORY NO.

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

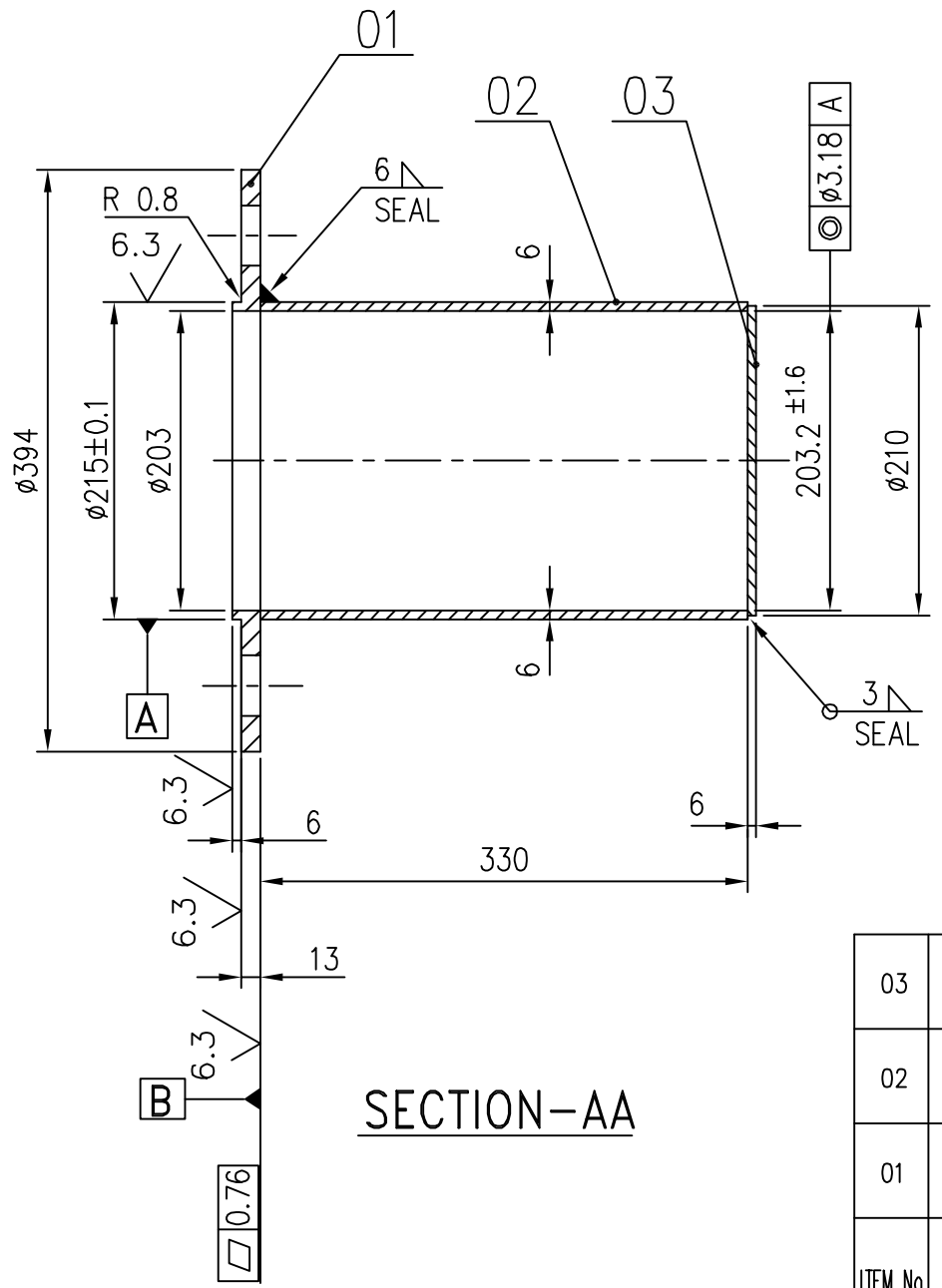
DJC

DRG.NO. 3-61-300-00691

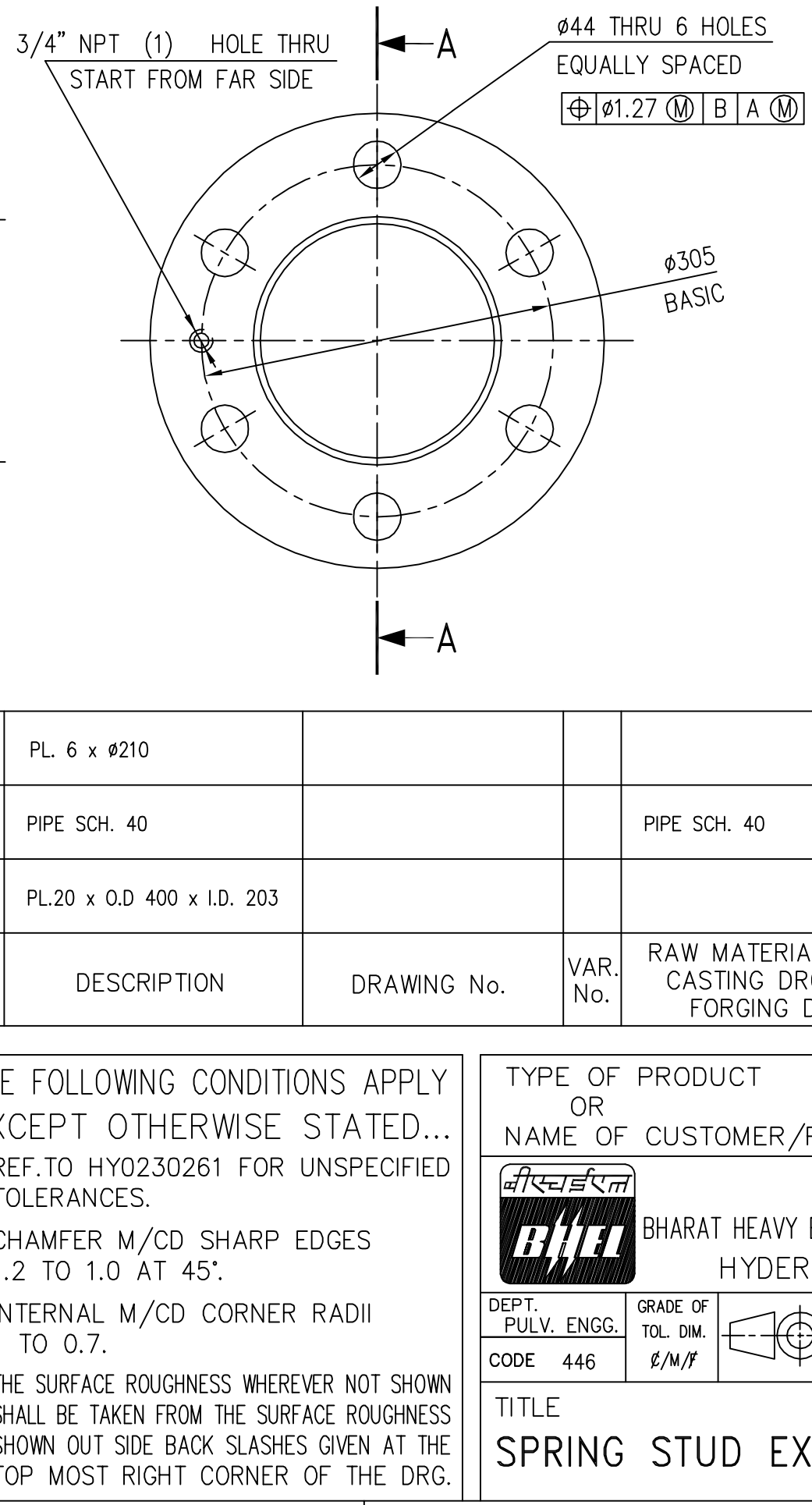
COMP. FILE NAME 36100691.DWG

REF.DRG.NO.

INVENTORY NO.



SECTION–AA



6.3

NOTES:–

1. BREAK ALL SHARP EDGES AND CORNERS UNLESS OTHERWISE NOTED.

ITEM No	DESCRIPTION	DRAWING No.	VAR. No.	RAW MATERIAL SIZE OR CASTING DRG.No. OR FORGING DRG. No.	MATERIAL CODE	NET WT.	GROSS WT.
					MATERIAL SPECN.	QUANTITY	
03	PL. 6 x Ø210				AA1011808030	1.600	
					AA10108	1	
02	PIPE SCH. 40			PIPE SCH. 40	AA1049355563	11.600	
					AA10455	1	
01	PL.20 x O.D 400 x I.D. 203				AA10118191139	8.500	
					AA10119	1	

REV.	DATE	ALTERED / CHECKED	APPD.
05	21.1.10	EMA / NDS	

ITEM01 MAT. CODE WAS AA1011819155

REV.	DATE	ALTERED / CHECKED	APPD.
04	8.12.04	EMA / NDS	SG

3/4" NPT WAS 3/4" RC.

REV.	DATE	ALTERED / CHECKED	APPD.
03	04.10.04	EMA / NDS	SG

TOL ADDED ON Ø215. DIM 6 ADDED. MACHINING SHOWN ON FLANGE AND SPIGOT FACES. Ø44 WAS Ø 41

THE FOLLOWING CONDITIONS APPLY EXCEPT OTHERWISE STATED...

1. REF.TO HY0230261 FOR UNSPECIFIED TOLERANCES.
2. CHAMFER M/CD SHARP EDGES 1.2 TO 1.0 AT 45°.
3. INTERNAL M/CD CORNER RADII 1 TO 0.7.
4. THE SURFACE ROUGHNESS WHEREVER NOT SHOWN SHALL BE TAKEN FROM THE SURFACE ROUGHNESS SHOWN OUT SIDE BACK SLASHES GIVEN AT THE TOP MOST RIGHT CORNER OF THE DRG.

TYPE OF PRODUCT
OR
NAME OF CUSTOMER/PROJECT

BHARAT HEAVY ELECTRICALS LTD.
HYDERABAD

	NAME	SIGN.	DATE
DRN.	ACAD		8.10.98
CHD.	ND.SAMUEL		8.10.98
APPD.	S.GHATGE		8.10.98

No.OF VAR. –

DEPT.	GRADE OF TOL. DIM.	SCALE	WEIGHT (KG)	REF. TO ASSY DRG.	ITEM No.	No.OF ITEMS
PULV. ENGG.	¢/M/f	1:5	21.70	B–101–01420–2	–	–
CODE 446						

TITLE

SPRING STUD EXTENSION CAP

DRAWING No. 3–61–300–00691 REV. 05

SHEET No. 1 No. OF SHEETS 1

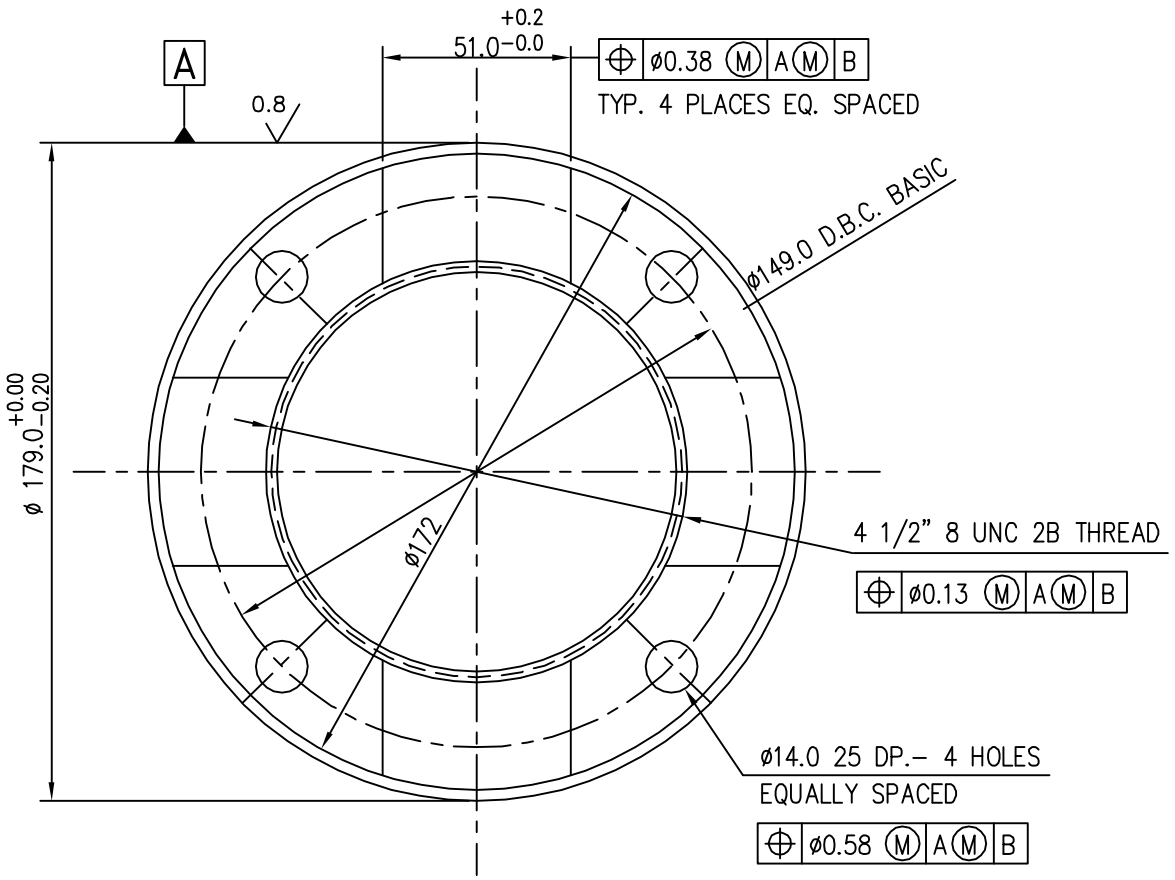
TD–151/REV. 03 SIZE A3

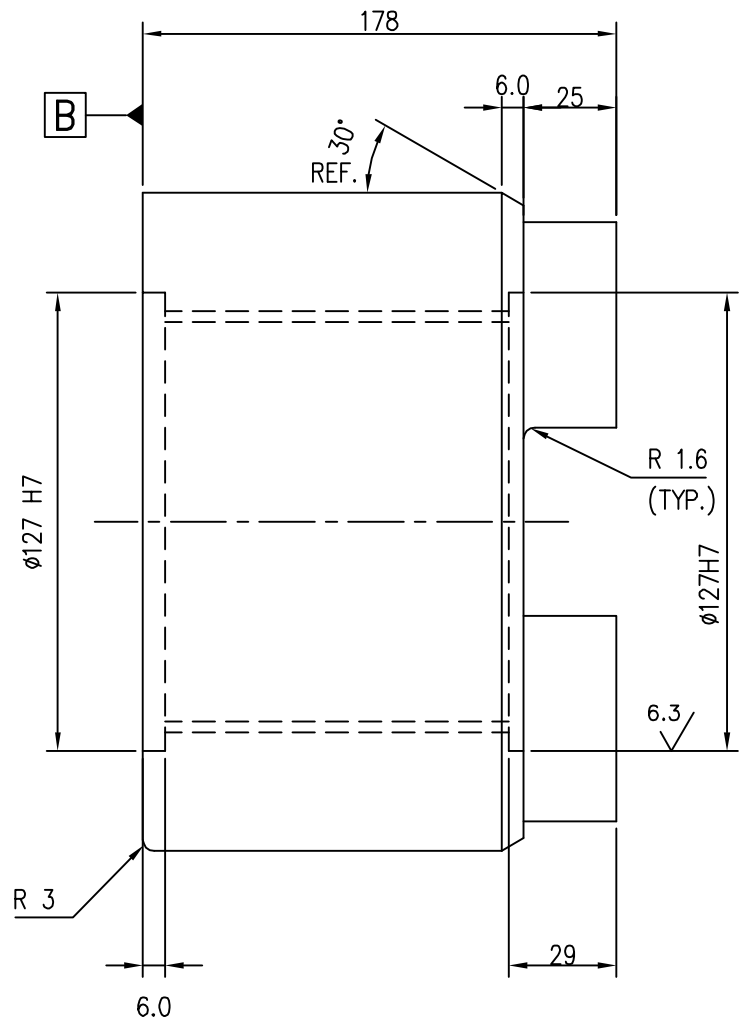
FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DJC

DRG.NO. 3-61-300-00692





NOTES:−

1. THE ENTIRE ø179.0 SURFACE IS TO BE HARD CHROME PLATED TO A RADIAL THICKNESS OF 0.10−0.15
2. BREAK ALL SHARP EDGES AND CORNERS UNLESS OTHERWISE NOTED.
3. FORGING TO BE SUPPLIED IN R/M CONDITION WITH 5±1 ALLOWANCE ON TOOL POINT.

ITEM NO	DESCRIPTION	DRAWING NO.	VAR. NO.	RAW MATERIAL SIZE OR CASTING DRG.NO. OR FORGING DRG.NO.	MATERIAL CODE	UNIT WT.
					MATERIAL SPECN.	QUANTITY
01	FORGING			OD185X ID 100X 185 LG.	BA9517042000 HY19370	14.50

THE FOLLOWING CONDITIONS APPLY EXCEPT OTHERWISE STATED...

1. REF.TO HY0230261 FOR UNSPECIFIED TOLERANCES.
2. CHAMFER M/CD SHARP EDGES 1.2 TO 1.0 AT 45°.
3. INTERNAL M/CD CORNER RADII 1 TO 0.7.
4. THE SURFACE ROUGHNESS WHEREVER NOT SHOWN SHALL BE TAKEN FROM THE SURFACE ROUGHNESS SHOWN OUT SIDE BACK SLASHES GIVEN AT THE TOP MOST RIGHT CORNER OF THE DRG.

REV.	DATE	ALTERED	CHECKED	APPD.	ALTERED BY
06	22.12.04	NOTE 3 ADDED. FORGING SIZE IN BOM CORRECTED.	NDS	S.G	
05	5.1.03	ø179 IN NOTE 1 WAS ø178 AND LENGTH 178 WAS 128	NDS	S.G	B.N.R
04	08.09.03	ø179 −0.1 WAS ø178.00			
03	31.5.03	ø127H7 WAS ø127. ABOVE TOL ADDED FOR GRINDING MANDREL LOCATION. TOL +0.2/−0.0 ADDED ON DIM 51.			

TYPE OF PRODUCT
OR
NAME OF CUSTOMER/PROJECT

BHARAT HEAVY ELECTRICALS LTD.
HYDERABAD

	NAME	SIGN.	DATE
DRN.	B.N.R		15.9.98
CHD.	N.D.S		15.9.98
APPD.	S.G		15.9.98

NO.OF VAR. −

DEPT.	GRADE OF TOL. DIM.	SCALE	WEIGHT (KG)	REF. TO ASSY DRG.	ITEM NO.	NO.OF ITEMS
PULV. ENGG. CODE 446	¢/M/f	1:2	14.5	B−101−01427 REV. 4 CE P/N 101.01427	−	−

TITLE
SPRING STUD LOCKNUT

DRAWING NO. 3−61−300−00692 REV. 06

SHEET NO. 1 NO OF SHEETS 1

TD−151/REV. 03 SIZE A3

REF.DRG.NO.

INVENTORY NO.

COMP. FILE NAME 36100692.DWG

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

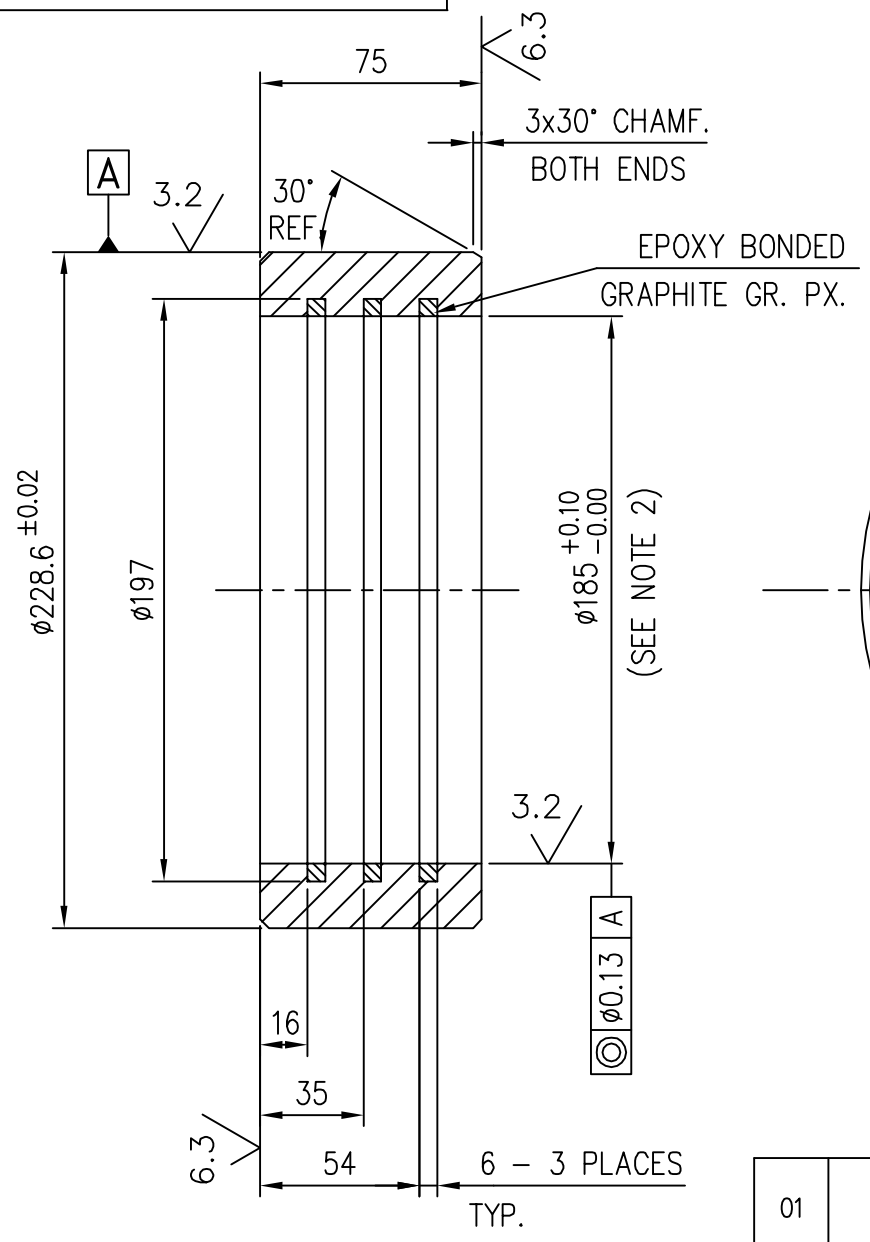
DJC

DRG.NO. 3-61-300-00693

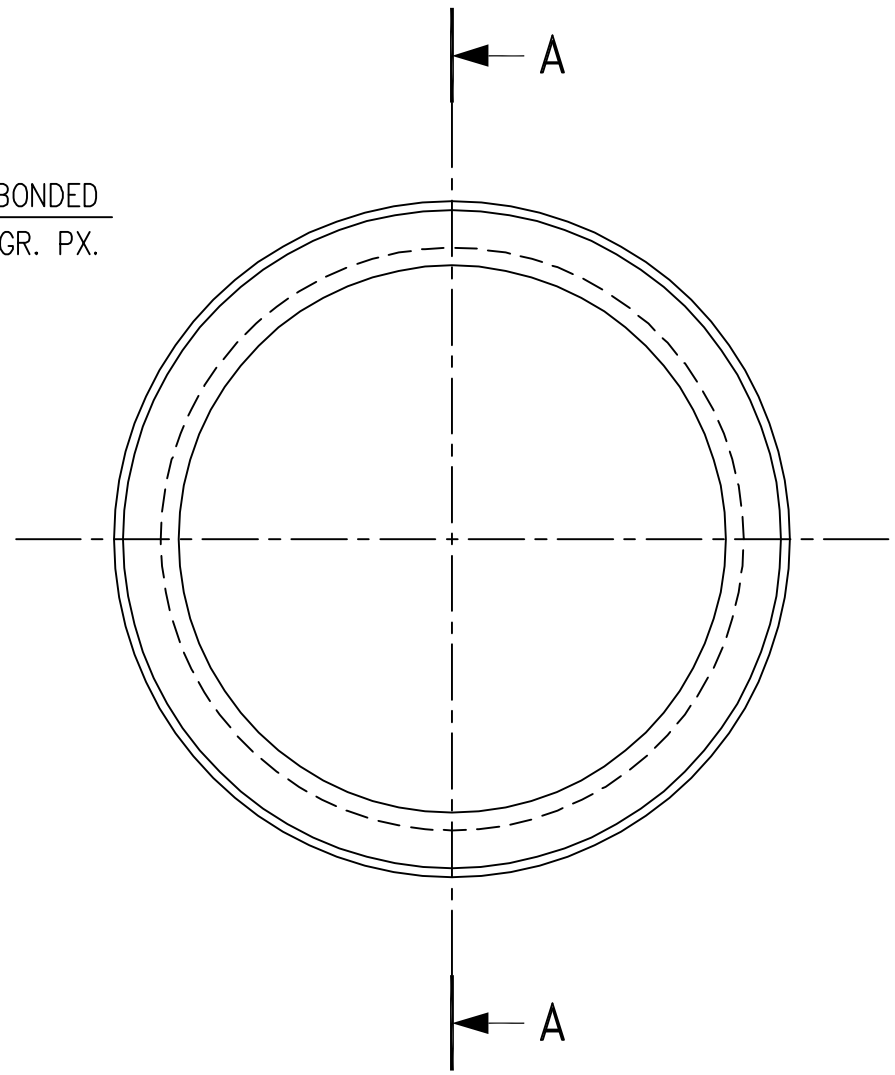
COMP. FILE NAME 36100693.DWG

REF.DRG.NO. B-101-01680-0

INVENTORY NO.



SECTION A-A



6.3 3.2

NOTES:-

1. MATERIAL : B 271 ALLOY 86300 BRONZE AND EPOXY BONDED GRAPHITE GR. PX OR EQUI.
2. BORE TO BE FINISH MACHINED AFTER BONDING GRAPHITE.
3. BREAK ALL SHARP EDGES AND CORNERS UNLESS OTHERWISE NOTED.

ITEM No	DESCRIPTION	DRAWING No.	VAR. No.	RAW MATERIAL SIZE OR CASTING DRG.No. OR FORGING DRG. No.	MATERIAL CODE	NET WT.	GROSS WT.
01					BA9610273009	7.80	
					MATERIAL SPECN.	QUANTITY	1

REV.	DATE	ALTERED	CHECKED	APPD.

REV.	DATE	ALTERED N.D.S	CHECKED S.G	APPD.
02	08.10.98			

DRAWING REDRAWN ON CAD INCORPORATING ALL THE PREVIOUS REVISIONS.
185 +0.1 WAS 185

THE FOLLOWING CONDITIONS APPLY EXCEPT OTHERWISE STATED...

1. REF.TO HY0230261 FOR UNSPECIFIED TOLERANCES.
2. CHAMFER M/CD SHARP EDGES 1.2 TO 1.0 AT 45°.
3. INTERNAL M/CD CORNER RADII 1 TO 0.7.
4. THE SURFACE ROUGHNESS WHEREVER NOT SHOWN SHALL BE TAKEN FROM THE SURFACE ROUGHNESS SHOWN OUT SIDE BACK SLASHES GIVEN AT THE TOP MOST RIGHT CORNER OF THE DRG.

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: 883 XRP BOWL MILL

BHARAT HEAVY ELECTRICALS LTD.
HYDERABAD

	NAME	SIGN.	DATE	No.OF VAR.
DRN.	N.D.S		15.9.98	–
CHD.	S.G		15.9.98	
APPD.	K.M.R.		15.9.98	

DEPT. PULV. ENGG.	GRADE OF TOL. DIM.	SCALE	WEIGHT (KG)	REF. TO ASSY DRG.	ITEM No.	No.OF ITEMS
CODE 446	¢/M/f	1:2	7.80	1.61.388.01055	22	30

TITLE: SPRING STUD BEARING

DRAWING No. 3-61-300-00693 REV. 02

SHEET No. 1 No. OF SHEETS 1

TD-151/REV. 03 SIZE A3

FIRST ANGLE PROJECTION

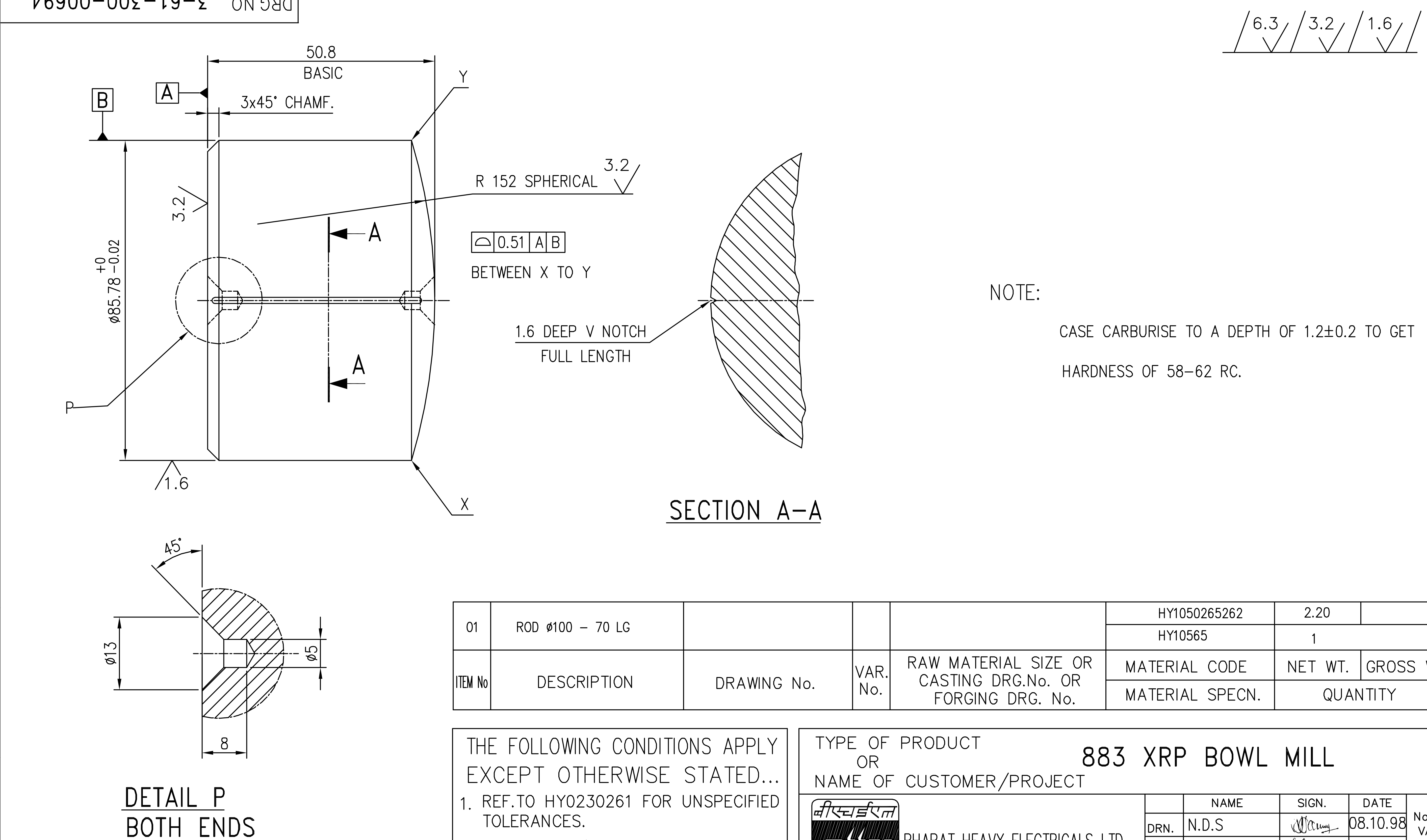
(ALL DIMENSIONS ARE IN mm)

DJC

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

INVENTORY NO.	REF.DRG.NO.	COMP. FILE NAME
	B-101-01682-1	36100694.DWG

DRG.NO. 3-61-300-00694



NOTE:

CASE CARBURISE TO A DEPTH OF 1.2±0.2 TO GET HARDNESS OF 58-62 RC.

ITEM No	DESCRIPTION	DRAWING No.	VAR. No.	RAW MATERIAL SIZE OR CASTING DRG.No. OR FORGING DRG. No.	MATERIAL CODE / MATERIAL SPECN.	NET WT. / QUANTITY	GROSS WT.
01	ROD ø100 - 70 LG				HY1050265262 / HY10565	2.20 / 1	

REV.	DATE	ALTERED	CHECKED	APPD.
03	8.3.03	CASE CARBURISE NOTE,DETAIL P, CENTER HOLES ADDED. DIM 50.8 WAS 60.8.	(signed)	(signed)
02	08.10.98	DRAWING REDRAWN ON CAD INCORPORATING ALL THE PREVIOUS REVISIONS.	(signed)	(signed)

THE FOLLOWING CONDITIONS APPLY EXCEPT OTHERWISE STATED...

1. REF.TO HY0230261 FOR UNSPECIFIED TOLERANCES.
2. CHAMFER M/CD SHARP EDGES 1.2 TO 1.0 AT 45°.
3. INTERNAL M/CD CORNER RADII 1 TO 0.7.
4. THE SURFACE ROUGHNESS WHEREVER NOT SHOWN SHALL BE TAKEN FROM THE SURFACE ROUGHNESS SHOWN OUT SIDE BACK SLASHES GIVEN AT THE TOP MOST RIGHT CORNER OF THE DRG.

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: 883 XRP BOWL MILL

बीएचईएल BHEL — BHARAT HEAVY ELECTRICALS LTD. HYDERABAD

	NAME	SIGN.	DATE
DRN.	N.D.S	(signed)	08.10.98
CHD.	S.G	(signed)	08.10.98
APPD.	K.M.R	(signed)	08.10.98

No.OF VAR.: -

DEPT.	GRADE OF TOL. DIM.		SCALE	WEIGHT (KG)	REF. TO ASSY DRG.	ITEM No.	No.OF ITEMS
PULV. ENGG. / CODE 446	¢/M/∮		1:1	2.20	1.61.388.01055	27	30

TITLE: SPRING STUD INSERT

DRAWING No. 3-61-300-00694 — REV. 03

SHEET No. 1 — No. OF SHEETS 1

TD-151/REV. 03 SIZE A3

FIRST ANGLE PROJECTION

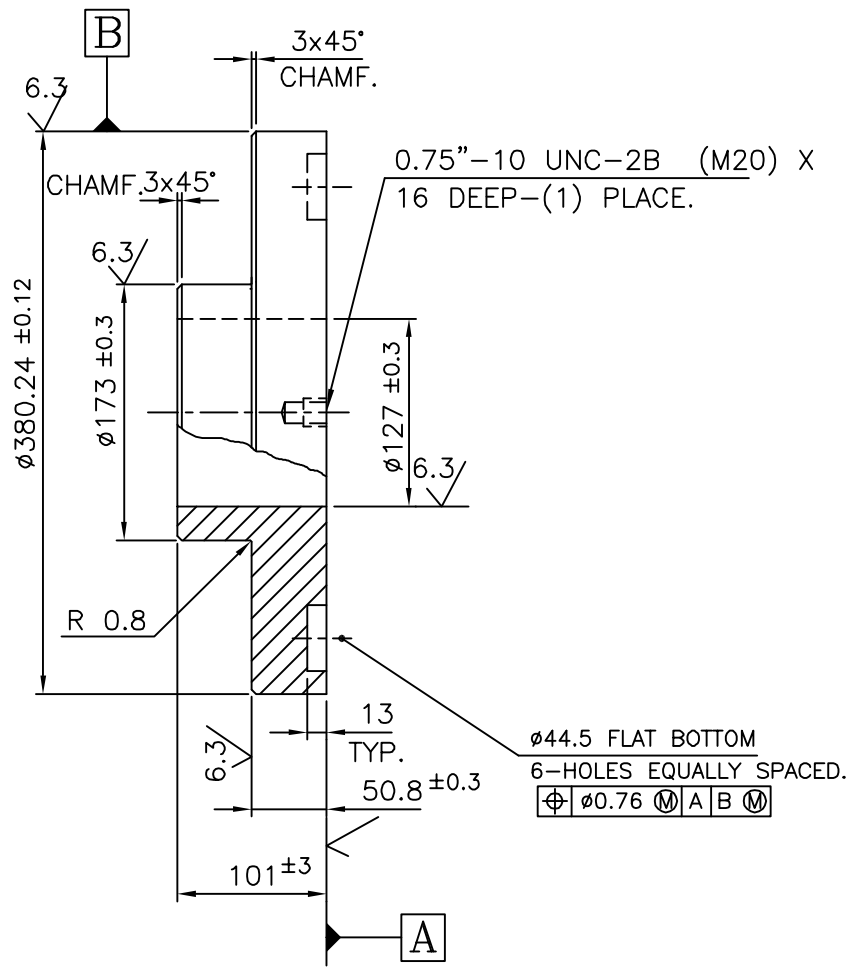
(ALL DIMENSIONS ARE IN mm)

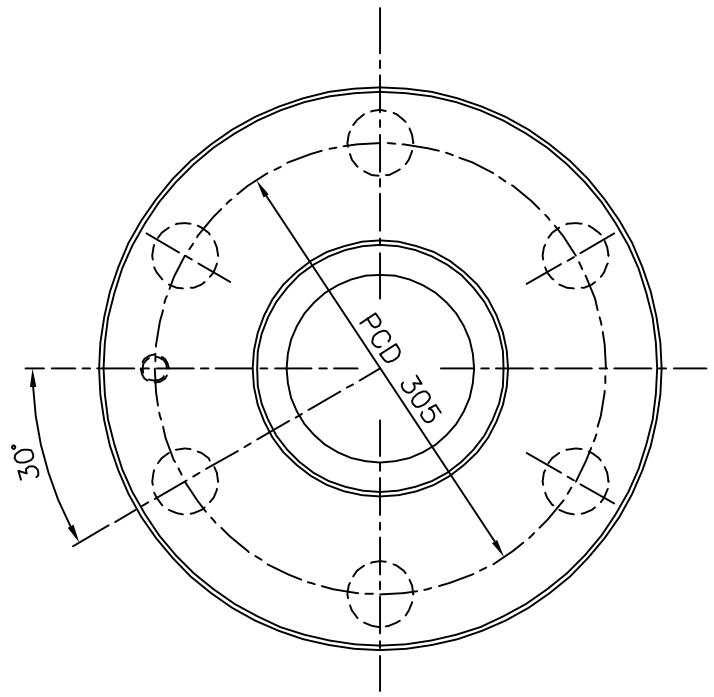
DRG.NO. 3-61-300-00695

36100695.DWG FILE NAME

REF.DRG.NO.

INVENTORY NO.





6.3

NOTES:-

01. BREAK ALL SHARP EDGES AND CORNERS UNLESS OTERWISE NOTED.
02. ALL DIMETERS TO BE ◎ ø0.25 B UNLESS OTHERWISE SPECIFIED.
03. VAR-01 WITH INCH THDS.
    VAR -02 WITH METRIC THDS.

ITEM NO	DESCRIPTION	DRAWING NO.	VAR. NO.	RAW MATERIAL SIZE OR CASTING DRG.NO. OR FORGING DRG.NO.	MATERIAL CODE / MATERIAL SPECN.	NET WT. / QUANTITY	GROSS WT.
	CASTING				BA9211118506 / AA19511	50.30	

REV.	DATE	ALTERED	CHD.	APPD.
03	8.12.04	ZONE M20 ADDED FOR VAR 02		
02	20.2.99	ZONE DRAWING REDRAWN NOTE -3 ADDED.		

THE FOLLOWING CONDITIONS APPLY EXCEPT OTHERWISE STATED...

1. REF.TO HY0230261 FOR UNSPECIFIED TOLERANCES.
2. CHAMFER M/CD SHARP EDGES 1.2 TO 1.0 AT 45°.
3. INTERNAL M/CD CORNER RADII 1 TO 0.7.
4. THE SURFACE ROUGHNESS WHEREVER NOT SHOWN SHALL BE TAKEN FROM THE SURFACE ROUGHNESS SHOWN OUT SIDE BACK SLASHES GIVEN AT THE TOP MOST RIGHT CORNER OF THE DRG.

TYPE OF PRODUCT
OR
NAME OF CUSTOMER/PROJECT

BHARAT HEAVY ELECTRICALS LTD.
HYDERABAD

	NAME	SIGN.	DATE
DRN.	UNIC/N.D.S		28.6.97
CHD.	B.M.R		11.8.97
APPD.	K.M.R		11.8.97

NO.OF VAR.

DEPT.	SCALE	WEIGHT (KG)	REF. TO ASSY DRG.	ITEM NO.	NO.OF ITEMS
PULV ENGG. CODE 446	1:5	50.30	7B- 101-01674-1 CE PIN.101-01674		

TITLE

SPRING GUIDE

DRAWING NO. 3-61-300-00695 REV. 03

SHEET NO. 01 NO OF SHEETS 02

TD-151/REV. 03 SIZE A3

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

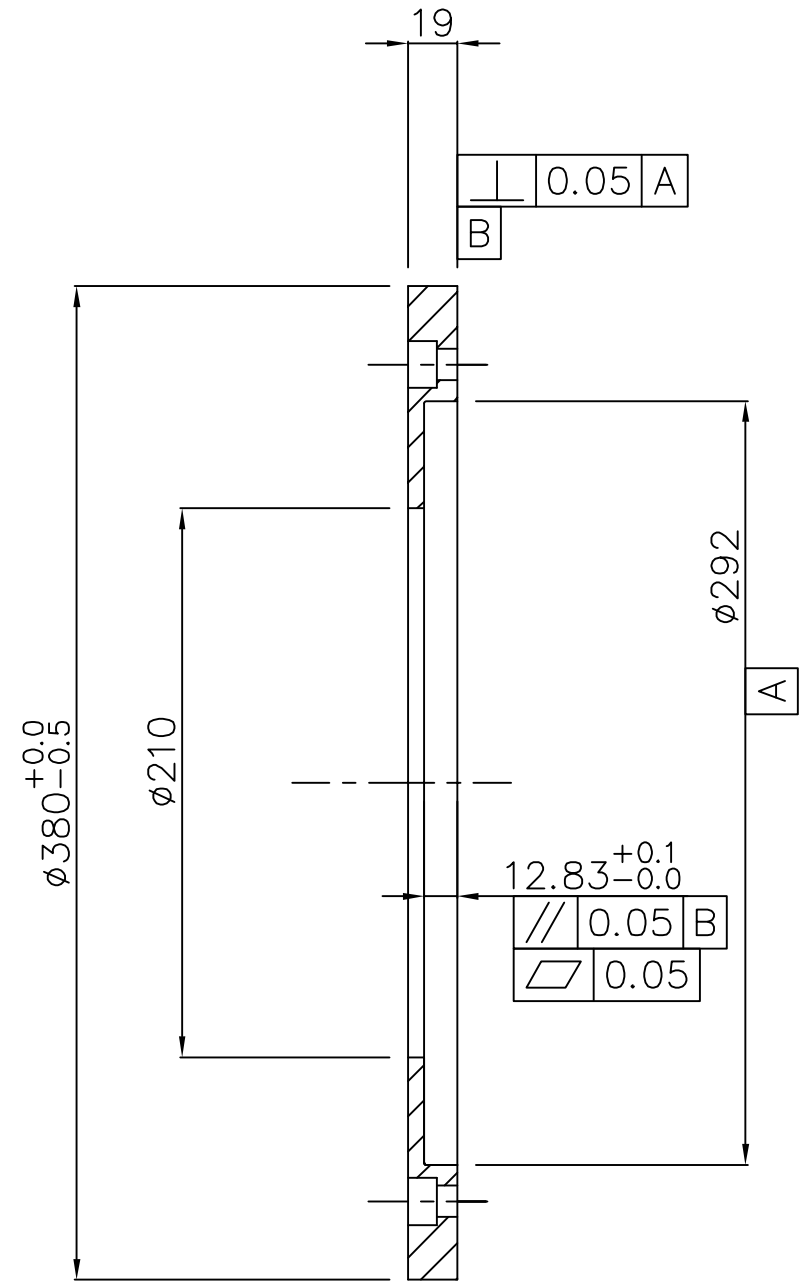
DRG. NO. 3-61-300-03284

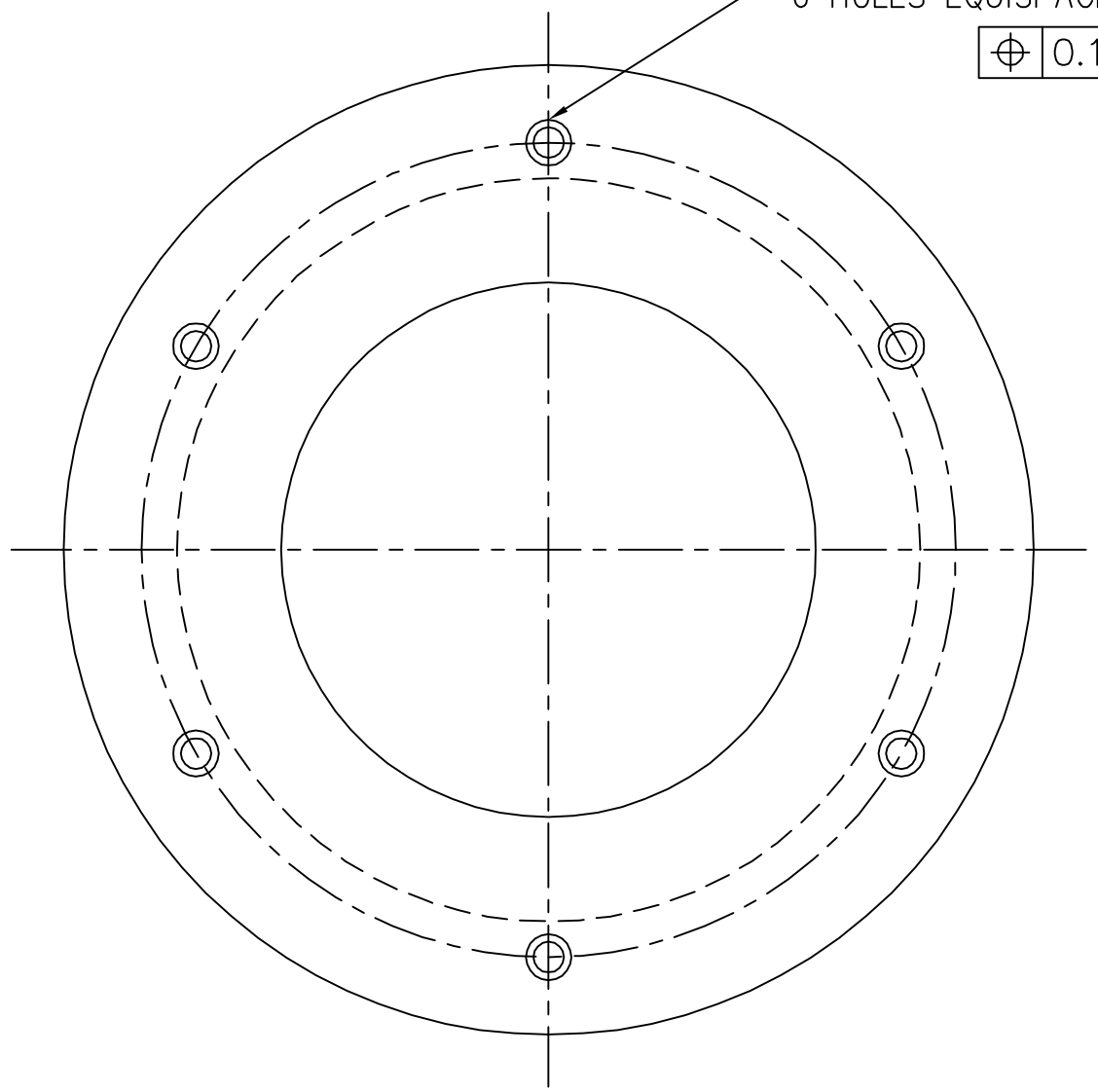
COMPUTER FILE NAME 3610 .DWG

REF. DRG. NO.

SIGN. AND DATE

INVENTORY NO





3.2

1. ALL DIMETERS TO BE Ⓜ 0.2 A UNLESS OTHER WISE NOTED
2. ALL SURFACE FINISHES TO BE 6.3 UNLESS OTHER WISE NOTED

ITEM NO.	DESCRIPTION	DRAWING NO.	VAR. NO.	RAW MATERIAL SIZE OR CASTING DRG. NO. OR FORGING DRG. NO.	MATERIAL CODE	NET WT.	GROSS WT.
	PLATE			25 X ø405	AA1011819155	8.60	25.0
					AA10119	1	
					MATERIAL SPECN.	QUANTITY	

THE FOLLOWING CONDITIONS APPLY EXCEPT OTHERWISE STATED.

1. REF. TO HY0230261 FOR UNSPECIFIED TOLERANCES.
2. CHAMFER M/CD. SHARP EDGES 1.2 TO 1.0 AT 45°.
3. INTERNAL M/CD. CORNER RADII 1 TO 0.7
4. THE SURFACE ROUGHNESS WHERE-EVER NOT SHOWN SHALL BE TAKEN FROM THE SURFACE ROUGHNESS SHOWN OUT SIDE THE BACK SLASH GIVEN OR THE TOP MOST RIGHT CORNER OF THE DRG.

TYPE OF PRODUCT 1003 XRP BOWL MILL

NAME OF CUSTOMER/PROJECT

BHARAT HEAVY ELECTRICALS LIMITED
HYDERABAD

	NAME	SIGN.	DATE	NO.OF VAR.
DRN.	R. RANJAN		30.7.09	
CHD.	AMAN SURIN		30.7.09	
APPD.	S.CHATGE		30.7.09	

DEPT.	UNTOL. DIMS. GR.		SCALE	WEIGHT (KG)	REF. TO ASSY DRG.	ITEM NO.	NO.OF ITEMS
PULV ENGG. CODE 446	¢/M/¢		1:1	8.60			

TITLE

SPRING AIR SEAL CAP

DRAWING NO. 3-61-300-03284 REV. 00

SHEET NO. 01 NO OF SHEETS 01

REV.	DATE	ALTERED	APPD.	REV.	DATE	ALTERED	APPD.	REV.	DATE	ALTERED E.M.ASHOK	APPD.
		CHD.				CHD.				CHD.	
ZONE				ZONE				ZONE			

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

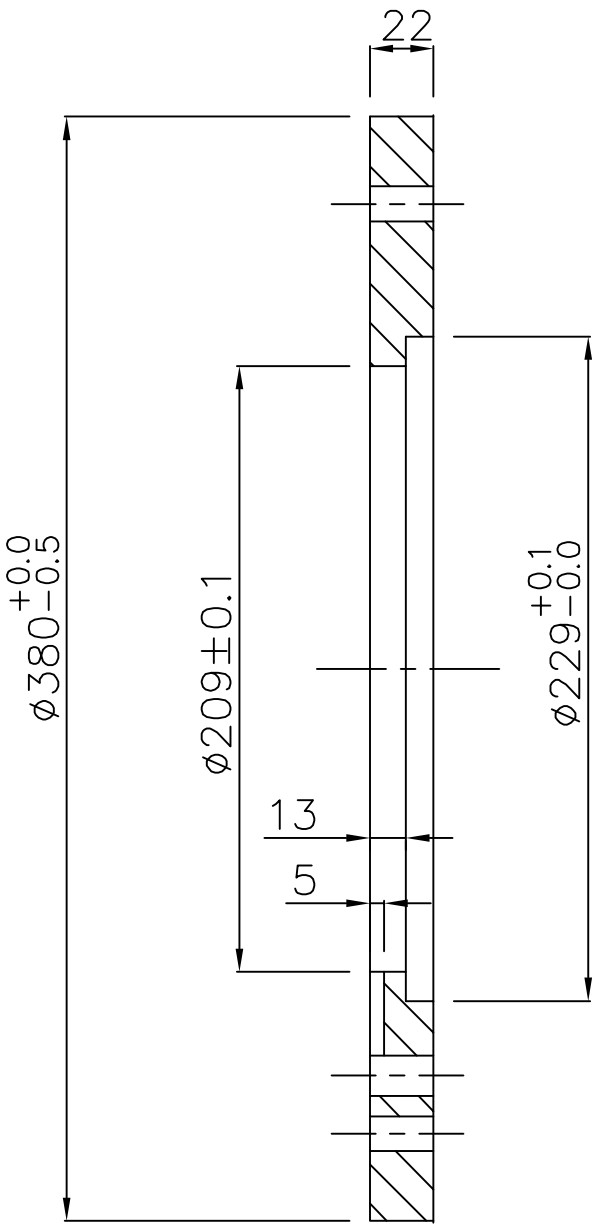
DRG. NO. 3-61-300-03285

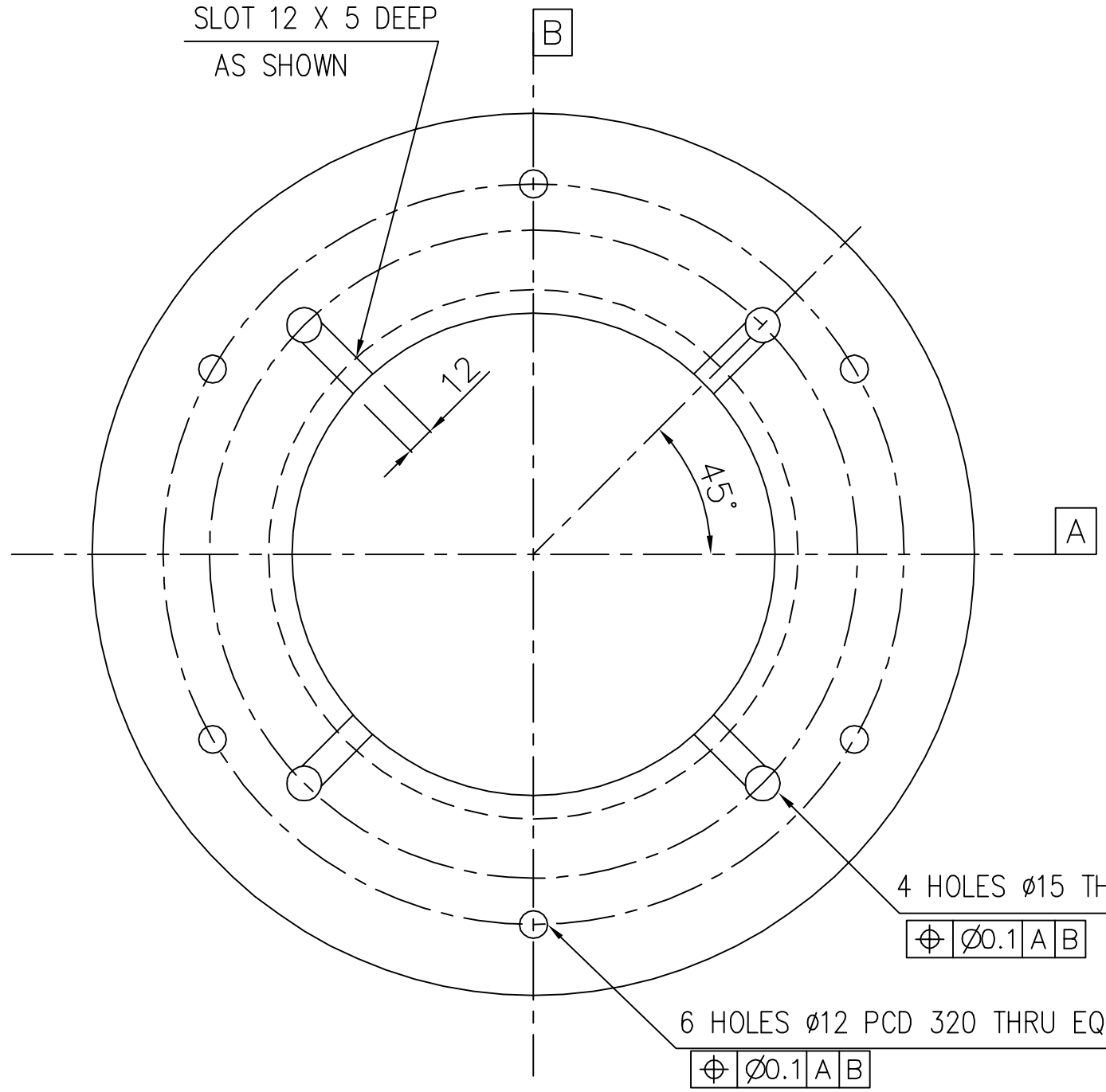
COMPUTER FILE NAME 3610 .DWG

REF. DRG. NO.

SIGN. AND DATE

INVENTORY NO





3.2

ITEM NO.	DESCRIPTION	DRAWING NO.	VAR. NO.	RAW MATERIAL SIZE OR CASTING DRG. NO. OR FORGING DRG. NO.	MATERIAL CODE	NET WT.	GROSS WT.
	PLATE			28 X ø380	AA1011819155	13.0	25.0
					AA10119	1	
					MATERIAL SPECN.	QUANTITY	

THE FOLLOWING CONDITIONS APPLY EXCEPT OTHERWISE STATED.

1. REF. TO HY0230261 FOR UNSPECIFIED TOLERANCES.
2. CHAMFER M/CD. SHARP EDGES 1.2 TO 1.0 AT 45°.
3. INTERNAL M/CD. CORNER RADII 1 TO 0.7
4. THE SURFACE ROUGHNESS WHERE-EVER NOT SHOWN SHALL BE TAKEN FROM THE SURFACE ROUGHNESS SHOWN OUT SIDE THE BACK SLASH GIVEN OR THE TOP MOST RIGHT CORNER OF THE DRG.

TYPE OF PRODUCT 1003 XRP BOWL MILL

NAME OF CUSTOMER/PROJECT

BHARAT HEAVY ELECTRICALS LIMITED
HYDERABAD

	NAME	SIGN.	DATE	NO.OF VAR.
DRN.	R. RANJAN		30.7.09	
CHD.	AMAN SURIN		30.7.09	
APPD.	S.GHATGE		30.7.09	

DEPT.	UNTOL. DIMS. GR.		SCALE	WEIGHT (KG)	REF. TO ASSY DRG.	ITEM NO.	NO.OF ITEMS
PULV ENGG. CODE 446	¢/M/¢		1:1	13.0			

TITLE

RETAINER PLATE

DRAWING NO. 3-61-300-03285 REV. 00

SHEET NO. 01 NO OF SHEETS 01

REV.	DATE	ALTERED	APPD.	REV.	DATE	ALTERED	APPD.	REV.	DATE	ALTERED E.M.ASHOK	APPD.
		CHD.				CHD.				CHD.	
ZONE				ZONE				ZONE			

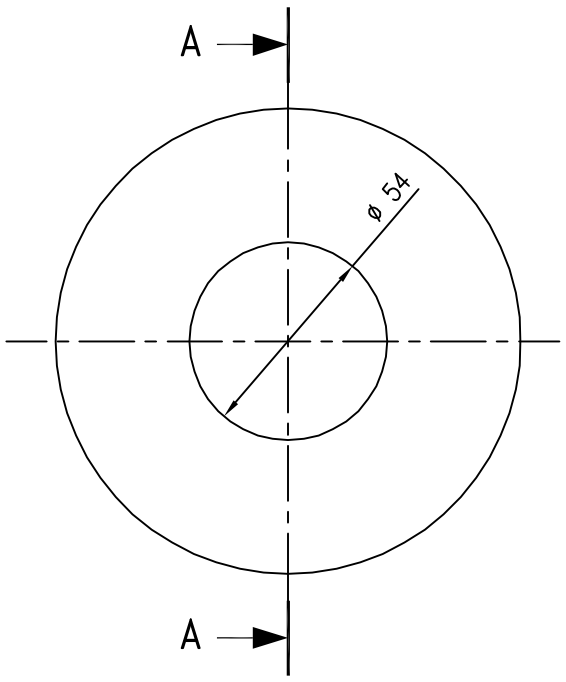
FIRST ANGLE PROJECTION

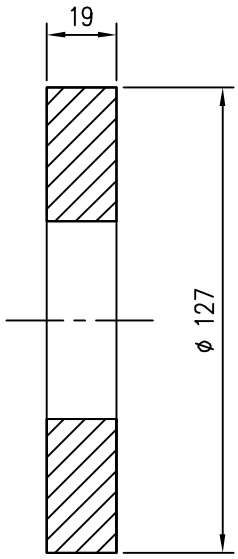
ALL DIMENSIONS ARE IN mm.

REV.	DATE			REV.	DATE			REV.	DATE		
02	15.09.98	ALTERED	N.D.S.			ALTERED				ALTERED	DJC
		CHECKED	S.G			CHECKED				CHECKED	
		APPROVED	K.M.R			APPROVED				APPROVED	

DRAWING REDRAWN ON CAD INCORPORATING ALL THE PREVIOUS REVISIONS.

6.3





SECTION A-A

NOTE:-

BREAK ALL SHARP EDGES AND CORNERS UNLESS OTHERWISE NOTED.

PL. 25 x ø127			AA1011819155	1.548
			AA10119	1
DESCRIPTION & DRG. No.	VAR No.	RAW MATERIAL SIZE OR CASTING DRG.NO. OR FORGING DRG.NO.	MATL. CODE	NET.WT. / GROSS WT
			MATL. SPECN.	QTY.

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: 883 XRP BOWL MILL

BHARAT HEAVY ELECTRICALS LTD. HYDERABAD

	NAME	SIGN	DATE
DRN.	N.D.S.		15.9.98
CKD.	S.G		15.9.98
APPD.	K.M.R		18.9.98

NO.OF VAR. –

DEPT.	GRADE OF TOL. DIM.	SCALE	WEIGHT(K.G.)	REF.TO ASSY.DRG.	ITEM No.	No.OF ITEM
PULV. ENGG.	¢/M/f	1:2	1.548	1-61-388-01065	16	30
CODE 446						

TITLE: KEEPER WASHER

DRAWING No. 4-61-300-00782 REV. 02

SHT. No. 1 | No. OF SHT. 1

REF. TO HY0230261 FOR UNSPECIFIED TOLERANCES.

SIGN. & DATE | REF. DRG. No. A-101-01437-2 | COMPUTER No. 46100782.DWG | 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. | INVENTORY NO.

FIRST ANGLE PROJECTION

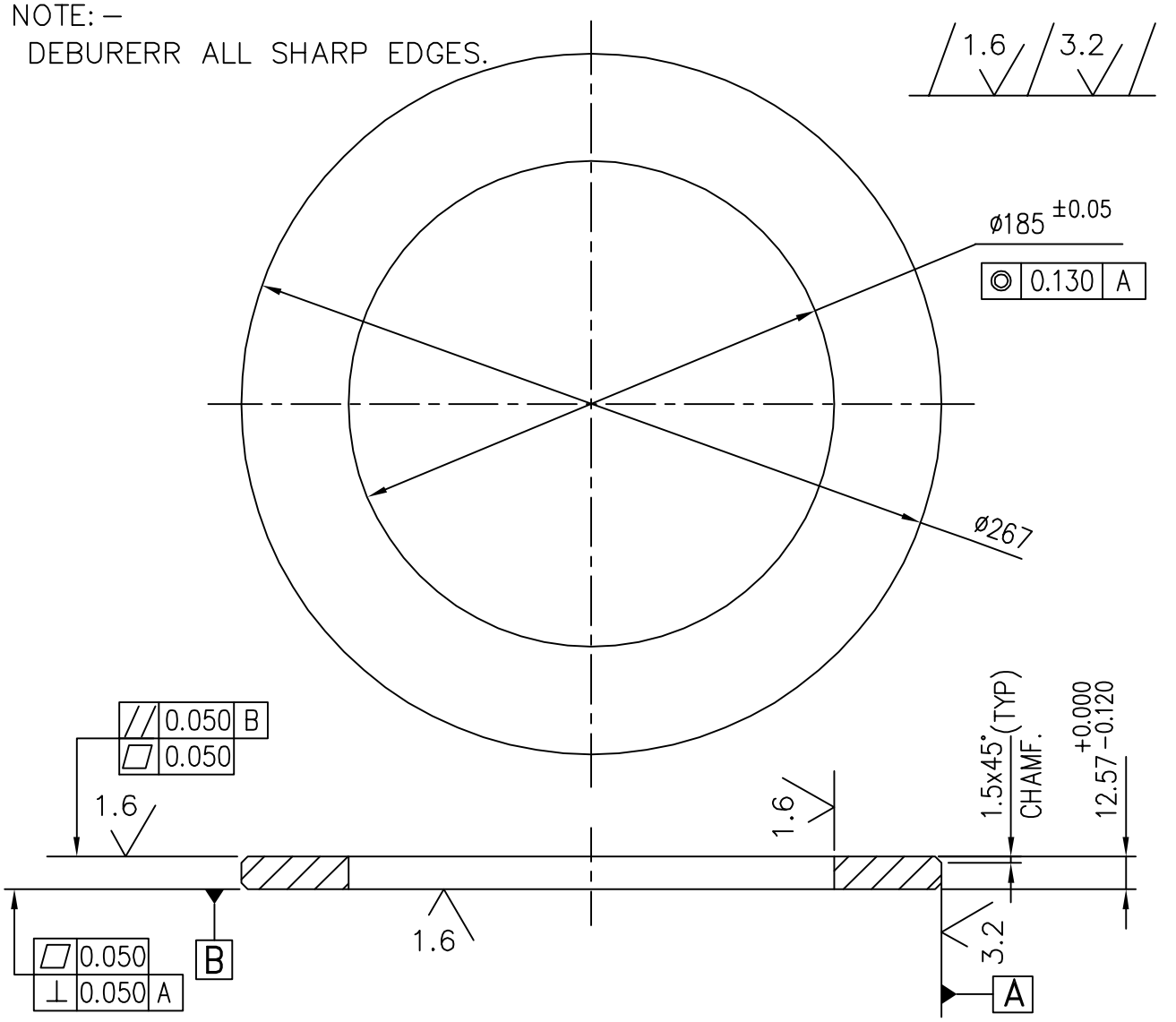
ALL DIMENSIONS ARE IN mm.

REV.	DATE		REV.	DATE		REV.	DATE	
01	08.10.98	ALTERED N.D.S.			ALTERED			ALTERED
		CHECKED S.G			CHECKED			CHECKED
		APPROVED K.M.R			APPROVED			APPROVED

DJC

DRAWING REDRAWN ON CAD

NOTE: –
DEBURERR ALL SHARP EDGES.



		PL. 20 x ø280	AA1011819139	3.270
			AA10119	1
DESCRIPTION & DRG. No.	VAR No.	RAW MATERIAL SIZE OR CASTING DRG.NO. OR FORGING DRG.NO.	MATL. CODE	NET.WT. / GROSS WT
			MATL. SPECN.	QTY.

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: 883 XRP BOWL MILL

BHARAT HEAVY ELECTRICALS LTD.
HYDERABAD

	NAME	SIGN	DATE
DRN.	N.D.S.		08.9.98
CKD.	S.G		08.9.98
APPD.	K.M.R		08.9.98

NO.OF VAR. –

DEPT.	GRADE OF TOL. DIM.	SCALE	WEIGHT(K.G.)	REF.TO ASSY.DRG.	ITEM No.	No.OF ITEM
PULV. ENGG.	₵/M/F	1:2.5	3.270	1-61-388-01055	24	30
CODE 446						

TITLE: SPRING ORIFICE PLATE

DRAWING No. 4-61-300-00983 REV. 01

SHT. No. 1 | No. OF SHT. 1

REF. TO HY0230261 FOR UNSPECIFIED TOLERANCES.

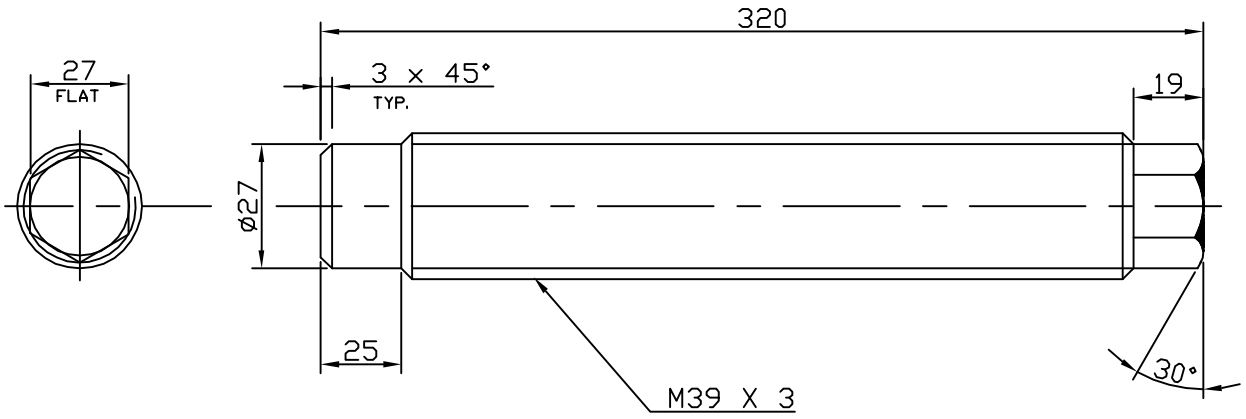
SIGN. & DATE | REF. DRG. No. | COMPUTER No. 46100983.DWG | INVENTORY NO.

FIRST ANGLE PROJECTION

ALL DIMENSIONS ARE IN mm.

REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED
01	11.2.06	CHECKED			CHECKED			CHECKED
		APPROVED			APPROVED			APPROVED

LENGTH 320 WAS 260. WT. & RAW MAT SIZE CHANGED.



ROD		ø40 X 330 L	HY1060264161	2.65
			HY10664	1
DESCRIPTION & DRG.NO.	VAR NO.	RAW MATERIAL SIZE OR CASTING DRG.NO. OR FORGING DRG.NO.	MATL. CODE	NET.WT. / GROSS WT
			MATL. SPECN.	QTY.

TYPE OF PRODUCT OR
NAME OF CUSTOMER/PROJECT

BHARAT HEAVY ELECTRICALS LTD.
HYDERABAD

	NAME	SIGN	DATE
DRN.	E.M.ASHOK		8-1-99
CKD.	S.GHATGE		8-1-99
APPD.	K.M.RAO		8-1-99

NO.OF VAR.

DEPT.	PULVE ENGG	SCALE	WEIGHT(K.G.)	REF.TO ASSY.DRG.	ITEM NO.	NO.OF ITEM
CODE	446	1:2	2.65			

TITLE

HI-TENSILE STUD M39 X 3

DRAWING NO. 4-61-300-02303

REV. 01

SHT.NO. | NO.OF SHT.

COMPUTER NO.

REF. DRG. NO.

SIGN. & DATE

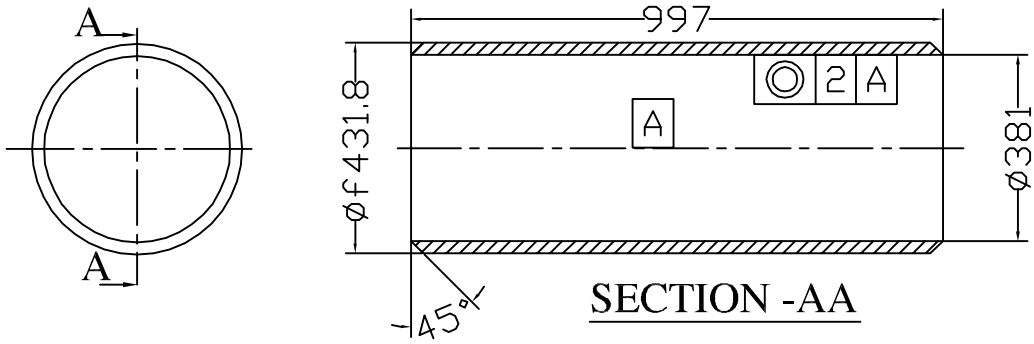
INVENTORY NO. 46102303

REF. TO HY0230261 FOR UNSPECIFIED TOLERANCES.

FIRST ANGLE PROJECTION

ALL DIMENSIONS ARE IN mm.

REV.	DATE	ALTERED / CHECKED / APPROVED	REV.	DATE	ALTERED / CHECKED / APPROVED	REV.	DATE	ALTERED / CHECKED / APPROVED
01	18.2.11		02	3.9..11				
DETAIL B WAS AT ONE PLACE			DETAILS B FOR WELDING REMOVED. R/M WAS PL 25X1290x1005.NOTES 1,2,3 FOR BUTT WELDING DELETED.					



SECTION -AA

COMPUTER NO. 4619022

REF. DRG. NO.

SIGN. & DATE

INVENTORY NO.

PIPE		OD 431.8X25.4X1000	HY1049055870	250.0	254.0
			AA10455	1	
DESCRIPTION & DRG.NO.	VAR NO.	RAW MATERIAL SIZE OR CASTING DRG.NO. OR FORGING DRG.NO.	MATL. CODE	NET.WT.	GROSS WT
			MATL. SPECN.	QTY.	

TYPE OF PRODUCT OR
NAME OF CUSTOMER/PROJECT

REF. TO HY0230261 FOR UNSPECIFIED TOLERANCES.

BHARAT HEAVY ELECTRICALS LTD.
HYDERABAD

	NAME	SIGN	DATE	NO.OF VAR.
DRN.	PALLAVI		29.09.2010	
CKD.	JAYANT		29.09.2010	
APPD.	S.G		29.09.2010	

DEPT.	CODE	SCALE	WEIGHT(K.G.)	REF.TO ASSY.DRG.	ITEM NO.	NO.OF ITEM
PULV. ENGG	446	1:15	250.0	26130402998		

TITLE: PIPE

DRAWING NO. 4.61.304.03335

REV. 02

SHT.NO. 1 NO.OF SHT. 1

STRUCTURAL STEEL-STANDARD QUALITY

(PLATES, SECTIONS, STRIPS, FLATS & BARS)

(ORDERING DESCRIPTION)

1.0 GENERAL:

This specification governs the quality requirements of structural steel plates, strips, flats, bars and sections such as angles, beams, channels and tees etc. of IS: 2062 – 2011, Gr: E250, Quality A

2.0 APPLICATION:

For general engineering purpose.

3.0 CONDITION OF DELIVERY:

Plates, Bars & Sections: Hot rolled in straight lengths without twists & Bends

4.0 COMPLIANCE WITH NATIONAL STANDARDS:

Material shall comply with the requirements of IS: 2062 – 2011, Gr: E250, Quality A

Material offered to EN 10025-2:2004 Gr. S275JR is also acceptable. The tolerance on dimensions for plates shall comply with EN 10029.

5.0 DIMENSIONS AND TOLERANCES:

5.1 DIMENSIONS:

5.1.1 Sizes

Material shall be supplied to the dimensions specified on BHEL Order.

5.1.2 Length

Unless otherwise specified, hot rolled bars and sections shall be supplied in 3 to 6 metres length.

5.2 Tolerances:

5.2.1 The tolerances on hot rolled material shall comply with IS: 1852. However, no plate shall be under the specified thickness at any point.

5.2.2 Straight for hot rolled bars:

Unless otherwise specified, the permissible deviation in straightness shall not exceed 5 mm in any 1000 mm length.

6.0 HARDNESS (BRINELL):

When tested in accordance with IS: 1500, the material shall show a brinell hardness in the range of 120-156 HB.

Note: Hardness test shall be conducted only when tensile test cannot be performed.

7.0 TEST CERTIFICATES:

Unless otherwise specified, three copies of test certificates shall be supplied.

In addition, the supplier shall ensure to enclose one copy of the test certificate along with their dispatch documents to facilitate quick clearance of the material.

The test certificate shall bear the following information.

AA10108 Rev.11 / IS:2062 Grade: E250 Quality A / EN 10025-2 Gr. S275JR,

BHEL order no., Melt no. Size, Results of chemical analysis and Mechanical tests, Supplier's name, Identification no. TC no., Signature of competent authority etc.

8.0 PACKING AND MARKING:

Plates shall be transported suitably to avoid damage during transit.

For plates below 10 mm thick, each pile (preferably of 16 plates) and each plate 10 mm thick & over shall be marked with melt no. AA10108, BHEL order no., Supplier's name, Identification no., Size & weight on any one corner and encircled with paint preferably of white colour.

9.0 REFERRED STANDARDS (Latest publications including amendments):

1) IS: 1500 2) IS: 1852 3) EN 10029

STRUCTURAL STEEL - WELDABLE QUALITY
(PLATES, SECTIONS, STRIPS, FLATS AND BARS)

ORDERING DESCRIPTION

1.0 GENERAL:

The material shall conform to IS 2062 – 2011, E250-Gr.BR (with mandatory Impact Test) or DIN EN 10025-2:2005, Gr. S275JR and comply with following additional requirements.

2.0 APPLICATION:

For general engineering purposes, suitable for welding.

3.0 CONDITION OF DELIVERY:

3.1 Bars & Sections shall be supplied in Hot rolled in straight lengths without twists and bends.

3.2 The material shall be supplied as per IS: 2062 – 2011, E250 Gr.BR (with mandatory Impact Test) or as per DIN EN 10025-2:2005 Gr. 275JR.

3.3 Any other additional requirement as per BHEL Purchase order.

4.0 DIMENSIONS AND TOLERANCES:

4.1 Sizes:

Material shall be supplied to the dimensions specified in BHEL Order.

4.2 Tolerances:

The tolerances on hot rolled material shall comply with IS: 1852 or any other equivalent national standard.

4.3 Straightness for hot rolled bars:

Unless otherwise specified, the permissible deviation in straightness shall not exceed 5 mm in any 1000 mm length.

5.0 TEST SAMPLES:

The selection of test pieces for all tests like Chemical, Mechanical etc. shall be as per IS: 2062, E250-Gr.BR or DIN EN 10025-2, Gr. S275JR.

CORPORATE PURCHASING SPECIFICATION

6.0 ULTRASONIC EXAMINATION:

Plates shall be ultrasonically examined in accordance with BHEL standard AA0850120 (or ASTM-A435) as detailed below and shall comply with the acceptance standards specified therein.

6.1 For plates above 40 mm thick:

Shall be ultrasonically examined unless when otherwise specified in order.

7.0 TEST CERTIFICATES:

Unless otherwise specified, three copies of test certificates shall be supplied.

In addition, the supplier shall ensure to enclose one copy of the test certificate along with their dispatch documents to facilitate quick clearance of the material.

The test certificate shall bear the following information:

AA10119 - Rev.No.15/ IS: 2062-Gr: BR (with mandatory Impact test) or DIN EN 10025-2, Gr. S275JR,

BHEL order No.

Melt No, Size & Quantity, Batch No with heat treatment details, Results of Chemical analysis,

Mechanical tests & NDT, Supplier's name, Identification No, TC No, Signature of Competent Authority, etc.

8.0 PACKING AND MARKING:

Plates shall be transported suitably to avoid damage during transit.

Each plate shall be marked with Melt No. Material grade and specification, BHEL Order No, Supplier's Name Identification No, Size & weight, on any one corner and encircled with paint preferably of white colour.

9.0 REJECTION AND REPLACEMENT

If the material does not comply with the requirements of this specification during receipt inspection at BHEL or if any defect is found during further processing of material, BHEL reserves the right to reject the whole consignment and the supplier shall replace the material free of cost. The rejected material shall be taken back by the supplier after fulfilling the commercial terms and conditions.

10.0 REFERRED STANDARDS (Latest publications including amendments):

1) IS: 1852 2) ASTM - A435 3) AA0850120

26/6/14

CS-721

BHEL	**CORPORATE PURCHASING SPECIFICATION**	AA10455
		Rev No.10
		PREFACE SHEET

CARBON STEEL SEAMLESS PIPES FOR HIGH TEMPERATURE SERVICE

FOR INTERNAL USE ONLY
REMOVE THIS PREFACE BEFORE ISSUE TO SUPPLIERS

Equivalent/Comparable Standards:

1. AMERICAN : ASME SA106, Gr:B

Suggested/Probable Suppliers and Grades:
Refer User plant vendors list

User Plant References:

1. HEP, BHOPAL : PS10145 / PS10151 / PS10158
2. HEEP, HARDWAR : ---
3. HPEP, HYDERABAD : ASTM A106, Gr:B
4. HPBP, TRICHY : TDC:1-001/C
5. PC, CHENNAI : ASTM A106, Gr:B

21/12/18

CS-944

DRC-5211

Revisions: Cl.No.10 revised in line with latest IBR requirement			**APPROVED:** INTERPLANT MATERIAL RATIONALISATION COMMITTEE – MRC(FCF+HTM)		
Rev No.10	Amd No.01	Reaffirmed	Prepared	Issued	Dt. of 1st Issue
Dt:08-12-2018	Dt:20-12-2018	Year:	HPBP, Trichy	Corp.R&D	June, 1978

	CORPORATE PURCHASING SPECIFICATION	AA10455
		Rev No. 10
		PAGE 1 of 2

CARBON STEEL SEAMLESS PIPES FOR HIGH TEMPERATURE SERVICE

(ORDERING DESCRIPTION FOR ASME SA106, Gr: B ATTESTED MATERIAL)

1 GENERAL:

The pipes shall conform to the latest version for ASME SA106, Gr:B and comply with the following additional requirements.

2 APPLICATION:

For high temperature service at stress levels and temperatures allowed by ASME Boiler & Pressure Vessel Code, Section I & Indian Boiler Regulations.

3 DIMENSIONS AND TOLERANCES:

3.1 Sizes

Pipe OD X Thickness shall be as specified on BHEL order. Unless otherwise specified, pipes shall be supplied in single random lengths of 4.8 to 6.7 meters.

3.2 Tolerances

As per ASME SA 530

4 MANUFACTURE

Either hot finished or cold drawn.

5 CHEMICAL COMPOSITION

Carbon content shall be restricted to 0.25%, max

6 MECHNICAL PROPERTIES

6.1 Bend Test

One pipe per melt / size upto 60.3mm OD (nominal size) shall be subjected to bend test as per ASME SA106.

6.2 Flattening

One pipe per melt / size over 60.3 mm OD (nominal size) shall be subjected to flattening test at one end of the pipe as per ASME SA106.

For pipes of sizes 10 inches and above (≥ 254 mm) may be bend tested as per ASME SA106.

7 HYDROSTATIC TEST / NDT

Each length of pipe shall be subjected to Hydrostatic test as per ASME SA530.

As an alternative to the Hydrostatic test, each length of pipe shall be subjected to NDT as given below:

a) For thickness upto 3.6mm, inclusive, Eddy current test as per ASME SE309 or for thickness upto 12mm, inclusive, Flux leakage test as per ASME SE570

or

CS-944 21/1/19

Revisions: Cl.No.10 revised in line with latest IBR requirement			**APPROVED:** INTERPLANT MATERIAL RATIONALISATION COMMITTEE – MRC(FCF+HTM)		
Rev No.10	Amd No.	Reaffirmed	Prepared HPBP, Trichy	Issued Corp.R&D	Dt. of 1st Issue June, 1978
Dt:08-12-2018	Dt:	Year:			

CORPORATE PURCHASING SPECIFICATION

b) Ultrasonic test as per ASME SE213.

Norms of acceptance shall be as specified in the respective standards mentioned above.

8 INSPECTION AT SUPPLIER'S WORKS

BHEL's representative shall have free access at all times to all parts of the manufacture's works, until the work on the contract of BHEL is being performed. The manufacturer shall offer BHEL's representative all reasonable facilities, without charge, to satisfy the latter that the material is being furnished in accordance with the specification.

9 REPAIRS

1) Repair involving fusion welding is prohibited.

2) When defects are repaired by mechanical means, the wall thickness requirements shall be satisfactorily met with and the surfaces shall be smoothly dressed up without any sharp edges.

10 CERTIFICATION:

Certification in IBR Form III-A for finished pipes from "IBR-Well Known Pipe Maker" or "Inspecting Authority", as applicable, shall be submitted to BHEL.

11 PACKING AND MARKING:

As per BHEL Standard AA0490001.

12 REJECTION & REPLACEMENT

If each length of pipe does not comply with the requirements of this specification during receipt inspection at BHEL or if any defect is found during further processing of pipes BHEL reserves the right to reject the whole consignment and the supplier shall replace the material free of cost. The rejected material shall be taken back by the supplier after fulfilling the commercial terms and conditions

13 REFERRED STANDARDS (Latest publications including amendments):

1) ASME SA530 2) ASTM A370 3) ASME SE309 4) ASME SE570

5) ASME SE213 6) AA0490001

CE-944 24/1/18

CARBON STEEL CASTINGS-FUSION WELDING QUALITY

1.0 GENERAL

This specification governs the quality requirements of Carbon Steel Castings-Fusion Welding Quality.

2.0 APPLICATION

For pressure containing parts for high temperature service and of quality suitable for assembly with other castings or wrought steel parts by fusion welding.

3.0 CONDITION OF DELIVERY

Normalised / Normalised & tempered

Rough machining of the castings shall be carried out, unless otherwise specified in BHEL order/drawing.

Castings shall not be painted

4.0 COMPLIANCE WITH NATIONAL STANDARDS

There is no Indian standard covering this material. However, assistance has been derived from ASTM A 216-1993, Gr: WCC, in preparing this specification.

5.0 DIMENSIONS AND TOLERANCES

The castings shall be true to the pattern/drawing.

Holes for machining up to and including 50 mm in diameter are to be cast solid, unless otherwise stated in BHEL order/drawing.

Unless otherwise specified in BHEL order/drawing, untoleranced dimensions for the castings shall be as per tolerance class 4 of BHEL standard AA 023 04 02.

6.0 MANUFACTURE

The steel for the castings shall be made by basic electric furnace process or such other process as may be agreed to between BHEL and the manufacturer.

The steel shall be fully killed.

7.0 HEAT TREATMENT

Heat treatment shall be carried out at suitable temperatures to give the properties specified.

Any flame or arc cutting which may have to be done, shall be carried out before heat treatment.

Test pieces shall also be heat treated along with the castings they represent.

8.0 FINISH

All castings shall be properly fettled and dressed and all surfaces shall be thoroughly cleaned.

Machined surfaces shall have the surface finish as indicated in the drawing

9.0 FREEDOM FROM DEFECTS

Castings shall be free from defects such as porosity , blow holes, sand inclusion, shrinkage, cavities, hard spots, cold shuts, cracks, etc., which may adversely affect machining and utility of castings.

When it is necessary to remove risers by flame cutting, care shall be taken to make the cut at a sufficient distance from the body of the casting so as to prevent any defect being introduced into the casting due to local heating.

10.0 CHEMICAL COMPOSITIION

The melt analysis of steel and the permissible variation in the composition of the castings from the melt analysis shall be as specified below:

Element	Melt analysis, Percent, max	Permissible Variation, percent
*Carbon	0.25	0.02
Silicon	0.60	0.05
*Manganese	1.20	0.06
Sulphur	0.045	0.008
Phosphorus	0.040	0.008

Note: 1. In the interest of uniform welding, the concentration of the unspecified alloying elements shall not exceed the limits specified below. Whenever specified in the enquiry/order, the test results of these elements shall also be included in the test certificate. However, the manufacture shall ensure that these elements are within the limits specified.

Element	Percent, Max.
Copper	0.30
Nickel	0.50
Chromium	0.50
Molybdenum	0.20
Vanadlum	0.03
1. Total content of these unspecified elements	1.00

2. For each reduction of 0.01% below the specified maximum carbon content, an increase of 0.04% Mn above the maximum specified will be permitted up to a maximum of 1.40%.

11.0 TEST SAMPLES

Manufacturers shall carryout mechanical testing as per following sampling plan.

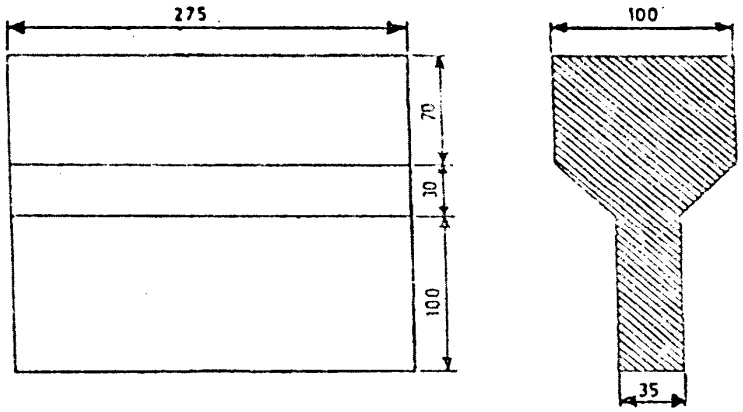
11.1 Unless otherwise specified for castings weighting up to 500 kg. piece weight one keel block, separately cast per melt per heat treatment batch shall be supplied according to the sketch given below:

11.2 Unless otherwise specified castings weighing more than 500 kg shall be provided with integrally cast keel block.

11.3 Retests shall be carried out as per IS : 8800

11.4 Keel blocks with proper identification and representative of the castings shall be supplied along with the consignment for testing at BHEL works.

DETAIL OF KEEL BLOCK



ALL DIMENSIONS IN mm

12.0 MECHANICAL PROPERTIES:

The test pieces, after being heat treated as per clause Cl.7.0 above, shall show the following properties:

12.1 Tensile

The test pieces shall show the following properties when tested in accordance with ASTM A 370

Tensile strength	:	485 - 655 N/mm^2
Yield strength	:	275 N/mm^2, min.
Elongation on 50mm gauge length	:	22 percent, min.
Reduction in area	:	35 percent, min.

12.2 Hardness (Brinell): for information only:

150 - 205 HB.

13.0 NON-DESTRUCTIVE TESTS:

The following tests shall be conducted:

1) Ultrasonic examination to BHEL standard AA 085 01 04 / AA 085 01 05
2) Liquid penetrate examination to BHEL standard AA 085 0131.
3) Magnetic particle examination to BHEL standard AA 085 01 33 and norms of acceptance as per BHEL standard AA 085 01 34.

Norms of acceptance shall be as specified in BHEL order/drawing

14.0 REPAIR OF CASTINGS

The manufacturer without the prior permission of BHEL shall not carry out repair of castings.

15.0 SCOPE OF THIRD PARTY INSPECTION:

Wherever, separate quality plan is not attached, the scope of third party inspection shall be as follows:

1. Review of supplier's declared chemical composition.
2. Selection of test samples for mechanical tests and witness of mechanical tests.
3. Witness of Non-destructive tests as applicable.
4. Review of HT charts.
5. Dimensional inspection.

16.0 TEST CERTIFICATES

Three copies of test certificates shall be supplied unless otherwise stated in BHEL order, preferably in the test certificate format annexed to this specification (Annexure -1).

In addition, the supplier shall ensure to enclose one copy of the test certificate along with their dispatch documents to facilitate quick clearance of the material.

The test certificate shall bear the following information:

i) Dimensional inspection.

ii) Detail of heat treatment

iii) Chemical composition & unspecified alloying elements whenever called for

iv) Results of mechanical tests

v) Results of NDT tests.

17.0 PACKING AND MARKING

Castings shall be suitably packed to prevent corrosion and damage during transit. Machined surfaces shall be properly protected with anticorrosive compounds. Each package or casting (when supplied separately) shall be legibly marked with the following information.

AA 195 11: C.S. Castings - F.W. Quality
BHEL Order No.
Consignment/Identification No.
Melt No.
Weight
Supplier's Name

18.0 REFERRED STANDARDS (Latest Publications Including Amendments):

1. AA 023 04 02	2. AA 085 01 04	3. AA 085 01 05	4. AA 085 01 31
5. AA 085 01 34	6. ASTM A 216	7. ASTM A 370	8. IS : 8800

ANNEXURE 1 - RECOMMENDED TEST CERTIFICATE FORMAT FOR CASTINGS

SUPPLIERS'S NAME AND ADDRESS

1. Customer :
2. TC No. & Date :
3. PO No. :
4. Process of Melting :
5. Deoxidisation Process
6. Cast No. & Date :
7. Batch No. :
8. Heat Code :
9. Spec.. No. :
10. Test Bar Size

II. CASTING COVERED BY T.C.

Sl. No.	Drawing No. & Item No.	Description	Quantity & Weight

12. CHEMICAL COMPOSITION (PERCENT)

Element	C	Sl	Mn	S	P										
As per Min.															
Spec. Max..															
Actual Values.															

13. HEAT TREATMENT
(To be accompanied by Recorder Chart, wherever called for)

Condition	Temp.°C	Soaking Time, Hrs..	Cooling Medium

14. MECHANICAL PROPERTIES

	T.S. N/mm2	Y.S. 0.5/0.2% Proof N/mm2	% E on GL 5.65 SO	% R.A. Min	Hardness BHN Min. 3 Values	Impact Value, Joules	Bend	
As per Min.								
Spec. Max.								
Actual Values.								

15. Surface Finish (When called for in the order/drg)	
16. DIMENSIONAL INSPECTION	

17.NON-DESTRUCTIVE TESTS

Nature of Test	Acceptance Level	Instrument used	Range	Results	Any other details
Ultrasonic					
Radiographic					
Dye Penetrant/ Magnetic Particle					

18. OTHER TESTS, IF ANY (MICRO-Scopic, Hydraulic, Etc.)	
19. IDENTIFICATION ON CASTING AS PER CPS.	

We hereby certify that the items mentioned above have been tested and inspected in our presence and are found to be in accordance with the drawings, specifications and purchase order.

Signature & Seal of the Inspecting Officer (Purchase Representative)

Date :

Signature and Seal of the Chief of Quality Control Chief Metallurgist of the Supplier.

Date :

INSTRUCTION:

a) If steel is produced by LD or Oxygen process, Nitrogen content should be furnished and shall not exceed 0.009%
b) Test Certificates are to be furnished as per Purchase Order and Specifications, in A4 Size transparent paper.
c) All the entries including signature should be in black ink.
d) If testing is done by outside agencies, the original TCs shall be furnished.
e) The actual Test Certificate may run into more than one A4 size paper, if needed, to facilitate filling up of details.

RUST PREVENTIVE HARD FILM, BLACK (TRP)

1.0 GENERAL:

This specification governs the quality requirements of temporary rust preventive (TRP), coating a hard film on drying. The material consists of film forming ingredients dissolved in solvents to give a low viscous liquid at room temperature. On evaluation of solvents, a thin though abrasion resistant film capable of being handled without damage shall be obtained. Normally this material gives protection upto six months and thereafter requires inspection and reapplication, if necessary.

2.0 APPLICATION:

Depending upon components and their sizes, the rust preventive can be applied by brush, dip or spray. Two liberal coats are desirable for adequate protection. The surface to be coated with anti rust solution should be absolutely clean and free from rust.

3.0 REMOVAL:

This TRP can be removed by cotton cloth soaked in white spirit to BHEL specification AA 56701.

4.0 COLOUR : Steel Black.

5.0 COMPLIANCE WITH NATIONAL STANDARDS:

The material shall comply with the requirements of the following national standards and also meet the requirements of this specification.

IS: 1153 - 2000:RA-2005 Temporary Corrosion Preventive, Fluid, Hard Film, Solvent deposited,

6.0 COMPOSITION:

The composition shall be based on asphalt, mineral oil and inhibitive pigments with suitable additives.

7.0 TEST SAMPLES:

Half a litre of sample shall be taken for testing and approval.

8.0 PROPERTIES:

When tested in accordance with the relevant clauses of BHEL standard AA 085 00 01, the test sample shall show the following properties:

8.1 Consistency : 90 ± 10 seconds in Ford Cup No.4 at 27± 0.5^{0}C.

8.2 Drying Time : Tack free: Within one hour
Hard dry : 16 hours

8.3 Flash Point : 32^{0}C, min.

8.4 Weight : 11 ± 0.5 kg per 10 litres.

8.5 Non-volatile Matter : 58 ± 2% by mass.

8.6 Test for Adhesion : To pass the test

8.7 Spreading Capacity : 8.0 sq.meter/litre, minimum

8.8 Protection against corrosion at high temperature and humidity:

To pass the test for 360 hours, minimum..

9.0 TYPE TESTS:

Whenever specified, the following tests shall be carried out, as per the methods mentioned against each:

i) **Protection against corrosion under conditions of condensation (IS:101, part 6/sec.1):**

No sign of corrosion on the surface after 21 days of exposure.

10.0 TEST CERTIFICATES:

Three copies of test certificates shall be supplied alongwith each consignment, giving the following information:

In addition, the supplier shall ensure to enclose one copy of the test certificate alongwith the despatch documents to facilitate quick clearance of the material.

AA 551 54, Rev. 03 : Rust preventive hard film, black (TRP)
BHEL Order No.
Batch / Lot No.
Supplier's/ Manufacturer's Name and Trade mark, if any
Date of manufacture and expiry
Test results of clause 8.0 & 9.0.

11.0 KEEPING PROPERTY:

When stored in a covered dry place in the original sealed containers under normal temperature conditions, the material shall retain the properties prescribed in this specification for a period of not less than 12 months after the date of manufacture which shall be subsequent to the date of placing the order.

12.0 PACKING & MARKING:

Unless otherwise specified, the material shall be supplied in 4 kg steel containers, which shall be leak free, dry and clean.

Each container shall marked with the following information:

AA 551 54: Rust preventive hard film, black (TRP)
BHEL Order No.
Supplier's / Manufacturer's Name and Trade mark, if any
Batch No./Lot No.
Date of manufacture and expiry
Quantity supplied

8.0 ENVIRONMENTAL REQUIREMENTS:

The supplier shall furnish Material Safety Data Sheet **(MSDS)** covering all information relating to human safety and environmental impacts of the hazardous materials particularly during their transportation, storage, handling and disposal alongwith each supply.

Each container shall be marked with corresponding symbol and minimum worded cautionary notice for flammable / corrosive / toxic / harmful / irritant and oxidizing etc. as applicable

13.0 REFERRED STANDARDS (Latest Publications Including Amendments):

1. AA 085 00 01 2. AA 56701 3. IS: 1153

RUST PREVENTIVE, DRYING TYPE – PIGMENTED (TRP)

1.0 GENERAL:

This specification governs the quality of pigmented drying temporary hard film TRP coating. The material consists of a film forming synthetic resin, inhibition pigment (zinc chromate/ zinc phosphate) and suitable additives. This bright yellow pigmented preservative gives long term preservation at medium and high ambient upto one year and needs inspection and reapplication, if necessary.

2.0 APPLICATION:

Depending upon the components and their size, the rust preventive can be applied by brush, spray or dip. Two liberal coats are desirable for adequate protection.
The surface to be coated with rust solution should be scrupulously clean and devoid of rust.

3.0 COLOUR:

Yellow.

4.0 COMPLIANCE WITH NATIONAL STANDARDS:

There is no Indian standard covering this material.

5.0 CHEMICAL COMPOSITION:

The composition shall be based on synthetic resin inhibitive pigment (zinc chromate/zinc phosphate) with suitable additives.

6.0 TEST SAMPLES:

Half a litre of sample shall be taken from each consignment for testing and approval.

6.1 To draw a representative sample, the contents of the container selected for sampling shall be mixed as thoroughly as possible by shaking or stirring or both or by rolling, so as to bring all portions into uniform distribution.

6.2 The samples shall be taken in a suitable, clean, dry air-tight glass bottle of one liter capacity. It should be almost but not completely filled by the sample.

6.3 In case of failure of first sample, two samples shall be drawn from other two drums of the same consignment at random and failure of the second sample in complying with the specification will lead to the rejection of the whole consignment.

7.0 PROPERTIES:

When tested in accordance with test methods mentioned against each, the test sample shall show the following properties:

7.1 Consistency (AA 085 00 01):

60 – 70 seconds in cup No. 4 to IS: 3944 -1982, RA-2005at 27± 0.5^0 C.

7.2 Drying Time (AA 085 00 01):

Touch dry : within one hour

Hard dry : 16 hours

7.3 Weight in kg per 10 litres (AA 085 00 01):

14.0 ± 0.5

7.4 Non-volatile Content (AA 085 00 01):

73 ± 2% by mass.

7.5 Test for Adhesion (AA 085 00 01):

To pass the test.

7.6 Protection Against Corrosion at High Temperature and Humidity (AA 085 00 01):

No sign of corrosion under the film.

7.7 Scratch Hardness (IS: 1153):

To pass the test.

8.0 REMOVAL:

This shall be removable by using white spirit to BHEL specification AA 567 01.

9.0 TYPE TESTS:

9.1 Flash Point (AA 085 00 01):

Above 35^0 C.

9.2 Spreading capacity (AA 085 00 01):

6.5 sq.m per litre. minimum.

9.3 Salt spray Test for 7 days (IS:2074):

No sign of corrosion underneath the paint film.

10.0 TEST CERTIFICATES

Three copies of test certificates shall be supplied alongwith each consignment, giving the following information:

In addition, the supplier shall ensure to enclose one copy of the test certificate alongwith the despatch documents to facilitate quick clearance of the material.

AA 5551 55, Rev. 02 : Rust preventive, drying type-pigmented (TRP)
BHEL Order No.
Batch / Lot No.
Supplier's/ Manufacturer's Name and Trade mark, if any
Date of manufacture and expiry
Test results of clause 7.0.

11.0 KEEPING PROPERTY:

When stored in a covered dry place in the original sealed containers under normal temperature conditions, the material shall retain the properties prescribed in this specification for a period of not less than 12 months after the date of manufacture which shall be subsequent to the date of placing the order.

12.0 PACKING & MARKING

Unless otherwise stated, the TRP shall be supplied in 4 kg steel containers.

Each container shall bear the following information:

AA 551 55: Rust preventive, drying type-pigmented (TRP)

BHEL Order NO.
Supplier's / Manufacturer's Name
Trade mark, if any
Date of manufacture and expiry
Batch No.
Quantity supplied

13.0 ENVIRONMENTAL REQUIREMENTS:

The supplier shall furnish Material Safety Data Sheet **(MSDS)** covering all information relating to human safety and environmental impacts of the hazardous materials particularly during their transportation, storage, handling and disposal alongwith each supply.

Each container shall be marked with corresponding symbol and minimum worded cautionary notice for flammable / corrosive / toxic / harmful / irritant and oxidizing etc. as applicable

14.0 REFERRED STANDARDS (Latest Publications Including Amendments)

1. AA 085 00 01
2. AA 567 01
3. IS: 1153
4. IS 2074
5. IS 3944

ANTI-CORROSIVE PRIMING PAINT

1.0 GENERAL:

This specification governs the quality requirements of air drying Anti Corrosive ready mixed Red oxide Zinc phosphate priming paint which shall be capable of being brushed, sprayed by conventional methods. The priming paint shall be suitable to be thinned with MTO/white spirit conforming to BHEL specification AA56701.

The paint shall be compatible with high quality full glossy outdoor finishing paint to BHEL specification AA56126 (IS: 2932), when surfaces primed with this paint are coated with 2 coats of finishing paint.

2.0 APPLICATION:

The material shall be intended for use as a primer coat in the painting system for protection of steel surfaces against corrosion for outdoor and indoor application on Electrical equipment. Normally, for best performance the surface to be coated shall be ensured free from oil, loose rust/dust etc., followed by blast cleaning to Sa 2 1/2.

This shall be followed by application of two coats of the priming so as to achieve dft of 30 microns, min.

3.0 COMPLIANCE WITH NATIONAL STANDARDS:

The material shall comply with the requirements of the following national standard and also meet the requirements of this specification.

IS: 12744 – 1989 (Reaffirmed 2004): Ready Mixed Paint, Air Drying, Red Oxide-Zinc Phosphate Priming-Specification.

4.0 COLOUR: The colour of the material shall be that of red oxide.

5.0 FINISH: Smooth and Matt to Egg shell flat

6.0 FREEDOM FROM DEFECTS:

The priming paint shall remain free from defects like hard settling of pigments, thick and hard skinning etc., when kept in closed container and livering (excessive viscosity build up) during its rated shelf life.

The dried surface of the coating shall be smooth, uniform, homogenous appearance and shall be free from physical defects like, pinholes, wrinkles, hard particles, blisters, air bubbles etc.

7.0 CHEMICAL COMPOSITION:

The paint shall be formulated with anti-corrosive pigments like Red oxide of iron, Zinc phosphate, extenders etc., dispersed in unsaponifiable modified alkyd medium in solvent, thinner and drier in suitable proportions so as to satisfy the requirements prescribed in this

specification. The raw materials used in the formulation of the priming paint shall be of good quality and conform to following Indian standards.

a) Zinc Phosphate : IS: 10897

b) Red Oxide of Iron : IS: 44

c) Petroleum hydrocarbon solvent : IS: 1745

The supplier of the material has to certify that the paint supplied shall be free from lead or its compounds and also meets the legislative requirements of ISO 14001.

8.0 TEST SAMPLES AND TEST METHODS:

Tender samples will not be required when once the type approval is given and the supplier concerned declared that the material for which the tender is given of the same quality as the type approved sample.

500ml of thoroughly mixed sample representing lot be drawn from randomly selected drum and shall be sent to laboratory for testing. The testing shall be done in accordance with relevant part and section of IS: 101 or as specified in this specification.

9.0 PROPERTIES:

9.1. Drying Time

Surface dry : 2 hours, maximum

Hard dry : 12 hours, maximum

9.2. Consistency

Smooth and uniform and suitable for brushing without appreciable drag on the brush or spraying as required.

Efflux time by Ford cup No. 4, at 27 ± 20°C: 80 - 120 secs.

9.3. Mass per Ten Litres:

13.5 kgs. min.

9.4. Flash Point:

30°C, min

9.5. Scratch Hardness:

When tested on coated panels air dried for 48 hrs and tested at a load of 1500g on steel panels and 1000g on tinned mild steel panels, no such scratch as to show the bare metal shall be produced.

9.6. Flexibility and Adhesion:

When tested on coated panels air dried for 48 hrs, no visible damage or detachment of coating shall take place and passes the test when tested by cylindrical bend test method.

9.7. Resistance to Salt Spray:

When tested as per test method of IS 2074, the test panel prepared from the followed by air drying for 48 hrs, material shall show no sign of corrosion after continuous exposure for 96 hrs, in salt spray cabinet.

9.8. Protection against Corrosion under Conditions of Condensations:

The coated panels air dried for 48 hrs, are subjected to continuous exposure, shall show no sign of deterioration of the coating & metal surface show no sign of corrosion.

9.9. COMPOSITION:

9.9.1. Pigment Content: 50 ± 5% by mass

9.9.2. Zinc Phosphate (IS 10897): 16.0%, min. by mass on pigment

9.9.3. Red Oxide AS Fe_2O_3 (IS 44): 50.0%, min. by mass on pigment

10.0 VOLUME SOLIDS: 40.0% min. (Pigment + Binder) by weight.

11.0 COMPATIBILITY TEST WITH COATS:

The primer paint shall be fully compatible with top coats like, High quality full glossy finishing paint conforming to AA56126 /IS 2932, when tested as per method prescribed in Annexure-1.

12.0 WET OPACITY (FOR INFORMATION ONLY):

Theoretical coverage: 10 sq.m / litre @ Dft: 35 microns.

13.0 TEST CERTIFICATES:

Unless otherwise stated, three copies of test certificates shall be supplied along with each consignment.

In addition, the supplier shall ensure to enclose one copy of the test certificates along with their despatch documents to facilitate quick clearance of the material.

The test certificates shall bear the following information:
AA56101 Rev. No. 07 - ANTI-CORROSIVE PRIMING PAINT

BHEL order:

Supplier's Name and address

Identification/Trade Mark, if any.

Batch No/Lot No.:

Date of Manufacture and Expiry.

Lot Quantity:

Test results of clause 7.0 to 12.0.

Special Instructions, if any.

14.0 KEEPING PROPERTY:

When the material stored in a covered dry place in the original sealed container at under ambient conditions, the same shall retain the properties prescribed in this specification for a period of at least 12 months after the date of manufacture, which shall not be subsequent to the date of placing the order and not earlier than one month of the scheduled delivery date mentioned in BHEL order.

CORPORATE PURCHASING SPECIFICATIONS

15.0 ENVIRONMENTAL REQUIREMENTS:

The supplier shall furnish Material Safety Data Sheet (MSDS) covering all information relating to human safety and environmental impacts of the hazardous materials particularly during their transportation, storage, handling and disposal along with each supply. Each container shall be marked with corresponding symbol and minimum worded cautionary notice for flammable / corrosive / toxic / harmful / irritant and oxidizing etc. as applicable.

16.0 PACKING & MARKING:

Unless otherwise stated, the paint shall be supplied in packing size as specified in BHEL order and shall be packed in air tight leak -proof metal container conforming to IS: 1407 and IS: 2552. Each container shall bear following information neatly written or pasted on the container.

AA56101 - ANTI-CORROSIVE PRIMING PAINT

BHEL order:

Name of supplier and address:

Identification/Trade Mark, if any.

Quantity of material:

Batch No/Lot No.:

Date of Manufacture and Expiry.

Special Instructions, if any:

17.0 REFERRED STANDARDS (Latest Publications Including Amendments):

1) IS : 44
2) IS : 101
3) IS : 1407
4) IS : 1745
5) IS : 2074
6) IS : 2552
7) IS : 2932
8) IS : 10897
9) IS : 12744
10) IS : 13262
11) ASTM D 3359
12) AA56126
13) AA56701

ANNEXURE-I

TEST FOR COMPATIBILITY OF ANTI-CORROSION PRIMING PAINT (AA 56101) WITH TOP COATS OF FINISHING PAINT (AA56126/IS: 2932)

The compatibility of anti- corrosive priming paint conforming to AA 56101 with top coat finishing paint to AA 56126/IS: 2932, shall be checked by Cross-cut tape adhesion method prescribed in ASTM D 3359. The adhesion tape used shall conform to IS: 13262 or any other tape bearing ISI mark having sufficient adhesion strength.

A Steel plate of size 150x100mm is taken for testing compatibility. Thoroughly clean the plate with emery to make it free from rust, oil, dust etc. Apply two coats of homogenized anticorrosive priming paint after allowing coating to dry over night before, application of next coat.

Apply two coats of top coat finishing paint evenly covering plate completely. Allow the coatings, to dry for 48 hours at ambient conditions before performing the cross cut adhesion test.

Test method B shall be followed and the acceptance criteria shall be 4 B, i.e., small flakes of the coating material are detached at intersections and less than 5% of the area is affected

GENERAL TOLERANCES – TOLERANCES FOR LINEAR AND ANGULAR DIMENSIONS WITHOUT INDIVIDUAL TOLERANCE INDICATIONS

0.0 GENERAL:

When selecting the tolerance class, the respective customary workshop accuracy has to be taken into consideration. If smaller tolerances are required or larger tolerances are permissible and more economical for any individual feature, such tolerances should be indicated to the relevant nominal dimension(s).

General tolerances for linear and angular dimensions apply when drawings or associated specifications refer to this standard in accordance with clauses 3 and 4. If there are general tolerances for other processes, as specified in other International standards, reference shall be made to them on the drawings or associated specifications. For a dimension between an unfinished and a finished surface, e.g. of cast or forged parts, for which no individual tolerance is directly indicated, the larger of the two general tolerances in question applies, e.g. for castings, see ISO 8062, Castings - System of Dimensional Tolerances.

1.0 SCOPE:

The standard is intended to simplify drawing indications and it specifies general tolerances for linear and angular dimensions without individual tolerance indications in four tolerance classes.

It applies to the dimensions of parts that are produced by metal removal or parts that are formed from sheet metal.

NOTE: 1. The concepts behind the general tolerancing of linear and angular dimensions are described in Annex - A.

2. These tolerances may be suitable for use with materials other than metals.

This standard only applies for the following dimensions which do not have an individual tolerance indication:

a) Linear dimensions (e.g. external sizes, internal sizes, step sizes, diameters, radii, distances, external radii and chamfer heights for broken edges).

b) Angular dimensions, including angular dimensions usually not indicated, e.g. right angles (90°), unless reference to IS:2102(Pt.2) is made, or angles of uniform polygons.

c) Linear and angular dimensions produced by machining assembled parts.

It does not apply for the following dimensions:

a) Linear and angular dimensions which are covered by reference to other standards on general tolerances.

b) Auxiliary dimensions indicated in brackets.

c) Theoretically exact dimensions indicated in rectangular frames.

2.0 COMPLIANCE WITH STANDARDS:

This standard is based on IS:2102 (Pt.1)-1993 (ISO:2768-1).

3.0 GENERAL TOLERANCES:

3.1 Linear dimensions are given in Table 1 and 2.

3.2 Angular dimensions: General tolerance specified in angular units control only the general orientation of lines or line elements of surfaces, but not their form deviations.

The general orientation of the line derived from the actual surface is the orientation of the contracting line of ideal geometrical form. The maximum distance between the contacting line and the actual line shall be the least possible value (see IS:12160).

The permissible deviations of angular dimensions are given in Table - 3.

CORPORATE STANDARD

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4.0 INDICATIONS ON DRAWINGS:

If general tolerances in accordance with this standard shall apply, the following information shall be indicated.

Example: AA 023 02 08 m

5.0 REJECTION:

Unless otherwise stated, work pieces exceeding the general tolerance shall not lead to automatic rejection provided that the ability of the work piece to function is not impaired (see clause A4).

6.0 NOTE:

6.1 For "Permissible deviations for untoleranced dimensions of castings" refer AA 023 04 02.
6.2 For "Tolerances and machining allowances for flame cutting" refer AA 062 11 01.
6.3 For "General tolerances for welding construction for length and angles" refer AA 062 11 04.
6.4 For "General tolerances for welded structures form and position" refer AA 062 11 05.

Table 1 — Permissible deviations for linear dimensions except for broken edges (external radii and chamfer heights, see table 2)

Values in millimetres

Tolerance class		Permissible deviations for basic size range							
Designation	Description	0.5[1] up to 3	over 3 up to 6	over 6 up to 30	over 30 up to 120	over 120 up to 400	over 400 up to 1 000	over 1 000 up to 2 000	over 2 000 up to 4 000
f	fine	± 0,05	± 0,05	± 0,1	± 0,15	± 0,2	± 0,3	± 0,5	–
m	medium	± 0,1	± 0,1	± 0,2	± 0,3	± 0,5	± 0,8	± 1,2	± 2
c	coarse	± 0,2	± 0,3	± 0,5	± 0,8	± 1,2	± 2	± 3	± 4
v	very coarse	–	± 0,5	± 1	± 1,5	± 2,5	± 4	± 6	± 8

1) For nominal sizes below 0,5 mm, the deviations shall be indicated adjacent to the relevant nominal size(s).

Table 2 — Permissible deviations for broken edges (external radii and chamfer heights)

Values in millimetres

Tolerance class		Permissible deviations for basic size range		
Designation	Description	0,5[1] up to 3	over 3 up to 6	over 6
f	fine	± 0,2	± 0,5	± 1
m	medium			
c	coarse	± 0,4	± 1	± 2
v	very coarse			

1) For nominal sizes below 0,5 mm, the deviations shall be indicated adjacent to the relevant nominal size(s).

Table 3 — Permissible deviations of angular dimensions

Tolerance class		Permissible deviations for ranges of lengths, in millimetres, of the shorter side of the angle concerned				
Designation	Description	up to 10	over 10 up to 50	over 50 up to 120	over 120 up to 400	over 400
f	fine	± 1°	± 0°30'	± 0°20'	± 0°10'	± 0°5'
m	medium					
c	coarse	± 1°30'	± 1°	± 0°30'	± 0°15'	± 0°10'
v	very coarse	± 3°	± 2°	± 1°	± 0°30'	± 0°20'

Annex A
(informative)

Concepts behind general tolerancing of linear and angular dimensions

A.1 General tolerances should be indicated on the drawing by reference to this standard in accordance with clause 4.

The values of general tolerances correspond to tolerance classes of customary workshop accuracy, the appropriate tolerance class being selected and indicated on the drawing according to the requirement of the components.

A.2 Above certain tolerance values, there is usually no gain in manufacturing economy by enlarging the tolerance. For example, a feature having a 35mm diameter could be manufactured to a high level of conformance in a workshop with "customary medium accuracy". Specifying a tolerance of ± 1mm would be of no benefit in this particular workshop, as the general tolerance values of ±0.3mm would be quite adequate.

However, if, for functional reasons, a feature requires a smaller tolerance value than the general tolerance values, these should not be indicated adjacent to the dimension but should be stated on the drawing as described in clause 4. This type of tolerance allows full use of the concept of general tolerancing.

There will be "exceptions to the rule" where the function of the feature allows a larger tolerance than the general tolerances, and the larger tolerance will provide manufacturing economy. In these special cases, the larger tolerance should be indicated individually adjacent to the dimension for the particular feature. e.g. the depth of blind holes drilled at assembly.

A.3 Using general tolerances leads to the following advantages:

a) drawings are easier to read and thus communication is made more effective to the user of the drawing;

b) the design draughtsman saves time by avoiding detailed tolerance calculations as it is sufficient to know that the function allows a tolerance grater than or equal to the general tolerance;

c) the drawing readily indicates which feature can be produced by normal process capitability, which also assists quality engineering by reducing inspection levels;

d) those dimensions remaining, which have individually indicated tolerances, will, for the most part, be those controlling features for which the function requires relatively small tolerances and which therefore may require special effort in the production - this will be helpful for production planning and will assist quality control services in their analysis of inspection requirements;

e) purchase and sub-contract supply engineers can negotiate orders more readily since the "customary workshop accuracy" is known before the contract is placed; this also avoids arguments on delivery between the buyer and supplier, since in this respect the drawing is complete.

These advantages are fully obtained only when there is sufficient reliability that the general tolerances will not be exceeded, i.e. when the customary workshop accuracy of the particular workshop is equal to or finer than the general tolerances indicated in the drawing .

The workshop should therefore

- find out by measurements what is customary workshop accuracy is;

- accept only those drawings having general tolerances equal to or greater than its customary workshop accuracy;

- check by sampling that its customary workshop accuracy does not deteriorate.

Relying on underlined "good workmanship" with all its uncertainties and misunderstandings is no longer necessary with the concept of general geometrical tolerances. The general geometrical tolerances defines the required accuracy of "good workmanship".

A.4 The tolerance the function allows is often greater than the general tolerances. The function of the part is, therefore, not always impaired when the general tolerance is (occasionally) exceeded at any feature of the workpiece. Exceeding the general tolerance should lead to a rejection of the workpiece only if the function is impaired.

ACCEPTANCE STANDARDS FOR LIQUID PENETRANT EXAMINATION OF WELDS

1.0 SCOPE:

1.1 This standard covers the "Acceptance Standards For Liquid Penetrant Eamination Of Wleds' .

1.2 The procedure for liquid penetrant examination shall be as per Corporate Standard AA 085 01 31: Procedure For Liquid Penetrant Examination.

1.3 This standard is based on ASME Section 8, Division 1, Appendix 8.

2. DEFINITION OF IHDICATIONS:

Relevant indications are those which result from mechanical discontinuities. Indications with major dimensions greater than 1.6 mm only shall be considered relevant.

2.1 Linear indications are those indications in which the length is more than three times the width.

2.2 Rounded indications are those indications which are circular or elliptical with the length equal to or less than 3 times the width.

2.3 Any questionable or doubtful indications shall be retested to verify whether or not they are relevant.

2.4 Localised surface imperfections, such as may occur from machining marks, surface conditions or incomplete bond between base metal and cladding may produce similar indications which are not relevent to the detection of unacceptable discontinuities.

3. ACCEPTANCE STANDARDS:

All surfaces to be examined shall be free from:

a) relevent linear indications.

b) relevent rounded indications greater than 4.8 mm.

c) four or more rounded defects in line separated by 1.6 mm or less (edge to edge) except where the specification for the material establishes different requirements for acceptance so far as defects are concerned.

PROCEDURE FOR LIQUID PENETRANT EXAMINATION

1.0 SCOPE:

1.1 This standard details the procedure for liquid penetrant examination of non-porous ferrous and non-ferrous and non-metallic materials such as ceramics, plastics, glass, etc.

1.2 Typical surface discontinuities detectable by this method are cracks, seams, laps, cold shuts, porosity, laminations, etc.

1.3 This standard conforms substantially with ASTM E 165 ~~—1980 (Reapproved 1985)~~ and ASME code section V, Article 6. (01)

2.0 PERSONNEL REQUIREMENT:

Personnel performig non-destructive examination and evaluation shall be qualified to the recommended practice SNT-TC-1A or any other recognised practice.

3.0 DESCRIPTION:

In principle a liquid penetrant is applied to the surface to be examined and allowed to enter discontinuities, excess penetrant removed, the part dried and a developer applied. The developer functions both as a blotter to absorb penetrant that has been trapped in discontinuities and as a contrasting back ground to enhance the visibility of penetrant indications.

4.0 APPROVED METHODS & MATERIALS:

4.1 Either a colour contrast or fluorescent penetrant method may be used. Any one of the following penetrants shall be used:

(a) Solvent Removable
(b) Post Emulsifying
(c) Water Washable

4.2 For nickel base alloys and/or for stainless steel materials used in nuclear components the penetrant materials, cleaner, penetrant developer, etc., used shall not contain sulphur or halogen above 1% by weight.

4.3 Selection of liquid penetrant material shall be from the same family (brand). Inter-mixing of family of liquid penetrant materials is not allowed.

5.0 PROCEDURE:

5.1 Surface Preparation:

5.1.1 Surface preparation by grinding or machining or other method may be employed where surface irregularities may mask indications of unacceptable discontinuities.

5.1.2 The surface to be examined and all adjacent areas within at least 25 mm shall be dry and free from any dirt, lint, scale, rust, welding flux, weld spatter, grease, oil or other extraneous matter that could obscure surface openings or otherwise interfere with examination.

5.1.3 The surface to be examined shall be cleaned with detergents, organic solvents, descaling solutions or paint removers. Degreasing and ultrasonic cleaning may be employed to increase cleaning efficiency. Cleaning method employed is an important part of the examination procedure. Cleaning solvents shall meet the requirements of Cl.4.2

Caution: Blasting with shot or dull sand, rotofinishing, buffing, wire brusing the soft material or machining with dull tools shall not be used as they may peen the discontinuities at the surface.

5.2 **Drying:**

Drying, after cleaning the surface to be examined, shall be accomplished by normal evaporation or with forced hot air, as appropriate. A minimum period of time shall be established to ensure that the cleaning solution has evaporated prior to application of the penetrant.

5.3 **Application Of Penetrants:**

5.3.1 The penetrant shall be applied by dipping, brushing or spraying. If the penetrant is applied by spraying using compressed air type apparatus, filters shall be placed at the air inlet to preclude contamination of penetrant by oil, water or dirt sediment that may have collected in the lines. Spraying should only be performed in a booth equipped with exhaust system.

5.3.2 The length of penetration time is critical and depends upon the material being inspected, the process through which it has passed and the type of discontinuities expected. The recommended penetration time is given in Table 1.

5.3.3 The temperature of the penetrant and the surface of the part to be examined shall not be below 10°C(50°F) nor above 50°C(125°F) throughout the examination period. Local heating or cooling is permitted provided the temperatures remain in the range of 10 to 50°C during the examination. Where it is not practical to comply with these temperature limitations, other temperatures and times shall be used provided the procedures are qualified as described in Annexure-I.

5.4 **Removal Of Excess Penetrant:**

After the penetration time specified in the procedure has elapsed, any penetrant remaining on the surface shall be removed, taking care to minimise removal of penetrant from discontinuities.

5.4.1 **Postemulsifying Penetrants:**

The emulsifier shall be applied by spraying or dipping. The emulsifying time shall not exceed 5 minutes. After emulsification, the mixture shall be removed by water spray.

5.4.2 **Solvent Removable Penetrants:**

Excess penetrant shall be removed by wiping with a cloth or absorbent paper repeating the operation until most tracesof penetrants have been removed. The remaining traces shall be removed by wiping the surface lightly with cloth or absorbent paper moistened with solvent.

Caution: Care shall be taken to avoid excess solvent as this may remove penetrants from discontinuities. Flushing the surface with solvent following the application of the penetrant and prior to developing is prohibited.

5.4.3 **Water Washable Penetrants:**

Excess water washable penetrant shall be removed with a water spray. The water pressure shall not exceed 0.35 N/mm² (50 Psi) and the water temperature shall not exceed 43.3°C (110°F).

5.5 **Drying:**

Surface shall be dried before the application of developer.

5.5.1 a) If postemulsifying or water washable method is used, the surface shall be dried by blotting with clean materials or by using circulating warm air, provided the temperature of the surface is not raised above 50°C (125°F).

b) For solvent removable method, the surface may be dried by normal evaporation, blotting, wiping or forced air.

5.6 **Application Of Developer:**

The developer shall be applied as soon as possible after the removal of the excess penetrant. Two types of developer, dry or wet,shall be used with fluorescent penetrant. With colour contrast penetrants, only wet developer shall be used.

5.6.1 **Application Of Dry Developer:**

Dry developer shall be applied by a soft brush, a hand operated powder bulb or a powder gun or other means provided the powder is dusted evenly over the entire surface being examined.

5.6.2 **Application Of Wet Developer**

Prior to applying suspension type wet developer to the surface, the developer must be thoroughly agitated to ensure adequate dispersion of suspended particles.

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(a) **Aqueous Developer Application:**

Aqueous developer may be applied to either a wet or dry surface. It shall be applied by dipping, spraying or other means provided a thin coating is obtained over the entire surface being examined. Drying time may be decreased by using warm air, provided the surface temperature of the part is not raised above 50°C.

(b) **Non-aqueous Developer Application:**

Non-aqueous developer shall be applied only on a dry surface. It shall be applied by spraying, except where safety or restricted access preclude it. Under such conditions developer may be applied by brushing. Drying shall be by normal evaporation.

6.0 **EXAMINATION:**

Observe the surface during the application of the developer to detect nature of any indications which tend to bleed out profusely. Final examination shall be done between 7 minutes at the earliest and 30 minutes at the latest after application of the developer. The nature of discontinuities corresponding to the indications shall be defined depending upon the method of setting, appearance, direction, shape and dimensions of the same. If the bleed out does not alter the examination results, longer periods are permitted. If the surface to be examined is large enough to preclude complete examination within the prescribed time the surface shall be examined in increments.

6.1 **Colour Contrast Penetrants (Visible Dye Penetrants):**

6.1.1 With colour contrast penetrants the developer forms a reasonably uniform coating. Surface discontinuities are indicated by bleeding out of the penetrant which is normally of a deep red colour. Indication with a light pink colour may indicate excessive cleaning. Inadequate cleaning may leave an excessive background making interpretation difficult.

6.1.2 Adequate illumination is required to ensure no loss of the sensitivity in the examination. Examination shall be done under natural or suitable light (illumination level shall be in the order of 500 LUX).

6.2 **Fluorescent Penetrants:**

Examination of the surface shall be carried out with a high intensity black light in a darkened area or booth. Black light shall have a wave length of 3650 A°. The bulbs shall be allowed to warm up for not less than 5 minutes prior to use in the examination. The black light intensity shall be at least of 800 uW/cm^2 on the surface of the part being examined and the light source being kept at a distance of at least 375 mm from the surface being examined. The operator should allow his eyes to become accustomed to the darkness of the inspection booth for at least 5 minutes before inspecting the parts. He should avoid looking directly into the black light and also avoid going from the darkness to

the light and back again without allowing sufficient time for his eyes to adjust to the darkness. The intensity shall be measured at least once every 8 hours and whenever the work station is changed.

7.0 **EVALUATION OF INDICATIONS & INTERPRETATION:**

7.1 As the developer dries to a smooth, even white coating, indications will appear at the locations of discontinuities. Depth of surface discontinuities may be correlated with the richness of colour and speed of bleeding out. However, localised surface imperfections such as may occur from machining marks or surface conditions may produce similar indications which are non-relevant.

7.2 Usually, a crack or similar opening will show a line and light cracks or partially welded lap will show a broken line. Gross porosity may produce large indications covering an entire area. Very fine porosity is indicated by random dots.

7.3 Any non-relevant indication shall be regarded as a defect until the indication is either eliminated by surface conditioning or it is Proved non-relevant by other NDT methods.

7.4 Linear indications are those indications in which the length is more than three times the width. Rounded indications are indications which are circular or elliptical with the length less than three times the width.

7.5 All indications shall be evaluated in terms of the acceptance standards of the referencing documents.

8.0 **ACCEPTANCE STANDARDS:**

8.1 For castings - Refer Corporate Standard AA 085 01 32.

8.2 For Austenitic Forgings - Refer Corporate Standard AA 085 01 30.

8.3 For Welds - Refer Corporate Standard AA 085 01 29.

9.0 **POST EXAMINATION CLEANING:**

Surfaces examined shall be cleaned after evaluation of the test with dry cotton rag with or without water rinse.

TABLE - 1 (Clause 5.3.2)

Suggested Penetration Time For Post-emulsified And Solvent Removable Penetrants

Material	Form	Type of discontinuity	*Penetration time (min.)
Aluminium	Castings	Porosity	5
		Cold shut	5
	Extrusions & Forgings	Laps	10
		Lack of fusion	5
	Welds	Porosity	5
	All forms	Cracks	10

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TABLE - 1 (Clause 5.3.2) Contd.

Material	Form	Type of discontinuity	*Penetration time (min.)
Magnesium	Castings	Porosity	5
		Cold shut	5
	Extrusions & Forgings	Laps	10
		Lack of fusion	10
	Welds	Porosity	10
	All forms	Cracks	10
Steel	Castings	Porosity	10
		Cold shut	10
	Extrusions & Forgings	Laps	10
		Lack of fusion	20
	Welds	Porosity	20
	All forms	Cracks	20
Brass & Bronze	Castings	Porosity	5
		Cold shut	5
	Extrusions & Forgings	Laps	10
		Lack of fusion	10
	Brazed parts	Porosity	10
	All forms	Cracks	10
Plastics	All forms	Cracks	5
Glass	All forms	Cracks	5
Carbide tipped tools	All forms	Lack of fusion	5
		Porosity	5
		Crack	20
Titanium & high temperature alloys	All forms		20 to 30
Ceramic	All forms	Cracks	5
		Porosity	5

* For lower temperatures, penetration time should be increased.

ANNEXURE - 1 (Clause 5.3.3)

PROCEDURE FOR NON-STANDARD TEMPERATURES

A.1 **General:**

When it is not practical to conduct a liquid penetrant examination within the temperature range of 15.6 to 51.6°C (60 to 125°F), the examination procedure at the proposed lower or higher temperature range requires qualification. This shall require the use of a quench cracked aluminium block, which is designated as 'Liquid Penetrant Comparator Block'.

A.2 **Liquid Penetrant Comparator Block:**

The liquid penetrant comparator block shall be made of aluminum, ASTM B209, Type 2024 or SB-211. Type 2024, 10 mm (3/8 in.) thick, and shall have approximate face dimensions of 50 mm x 75 mm (2 in. x 3 in.). At the centre of each face, an area approximately 25 mm in diameter shall be marked with a 510°C (950°F) temperature indicating crayon or paint. The marked area shall be heated with a blow torch, a Bunsen burner or similar device to a temperature between 510°C (950°F) and 524°C (975°F). The specimen shall then be immediately quenched in cold water which produces a network of the fine cracks on each face. The block shall then be dried by heating to approximately 149°C (300°F). After cooling, the block shall be cut into two halves. One half of the specimen shall be designated block 'A' and the other block 'B' for identification in subsequent processing. Figure 1 illustrates the comparator blocks "A" and "B". As an alternate to cutting the block in half to make blocks "A" and "B", separate blocks 50 mm x 75 mm (2 in. x 3 in.) can be made using the heating and quenching technique as described above. Two comparator blocks with closely matched crack patterns may be used. The blocks shall be marked "A" and "B".

A.3 **Comparator Application:**

(a) If it is desired to qualify a liquid penetrant examination procedure at a temperature of less than 15.6°C (60°F) the proposed procedure shall be applied to block "B" after the block and all materials have been cooled and held at the proposed examination temperature until the comparison is completed. A standard procedure which has previously been demonstrated as suitable for use shall be applied to block "A" in the 15.6 to 51.6°C (60 to 125°F) temperature range. The indications of cracks shall be compared between blocks "A" and "B". If the indications obtained under the proposed condition on block "B" are essentially the same as obtained on block "A" during examination at 15.6 to 51.6°C (60 to 125°F), the proposed procedure shall be considered qualified for use.

(b) If the proposed temperature for the examination is above 51.6°C (125°F), block "B" shall be held at this temperature throughout the examination. The indication of cracks shall be compared as described in T-647.3(a) while block "B" is at the proposed temperature and block "A" is at the 15.6 to 51.6°C (60 to 125°F) temperature range.

(c) A procedure qualified at a temperature lower than 15.6°C (60°F) shall be qualified from that temperature to 15.6°C (60°F).

(d) To qualify a Procedure for temperatures above 51.6°C (125°F), the upper and lower temperature limits shall be established and the procedure qualified at these temperatures.

(e) As an alternate to the requirements of (a) and (b) when using color contrast penetrants, it is permissible to use a single comparator block for the standard and non-standard temperatures and to make the comparison by photography.

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(f) When the single comparator block and photographic technique is used, the processing details (as applicable) described in (a) and (b) above shall apply. The block shall be thoroughly cleaned between the two processing steps. Photographs shall be taken after processing at the nonstandard temperature and then after processing at the standard temperature. The indication of cracks shall be compared between the two photographs. The same criteria for qualification as (a) above shall apply.

(g) Identical photographic techniques shall be used to make the comparison photographs.

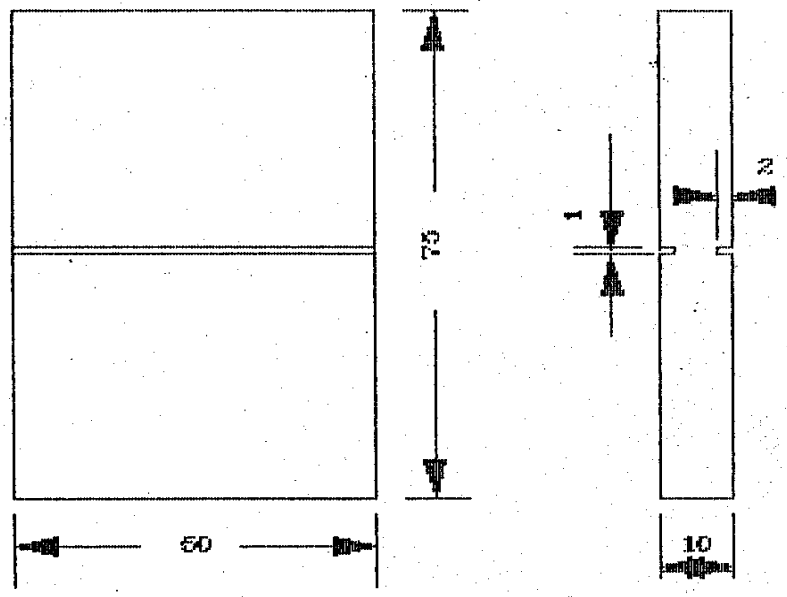

FIGURE: 1-LIQUID PENETRANT COMPARATOR BLOCK

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SCREWS, HEXAGON HEAD, PRODUCT GRADE 'A' COARSE PITCH, STEEL, PROPERTY CLASS 8.8 (M6 - M24)

1.0 DESIGNATION:

A product Gr. A hexagon head, steel screws of thread M8, length 50 mm, coarse pitch and conforming to property class 8.8 shall be designated as:

1.1 On drawings:

i) Material specification column : AA 712 11 23
ii) Description column : SCRU HEX A M8X50 - 8.8

1.2 On indents:

Screws Hex A M8 X 50 - 8.8 ; AA7121123

1.3 For issuing enquiries and on purchase orders:

While issuing enquiries and purchase orders\, delete BHEL standard number from the above description and add the information given under clause 2.0

2.0 COMPLIANCE WITH STANDARDS:

2.1 Dimensions, tolerances & general Requirements:

As per IS: 1364, Part 2 - 2002

2.2 Mechanical Properties:

To conform to property class 8.8 as specified in Table - 3 of IS: 1367, Part 3
Permissible hardness 238 - 350 HB for sizes M6 - M10.

2.3 Threads:

Pitch-coarse to IS: 4218, Part 2
Tolerance quality - Medium
Tolerance class - 6g

2.4 Identification Marking:

As per clause 9 of IS: 1367, Part 3

2.5 Surface Discontinuity: As per IS: 1367, Part 9

2.6 Finish: As specified in BHEL order

4/3/18

CS-837

Revisions :			**APPROVED:** INTERPLANT MATERIAL RATIONALSIZATION COMMITTEE (MRC-F)		
Rev. No. 08	**Amd.No.**		**Prepared**	**Issued**	**Dt. of 1st Issue**
Dt:14-11-15	**Dt :**	**Year :**	**HARDWAR**	**Corp. R&D**	**January, 1977**

CORPORATE STANDARD

3.0 NOTE:

3.1 Length and diameter combination (refer Table 1 on page 3 of 3) between the bold lines should only be used.

3.2 For screw threads, general (Metric) refer to BHEL standard AA 023 18 00.

3.3 For tolerance grade, position and class refer to BHEL standard AA 023 02 01.

3.4 Screws to this standard would be unplated, divisions wishing to have plated bolts would have to get them plated.

3.5 Weights given in this standard are for general reference only and are not for commercial transactions.

3.6 When fasteners are to be tested with in BHEL, the sampling and acceptance plan shall be as per IS:1367, Part 17

4.0 CROSS REFERRED STANDARDS (Latest publications including amendment):

1) IS: 1367, Part3, 9&17
2) IS: 4218, Part 2
3) AA 023 02 01
4) AA 023 18 00
5) AA 023 18 50

EXPLANATORY NOTE:

This standard was issued in Jan.1977 and was based on IS: 1364-1967. Subsequently many changes have been agreed upon at International level and as a result ISO 4014-88 was issued. Accordingly IS: 1364 has also been revised in line with ISO 4014 and issued in 2002 as part 1 2, 3, 4 & 5.

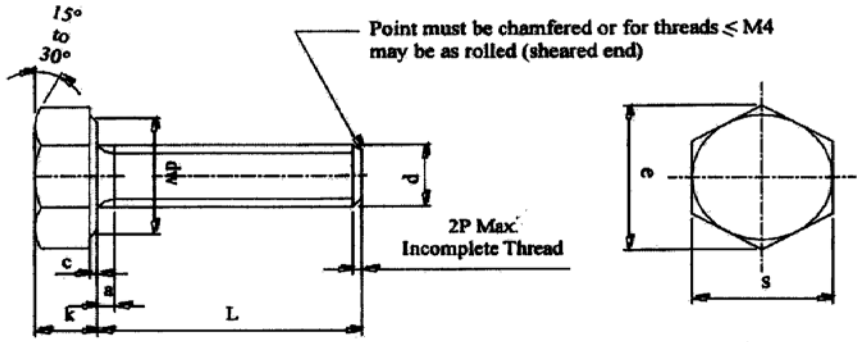
This revision in AA7121123 has been taken up to incorporate the changes in IS: 1364, Part 2- 2002.

The following major changes have been made in the revision:

- Clause 2.2, the year reference of IS: 1367, Part 3 "2002" has been removed.
- The column for Nom. length (L) 14, 75 & 85 has been excluded from the Table-1.
- Page-3, Table-1 and Fig.-1, has been modified and made more visible.

CS- 8555 4/3/11

CS-835 4/3/16



NOTE:

1. Corporate sub-codes are given in the Table-1.
2. For thread run out refer AA0231850.
3. Weights have been shown in kg. per 1000 Nos.
4. Sizes beyond chain dotted lines are for Prod.Gr.B

Table -1 **All dimensions in 'mm.'**

Thread Sizes d	Head					Washer			Un threaded length a Max.		10	12	16	20	25	30	35	40	45	50	55	60	65	70	80	90	100	110	120
	Flats s Max.	Flats s Min.	Crns. e Min.	Thickness k Max.	Thickness k Min.	Dia. d Min.	Thickness c Max.	Thickness c Min.																					
M6	10	9.78	11.05	4.15	3.85	8.9	0.5	0.15	3	Sub-Code	010	029	045	053	061	070	088												
										Weight	4.40	4.75	5.45	6.25	7.36	8.47	9.58									See Note - 4			
M8	13	12.73	14.38	5.45	5.15	11.6	0.6	0.15	4	Sub-Code		096	100	118	126	134	142	150		169		177	185						
										Weight		9.96	11.2	12.5	14.3	16.3	18.2	20.2		24.2		28.1	30.1						
M10	16	15.73	17.77	6.58	6.22	14.6	0.6	0.15	4.5	Sub-Code			207	215	223	231	240	258	266	274	282	290	304	312		320	339		
										Weight			21.4	23.4	25.9	28.9	32.0	35.1	38.2	41.2	44.3	47.4	50.5	53.6		65.9	72.0		
M12	18	17.73	20.03	7.68	7.32	16.6	0.6	0.15	5.30	Sub-Code				347	355	363	371	380	398	401	410	428	436	444	460		479		
										Weight				33.7	37.0	41.0	45.4	49.9	54.3	58.7	63.2	67.6	72.1	76.5	85.4		103.1		
M16	24	23.67	26.75	10.18	9.82	22.5	0.8	0.2	6.0	Sub-Code					487	495	509	517	525	533	541	550	568	576	592	606			
										Weight					71.7	78.4	85.07	92.2	100.1	108	115.8	123.7	131.6	139.5	155.3	171			
M20	30	29.67	33.53	12.72	12.28	28.2	0.8	0.2	7.5	Sub-Code																			
										Weight																			
M24	36	35.38	39.98	15.21	14.78	33.6	0.8	0.2	9	Sub-Code																			
										Weight																			

CORPORATE STANDARD

AA7121123

Rev. No. 08

PAGE No.3 OF 3

<PART NUMBER> <PART REVISION NUMBER>

SCREWS, CAP, HEXAGON SOCKET HEAD, PRODUCT GR. A, COARSE PITCH, STEEL, PROPERTY CLASS 12.9 (M3 - M36)

1.0 DESIGNATION:

A hexagon socket head, cap screw of nominal size M10, length 30mm, coarse pitch, product grade A and of property clause 12.9 shall be designated as :

1.1 On drawings:

i) Material specification column: AA 712 31 23
ii) Description column: SCRU CAP SOCK A M10 X 30 – 12.9

1.2 On indents:

Screw Hex socket head, cap A M10 X 30 – 12.9: AA 712 31 23.

1.3 For issuing enquiries and on purchase orders:

While issuing enquiries and purchase orders, delete BHEL standard number from above description and add the information given under clause 2.0

2.0 COMPLIANCE WITH STANDARDS:

2.1 Dimensions, Tolerances & General Requirements: As per IS: 2269 - 2006.

2.2 Mechanical properties:

To conform to property Cl. 12.9, as specified in table 3 of IS: 1367, Part 3

2.3 Threads:

Pitch-coarse to IS: 4218, Part 2
Tolerance quality: Medium.
Tolerance class: 5g - 6g.

2.4 Identification Marking:

As stated in clause 9 of IS: 1367, Part 3 (except for sizes up to M10)

2.5 Surface Discontinuity: As per IS: 1367, Part 9

2.6 Finish: Plated as specified in BHEL order.

3.0 NOTE:

3.1 Length and diameter combination (refer Table 1 on page 3 of 4) between the bold lines should only be used.
3.2 Sizes to the left side of the dotted lines are threaded to the head within 3P.

Revisions : As per Clause. 29.1.2 of 29th MOM of WG-F			APPROVED: INTERPLANT STANDARDIZATION COMMITTEE (WG-F)		
Rev. No. 07	Amd.No.		Prepared BHOPAL	Issued Corp. R&D	Dt. of 1st Issue January, 1977
Dt:15.04.2011	Dt :	Year :			

CORPORATE STANDARD

3.3 For screw threads, general (Metric) refer to BHEL standard AA 023 18 00

3.4 For tolerance grade, position and class refer to BHEL standard AA 023 02 01

3.5 Screws to this standard would be unplated, divisions wishing to have plated Screws would have to get them plated.

3.6 Weights given in this standard are for general reference only and are not meant for commercial transaction.

3.7 The screws to this standard can also be supplied with diamond / straight knurling on the external side of head.

3.8 When fasteners are to be tested with in BHEL, the sampling and acceptance plan shall be as per IS:1367, Part 17

4.0 REFERRED STANDARDS (Latest publications including amendment):

1) IS: 1367, Pt.3, 9 &17 2) IS: 2269 3) IS: 4218, Pt 2 4) AA 023 02 01

5) AA 023 18 00 6) AA 023 18 50

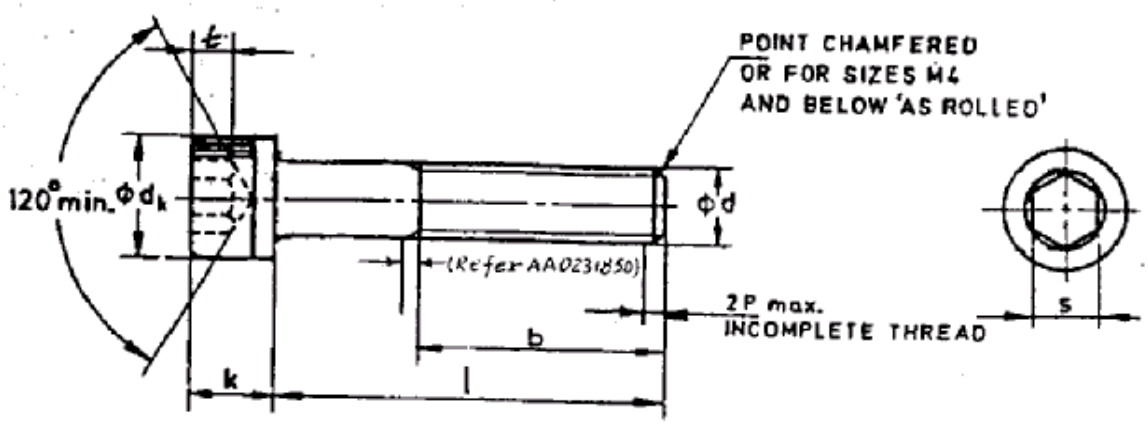


FIG . 1

NOTE

1. Corporate Sub-Code Numbers only are shown in Table 1.
2. Weights have been shown in kg per 1000 no.
3. For threaded runout refer AA 023 18 50.
4. Lengths above the thick dashed line are threaded to the head within 3P.

TABLE 1

All dimensions are in 'mm'

Size Nom ϕ d	Head		Socket		Thread length for ref. b		NOM LENGTH (L)																													
	Thk. Max. / Min K	Dia. Max. / Min ϕd_k	Across Flats Max / Min S	Depth Min. t			5	6	8	10	12	16	20	25	30	35	40	45	50	55	60	65	70	75	80	90	100	110	120	130	140	150	160	180	200
M3	3 / 2.86	5.68 / 5.32	2.56 / 2.52	1.3	18	Sub-Code																													
						Weight																													
M4	4 / 3.86	7.22 / 6.78	3.08 / 3.02	2	20	Sub-Code							387																						
						Weight																													
M5	5 / 4.82	8.72 / 8.28	4.095 / 4.02	2.5	22	Sub-Code				405			417																						
						Weight																													
M6	6 / 5.70	10.22 / 9.78	5.095 / 5.02	3	24	Sub-Code					018	026	034	042	050		063		077																
						Weight					5.03	5.73	8.53	764	8.75		109		122																
M8	8 / 7.64	13.27 / 12.73	6.095 / 6.02	4	28	Sub-Code						395	085	093	373	107	115		123			131													
						Weight							13.1	15.1	17.1	190	21.0		24.9			309													
M10	10 / 9.64	16.27 / 15.73	8.115 / 8.025	5	32	Sub-Code							140	158	166	433	174	441	182	450	190	204		212	468										
						Weight							22.5	25.0	28.0	31.0	34.7	37.3	40.3	43.4	46.5	49.5		55.7	58.9										
M12	12 / 11.57	18.27 / 17.73	10.115 / 10.025	6	36	Sub-Code							476	220	239		247	255	263			271	484			492									
						Weight							32.1	36.0	39.6		48.5	52.9	57.4			70.7	73.7												
M16	16 / 15.57	24.33 / 23.67	14.142 / 14.032	8	44	Sub-Code									280		299		301					310			328								
						Weight									81.1		94.8		107					150			189								
M20	20 / 19.48	30.33 / 29.67	17.23 / 17.05	10	52	Sub-Code											336		344					352											
						Weight											186		188.4					250											
M24	24 / 23.48	36.39 / 35.61	19.275 / 19.065	12	60	Sub-Code													506		514		522			530	549				557				
						Weight															333		363			435	479								
M30	30 / 28.48	45.39 / 44.61	22.275 / 22.065	15.5	72	Sub-Code																			565	573			581					
						Weight																													
M36	36 / 35.30	54.46 / 53.54	27.275 / 27.065	19	84	Sub-Code																													
						Weight																													

CORPORATE STANDARD

EXPLANATORY NOTE :

The following changes have been made in this revision:
Cl 2.1, 2.2, 2.3 & 2.5 - modified.

	CORPORATE STANDARD	AA7126938
		Rev. No. 05
		PAGE 1 of 3

SCREWS, HAMMER DRIVE, STEEL

1 DESIGNATION

A Hammer Drive screw of screw No.4, length 8 mm and made of steel shall be designated as

1.1 On drawings

i) Material specification column : AA7126938

ii) Description column : SCRU HAMMER No.4X8-ST

1.2 On indents

Screw, Hammer Drive, No. 4 × 8-ST: AA7126938

1.3 For issuing enquiries and on purchase orders

While issuing enquiries and purchase orders, delete BHEL standard number from the above description and add the information given under clause 2.

2 COMPLIANCE WITH STANDARDS

2.1 Dimensions, Tolerances & General Requirements

As per IS 7519-1974, Table-1 & 2

2.2 Material

As specified in IS 7519

2.3 Finish

As specified in BHEL order.

9/11/16

ES-0041

DRC-R5050

Revisions: As per clause 34.2.A) of MOM of MRC-F			APPROVED: INTERPLANT MATERIAL RATIONALISATION COMMITTEE – MRC (F)		
Rev. No. 05	Amd. No.	Reaffirmed	Prepared HEP, Bhopal	Issued Corp. R&D	Dt. of 1st Issue 01-01-1977
Dt: 25-10-2016	Dt:	Year:			

CORPORATE STANDARD

BHEL

3 NOTE

3.1 Length & Screw No. Combination (refer Table-1 at page 3 of 3) between the bold lines should only be used.

3.2 Hammer drive screws shall have fully formed threads, extending from the base of the pilot to the head, except that threads at the starting end and under the head may be complete for a length equal to one-half of the maximum screw diameter due to the natural flow of material in the thread forming operation.

3.3 The material shall be thick enough to provide adequate thread engagement and the thickness should not normally be less than the screw diameter.

3.4 Screws to this standard would be un-plated, divisions wishing to have plated screws would have to get them plated.

3.5 Weights given in this standard are for general reference only and are not meant for commercial transactions.

3.6 When fasteners are to be tested with in BHEL, sampling and acceptance plan shall be as per IS 1367, Part 17

4 REFERRED STANDARDS (Latest publications including amendment)

1) IS 1367, Part-17

EXPLANATORY NOTE

The following changes have been made in this revision

- Clause 1.2 modified.
- Clause 2.1, Re-affirmation year of IS: 7519 modified as 2006

14-00-52 9/11/18

CS-0041 9/11/16

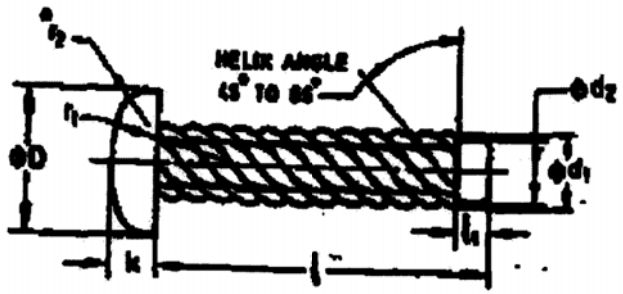


FIG . 1

Note:
1. Corporate Sub-code Numbers only are shown in the Table1.
2. Weights have been shown in kg. per 1000 Nos.

Table-1

All dimensions are in mm

Screw No.	Outside diameter d_1 Max.	HEAD		Pilot diameter d_2 Max.	Number of Thread Starts	Mating hole diameter H11		l_1 Min.	BASIC LENGTH (l)										
		Diameter D Max.	Height k Max.			Thin sheet metal , nonferrous castings, phenol	Cast Iron, thick sheet metal		Tol.	2.4	3.2	4.0	4.8	6.4	8.0	9.5	12.5	16.0	19.0
										± 0.4							± 0.8		
00	1.52	2.51	0.86	1.25	6	1.30	1.40	0.50	Sub- code										
									Weight										
0	1.90	3.23	1.24	1.60	6	1.65	1.75	0.90	Sub-code					012					
									Weight					0.16					
2	2.54	4.12	1.75	2.11	8	2.20	2.30	1.20	Sub-code					055					
									Weight					0.31					
4	2.95	5.36	2.18	2.44	7	2.55	2.70		Sub-code					020	063		101		
									Weight					0.49	0.58				
6	3.56	6.60	2.62	2.95	7	3.10	3.30		Sub-code					039	071	098			
									Weight					0.81					
8	4.24	7.85	3.05	3.45	8	3.70	3.90	1.60	Sub-code							080			
									Weight							1.30			
10	4.62	9.12	3.48	3.84	8	4.10	4.30		Sub-code								047		
									Weight								2.37		
12	5.38	10.36	3.89	4.50	8	4.80	5.00	2.00	Sub-code										
									Weight										
14	6.15	11.62	4.32	5.13	9	5.50	5.80		Sub-code								110		
									Weight										

CORPORATE STANDARD

AA7126938 | Rev. No. 05 | PAGE 3 of 3

WASHERS, MACHINED, STEEL

1.0 DESIGNATION:

A machined washer of size 8.4 mm made of steel shall be designated as:

1.1 On drawings:

i) Material specification column : AA7161001

ii) Description column : WASHER MCD 8.4 -ST

1.2 On indents:

Washer Machined 8.4 – Steel: AA7161001

1.3 For issuing enquiries and on purchase orders:

While issuing enquiries and purchase orders, delete BHEL standard number from the above description and add the information given under clause 2.0

2.0 COMPLIANCE WITH STANDARDS:

2.1 Dimensions, Tolerances and General requirements:

As per IS; 2016-1967, Table-1, Reaffirmed 2006

2.2 Material:

Steel as stated in IS: 2016

2.3 Finish: Plated as specified in BHEL order.

3.0 NOTE:

3.1 For machined washers of brass, refer to BHEL standard AA7161002

3.2 For machined washers of copper, refer to BHEL standard AA7161004

3.3 Washers to this standard would be unplated, divisions wishing to have plated washers would have to get them plated.

3.4 For general requirements of washers, refer BHEL standard AA0230408

3.5 Weights given in this standard are for general reference only and are not meant for commercial transactions.

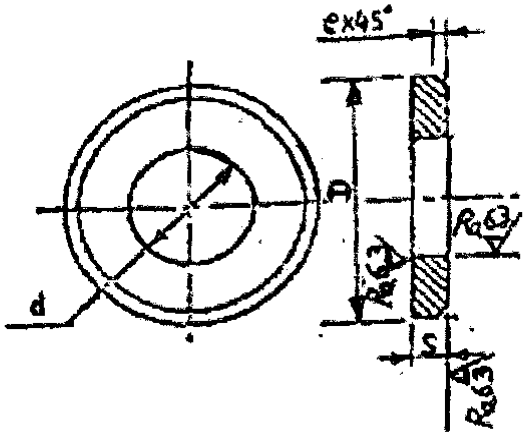
3.6 When fasteners are to be tested with in BHEL, the following sampling and acceptance plan based on IS:6821 (Table-2) shall be followed for physical properties.

LOT SIZE	SAMPLE SIZE	ACCEPTANCE NOS.
Up to 1000	5	0
1001 -3000	8	0
3001 -10000	13	0
10001-35000	20	0
over 35000	32	1

4.0 REFERRED STANDARDS (Latest publications including amendment):

1) IS:2016 2) IS: 6821 3) AA0230408

4) AA7161002 5) AA7161004



Note: 1. Corporate sub codes are shown in the Table.
2. Weights have been shown in kg per 1000 Nos

Table - 1

All dimensions in mm.

SIZE NOM. d H12	OUTSIDE DIAMETER D		THICKNESS S		e NOM.	FOR BOLT OR SCREWS SIZE	SUB-CODE	WEIGHT
	BASIC	TOL.	BASIC	TOL.				
1.7	4	+ 0 - 0.3	0.3	± 0.1	0.1	M 1.6		
2.2	5	+ 0 - 0.3	0.3	± 0.1	0.1	M 2	170	
2.7	6.5	+ 0 - 0.3	0.5	± 0.1	0.2	M 2.5	161	
3.2	7	+ 0 - 0.3	0.5	± 0.1	0.2	M 3	013	0.11
4.3	9	+ 0 - 0.3	0.8	± 0.1	0.3	M 4	021	0.29
5.3	10	+ 0 - 0.3	1.0	± 0.1	0.4	M 5	030	0.42
6.4	12.5	+ 0 - 0.4	1.6	± 0.2	0.6	M 6	048	1.08
8.4	17	+ 0 - 0.4	1.6	± 0.2	0.6	M 8	056	2.07
10.5	21	+ 0 - 0.5	2	± 0.2	0.6	M 10	064	3.98
13	24	+ 0 - 0.5	2.5	± 0.3	0.6	M 12	072	6.16
17	30	+ 0 -0.5	3	± 0.3	0.6	M 16	080	11.17
21	37	+ 0 - 0.8	3	± 0.3	1.0	M 20	099	16.70
25	44	+ 0 - 0.8	4	± 0.3	1.0	M 24	102	31.78
31	56	+ 0 - 1.0	4	± 0.3	1.0	M 30	110	52.95
37	66	+ 0 - 1.0	5	± 0.6	1.6	M 36	129	89.99
43	78	+ 0 - 1.0	7	± 1.0	1.6	M 42	137	180.3
50	92	+ 0 - 1.5	8	± 1.0	1.6	M 48	145	291.26
58	105	+ 0 - 1.5	9	± 1.0	1.6	M 56	188	421.8
66	115	+ 0 - 1.5	9	± 1.0	2.0	M 64	153	486.45

CORPORATE STANDARD

EXPLANATORY NOTE

This standard was first issued in January 1977. The standard was based on IS:2016 – 1967 for dimensions, Tolerances and general requirements. Subsequently many changes have been agreed upon at International & IPSC level and were reflected in IS:2016 – 1967, Reaffirmed 2006.
There is no change in IS:2016 – 1967, Reaffirmed 2006. This standard has been reviewed and brought up to date.
-Clause 3.6 “Sampling plan” for washers has been modified in line with IS:6821
-Clause 4.0 has been modified accordingly.

ANNEXURE-PKG-07/SOURCE **REV-01**

APPROVED VENDORS LIST FOR PROCUREMENT OF MODULAR SPRING ASSLY PART ITEMS.

1. ALLOY STEEL FORGING FOR SPRING PRE-LOAD STUD, LOCKNUT AND KEEPER (SPECN. HY19369 AND HY19370)

i	M/S ALKA FORGINGS	• 09873439011(Dilip)/ 9212552829 (Shakti Singh)
ii	M/S GHAZIABAD FORGINGS PVT. LTD	• 09810224774 (SANAJAY GOEL) 09811000062 (Saurabh)
iii	M/S GOOD LUCK ENGINEERING CO	• arun sharma-9910496376, 9717199007 (Sudhir)
iv	M/S HINDON FORGE PVT. LTD.	• 09811377660 (Ankur Agrawal) 9953998901 (POOJA)
v	M/s KISAAN DIE TECH PVT. LTD.	• 9899757394(NAIM SAIFI)
vi	M/S MACKEIL ISPAT & FORGING LTD	• 09233403401 (MR. SEN GUPTA)
vii	M/S PAHLAD RAI STEEL FORGINGS	• 9792114433(SUBHASH VAID)
viii	M/S PUNJAB HAMMERS PVT.LTD.	• 09914125121(MR.VIKAS GARG)
ix	M/s WESTERN INDIA FORGINGS PRIVATE	• 9075037716 / 9075037701(Mr. SURESH SUBRAMANIAM)

2. SEAMLESS STEEL PIPE OD 438.1X25.4 THK / OD 406 X 25 THK.

i	M/S INTERPIPE, UKRAINE	• +380567366006(MR.OLGA)
ii	M/S KIRTANLAL INTERNATIONAL DMCC	• +971 - 4 - 4329537 (5 lines)
iii	M/s NAVNEET METAL CORPORATION	• 09969064583(MR.S.R.VYAS)
iv	M/S NAVRATNA METAL CORPORATION	• Amrut M. Kanungo (09223366350),9821096139
v	M/S SANGHVI METALS	• 09869466950/9820190466 (GC Sanghvi)
vi	M/S SUMITOMO CORPORATION	• 9820339274 (Marian)
vii	M/S TENARIS GLOBAL SERVICES S.A.	• 0124 435 3612 / 0124 435 3613
viii	M/S TRANSWORLD FZC	• +971-4-4429281
ix	M/S VENUS INTERNATIONAL FZE	• +971-4-3274344/ +863758111899

3. STANDARD FASTENERS (BOLTS, SCREWS, GRUB SCREWS > CLASS 6.6 UPTO CLASS 10.9)

i	M/S ATLAS FASTENERS	• 09885515005 (Deep Chopdar) 9849960354, 09959472436
ii	M/S DEEPAK FASTENERS LIMITED	• 09316169217 (Sanjeev)/09357969330,8591061849
iii	M/S J.J. INDUSTRIES	• 9004764951- jitu bhai 9930739544
iv	M/S KAY PEE INDUSTRIES	• 9815677772 (MANIK AGRAWAL 7508777931
v	M/S LAKSHMI PRECISION SCREWS LTD	• 09254012456 (MITHILESH JAIN), 09254012040 (C.B. Singh),
vi	M/S LLOYDS INFRASYSTEMS	• 9872670644, 9814279229(Mr. SUNIL KUMAR)
vii	M/S NEW STAR INDUSTRIES	• 09872990349(MR. NARINDER BHAMRA)
viii	M/S PIONEER NUTS & BOLTS PVT LTD	• 7888697767-VIKAS 7888697773-daizy, 08146626922,
ix	M/S PRESIDENT ENGG. WORKS	• Prabhat -9558161144, 09870895585(NEHA) 09773476636,
x	M/S SATYA STEEL & METAL PRODUCTS	• 9336810199 (Surendra Kr)
xi	M/S SHRI ADINATH AUTOMOTIVE	• 09896948180, 09812332320(SHRI PRABHASH JAIN)
xii	M/S SREE PAVITHRA INDUSTRIES	• Mr.N.S.MANIAN-9841655196,9841052676(PURUSHOTTAM)

4. SOCKET HEAD CAP SCREWS CLASS 12.9

i	M/S CAPARO ENGINEERING INDIA LTD	• 09582212562(rajeev), 09711028657 (Vikas Dua)
ii	M/S D.K.HARDWARE MART	• 09231857658 (Lallan Bhagat)
iii	M/S DEEPAK FASTENERS LIMITED	• 09316169217 (Sanjeev)/09357969330,8591061849
iv	M/S KAY PEE INDUSTRIES	• 9815677772 (MANIK AGRAWAL 7508777931
v	M/S LAKSHMI PRECISION SCREWS LTD	• 09254012456 (MITHILESH JAIN), 09254012040 (C.B. Singh)
vi	M/S LLOYDS INFRASYSTEMS	• 9872670644, 9814279229(Mr. SUNIL KUMAR)
vii	M/S SATYA STEEL & METAL PRODUCTS	• 9336810199 (Surendra Kr)

22/06/2024

टी० रंजीत ... y Engineer

BHEL ... VARANASI

(DY.MANAGER-E&M)
BHEL HERP VARANASI

RECORD OF REVISIONS

REV. NO	DATE	REVISION DETAILS	REVISED	APPROVED
01	22/06/2020	NEW VENDORS ADDED	T RANJIT KUMAR	AMIT KUMAR

TDC FOR BOWL MILL PRESSURE SPRINGS

1.0 **SCOPE:**

1.1 This specification deals with the Quality requirements and other technical delivery conditions for Hot formed helical compression springs meant for Bowl Mills.

1.2 Any special requirement, not covered under this specification shall be indicated in the Design drawing or contract.

1.3 This specification is generally based on BS 1726. Additional points have been taken from ASTM A 125. DIN 1652 has also been referred for certain clauses.

2.0 **MATERIAL:**

2.1 The bars used for making helical springs shall conform to the specification mentioned in the drawing/ contract. Commonly used specifications for spring round are listed below unless specified in drg.

a. AISI 1095 or equivalent grades EN 44, 44B, 44D- BS 970; IS 3195/ 1965 GR.C 98 and IRS M 24.

2.2 The rounds shall be free from harmful defects like cracks, laps, pittings, piping etc.

2.3 The Bars for pressure springs for Bowl Mills need peeling/ grinding.

2.3.1. The peeling off or grinding shall be done to the extent that all seams or other surface defects are completely removed. The manufacturer should carry out MPI/ LPI on a few ground bars in each size to ensure that bulk being removed in grinding or peeling operation is sufficient to eliminate all surface defects.

2.4 No substitution of material shall be done without written consent of BHEL.

3.0 **MANUFACTURING**:

It is the responsibility of the manufacturer to inspect to ensure that good quality springs conforming to the requirements of this specification are made.

3.1 The ends of the cut of size rounds shall be tapered by forging.

3.5 In case the manufacturer requires a small change in design to suit his manufacturing, practice, especially in the type of and coil closing and total number of coils due to such modification the change may be got approved in advance. However, such variation should not affect the mean coil diameter, free length or load deflection characteristics.

4 **HEAT TREATMENT**:

As per ASTM A 125.

Note: The requirements of 5.1 and 5.2 do not imply that tests must be carried out for all the batches. Whenever required by BHEL Inspector, sample rounds may be heat treated along with springs and furnished to BHEL for their testing.

5 **METALLURGICAL REQUIREMENTS**:

Refer ASTM A 125

6 **TOLERANCES**:

Refer ASTM A-125

7 **END CONSTRUCTION** :

As per ASTM – A125

8. **LOAD- COMPRESSION CHARACTERISTICS :**

As Per ASTM A125

9. **COMPRESSION TEST OR SCRAGGING** :

As per ASTM A 125

10. **LOAD TEST** :

10.1 All the finished springs shall be subjected to load test.

10.2 Load test is made by compressing the springs gradually. The load applied in compressing the spring shall be measured for complete range of compression in atleast five equal stages.

10.3 Unless otherwise specified. Atleast 10% of the lot shall be compressed in stages of 20%, 40%, 60%, 80% and 100% of maximum required compression and corresponding loads should be recorded. For balance 90% of the lot, the compression may be in stages of 60% and 90%. The loads shall not vary from designed values beyond the tolerance.

Specified in Cl. 8.0 in case of 20% compression alone the variation beyond the tolerance limit may be acceptable.

During testing, if fixed loads are applied and corresponding deflections are read the tolerance given in Cl. 8.0 may be read in reverse and applied to such deflections.

11. **SURFACE TREATMENT** :

As per ASTM A 125 CATEGORY- S3

12. **PROTECTIVE COATING** :

As per A 125 CATEGORY - S 5

13 **IDENTIFICATION AND RECORD** :

13.1 Each spring shall be identified by a serial number. Manufacturer code along with year of manufacture (Like 75, 76 etc.) shall be hard punched on each spring.

13.2The manufacturer shall maintain the record of load testing for each spring identified by its serial number.

13.3Test report incorporating the test values for each spring (Identified by its serial number) shall be submitted.

13.4 After protective coating has been applied, all the springs shall be stenciled (in white paint) with serial number and spring designation.

13.5 Any additional identification by way of colour coding etc, if required by contractor, shall be adopted.

14. **PACKING & DESPATCHING** :

The inner and outer coil of the springs shall be matched for length and the inner coil shall be placed inside the outer coil while dispatching. Both the springs shall be tied together with wire string to facilitate using as a matched set. A record showing the serial numbers of the matched set shall accompany the despatch. The spring sets shall be properly packed to avoid transit damage.

PRODUCT STANDARD
PULVERISERS
HYDERABAD

Product STD NO.	BA 75019
Rev No. 01	
Page 5 of 5	

RECORD OF REVISIONS

REV. NO	DATE	REVISION DETAILS	REVISED	APPROVED
01	04.06.2003	TDC review, refer ASTM A-125 added for clauses 4, 5,6,7,8,9,11 and 12. Subclauses : 3.3, 3.4, 4.1, 4.1.1, 4.2, 5.1, 5.2, 6.1, 6.1.1, 6.2, 6.2.1, 6.2.2, 6.2.3 and 7.1 deleted	N.D.Samuel	Satish Ghatge.

TDC FOR BOWL MILL PRESSURE SPRINGS

1.0 **SCOPE:**

1.1 This specification deals with the Quality requirements and other technical delivery conditions for Hot formed helical compression springs meant for Bowl Mills.

1.2 Any special requirement, not covered under this specification shall be indicated in the Design drawing or contract.

1.3 This specification is generally based on BS 1726. Additional points have been taken from ASTM A 125. DIN 1652 has also been referred for certain clauses.

2.0 **MATERIAL:**

2.1 The bars used for making helical springs shall conform to the specification mentioned in the drawing/ contract. Commonly used specifications for spring round are listed below unless specified in drg.

a. AISI 1095 or equivalent grades EN 44, 44B, 44D- BS 970; IS 3195/ 1965 GR.C 98 and IRS M 24.

2.2 The rounds shall be free from harmful defects like cracks, laps, pittings, piping etc.

2.3 The Bars for pressure springs for Bowl Mills need peeling/ grinding.

2.3.1. The peeling off or grinding shall be done to the extent that all seams or other surface defects are completely removed. The manufacturer should carry out MPI/ LPI on a few ground bars in each size to ensure that bulk being removed in grinding or peeling operation is sufficient to eliminate all surface defects.

2.4 No substitution of material shall be done without written consent of BHEL.

3.0 **MANUFACTURING**:

It is the responsibility of the manufacturer to inspect to ensure that good quality springs conforming to the requirements of this specification are made.

3.1 The ends of the cut of size rounds shall be tapered by forging.

3.5 In case the manufacturer requires a small change in design to suit his manufacturing, practice, especially in the type of and coil closing and total number of coils due to such modification the change may be got approved in advance. However, such variation should not affect the mean coil diameter, free length or load deflection characteristics.

4 **HEAT TREATMENT**:

As per ASTM A 125.

Note: The requirements of 5.1 and 5.2 do not imply that tests must be carried out for all the batches. Whenever required by BHEL Inspector, sample rounds may be heat treated along with springs and furnished to BHEL for their testing.

5 **METALLURGICAL REQUIREMENTS**:

Refer ASTM A 125

6 **TOLERANCES**:

Refer ASTM A-125

7 **END CONSTRUCTION** :

As per ASTM – A125

8. **LOAD- COMPRESSION CHARACTERISTICS :**

As Per ASTM A125

9. **COMPRESSION TEST OR SCRAGGING** :

As per ASTM A 125

10. **LOAD TEST** :

10.1 All the finished springs shall be subjected to load test.

10.2 Load test is made by compressing the springs gradually. The load applied in compressing the spring shall be measured for complete range of compression in atleast five equal stages.

10.3 Unless otherwise specified. Atleast 10% of the lot shall be compressed in stages of 20%, 40%, 60%, 80% and 100% of maximum required compression and corresponding loads should be recorded. For balance 90% of the lot, the compression may be in stages of 60% and 90%. The loads shall not vary from designed values beyond the tolerance.

Specified in Cl. 8.0 in case of 20% compression alone the variation beyond the tolerance limit may be acceptable.

During testing, if fixed loads are applied and corresponding deflections are read the tolerance given in Cl. 8.0 may be read in reverse and applied to such deflections.

11. **SURFACE TREATMENT** :

As per ASTM A 125 CATEGORY- S3

12. **PROTECTIVE COATING** :

As per A 125 CATEGORY - S 5

13 **IDENTIFICATION AND RECORD** :

13.1 Each spring shall be identified by a serial number. Manufacturer code along with year of manufacture (Like 75, 76 etc.) shall be hard punched on each spring.

13.2The manufacturer shall maintain the record of load testing for each spring identified by its serial number.

13.3Test report incorporating the test values for each spring (Identified by its serial number) shall be submitted.

13.4 After protective coating has been applied, all the springs shall be stenciled (in white paint) with serial number and spring designation.

13.5 Any additional identification by way of colour coding etc, if required by contractor, shall be adopted.

14. **PACKING & DESPATCHING** :

The inner and outer coil of the springs shall be matched for length and the inner coil shall be placed inside the outer coil while dispatching. Both the springs shall be tied together with wire string to facilitate using as a matched set. A record showing the serial numbers of the matched set shall accompany the despatch. The spring sets shall be properly packed to avoid transit damage.

PRODUCT STANDARD
PULVERISERS
HYDERABAD

Product STD NO.	BA 75019
Rev No. 01	
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RECORD OF REVISIONS

REV. NO	DATE	REVISION DETAILS	REVISED	APPROVED
01	04.06.2003	TDC review, refer ASTM A-125 added for clauses 4, 5,6,7,8,9,11 and 12. Subclauses : 3.3, 3.4, 4.1, 4.1.1, 4.2, 5.1, 5.2, 6.1, 6.1.1, 6.2, 6.2.1, 6.2.2, 6.2.3 and 7.1 deleted	N.D.Samuel	Satish Ghatge.

1% CHROMIUM CASE HARDENING STEEL BARS, ANNEALED

(GR : 16 Mn Cr 5)

1.0 GENERAL:

This specification governs the requirements of 1% chromium case hardening bars.

2.0 APPLICATION :

For the manufacture of case hardened components.

3.0 CONDITION OF DELIVERY :

The bars shall be supplied in the hot / cold rolled/ forged and Annealed condition

4.0 COMPLIANCE WITH NATIONAL STANDARDS:

This specification complies with EN10084-1998 : Case hardening steels.
Gr : 16 Mn Cr5

5.0 DIMENSIONS AND TOLERANCES:

5.1 Dimensions : As specified in the order. Unless otherwise specified, the hot/cold rolled bars shall be supplied in random lengths of 3 to 6 meters. Forged bars shall be supplied in lengths of 1.5 to 3.0 metres.

5.2 Tolerance:

5.2.1 Rolled bars: The bars shall not vary from specified diameter or distance across flats by more than ± 2½ %.

5.2.2 Forged bars: The tolerance on the forged bars shall be as follows.

Diameter, mm	Tolerance, mm
50 mm to 175 mm	+ 8.0 mm
Above 175 mm	+ 12.5 mm

Note: (Hot rolled & forged bars).
Insignificant surface defects in the form of dent and ripple marks are permissible provided their depth does not exceed half the tolerance on each size.

6.0 MANUFACTURE:

The method of steel manufacture is left to the discretion of the manufacturer. However, air or mixed air and oxygen bottom blown converter process is not acceptable. The steel shall be fully killed.

7.0 FREEDOM FROM DEFECTS:

The bars shall be free from surface and internal defects such as piping, segregation etc.

8.0 **HEAT TREATMENT:**

8.1 The bars shall be soft annealed at 650 - 700° C and furnace cooled.

8.2 The recommended heat treatment for sample test pieces shall be as follows:
Blank Carburize at 880 - 980° C, followed by air cooling.
Hardening : At 860 - 900° C followed by quench in oil or water.

The tempering temperature shall be 150 - 200 ° C. The actual heat treatment cycle followed shall be reported in the Test certificate.

9. SELECTION OF TEST SAMPLES:

9.1 Chemical Analysis: Each melt shall be analysed for chemical composition

9.2 Mechanical Properties : One sample per melt per size shall be tested for mechanical properties after heat treatment as per clause 8.2. For the bars beyond 250 mm diameter, the test samples shall be forged to dia 250 mm then tested for mechanical properties after heat treatment as per clause 8.2.

9.3 Metallography tests : One sample per melt per size shall be tested for metallography tests.

10.0 CHEMICAL COMPOSITION:

The melt analysis of the material shall be as follows:

Element		C	Si	Mn	Cr	P	S
Melt analysis	Min .%	0.14	--	1.00	0.80	--	-
	Max. %	0.19	0.40	1.30	1.10	0.035	0.035
Permissible variation in product analysis		± 0.02	+0.03	±0.05	±0.05	+0.005	+0.005

11.0 MECHANICAL PROPERTIES:

11.1 **Tensile**: The mechanical properties of the hardened and tempered test bars of ruling section 30 mm shall be as follows:

Tensile Strength N/mm^2	0.2% Proof Stress min. N/mm^2	% Elongation min. (l = 5 d)
780 - 1080	590	10

11.2 **Hardness**: 5 % of the bars or minimum 2 numbers, in annealed condition shall be tested for Brinell Hardness and the value shall be 207 BHN max.

12.0 METALLOGRAPHY TEST :

12.1 **Grain size** : Grain size shall be 5 or finer when tested in accordance with ASTME 112.

12.2 **Cleanliness Rating** : Inclusion content shall be tested as per ASTME 45 and inclusion rating for all types shall not be more than 2.0 (thin series) and 1.5 (thick series). The inclusion of all types i.e. A, B, C & D may exist simultaneously.

13.0 ULTRASONIC TESTING :

Each bar above 50 mm dia/size shall be tested ultrasonically in accordance with corporate standard AA0850118 to ensure freedom from internal defects. The norms of acceptance shall be as per category 2 of the above standard.

14.0 INSPECTION AT SUPPLIER'S WORKS:

BHEL representative/BHEL appointed Inspection Agency shall have free entry and access to all areas where the manufacture of the bars is carried out. All reasonable facilities shall be extended to him including labour wherever necessary.

BHEL representative/BHEL appointed Inspection Agency shall be given sufficient advance intimation to witness the various processes, tests, etc. punching and identification of test coupons and execution of various tests shall be done in presence of BHEL representative/BHEL appointed Inspection Agency.

15.0 TEST CERTIFICATES:

Three copies of test certificates shall be supplied bearing the following details:

a) BHEL Order No.
b) BHEL Specification No: HY 10565 / Rev. 03
c) Supplier's name:
d) Identification No.
e) Size:
f) Cast No.
g) Details of heat treatment carried out on material and test samples.
h) Results of chemicals analysis and mechanical tests including hardness tests called for in this specification.
i) Results of ultrasonic tests and metallography tests.

16.0 PACKING AND MARKING:

The bars shall be suitably packed in bundles to prevent corrosion and damage during transit.

Bars above 50mm in diameter or of equivalent cross-sectional area shall be stamped HY10565 and Cast No. on the side near the end or on the end face.

A metal lable shall be securely attached to each bundle and shall bear the following information for bars of diameters less than 50 mm.

HY 105 65/Rev. 03
BHEL Order No.
Consignment or Identification No:
Cast No.
Size & Weight.
Supplier’s Name.

17.0 REJECTION AND REPLACEMENT:

In the event of the bar material proving defective in the course of further processing at BHEL, the same shall be rejected notwithstanding any previous acceptance.

The supplier shall replace the material forging at his own cost and the rejected bars shall be returned after all the commercial conditions are satisfied.

1% CHROMIUM CASE HARDENING STEEL BARS, ANNEALED

(GR : 16 Mn Cr 5)

1.0 GENERAL:

This specification governs the requirements of 1% chromium case hardening bars.

2.0 APPLICATION :

For the manufacture of case hardened components.

3.0 CONDITION OF DELIVERY :

The bars shall be supplied in the hot / cold rolled/ forged and Annealed condition

4.0 COMPLIANCE WITH NATIONAL STANDARDS:

This specification complies with EN10084-1998 : Case hardening steels.
Gr : 16 Mn Cr5

5.0 DIMENSIONS AND TOLERANCES:

5.1 Dimensions : As specified in the order. Unless otherwise specified, the hot/cold rolled bars shall be supplied in random lengths of 3 to 6 meters. Forged bars shall be supplied in lengths of 1.5 to 3.0 metres.

5.2 Tolerance:

5.2.1 Rolled bars: The bars shall not vary from specified diameter or distance across flats by more than ± 2½ %.

5.2.2 Forged bars: The tolerance on the forged bars shall be as follows.

Diameter, mm	Tolerance, mm
50 mm to 175 mm	+ 8.0 mm
Above 175 mm	+ 12.5 mm

Note: (Hot rolled & forged bars).
Insignificant surface defects in the form of dent and ripple marks are permissible provided their depth does not exceed half the tolerance on each size.

6.0 MANUFACTURE:

The method of steel manufacture is left to the discretion of the manufacturer. However, air or mixed air and oxygen bottom blown converter process is not acceptable. The steel shall be fully killed.

7.0 FREEDOM FROM DEFECTS:

The bars shall be free from surface and internal defects such as piping, segregation etc.

8.0 **HEAT TREATMENT:**

8.1 The bars shall be soft annealed at 650 - 700° C and furnace cooled.

8.2 The recommended heat treatment for sample test pieces shall be as follows:
Blank Carburize at 880 - 980° C, followed by air cooling.
Hardening : At 860 - 900° C followed by quench in oil or water.

The tempering temperature shall be 150 - 200 ° C. The actual heat treatment cycle followed shall be reported in the Test certificate.

9. SELECTION OF TEST SAMPLES:

9.1 Chemical Analysis: Each melt shall be analysed for chemical composition

9.2 Mechanical Properties : One sample per melt per size shall be tested for mechanical properties after heat treatment as per clause 8.2. For the bars beyond 250 mm diameter, the test samples shall be forged to dia 250 mm then tested for mechanical properties after heat treatment as per clause 8.2.

9.3 Metallography tests : One sample per melt per size shall be tested for metallography tests.

10.0 CHEMICAL COMPOSITION:

The melt analysis of the material shall be as follows:

Element		C	Si	Mn	Cr	P	S
Melt analysis	Min .%	0.14	--	1.00	0.80	--	-
	Max. %	0.19	0.40	1.30	1.10	0.035	0.035
Permissible variation in product analysis		± 0.02	+0.03	±0.05	±0.05	+0.005	+0.005

11.0 MECHANICAL PROPERTIES:

11.1 **Tensile**: The mechanical properties of the hardened and tempered test bars of ruling section 30 mm shall be as follows:

Tensile Strength N/mm^2	0.2% Proof Stress min. N/mm^2	% Elongation min. (l = 5 d)
780 - 1080	590	10

11.2 **Hardness**: 5 % of the bars or minimum 2 numbers, in annealed condition shall be tested for Brinell Hardness and the value shall be 207 BHN max.

12.0 METALLOGRAPHY TEST :

12.1 **Grain size** : Grain size shall be 5 or finer when tested in accordance with ASTME 112.

12.2 **Cleanliness Rating** : Inclusion content shall be tested as per ASTME 45 and inclusion rating for all types shall not be more than 2.0 (thin series) and 1.5 (thick series). The inclusion of all types i.e. A, B, C & D may exist simultaneously.

13.0 ULTRASONIC TESTING :

Each bar above 50 mm dia/size shall be tested ultrasonically in accordance with corporate standard AA0850118 to ensure freedom from internal defects. The norms of acceptance shall be as per category 2 of the above standard.

14.0 INSPECTION AT SUPPLIER'S WORKS:

BHEL representative/BHEL appointed Inspection Agency shall have free entry and access to all areas where the manufacture of the bars is carried out. All reasonable facilities shall be extended to him including labour wherever necessary.

BHEL representative/BHEL appointed Inspection Agency shall be given sufficient advance intimation to witness the various processes, tests, etc. punching and identification of test coupons and execution of various tests shall be done in presence of BHEL representative/BHEL appointed Inspection Agency.

15.0 TEST CERTIFICATES:

Three copies of test certificates shall be supplied bearing the following details:

a) BHEL Order No.
b) BHEL Specification No: HY 10565 / Rev. 03
c) Supplier's name:
d) Identification No.
e) Size:
f) Cast No.
g) Details of heat treatment carried out on material and test samples.
h) Results of chemicals analysis and mechanical tests including hardness tests called for in this specification.
i) Results of ultrasonic tests and metallography tests.

16.0 PACKING AND MARKING:

The bars shall be suitably packed in bundles to prevent corrosion and damage during transit.

Bars above 50mm in diameter or of equivalent cross-sectional area shall be stamped HY10565 and Cast No. on the side near the end or on the end face.

A metal lable shall be securely attached to each bundle and shall bear the following information for bars of diameters less than 50 mm.

HY 105 65/Rev. 03
BHEL Order No.
Consignment or Identification No:
Cast No.
Size & Weight.
Supplier’s Name.

17.0 REJECTION AND REPLACEMENT:

In the event of the bar material proving defective in the course of further processing at BHEL, the same shall be rejected notwithstanding any previous acceptance.

The supplier shall replace the material forging at his own cost and the rejected bars shall be returned after all the commercial conditions are satisfied.

ALLOY STEEL BARS - QUENCHED & TEMPERED

(GR: 42 Cr Mo 4)

1.0 GENERAL:

This specification governs the requirements of alloy steel bars of grade 42 Cr Mo 4 in quenched and tempered condition.

2.0 APPLICATION :

For the manufacture of high tensile and high temperature fasteners and other components requiring high tensile strength coupled with good ductility and resistance to shock and wear.

3.0 CONDITIONS OF DELIVERY :

The bars shall be supplied in hot rolled / forged and quenched and tempered condition.

4.0 COMPLIANCE WITH STANDARDS:

This specification complies in general with DIN EN 10083 / 1996, Grade : 42 Cr Mo4.

5.0 DIMENSIONS AND TOLERANCES:

5.1 Dimensions : The sizes shall be as specified in the order. Unless otherwise specified, the bars shall be supplied in random lengths of 3 to 5 metres.

5.2 Tolerance:

5.2.1 Hot rolled bars: The bars shall not vary from specified diameter or distance across flats by more than ± 2½ %.

5.2.2 Forged bars: The tolerance on the forged bars shall be as follows.

Diameter, mm	Tolerance, mm
50 mm to 175 mm	+ 8.0 mm
Above 175 mm	+ 12.5 mm

Note: (Hot rolled & forged bars).
Insignificant surface defects in the form of dent and ripple marks are permissible provided their depth does not exceed half the tolerance on each size.

6.0 MANUFACTURE:

Method of steel manufacture shall be at the manufacturer's discrection. The steel shall be fully killed..

7.0 HEAT TREATMENT:

7.1 The recommended heat treatment cycle shall be as follows:

Hardening : 820° - 860° C followed by water/ oil quenching.

Tempering at 540° - 680° C followed by Air cooling.

The actual heat treatment cycle followed shall be reported in Test Certificate.

7.2 If the bars need to be straightened after heat treatment, the bars shall be stress relieved, after straightening operation, at 30° C below the actual tempering temperature.

8.0 FREEDOM FROM DEFECTS:

The bars shall be free from Cracks, Scabs, laminations, and other harmful defects.

9.0 FINISH:

9.1 The surface of the bars shall be smooth without any laps, rolled in scales etc., Dents, roll marks and scratches are permitted provided their depth does not exceed half the tolerance limits .

9.2 The edges of bars shall be cut square by sawing or shearing and no crop ends shall be permissible.

10.0 CHEMICAL COMPOSITION:

The melt analysis of the material shall be as follows:

Element		C	Si	Mn	Cr	Mo	P	S
Melt Analysis	Min .	0.38	-	0.60	0.90	0.15	-	-
	Max.	0.45	0.40	0.90	1.20	0.30	0.035	0.035
Permissible variation in product analysis		± 0.02	+ 0.03	± 0.04	± 0.05	± 0.03	+ 0.005	+ 0.005

Note : Ni addition upto 0.50% is permitted for improving impact properties.

11.0 SELECTION OF TEST SAMPLES:

11.1 **Chemical Analysis**: Each melt shall be analysed for chemical composition.

11.2 **Mechanical Tests:**

11.2.1 One sample per lot, comprising of bars of same size, melt and heat treatment batch shall be taken for mechanical testing.

11.3 **Hardness:** Hardness shall be checked for 5% of the bars of same size, melt and heat treatment batch. In any case minimum two bars shall be tested for hardness.

12.0 MECHANICAL PROPERTIES :

The Mechanical properties of the material shall be as follows. For the size ranges upto 160 mm dia the properties given are for longitudinal specimen. For the size range 160 - 250, the properties for both longitudinal and transverse direction are given.

Ruling Section, mm	Tensile Strength N/mm^2	0.2% proof stress, min. N / mm^2	Elon-gation min. L = 5d	Reduction in area % min.	Notched bar impact strength min. (ISO - V notch) J	Hardness, BHN
Upto 16	1100-1300	900	10	40	--	315 - 375
>16 ≤40	1000-1200	750	11	45	25	285 - 335
>40 ≤100	900-1100	650	12	50	25	245 - 315
>100 ≤160	800-950	550	13	50	25	225 - 275
>160 ≤250 (L)	750-900	500	14	55	25	215 - 245
>160 ≤250 (T)	750-900	500	12	--	27 (DVM 3 mm - U notch)	215 - 245

NOTE: 1) The tensile test shall be carried out according to IS:1608 or any reputed national standard.

2) The charpy impact test shall be carried out according to IS:1757 or any reputed National Standard. The test shall be performed on ISO - Specimen of size 10x10x55mm with a 2 mm V-Notch.

3) The minimum impact value specified above is the average of 3 specimens from a single location. Only one value of the three can be below the specified minimum, but in no case below 2/3rd of the same. All the three values shall be reported.

4) The hardness shall be tested in accordance with IS 1500 or any other equivalent international standard.

13.0 RETESTS:

13.1 If any of the test specimen fails to meet the requirements specified in cl.12, the sample bar from which the test specimen was cut shall be rejected and two further sample bars from the same lot shall be taken for retest

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13.2 If the retests also fail, manufacturer is at liberty to reheat treat the bars in question. Not more than two reheat treatments are allowed. However, retempering is not considered as reheat treatment.

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13.3 If after reheat treatment, the mechanical properties are not complied with, the entire lot shall be rejected.

14.0 ULTRASONIC TEST:

All bars above 50 mm dia/side shall be ultrasonically tested according to ASTM:A388 (BHEL Standard AA0850118), to ensure freedom from defects.

The following defects (Category 2 of AA 0850118) shall be unacceptable.

i) Cracks, flacks, seams and laps.

ii) Defects giving indications larger than that from a 4mm diameter equivalent flaw.

iii) Groups of defects with maximum indication less than that from a 4mm diameter equivalent flaw which can not be seperated at testing sensitivity if the back echo is reduced to less than 50%.

iv) Defects giving indications of 2 to 4mm diameter equivalent flaw seperated by a distance less than four times the size of the larger of the adjacent flaws.

15.0 INSPECTION AT SUPPLIER'S WORKS:

The representative of BHEL shall have free access to the supplier's works at all times during the execution of the order, to satisfy himself that the material is produced as per the quality requirements of this specification. All reasonable facilities shall be extended to him, free of charge. He may also witness the sampling, testing and marking called for in this specification.

16.0 TEST CERTIFICATES:

16.1 Five copies of the test certificate shall be furnished giving the following details.

a) Specification No. HY10664 Rev. 06
b) Material Grade : 42 Cr Mo 4
c) BHEL Order No.
d) Size
e) Melt No.
f) Process of manufacture
g) Heat Treatment details and batch No.
h) Results of chemicals analysis and mechanical properties.
i) Results of hardness test.
j) NDT tests (if applicable).

17.0 PACKING AND MARKING:

17.1 Marking: All bars with cross sectional dimension greater than 50 mm shall be stamped with the melt number, specification number and supplier's trade mark on both the end faces of the bars.

Bars of sectional dimension 50 mm and below shall be bundled as per each size and a metal lable bearing the following information shall be securely attached to each bundle.

a) BHEL Specification No. HY10664 Rev .06
b) BHEL Order No.
c) Melt No. & Heat Treatment batch No.
d) Size & Weight
e) Supplier's trade mark.

17.2 Packing: The bars shall be suitably packed to prevent corrosion and damage during transit.

18.0 REJECTION AND REPLACEMENT:

In the event of the bar material proving defective in the course of further processing at BHEL, the same shall be rejected notwithstanding any previous acceptance.

The supplier shall replace the material forging at his own cost and the rejected bars shall be returned after all the commercial conditions are satisfied.

ALLOY STEEL BARS - QUENCHED & TEMPERED

(GR: 42 Cr Mo 4)

1.0 GENERAL:

This specification governs the requirements of alloy steel bars of grade 42 Cr Mo 4 in quenched and tempered condition.

2.0 APPLICATION :

For the manufacture of high tensile and high temperature fasteners and other components requiring high tensile strength coupled with good ductility and resistance to shock and wear.

3.0 CONDITIONS OF DELIVERY :

The bars shall be supplied in hot rolled / forged and quenched and tempered condition.

4.0 COMPLIANCE WITH STANDARDS:

This specification complies in general with DIN EN 10083 / 1996, Grade : 42 Cr Mo4.

5.0 DIMENSIONS AND TOLERANCES:

5.1 Dimensions : The sizes shall be as specified in the order. Unless otherwise specified, the bars shall be supplied in random lengths of 3 to 5 metres.

5.2 Tolerance:

5.2.1 Hot rolled bars: The bars shall not vary from specified diameter or distance across flats by more than ± 2½ %.

5.2.2 Forged bars: The tolerance on the forged bars shall be as follows.

Diameter, mm	Tolerance, mm
50 mm to 175 mm	+ 8.0 mm
Above 175 mm	+ 12.5 mm

Note: (Hot rolled & forged bars).
Insignificant surface defects in the form of dent and ripple marks are permissible provided their depth does not exceed half the tolerance on each size.

6.0 MANUFACTURE:

Method of steel manufacture shall be at the manufacturer's discrection. The steel shall be fully killed..

7.0 HEAT TREATMENT:

7.1 The recommended heat treatment cycle shall be as follows:

Hardening : 820° - 860° C followed by water/ oil quenching.

Tempering at 540° - 680° C followed by Air cooling.

The actual heat treatment cycle followed shall be reported in Test Certificate.

7.2 If the bars need to be straightened after heat treatment, the bars shall be stress relieved, after straightening operation, at 30° C below the actual tempering temperature.

8.0 FREEDOM FROM DEFECTS:

The bars shall be free from Cracks, Scabs, laminations, and other harmful defects.

9.0 FINISH:

9.1 The surface of the bars shall be smooth without any laps, rolled in scales etc., Dents, roll marks and scratches are permitted provided their depth does not exceed half the tolerance limits .

9.2 The edges of bars shall be cut square by sawing or shearing and no crop ends shall be permissible.

10.0 CHEMICAL COMPOSITION:

The melt analysis of the material shall be as follows:

Element		C	Si	Mn	Cr	Mo	P	S
Melt Analysis	Min .	0.38	-	0.60	0.90	0.15	-	-
	Max.	0.45	0.40	0.90	1.20	0.30	0.035	0.035
Permissible variation in product analysis		± 0.02	+ 0.03	± 0.04	± 0.05	± 0.03	+ 0.005	+ 0.005

Note : Ni addition upto 0.50% is permitted for improving impact properties.

11.0 SELECTION OF TEST SAMPLES:

11.1 **Chemical Analysis**: Each melt shall be analysed for chemical composition.

11.2 **Mechanical Tests:**

11.2.1 One sample per lot, comprising of bars of same size, melt and heat treatment batch shall be taken for mechanical testing.

11.3 **Hardness:** Hardness shall be checked for 5% of the bars of same size, melt and heat treatment batch. In any case minimum two bars shall be tested for hardness.

12.0 MECHANICAL PROPERTIES :

The Mechanical properties of the material shall be as follows. For the size ranges upto 160 mm dia the properties given are for longitudinal specimen. For the size range 160 - 250, the properties for both longitudinal and transverse direction are given.

Ruling Section, mm	Tensile Strength N/mm^2	0.2% proof stress, min. N / mm^2	Elon-gation min. L = 5d	Reduction in area % min.	Notched bar impact strength min. (ISO - V notch) J	Hardness, BHN
Upto 16	1100-1300	900	10	40	--	315 - 375
>16 ≤40	1000-1200	750	11	45	25	285 - 335
>40 ≤100	900-1100	650	12	50	25	245 - 315
>100 ≤160	800-950	550	13	50	25	225 - 275
>160 ≤250 (L)	750-900	500	14	55	25	215 - 245
>160 ≤250 (T)	750-900	500	12	--	27 (DVM 3 mm - U notch)	215 - 245

NOTE: 1) The tensile test shall be carried out according to IS:1608 or any reputed national standard.

2) The charpy impact test shall be carried out according to IS:1757 or any reputed National Standard. The test shall be performed on ISO - Specimen of size 10x10x55mm with a 2 mm V-Notch.

3) The minimum impact value specified above is the average of 3 specimens from a single location. Only one value of the three can be below the specified minimum, but in no case below 2/3rd of the same. All the three values shall be reported.

4) The hardness shall be tested in accordance with IS 1500 or any other equivalent international standard.

13.0 RETESTS:

13.1 If any of the test specimen fails to meet the requirements specified in cl.12, the sample bar from which the test specimen was cut shall be rejected and two further sample bars from the same lot shall be taken for retest

.

13.2 If the retests also fail, manufacturer is at liberty to reheat treat the bars in question. Not more than two reheat treatments are allowed. However, retempering is not considered as reheat treatment.

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13.3 If after reheat treatment, the mechanical properties are not complied with, the entire lot shall be rejected.

14.0 ULTRASONIC TEST:

All bars above 50 mm dia/side shall be ultrasonically tested according to ASTM:A388 (BHEL Standard AA0850118), to ensure freedom from defects.

The following defects (Category 2 of AA 0850118) shall be unacceptable.

i) Cracks, flacks, seams and laps.

ii) Defects giving indications larger than that from a 4mm diameter equivalent flaw.

iii) Groups of defects with maximum indication less than that from a 4mm diameter equivalent flaw which can not be seperated at testing sensitivity if the back echo is reduced to less than 50%.

iv) Defects giving indications of 2 to 4mm diameter equivalent flaw seperated by a distance less than four times the size of the larger of the adjacent flaws.

15.0 INSPECTION AT SUPPLIER'S WORKS:

The representative of BHEL shall have free access to the supplier's works at all times during the execution of the order, to satisfy himself that the material is produced as per the quality requirements of this specification. All reasonable facilities shall be extended to him, free of charge. He may also witness the sampling, testing and marking called for in this specification.

16.0 TEST CERTIFICATES:

16.1 Five copies of the test certificate shall be furnished giving the following details.

a) Specification No. HY10664 Rev. 06
b) Material Grade : 42 Cr Mo 4
c) BHEL Order No.
d) Size
e) Melt No.
f) Process of manufacture
g) Heat Treatment details and batch No.
h) Results of chemicals analysis and mechanical properties.
i) Results of hardness test.
j) NDT tests (if applicable).

17.0 PACKING AND MARKING:

17.1 Marking: All bars with cross sectional dimension greater than 50 mm shall be stamped with the melt number, specification number and supplier's trade mark on both the end faces of the bars.

Bars of sectional dimension 50 mm and below shall be bundled as per each size and a metal lable bearing the following information shall be securely attached to each bundle.

a) BHEL Specification No. HY10664 Rev .06
b) BHEL Order No.
c) Melt No. & Heat Treatment batch No.
d) Size & Weight
e) Supplier's trade mark.

17.2 Packing: The bars shall be suitably packed to prevent corrosion and damage during transit.

18.0 REJECTION AND REPLACEMENT:

In the event of the bar material proving defective in the course of further processing at BHEL, the same shall be rejected notwithstanding any previous acceptance.

The supplier shall replace the material forging at his own cost and the rejected bars shall be returned after all the commercial conditions are satisfied.

BOLTING STEEL BARS FOR HIGH TEMPERATURE SERVICE – H & T (Gr.:21CrMoV57)

1.0 GENERAL:

This specification governs the quality requirements of 21CrMoV57 bolting steel bars in hardened and tempered condition upto 600 mm diameter / size.

2.0 APPLICATION:

For the manufacture of steam turbine bolts, nuts, studs, spindles, bushes and other components operating in the temperature range of 300 - 540° C.

3.0 CONDITION OF DELIVERY:

Hot rolled/forged and hardened and tempered.

The bars shall be supplied with ends square and true. The bars shall be supplied in straight lengths without twists and bends.

4.0 COMPLIANCE WITH NATIONAL STANDARDS:

The material shall comply, in general, with the requirements of the following national standard and also meets the requirements of this specification.

DIN EN 10269-1999: Steels and nickel alloys for fasteners with specified elevated and/or Gr. 21 Cr Mo V 57 : low temperature properties.

5.0 DIMENSIONS AND TOLERANCES:

5.1 Sizes:

Bars shall be supplied to the dimensions specified in BHEL order.

5.1.1 Length:

Unless otherwise specified, hot rolled bars shall be supplied in 3 to 6 metres length or in multiples with maximum of 10 per cent, shorts down to 1 metre.

Forged bars shall be supplied in lengths of 1.5 to 3 metres.

5.2 Tolerance:

5.2.1 Hot rolled bars:

The bars shall not vary from specified diameter or distance across flats by more than ± 2½ %.

5.2.2 Forged bars:

The tolerance on the forged bars shall be as follows:

Diameter, mm	Tolerance, mm
50 to 125	+ 6.0
125 to 175	+ 8.0
175 ---	+ 12.5

Note: (FOR HOT ROLLED & FORGED BARS)
Insignificant surface defects in the form of dent and ripple marks are permissible provided their depth does not exceed half the tolerances on each size.

6.0 MANUFACTURE:

Steel shall be made by basic electric process and subsequently vacuum degaussed. If any other process is employed, it shall be to mutual agreement between the supplier and BHEL.

Note: Raw material like Ingots/Blooms/Billets required for forgings should be procured from BHEL approved sources alongwith test certificate.

7.0 HEAT TREATMENT:

7.1 The bars shall be heat treated to get the mechanical properties specified as per clause 12.0.

7.2 Following heat treatment is suggested:

Harden at 900-950°C
Temper at 680 - 720°C, minimum 2 hours.
Hardening above 950°C and tempering below 680°C shall not be done to avoid embrittlement.

7.3 The temperature shall be uniform all over the cross section. Minimum possible residual stresses shall be aimed with slow cooling and longer duration in tempering treatment.

7.4 If the bars need straightening after heat treatment, the straightening operation shall be followed by stress relief annealing at 30°C below the tempering temperature with slow cooling after the total straightening process.

8.0 FREEDOM FROM DEFECTS:

The bars shall be straight, sound and free from internal and surface defects viz., cracks, piping, scabs, laps, hairline cracks, etc. The bars shall be free from twists and bends.

9.0 FINISH:

9.1 The surface of the bars shall be smooth without any laps, rolled in scales, etc. Dents, roll marks and scratches are permitted provided their depth does not exceed half the tolerance limits specified in clause 5.0.

9.2 The edges of bars shall be cut square by sawing or shearing and no crop ends shall be permissible.

10.0 CHEMICAL COMPOSITION:

The analysis of the material and the permissible variation in the composition from the specified limits shall be as follows:

Element	Percent		Permissible variation, %
	min.	max.	
Carbon	0.17	0.25	± 0.02
Silicon	-	0.40	+ 0.05
Manganese	0.40	0.80	± 0.04
Chromium	1.20	1.50	± 0.05
Molybdenum	0.55	0.80	± 0.05
Vanadium	0.20	0.35	± 0.03
Sulphur	-	0.020	+ 0.005
Phosphorus	-	0.020	+ 0.005
Copper	-	0.20	
Tin	-	0.025	
Arsenic	-	0.010	
Antimony	-	0.010	
Aluminium	-	0.02	

Note: Nickel content of about 0.80% max. is permissible.

11.0 TEST SAMPLES:

11.1 Chemical analysis:

Each melt shall be analysed for chemical composition.

11.2 MECHANICAL TESTS:

A hardness test is to be carried out to verify the uniformity of the strength within the delivery lot (per melt and heat treatment batch). The test amount shall be 10% of the bars, but not less than 10 bars. In case of less than 10 bars, all bars shall be hardness tested. Mechanical properties shall be tested on hardest and softest bar.

The taking of specimens has to be carried out according to EN 10083-2 with the following exception:

Up to a diameter (d) or an edge length (a,b) > 100 mm, the transversal specimens can be taken with a distance of d/3 or a/3 and b/3 from outside (instead of longitudinal specimens).

12.0 MECHANICAL PROPERTIES:

12.1 Tensile:

When tested in accordance with IS:1608, the test pieces shall show the following properties (values for transverse specimens in brackets):

Property	Bar < 160mm	Bar 160-600mm
Tensile strength, N/mm²	700-850	700-850
0.2% Proof stress, N/mm²,min	550	550
Elongation (1= 5d), % min.	16	16 (13)
Reduction in area, % min.	60	60 (35)
Impact energy (J) *	63	63 (20)
Hardness (HB 30)	210-250	215-260

- **Charpy Impact (ISO - V) Value :**

When tested in accordance with IS : 1757, the piece shall show a minimum average Charpy impact value over three test values as specified above. Only one test value out of the three can be below the specified value but in no case shall be less than two-thirds the minimum specified value. All the 3 test values shall, however, be reported.

The test is applicable for bars of sizes above 16 mm only.

13.0 NON-DESTRUCTIVE TEST:

13.1 Verification inspection of all bars.

13.2 100% Ultrasonic inspection of all bars above 40mm size according to EN 10228-3 type 1a and 1b table 3). Acceptance criteria shall be quality class 4 according to EN 10228-3 (table 5). In general, the decision limit for loss of back wall echo is 4 dB and for the real reflector length max. 10mm.

14.0 RETESTS:

As per EN10021.

15.0 TEST CERTIFICATE:

Three copies of test certificates shall be supplied unless otherwise stated on the order. In addition the supplier shall ensure to enclose one copy of test certificate alongwith their dispatch documents to facilitate quick clearance of material.

The test certificate shall bear the following information:

BHEL references:
BHEL order No.
HY10665 , Rev.No. 03: Bolting Steel bars for HTS - H & T (Gr.:21CrMoV57)

Supplier Referances:
Supplier's Name
Heat or Cast No.
Process of manufacture
Identification No.
Particulars of heat treatment & Batch No.

Results of Tests:
Chemical analysis
Mechanical properties
Ultrasonic test
Results of dimensional inspection
Mill test certificate
The certificate must be signed by the Chief, Inspection Department / Chief Metallurgist of the supplier's plant.

16.0 PACKING AND MARKING:

Bars shall be suitably packed to prevent corrosion and damage during transportation.

Bars over 63 mm diameter shall be individually stamped / painted on one end face with cast number and HY10665. Bars of 63 mm diameter and less shall be bundled together and identified by means of a metal label stating the cast number and specification No. HY10665 attached to the bundle.

Each package shall, in addition bear the following information:

AA HY10665 : Bolting Steel bars for HTS - H & T (Gr.:21CrMoV57)
BHEL Order No.
Supplier's name and trade mark, if any.
Cast / Batch No.
Identification No.
Size and quantity supplied.

17.0 REFERRED STANDARDS (Latest Publications Including Amendments):

1) DIN 10269 2) IS: 3739 3) IS:1608 4) IS:1757
5) EN 10228-3 6) EN10021

ALLOY STEEL FORGINGS –H &T
GRADE : 40 Ni Cr Mo 65

1.0 GENERAL:

This specification governs the quality requirements of alloy steel forgings of grade 40 Ni Cr Mo 65.

2.0 APPLICATION:

Forgings are suitable for main vertical shaft and general engineering purposes requiring high tensile strength and good ductility.

3.0 CONDITION OF DELIVERY:

The forgings shall be supplied in hardened & tempered condition. Final stress relieving shall be performed if mentioned in the drawing. Forgings shall be rough machined unless otherwise specified.

4.0 COMPLIANCE WITH NATIONAL STANDARDS:

The forgings shall in general comply with the requirements of BS PD – 970: 2001, Gr. 817 M40.

5.0 DIMENSIONS AND TOLERANCES:

The dimensions shall be as per the ordering drawing and tolerances shall be as follows.

a) For finish machined component drawings the extra allowance of 3 mm/ surface shall be provided for finish machining at BHEL.

b) For rough machined forging drawings necessary finish machining allowance is included in the dimensions. Extra allowance is not required.

c) The tolerance on rough machined surface shall be ± 1mm dimension, unless otherwise specified in the drawing.

6.0 MANUFACTURE:

The method of steel manufacture shall be at the discretion of the supplier. However, mixed air open hearth & bessemer processes are not permitted.

The steel shall be fully killed. Sufficient discard shall be made from the ingot, if used as forging stock, to ensure freedom from piping, segregation and other defects.

The amount of hot working shall be sufficient to ensure uniform working throughout the cross-section.

Reduction ratio shall be minimum 4:1 for ingots and 1.5:1 for rolled /forged stock.

7.0 HEAT TREATMENT:

The forgings shall be heat-treated to attain the mechanical properties specified.

The recommended heat-treatment shall be as given below. Hardening in oil at a temperature of 820-850°C. Tempering at the temperature upto 700°C max.

However tempering between 280-500°C shall be avoided as it leads to temper embrittlement.

8.0 FINISH:

Surface finish of the forgings shall be 6.3 microns (r.m.s) to carryout ultrasonic test.

9.0 FREEDOM FROM DEFECTS:

Forgings shall be free-from cracks, flakes, seams segregation and other defects which may affect the utility of the forgings.

10.0 CHEMICAL COMPOSITION:

The melt analysis of the steel shall be as follows:

Element		C	Si	Mn	Ni	Cr	Mo	S	P
Melt Analysis	% Min.	0.36	0.10	0.45	1.30	1.00	0.20	-	-
	% Max.	0.44	0.40	0.70	1.70	1.40	0.35	0.040	0.030
Permissible variation in product Analysis		±0.02	±0.03	±0.03	±0.05	+0.05 -0.04	±0.02	+0.003	+0.003

11.0 TEST SAMPLES:

11.1 Test coupons shall be taken from each melt and each heat treatment batch/size unless integral test coupons are called for in the drawing/purchase order.

The test coupons shall be heat treated along with the forgings. In case of integral test coupons, the test pieces shall be cut from the forgings only after heat treatment. However the remaining integral test coupon after at supplier's end shall be kept integral with the forging and sent to BHEL.

Sufficient test material shall be sent to BHEL for cross-check where necessary.

11.2 Test samples shall be cut at as given unless other wise specified in the ordering drawing.

a) For Solid forgings: Distance of 1/3 radius or 1/6 diagonal from the outer surface.

b) For hollow forgings: Midway between the inner and outer surface of the wall thickness.

12.0 MECHANICAL PROPERTIES:

The test pieces shall have the following mechanical properties.

Ruling section min	Tensile Strength N/mm^2 Min	0.2% proof Strength N/mm^2 Min	% Elongation (L=5d) Min		Charpy Impact Strength (ISO-V) J, min	
			L	T	L	T
150	850-1000	680	13	10	50	37
>150-250	850-1000	650	13	10	35	26
>250-450	775-925	585	11	8	20	15

NOTE: a) Mechanical tests shall be performed preferably on tangential test samples. If the forging configuration does not allow for taking tangential test samples, longitudinal ones shall be used. L&T in the above table indicate values for longitudinal and transverse samples.

b) Tensile test shall be performed as per IS :1608 or any reputed National Standard.

c) The charpy impact test shall be performed on a 2mm ISO V-Notch, as per IS:1757 or any reputed National Standard.

The impact values indicated above are average of 3 values. All the 3 values shall be reported. Only one value can be lower than the minimum specified value but not less than 2/3 of the same.

13.0 NON-DESTRUCTIVE TESTS:

The following test shall be conducted on the forgings.

13.1 Ultrasonic test: Shall be performed as per AA0850118 with both longitudinal and shear waves and following shall be unacceptable defects, unless otherwise specified in the drawing.

i) Cracks, flaks, seams and laps

ii) Defects giving indications larger than that from a 4mm diameter equivalent flaw.

iii) Groups of defects with maximum indication less than that from a 4mm diameter equivalent flaw which cannot be separated at testing sensitivity if the back echo is reduced to less than 50%.

iv) Defects giving indication of 2 to 4mm diameter equivalent flaw separated by a distance less than four times the size of the larger of the adjacent flaws.

13.2 Magnetic particle test: MPI shall be conducted as per ASTM-A275:

Cracks and laps are not acceptable.

14.0 RETESTS:

If any of the selected test specimens fail to meet the specified requirement due to some mechanical reasons, another specimen may be taken for testing.

In the event of failure due to material heat-treatment, two more reheat-treatments shall be permitted. However, retempering is not considered as reheat-treatment.

15.0 INSPECTION AT SUPPLIER'S WORKS:

BHEL representative shall have free entry & access to all the areas of the where the manufacture of the forgings is carried out. All reasonable facilities shall be extended to him including labour wherever necessary.

BHEL representative shall be given sufficient advance intimation shall be given to the representative to witness the various process, tests etc. Punching & Identification of test coupons & forging and execution of various tests shall be done in the presence of BHEL representative.

16.0 TEST CERTIFICATE:

16.1 The supplier shall furnish three copies of the test certificate (English) with containing the following details.

1. HY 19369 Rev.04
2. BHEL Order No.
3. Item Description
4. Drawing No.
5. Supplier's Name.
6. Melt No.
7. Serial No. of the forging.
8. Heat treatment Details
9. Result of all test stipulated in this specification.

16.2 The test certificate shall be attested by the chief of Inspection /Chief Metallurgist of the Supplier and also by BHEL representative.

17.0 MARKING AND PACKING:

17.1 The following details shall be punched clearly on each forging and the same shall be encircled by paint:

1) HY 19369 Rev.04
2) BHEL Order No.
3) Melt No.
4) Serial No. of the forging
5) Drawing No.
6) BHEL Inspector's stamp
7) Supplier's Name.

The forgings shall be suitably packed to prevent damage and corrosion during transit. In the case of overseas supplies, the packing shall be seaworthy.

18.0 REJECTION AND REPLACEMENT:

In the event of the forging proving defective in the course of further processing at BHEL, the same shall be rejected not withstanding any previous acceptance.

The supplier shall replace the rejected forgings at his own cost, and the rejected forgings shall be returned after all the commercial conditions are satisfied.

ALLOY STEEL FORGINGS –H &T
GRADE : 40 Ni Cr Mo 65

1.0 GENERAL:

This specification governs the quality requirements of alloy steel forgings of grade 40 Ni Cr Mo 65.

2.0 APPLICATION:

Forgings are suitable for main vertical shaft and general engineering purposes requiring high tensile strength and good ductility.

3.0 CONDITION OF DELIVERY:

The forgings shall be supplied in hardened & tempered condition. Final stress relieving shall be performed if mentioned in the drawing. Forgings shall be rough machined unless otherwise specified.

4.0 COMPLIANCE WITH NATIONAL STANDARDS:

The forgings shall in general comply with the requirements of BS PD – 970: 2001, Gr. 817 M40.

5.0 DIMENSIONS AND TOLERANCES:

The dimensions shall be as per the ordering drawing and tolerances shall be as follows.

a) For finish machined component drawings the extra allowance of 3 mm/ surface shall be provided for finish machining at BHEL.

b) For rough machined forging drawings necessary finish machining allowance is included in the dimensions. Extra allowance is not required.

c) The tolerance on rough machined surface shall be ± 1mm dimension, unless otherwise specified in the drawing.

6.0 MANUFACTURE:

The method of steel manufacture shall be at the discretion of the supplier. However, mixed air open hearth & bessemer processes are not permitted.

The steel shall be fully killed. Sufficient discard shall be made from the ingot, if used as forging stock, to ensure freedom from piping, segregation and other defects.

The amount of hot working shall be sufficient to ensure uniform working throughout the cross-section.

Reduction ratio shall be minimum 4:1 for ingots and 1.5:1 for rolled /forged stock.

7.0 HEAT TREATMENT:

The forgings shall be heat-treated to attain the mechanical properties specified.

The recommended heat-treatment shall be as given below. Hardening in oil at a temperature of 820-850°C. Tempering at the temperature upto 700°C max.

However tempering between 280-500°C shall be avoided as it leads to temper embrittlement.

8.0 FINISH:

Surface finish of the forgings shall be 6.3 microns (r.m.s) to carryout ultrasonic test.

9.0 FREEDOM FROM DEFECTS:

Forgings shall be free-from cracks, flakes, seams segregation and other defects which may affect the utility of the forgings.

10.0 CHEMICAL COMPOSITION:

The melt analysis of the steel shall be as follows:

Element		C	Si	Mn	Ni	Cr	Mo	S	P
Melt Analysis	% Min.	0.36	0.10	0.45	1.30	1.00	0.20	-	-
	% Max.	0.44	0.40	0.70	1.70	1.40	0.35	0.040	0.030
Permissible variation in product Analysis		±0.02	±0.03	±0.03	±0.05	+0.05 -0.04	±0.02	+0.003	+0.003

11.0 TEST SAMPLES:

11.1 Test coupons shall be taken from each melt and each heat treatment batch/size unless integral test coupons are called for in the drawing/purchase order.

The test coupons shall be heat treated along with the forgings. In case of integral test coupons, the test pieces shall be cut from the forgings only after heat treatment. However the remaining integral test coupon after at supplier's end shall be kept integral with the forging and sent to BHEL.

Sufficient test material shall be sent to BHEL for cross-check where necessary.

11.2 Test samples shall be cut at as given unless other wise specified in the ordering drawing.

a) For Solid forgings: Distance of 1/3 radius or 1/6 diagonal from the outer surface.

b) For hollow forgings: Midway between the inner and outer surface of the wall thickness.

12.0 MECHANICAL PROPERTIES:

The test pieces shall have the following mechanical properties.

Ruling section min	Tensile Strength N/mm^2 Min	0.2% proof Strength N/mm^2 Min	% Elongation (L=5d) Min		Charpy Impact Strength (ISO-V) J, min	
			L	T	L	T
150	850-1000	680	13	10	50	37
>150-250	850-1000	650	13	10	35	26
>250-450	775-925	585	11	8	20	15

NOTE: a) Mechanical tests shall be performed preferably on tangential test samples. If the forging configuration does not allow for taking tangential test samples, longitudinal ones shall be used. L&T in the above table indicate values for longitudinal and transverse samples.

b) Tensile test shall be performed as per IS :1608 or any reputed National Standard.

c) The charpy impact test shall be performed on a 2mm ISO V-Notch, as per IS:1757 or any reputed National Standard.

The impact values indicated above are average of 3 values. All the 3 values shall be reported. Only one value can be lower than the minimum specified value but not less than 2/3 of the same.

13.0 NON-DESTRUCTIVE TESTS:

The following test shall be conducted on the forgings.

13.1 Ultrasonic test: Shall be performed as per AA0850118 with both longitudinal and shear waves and following shall be unacceptable defects, unless otherwise specified in the drawing.

i) Cracks, flaks, seams and laps

ii) Defects giving indications larger than that from a 4mm diameter equivalent flaw.

iii) Groups of defects with maximum indication less than that from a 4mm diameter equivalent flaw which cannot be separated at testing sensitivity if the back echo is reduced to less than 50%.

iv) Defects giving indication of 2 to 4mm diameter equivalent flaw separated by a distance less than four times the size of the larger of the adjacent flaws.

13.2 Magnetic particle test: MPI shall be conducted as per ASTM-A275:

Cracks and laps are not acceptable.

14.0 RETESTS:

If any of the selected test specimens fail to meet the specified requirement due to some mechanical reasons, another specimen may be taken for testing.

In the event of failure due to material heat-treatment, two more reheat-treatments shall be permitted. However, retempering is not considered as reheat-treatment.

15.0 INSPECTION AT SUPPLIER'S WORKS:

BHEL representative shall have free entry & access to all the areas of the where the manufacture of the forgings is carried out. All reasonable facilities shall be extended to him including labour wherever necessary.

BHEL representative shall be given sufficient advance intimation shall be given to the representative to witness the various process, tests etc. Punching & Identification of test coupons & forging and execution of various tests shall be done in the presence of BHEL representative.

16.0 TEST CERTIFICATE:

16.1 The supplier shall furnish three copies of the test certificate (English) with containing the following details.

1. HY 19369 Rev.04
2. BHEL Order No.
3. Item Description
4. Drawing No.
5. Supplier's Name.
6. Melt No.
7. Serial No. of the forging.
8. Heat treatment Details
9. Result of all test stipulated in this specification.

16.2 The test certificate shall be attested by the chief of Inspection /Chief Metallurgist of the Supplier and also by BHEL representative.

17.0 MARKING AND PACKING:

17.1 The following details shall be punched clearly on each forging and the same shall be encircled by paint:

1) HY 19369 Rev.04
2) BHEL Order No.
3) Melt No.
4) Serial No. of the forging
5) Drawing No.
6) BHEL Inspector's stamp
7) Supplier's Name.

The forgings shall be suitably packed to prevent damage and corrosion during transit. In the case of overseas supplies, the packing shall be seaworthy.

18.0 REJECTION AND REPLACEMENT:

In the event of the forging proving defective in the course of further processing at BHEL, the same shall be rejected not withstanding any previous acceptance.

The supplier shall replace the rejected forgings at his own cost, and the rejected forgings shall be returned after all the commercial conditions are satisfied.

ALLOY STEEL FORGINGS-H & T

GRADE: 40 Ni Cr Mo 65

1. GENERAL :

This specification governs the quality requirements of alloy steel forgings of grade 40 Ni Cr Mo 65.

2. APPLICATION :

Forgings are suitable for general engineering purposes.

3. CONDITION OF DELIVERY :

The forgings shall be supplied in hardened, tempered condition. Forgings shall be rough machined unless otherwise specified.

4. COMPLIANCE WITH NATIONAL STANDARD :

The forgings shall in general comply with the requirements of BS: 970 : Part 1 : 1983; Gr: 817 M40.

5. DIMENSIONS AND TOLERANCES :

The dimensions and tolerances shall be as follows.

a) For finish machined component drawings the extra allowance of 3 mm/surface shall be provided for finish machining at BHEL.

b) For rough machined Forging drawings necessary finish machining allowance is included in the dimensions. Extra allowance is not required.

c) The tolerance on rough machined surface shall be ± 1 mm dimension, unless otherwise specified in the drawing.

.

6. MANUFACTURE :.

The method of steel manufacture shall be at the discretion of the supplier. However, air or mixed air & oxygen bottom blown converter process is not permitted.

The Steel shall be fully killed, sufficient discard shall be made from the ingot, if used as forging stock, to ensure freedom form piping, segregation and other defects.

The amount of hot working shall be sufficient to ensure uniform working throughout the cross-section.

Reduction ratio shall be minimum 4:1 for ingots and 1.5:1 for rolled/forged stock.

7. HEAT TREATMENT :

The forgings shall be heat-treated to attain the mechanical properties specified.

The recommended heat-treatment shall be as given below. Hardening in Oil from a temperature of 820-850^0 C.

Tempering at the temperature between 660^0 C max, However, tempering between 280 and 500^0 C shall be avoided, as it leads to temper embrittlement.

8. FINISH :

Surface finish of the forgings shall be 6.3 microns (r.m.s) to carry out ultrasonic test.

9. FREEDOM FROM DEFECTS :

Forgings shall be free-from cracks flakes, seams, segregation and other defects which may affect the utility of the forgings.

10. CHEMICAL COMPOSITION :

The melt analysis of the steel shall be as follows :

Element		C	Si	Mn	Ni	Cr	Mo	S	P
Melt Analysis	% Min	0.36	0.10	0.45	1.30	1.00	0.20	-	-
	% Max	0.44	0.35	0.70	1.70	1.40	0.35	0.025	0.025
Permissible Variation In product analysis		±0.02	±0.03	±0.03	±0.05	-0.04 +0.05	±0.02	+0.003	+0.003

11. TEST SAMPLES :

11.1 Test coupons shall be taken from each melt and each heat-treatment batch/size unless integral test coupons are called for in the drawing/purchase order

The test coupons shall be heat treated along with the forgings. In case of integral test coupons, the test pieces shall be cut from the forgings only after heat treatment. However the remaining integral test coupon after testing at supplier's end shall be kept integral with the forging and sent to BHEL.

Sufficient test material shall be sent to BHEL for cross-check where necessary.

11.2 Test samples shall be cut at

a) For Solid forgings: Distance of 1/3 radius or 1/6 diagonal from the outer surface.

b) For hollow forgings: Midway between the inner and outer surface of the wall thickness.

Separately forged test pieces shall be forged to the ruling section of the actual forgings they represent.

12. MECHANICAL PROPERTIES :

Mechanical properties for the ruling section of 100mm shall be as given below.

Tensile Strength N/mm^2	o.2% Proof Stress N/mm^2 Min	% Elongation (L=5d) min		Charpy Impact Strength (ISO-v) J, Min	
		L	T	L	T
925-1075	755	12	10	42	30

NOTE:

a) Mechanical tests shall be performed preferably on tangential test samples. If the forging configuration does not allow for taking tangential test samples, longitudinal ones shall be used. L&T in the above table indicate values for longitudinal and transverse samples.

b) Tensile test shall be performed as per IS : 1608 or any reputed National Standard.

c) The charpy inpact test shall be performed on 2 mm ISO V-Notch, as per IS: 1757 or any reputed National Standard.

The impact values indicated above are average of 3 values. All the 3 values shall be reported. Only one value can be lower than the minimum specified value but not less than 2/3 of the same.

13. NON-DESTRUCTIVE TESTS :

The following tests shall be conducted on the forgings.

13.1 Ultrasonic test: Ultrasonic test shall be carried out performed as per ASTM :A388 (BHEL Standard AA 0850118) and following shall be unacceptable defects. (Category 2, AA 0850118).

i) Cracks, flakes, seams and laps.
ii) Defects giving indications larger than that from a 4mm diameter equivalent flaw.
iii) Groups of defects with maximum indication less than that from a 4mm diameter equivalent flaw which cannot be separated at testing sensitivity if the back echo is reduced to less than 50%.
iv) Defects giving indication of 2 to 4 mm diameter equivalent flaw separated by a distance less than four times the size of the larger of the adjacent flaws.

13.2 **Magnetic particle test:** MPI shall conducted as per ASTM-A275.

Cracks and laps are not acceptable.

14. **RETESTS :**

If any of the selected test specimens fail to meet the specified requirement due to some mechanical reasons, another specimen may be taken for testing.

In the event of failure due to material heat-treatment only two more reheat-treatments shall be permitted. However retempering is not considered as reheat-treatment.

15. **INSPECTION AT SUPPLIER'S WORKS :**

BHEL representative shall have free entry and access to all areas where the manufacture of the forging is carried out. All reasonable facilities shall be extended to him including labour where necessary.

BHEL representative shall be given sufficient advance intimation to witness the various processes, tests etc. Punching and identification of test coupons & forgings and execution of various tests shall be done in his presence of BHEL representative.

16.0 **TEST CERTIFICATE :**

16.1 The suppliers shall furnish five copies of the test certificate (English) with one transparent copy containing the following details.

1) HY 19370. Rev.01
2) BHEL Order No:
3) Item Description.
4) Drawing No:
5) Supplier"s NameMolt No:
6) Melt No.
7) Serial No. of forging
8) Heat Treatment details.
9) Results of all tests stipulated in this Specification.

16.2 The test certificate shall be attested by the Chief of Inspection/Chief Metallurgist of the supplier and also by BHEL representative.

17. MARKING AND PACKING :

17.1 The following details shall be punched clearly on each forging and the same shall be encircled by paint:

1) HY19370/ Rev No. 01
2) BHEL Order No.
3) Melt No.
4) Serial No. of the forging
5) Drawing No.
6) BHEL Inspectors Stamp.
7) Supplier's Name.

The forgings shall be suitably packed & prevented from damage and corrosion during transit. In the case of imported forgings, the packing shall be seaworthy.

18. REJECTION AND REPLACEMENT :

In the event of the forging proving defective in the course of further processing at BHEL, the same shall be rejected notwithstanding any previous acceptance.

The supplier shall replace the rejected forging at his own cost and the rejected forging shall be returned after all the commercial conditions are satisfied.

ALLOY STEEL FORGINGS – H & T

GR: 40 Ni Cr Mo 65

1. Clause 4.0: Compliance with National Standards
The existing clause should be replaced with the following:
"The forgings shall be in general comply with the requirement of BS970 – Part 3 – 1991, Gr.817 M40".

2. Clause 10.0: Chemical Composition
Si – content shall be read as 0.10 to 0.40%

S – content shall be read as 0.040% max.

P - content shall be read as 0.035% max.

REF:	Amd.No.	APPROVED	ISSUED	DATE	CUM.Sr.No
	01	AGM(E&CC)	MANAGER, (STDS.ENGG	FEB.93	0029

STUD WITH TWO NUTS (M12 – M27) STEEL

1.0 DESIGNATION:

A stud with two nuts of threaded size 20 mm, pitch 2.5 mm, length 100 mm and made of steel shall be designated as

i) Material Specification Column : HY7142198

ii) Description Column : STUD WITH TWO NUTS M20X2.5X100-ST

2.0 MATERIAL:

STUD : Low alloy steel (ASTM A193 M B7)

NUTS : Low carbon steel (ASTM A194 M 2H)

3.0 COMPLIANCE WITH NATIONAL STANDARDS:

3.1 Dimensions and tolerances as per IS 14962 Part 1-2001 (ISO 965-1-1998) (Studs & Nuts). and IS 1364, Part 3-2002 (For Nuts)

3.2 Threads:

Tolerance grade for stud – 6g
Tolerance grade for nuts – 6H

3.3 Heat treatment:

Hardened and Tempered.

3.4 Protective Coating:

Black oxidised.

4.0 INSPECTION:

The stud with two nuts shall be inspected at supplier's works by BHEL Inspector or Lloyds inspector.

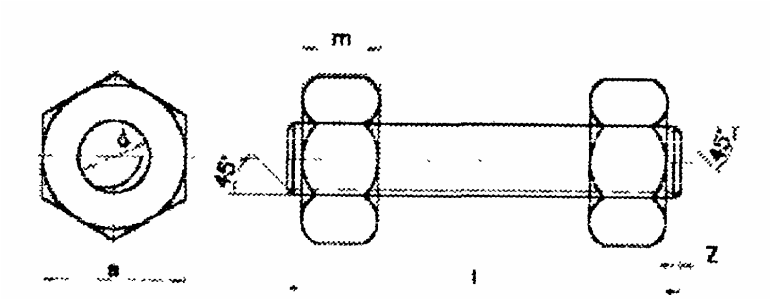
5.0 TEST CERTIFICATES:

Three copies of test certificates of (i) chemical composition, (ii) mechanical test shall be furnished. The test certificates shall be signed by M/s Lloyds Inspectors.

6.0 NOTE:

6.1 Studs to this standard would be unplated. User departments wishing to have them plated, would mention the same in the indents.

6.2 For stud with two nuts (M30-M70) refer to standard HY7142299 latest revision.



All dimensions are in mm

Nominal size d	Pitch	Stud		Nut		Component code
		l	z	s	m	
M12	1.75	60	1.75	18	11	HY7142198010
		80				HY7142198028
		90				HY7142198036
		100				HY7142198044
		130				HY7142198923
M16	2.0	40	2.0	24	15	HY7142198834
		90				HY7142198052
		100				HY7142198060
		110				HY7142198079
		120				HY7142198087
		130				HY7142198095
		150				HY7142198117
		170				HY7142198869
		180				HY7142198877
		190				HY7142198885
		225				HY7142198893
		250				HY7142198850
M20	2.5	60	2.5	30	18	HY7142198125
		70				HY7142198133
		80				HY7142198141
		90				HY7142198150
		100				HY7142198168
		110				HY7142198176
		120				HY7142198184
		130				HY7142198192
		140				HY7142198206
		150				HY7142198214
		160				HY7142198222
		170				HY7142198230
		180				HY7142198249
		190				HY7142198257
		200				HY7142198265

All dimensions are in mm

Nominal size d	Pitch	Stud		Nut		Component code
		l	z	s	m	
M20	2.5	225	2.5	30	18	HY7142198273
		250				HY7142198281
		275				HY7142198290
		300				HY7142198303
		350				HY7142198311
M22	2.5	100	2.5	34	19	HY7142198320
		120				HY7142198338
		130				HY7142198346
		140				HY7142198354
		150				HY7142198362
		160				HY7142198370
		170				HY7142198389
		190				HY7142198400
		200				HY7142198419
		225				HY7142198435
M24	3.0	100	3.0	36	21	HY7142198443
		110				HY7142198451
		120				HY7142198460
		130				HY7142198478
		140				HY7142198486
		150				HY7142198494
		160				HY7142198508
		170				HY7142198516
		180				HY7142198524
		190				HY7142198532
		200				HY7142198540
		225				HY7142198559
		250				HY7142198567
		275				HY7142198575
		300				HY7142198583
		325				HY7142198591
M27	3.0	100	3.0	41	24	HY7142198613
		120				HY7142198621
		130				HY7142198630
		140				HY7142198648
		150				HY7142198656
		160				HY7142198664
		170				HY7142198672
		180				HY7142198680
		190				HY7142198699
		200				HY7142198702

All dimensions are in mm

Nominal size d	Pitch	Stud		Nut		Component code
		l	z	s	m	
M27	3.0	225	3.0	41	24	HY7142198710
		240				HY7142198737
		250				HY7142198745
		275				HY7142198753
		300				HY7142198761
		325				HY7142198770
		375				HY7142198796
		400				HY7142198800
		450				HY7142198818
		500				HY7142198826

PLUG, SQUARE HEAD, NPT

1.0 GENERAL:

This standard covers ratings, dimensions, tolerances and other requirements for plug, square head, NPT as per ASME B16.11.

2.0 APPLICATION:

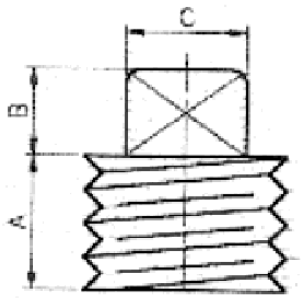
General engineering and for closing of pipe ends.

3.0 DESIGNATION:

A square head plug nominal pipe size 1" made of carbon steel, with NPT threads shall be designated as:

SQ HEAD PLUG 1" CS NPT

4.0 DIMENSIONS AND TOLERANCES:



SKETCH - 1

4.1 **STAINLESS STEEL (SA 182 F321)**

(All dimensions are in mm)

NOMINAL PIPE SIZE IN INCHES	LENGTH (Min) A	PLUGS SQUARE HEAD		WEIGHT / PIECE KG	COMPONENT CODE
		HEIGHT OF SQUARE (Min) B	WIDTH FLATS (Min) C		
1/8	10	6	7	0.007	
¼	11	6	10	0.014	HY7242574420
3/8	13	8	11	0.029	HY7242574439
½	14	10	14	0.057	HY7242574447
¾	16	11	16	0.085	HY7242574455
1	19	13	21	0.142	HY7242574463
1 1/4	21	14	24	0.255	
1 1/2	21	16	28	0.397	HY7242574471
2	22	18	32	0.735	
2 1/2	27	19	36	1.075	
3	28	21	41	1.588	
4	32	25	65	2.02	

4.2 **CARBON STEEL (SA 105)**

(All dimensions are in mm)

NOMINAL PIPE SIZE IN INCHES	LENGTH (Min) A	PLUGS SQUARE HEAD		WEIGHT / PIECE KG	COMPONENT CODE
		HEIGHT OF SQUARE (Min) B	WIDTH FLATS (Min) C		
1/8	10	6	7	0.0 07	HY7242574013
¼	11	6	10	0.014	HY7242574021
3/8	13	8	11	0.029	HY7242574030
½	14	10	14	0.057	HY7242574048
¾	16	11	16	0.085	HY7242574056
1	19	13	21	0.142	HY7242574064
1 1/4	21	14	24	0.255	HY7242574072
1 1/2	21	16	28	0.397	HY7242574080
2	22	18	32	0.735	HY7242574099
2 1/2	27	19	36	1.0 75	HY7242574102
3	28	21	41	1.588	HY7242574110
4	32	25	65	2.02	HY7242574129

4.3 **ALLOY STEEL (SA 182 F11)**

NOMINAL PIPE SIZE IN INCHES	LENGTH (Min) A	PLUGS SQUARE HEAD		WEIGHT / PIECE KG	COMPONENT CODE
		HEIGHT OF SQUARE (Min) B	WIDTH FLATS (Min) C		
1/8	10	6	7	0.007	
¼	11	6	10	0.014	HY7242574226
3/8	13	8	11	0.029	
½	14	10	14	0.057	
¾	16	11	16	0.085	
1	19	13	21	0.142	
1 1/4	21	14	24	0.255	
1 1/2	21	16	28	0.397	
2	22	18	32	0.735	
2 1/2	27	19	36	1.075	
3	28	21	41	1.588	
4	32	25	65	2.02	

5.0 Inspection will be carried out at supplier's works by BHEL representative.

6.0 Technical delivery conditions shall be as per plant standard no. HY0851497.

BHEL HERP VARANASI
QUALITY PLAN

MODULAR SPRING ASSEMBLY FOR XRP-1043/1003/883 MILLS

DRG. NO. 26130403010, 26130002919

SL.NO.	COMPONENT	CHARACTERISTIC CHECKED	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENTS & ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
							P	W	V	
1.0	Raw Material analysis									
	i. Casting for Spring guide, Spring housing cover, Spring stud adapter,	Chemical & Mechanical properties, Heat treatment,soundness	Review of Chemical, Mechanical T.C., H.T.chart,	1 sample per heat batch	AA10119	TC	3	-	2	
	ii. Forging of /journal Spring Pre-Load stud, Spring stud locknut keeper, Spring stud locknut	Chemical and Mechanical properties. Heat treatment, soundness	Review of Chemical & mecanical TC., H.T. Chart, UST report, M.P.I. Report	1 sample per heat batch	HY19369, HY19370	TC	3	-	2	Raw matl. To be procured from BHEL Approved sources only (Aproved sources shall be as per Annexure PKG-07/SOURCE)
	iii. Raw matl. of High tensile stud, Spring Stud Insert	Chemical and Mechanical properties. Heat treatment (as applicable in relevant standards)	Review of Chemical & mecanical TC., H.T. Chart	1 sample per heat batch	HY10664, HY10665	TC	3	-	2	
	iv. Raw matl. for Journal Spring Hsg., retainer plate, Orifice plate, stud extension cap, Air seal cap	Chemical & Mechanical properties, Soundness of plates > 25 thk.	Review of material TC.	1 sample per heat batch	AA10119, AA10455	TC	3	-	2	Plates> 25 mm thick should be of UST quality only.
	v. Spring Stud Bearing, Hsg. Cover Wear Sleeve	Chemical & Mechanical properties,	Review of material TC.	1 sample per batch	ASTM B271 ALLOY 86300	TC	3	-	2	
2.0	Fabrication of Spring Hsg.	i. Review of WPS, PQR and WQR	Review of Documents	100%	-	Insp.Report	3	-	2	WPS, PQR and WQR to be submitted by the party for approval prior to manufacturing
		ii. Fit up exam	Measurement	100%	Drawing	Dim.report	3	-	2	
		iii.Heat Treatment	Review of HT Chart	100%	Refer remarks column for H.T.cycle		3	-	2	Following SR Cycle to be followed. Heat raise free below 425° C Rate of heating : 80° C/Hour upto 600-650° C Soaking Time : 120 minutes Rate of cooling : 100° C/Hour upto 425° C
		iv. D.P.Testing of welded joints	D.P.test	100%	AA0850131 & AA0850129	TC	3	2	-	10% D.P.test shall be witnessed by BHEL Inspector
		v.Soundness of Butt welded joints (in case pipe made from plate)	Spot RT testing	10%	HY0850170	Insp.Report	3	-	2	RT films and report shall be reviewed by BHEL Inspector
3.0	In process Inspection	i.Dimensions of components after machining	Measurement	100%	Drawing	Dimension report	3	-	2	unspecified tolerances shall be maintained as per medium tol. Grade of bhel specn. AA0230208
		ii.Thickness of Chrome plating and Harddness of Chrome plated surface of Spring Pre-load Stud.	coating thickness Measurement on Job and Hardness test	100%	Drawing	TC	3	2	-	In case hardness test on job is not possible. The hardness test can be carried out on flat test piece (having same chrome plating thickness as job) which is chrome plated along with job.
4.0	Final Inspection after machining and assly.	i. Dimensions after final assly	Measurement	100% by Vendor 10 % by BHEL	Drawing.	Dimension Report	3	2	-	unspecified tolerances shall be maintained as per medium tol. Grade of bhel specn. AA0230208
		iv. Painting & preservation	Paint shade and DFT	10% by BHEL on random basis	As per painting scheme mentioned in remarks column. Final DFT of primer coating shall be 40. microns	Insp.Report	3	2	-	Surface Preparation to be done with Abrasive blast clean to Sa2-1/2as per ISO:8501-1. All machined surfaces are to be protected by applying one coat of TRP-specn.AA55154. All inside and outside surfaces(except machined surfaces) are to be painted with two coats of anti corrosive primer (specn. AA56101).
		iv.Make of fasteners	Review of documents	100%			-	-	2	All fasteners should be of appropriate class as mentioned in respective drawings. The fasteners of class 8.8 and above should be sourced from approved sources mentioned in Annexure PKG-07/SOURCE
		v.Identification & Marking	Punching of Drg. No., P.O.No. & Inspector Seal	100% by BHEL	-	Inspection Report	3/2	2	-	

		APPROVED BY	MANAGER P&D
QP. NO.	RV/FAB & MCD./58 Rev-00	SIGNATURE & DATE	
DATE	20.06.12		
PG. NO.	1 OF 1		

P = PERFORM T.C. = TEST CERTIFICATE
W = WITNESS H.T. = HEAT TREATMENT
V = VERIFY
3 = VENDOR
2 = BHEL