Bharat Heavy Electricals Limited

Heavy Equipment Repair Plant

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

Enquiry Number : **E-RC-304-23-0233-61-1** Date : **27/Jul/2023**

Enquiry For Material :-

Sl No	Material Description	Material Code	Quantity	Unit
1	JOURNAL HEAD (HY-34.00) - FULLY M/CD CARBON STEEL CASTING AS PER DRG. 16137600016/13 WITH MATL AS PER SPECN. AA19511/09	RV9211100160*	100.0	NOS

Remarks

(A) SCOPE OF SUPPLY:

1. THIS ENQUIRY HAS BEEN RAISED FOR ENTERING INTO FRAMEWORK AGREEMENT WITH VENDORS FOR CASTINGS. SEPARATE INDENTS WILL BE GIVEN TIME TO TIME AS PER REQUIREMENT FOR PLACING THE PO UNDER THIS RC. ITEM QUANTITY MENTIONED IN THE ENQUIRY IS TENTATIVE & IT MAY INCREASE OR DECREASE AS PER OUR FINAL REQUIREMENT.

2. RATES OF ITEMS AGAINST FA WILL BE FIRM & VALID FOR ORDERING FOR A PERIOD OF ONE YEAR FROM THE DATE OF AGREEMENT. PRICE VARIATION CLAUSE (PVC) IS NOT ACCEPTABLE.

AFTER FINALIIZATION OF RATE CONTRACT, PO QUANTITY WILL BE PLACED AS PER REQUIREMENT.

(B) SUPPLY CONDITION :

1. ITEM TO BE SUPPLIED AT BHEL HERP STORES.
2. PRE-DESPATCH INSPECTION WILL BE CARRIED OUT AT PARTY'S WORKS BY BHEL REPRESENTATIVE AS PER QUALITY PLANS QP NO. RV/C&F/112 REV-01

(C) TECHNICAL DELIVERY CONDITION:
1. MATERIAL SHOULD BE AS PER SPECN.AA19511/09.
2. DIMENSIONS AND TOLERANCES TO BE MAINTAINED AS PER DRG.
3. UN-SPECIFIED CASTING TOLERANCES TO BE MAINTAINED AS PER TOL. CL.4 OF STANDARD AA0230402.
4. UST, MPI & DP TEST AS PER CL. 13 OF THE SPECN. AA19511 IS TO BE DONE.
5. ALL THE TECHNICAL NOTINGS MENTIONED IN THE RESPECTIVE DRGS. SPECIFICATION & QUALITY PLANS SHOULD BE STRICTLY FOLLOWED.
6. HEAT TREATMENT CHART IS REQUIRED.
7. DIMENSIONS REPORT IS REQUIRED.
8. CASTING SHOULD BE PROPERLY FETTLED.

(D) TEST CERTIFICATE: REQUIRED FOR CHEMICAL & MECHANICAL PROPERTIES OF RAW MATL ALONG WITH UT, MPI & DP REPORT REQUIRED AS PER QP.

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

(F) PACKING INSTRUCTIONS: ALL FULLY MACHINED ITEMS SHOULD BE SUPPLIED IN WOODEN CRATES BY APPLYING PROPER RUST PREVENTIVE ELEMENTS.

(G) RATE CONTRACT VALIDITY: FOR ONE (01) YEAR FROM THE DATE OF AGREEMENT.

(H) SPECIAL REMARKS:

1. DUE TO LARGE QUANTITY & VALUE OF MILL SPARES, MORE THAN ONE SOURCE SHOULD BE CONSIDERED FOR MEETING OUR REQUIREMENT.

2. ITEM WISE MAXIMUM QTY IN EACH LOT (WHICH MAY BE REQUIRED IN A PARTICULAR ORDER) WILL BE 30 NOS. THERE WILL BE A GAP OF 01 MONTH BETWEEN TWO CONSECUTIVE LOTS.

3. DELIVERY IS WITHIN 120 DAYS FROM DATE OF PO FOR FIRST LOT.

(I) SPLITTING CONDITION:

1. THE SPLITTING WILL BE DONE WITH RESPECT TO TOTAL QUANTITY OF ITEM.

2. BHEL WILL SPLIT THE TOTAL QUANTITY FOR ENTERING INTO FRAMEWORK AGREEMENT BETWEEN TWO VENDORS IN RATIO OF 60:40. IF NONE OF THE OTHER BIDDERS ACCEPT THE L1 PRICE, THEN THE ENTIRE QUANTITY OF THE TENDER WOULD BE ORDERED TO THE ORIGINAL L1 PARTY ONLY.

3. IN NO CASE THE HIGHEST QUOTED BIDDER (H1) WILL BE GIVEN THE OPPORTUNITY OF THE QUANTITY SPLIT.

4. THE EQUATED L1 PRICE ON TOTAL COST BASIS TO BHEL WOULD BE COUNTER OFFERED TO THE NEXT HIGHER BIDDER IN ORDER OF THEIR RANKING AND THE QUANTITY SPLIT WOULD BE GIVEN TO THE BIDDER WHO ACCEPT THE EQUATED L1 PRICE ON THE BASIS OF THEIR RANKING IN THE PRICE BID.

5. AT ANY POINT OF TIME OR IF THE PERFORMANCE OF ANY VENDOR IS FOUND UNSATISFACTORY, THE ABOVE DISTRIBUTION RATIO MAY BE CANCELLED OR CHANGED BY BHEL AND ITEMS MAY BE PROCURED FROM PERFORMING VENDORS.

(J) REVERSE AUCTION:

1. BHEL SHALL BE RESORTING TO REVERSE AUCTION (RA) (GUIDELINES AS AVAILABLE ON WWW.BHEL.COM) FOR THIS TENDER. RA SHALL BE CONDUCTED AMONG ALL THE TECHNO? COMMERCIALLY QUALIFIED BIDDERS.

2. PRICE BIDS OF ALL TECHNO? COMMERCIALLY QUALIFIED BIDDERS SHALL BE OPENED AND SAME SHALL BE CONSIDERED AS INITIAL BIDS OF BIDDERS IN RA. IN CASE ANY BIDDER(S) DO(ES) NOT PARTICIPATE IN ONLINE REVERSE AUCTION, THEIR SEALED ENVELOPE PRICE BID ALONG WITH APPLICABLE LOADING, IF ANY, SHALL BE CONSIDERED FOR RANKING.

(K) ALL OTHER TERMS AND CONDITIONS SHALL BE AS PER GTC ATTACHED WITH ENQUIRY.

PQR FOR GEM

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 the item/s as per drng/spec..	
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.	
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 / Matl.Acceptance Report and item drawings/specs.. 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	**Manufacturing Process Plan:**	
4.a	Bidders shall submit detailed Manufacturing process Plan along with the Technical Offer.	
5	**Annual Turnover:**	
5.a	Turnover of the supplier should be as per GeM (Government e-market place) guide lines (Maximum limit to be taken). Bidders should enclose Audited Balance sheets and Profit & Loss account statement of last three consecutive years in the Part I bid.	
6	After placement of Purchase Order, Vendor shall submit Material Test Certificate before dispatching the Material to BHEL, for review and Dispatch clearance.	
7	Bidder will supply item/s exactly as per enquiry.	

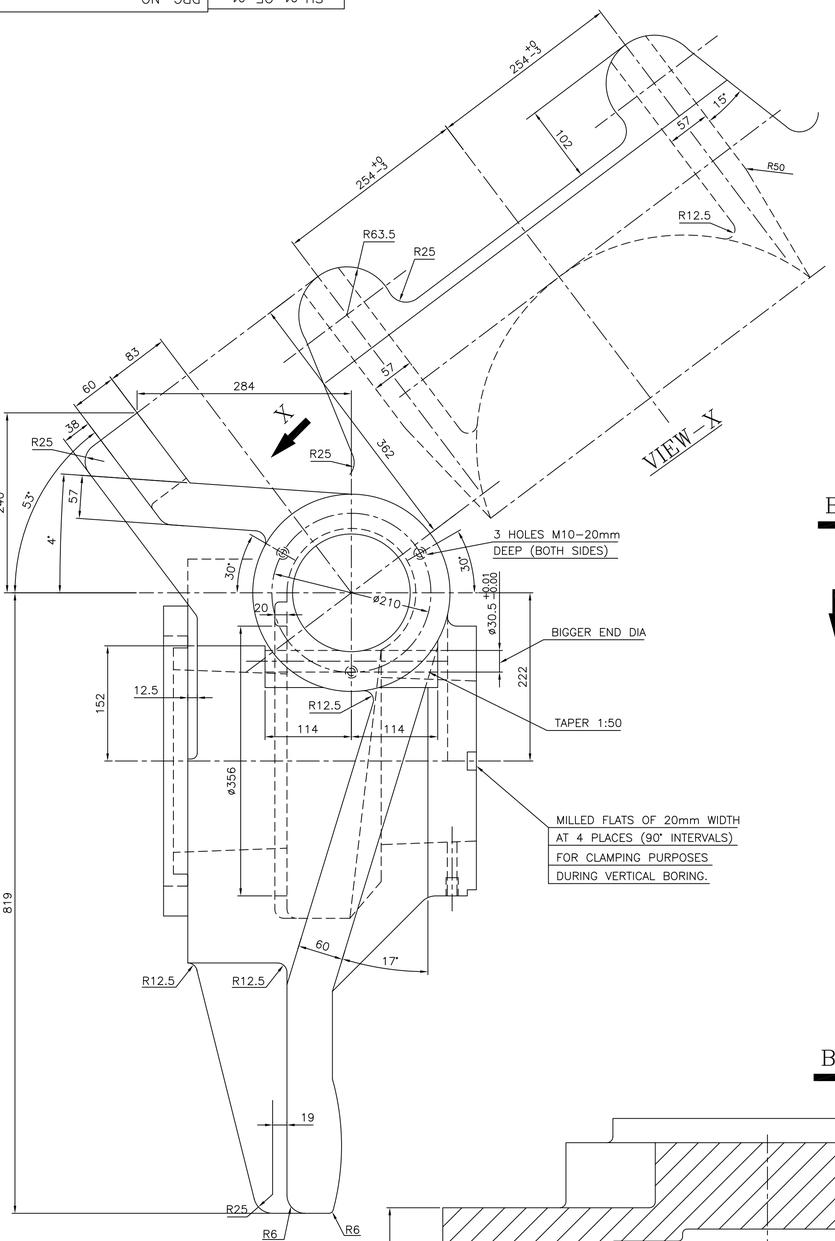
Note: Non Submission of the above requested documents/non compliance to the above points will result in rejection of the Offers without further Notice/Intimation to the Bidder and no correspondance will be entertained at later date.

FIRST ANGLE PROJECTION

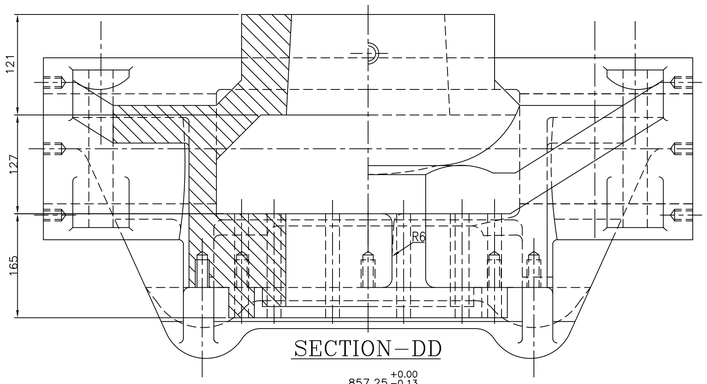
(ALL DIMENSIONS ARE IN mm)

DRG. NO 1-61-376-00016 | SH. 01 OF 01

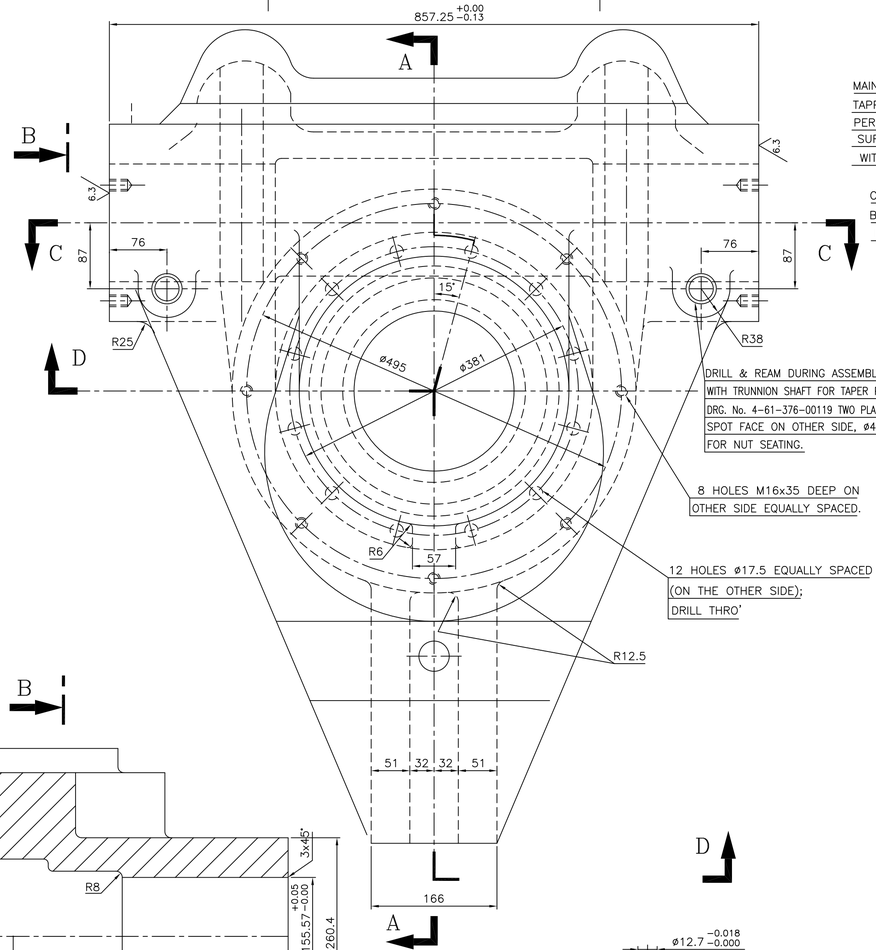
COMPUTER FILE NAME 16100016.DWG | REF. DRG. NO. | SIGN. AND DATE | INVENTORY NO

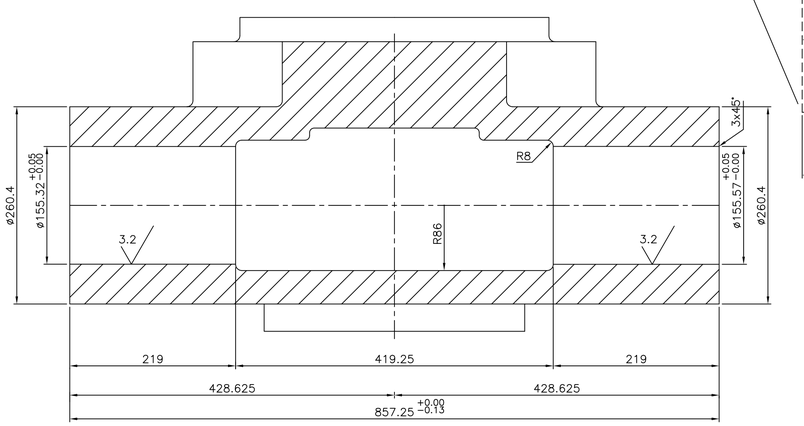


VIEW–BB

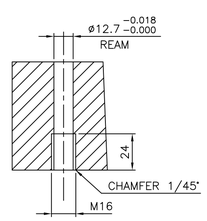


SECTION–DD





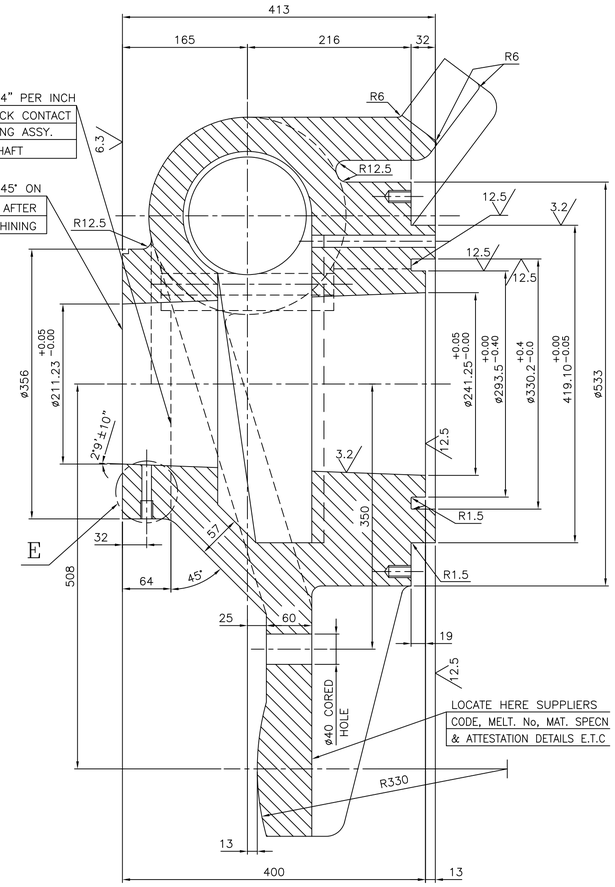
SECTION–CC



DETAIL–E

MAINTAIN TAPPER 0.03754" PER INCH PER SIDE. CHECK CONTACT SURFACE DURING ASSY. WITH JRNL. SHAFT

CHAMFER 3x45° ON BOTH SIDES AFTER FINISH MACHINING



SECTION–AA

ITEM NO.	DESCRIPTION	DRAWING NO.	VAR NO.	RAW MATERIAL SIZE OR CASTING DRG. NO. OR FORGING DRG. NO.	MATERIAL CODE	NET WT.	GROSS WT
	CASTING				BA9211122015	669.000	
					AA19511	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

NAME OF CUSTOMER/PROJECT

BHARAT HEAVY ELECTRICALS LIMITED
HYDERABAD

	NAME	SIGN.	DATE	NO.OF VAR.
DRN.	UNIC /NDS		20.11.98	
CHD.	SG		20.11.98	NA
APPD.	K.M.R		20.11.98	

DEPT.	UNTOL. DIMS. GR.		SCALE	WEIGHT (KG)	REF. TO ASSY DRG.	ITEM NO.	NO.OF ITEMS
PULV ENGG. CODE 446	E/M/F		1:4 NTS	669.000	D-80-163-3 10-F-002-009	NA	NA

TITLE

JOURNAL HEAD

CARD CODE | DRAWING NO. 1-61-376-00016 | REV. 13

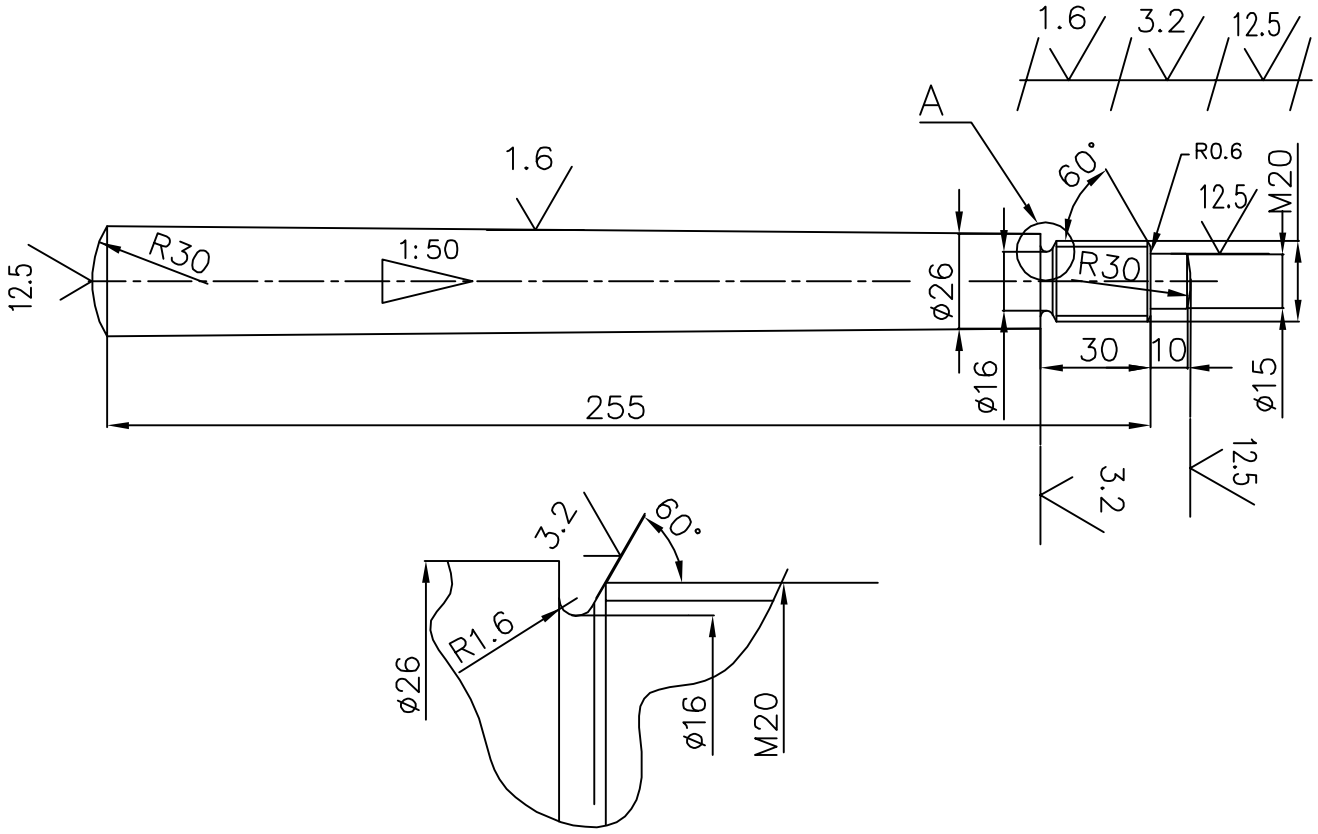
SHEET NO. 01 | NO OF SHEETS 01

REV.	DATE	ALTERED	APPD.	ZONE
13	19.7.13	CHD.	v.kumar	ZONE
		DIA OF BOSS 356 SHOWN. GROOVE DEPTH REDUCED TO 20		
12	99.7.13	CHD.		D12
		DIM. Ø293.5 +0.00 -0.40 WAS Ø298.5 +0.00 -0.40		
11	11.8.97	ALTERED UC	APPD.	ZONE
		DRAWING REDRAWN BY INCORPORATING ALL PREVIOUS REV.		

FIRST ANGLE PROJECTION

ALL DIMENSIONS ARE IN mm.

REV.	DATE		REV.	DATE		REV.	DATE	
01	14.04.95	ALTERED PAVAN KUMAR			ALTERED			ALTERED
		CHECKED Y.S.B.LAXMAN RAO			CHECKED			CHECKED
		APPROVED B.THYAGARAJAN			APPROVED			APPROVED
MAT. SPEC. WAS BM-C45 HYD. MAT.CODE ADDED.								



DETAIL A

REMOVE ALL SHARP CORNERS

TAPER PIN		ROD ø32 x 270	AA1020208147	1.30	1
			AA10208		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.	Yadagiri		25.05.00
CKD.	B.Pavan kumar		25.05.00
APPD.	Satish Ghatge		25.05.00

NO.OF VAR.

DEPT.	SCALE	WEIGHT(K.G.)	REF.TO ASSY.DRG.	ITEM NO.	NO.OF ITEM
PULV.ENGG	1:2	1.300	0.61.080.90006	NA	NA
CODE 446					

TITLE TAPER PIN (ø26 x 255)

DRAWING NO. 4-61-376-00119 REV. 01

SHT.NO. 01 NO.OF SHT. 01

REF. TO HY0230261 FOR UNSPECIFIED TOLERANCES.

SIGN. & DATE | REF. DRG. NO. | COMPUTER NO. 46100119.DWG | INVENTORY NO.

PERMISSIBLE DEVIATIONS FOR UNTOLERANCED DIMENSIONS OF CASTINGS

1.0 SCOPE:

This standard pertains to permissible dimensional tolerances on the as-cast surfaces of castings. his is not applicable to pressure die castings of non-ferrous metals and for castings which are difficult to produce from the technological point of view, in which case the deviations shall be agreed mutually.

NOTE: Supply in line with IS:4897 is also acceptable.

2.0 NOMENCLATURE:

2.1 Nominal Dimensions:

Nominal dimension is the dimension specified in the production drawing or in the production documents or the one to which the production deviations of the components are applicable.

2.2 Actual Dimension:

Actual dimension is the dimension measurable on the rough castings. Wherever possible several measurements of the dimensions are made and the maximum and minimum values are considered for assessment as to the compliance with tolerance limits, e.g. diameter of a ring or disc at various diametrically opposite points, the diameter of a cylinder at various points along the height, the lengths and breadths of a plate, etc.

2.3 Governing Dimensions:

Governing dimension is the maximum measurable dimension of the concerned part of the casting, in the plane perpendicular to the nominal dimension. With every nominal dimension, the corresponding governing dimension should be considered.

Governing dimension along with the nominal dimension on the rough casting, determines the limiting deviation of casting or its parts. Examples of governing dimensions for various cases are given in Table-1.

2.4 Allowable Dimensional Deviations:

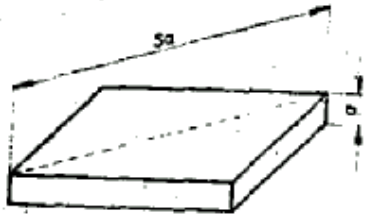
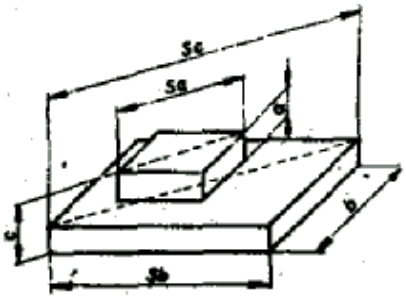
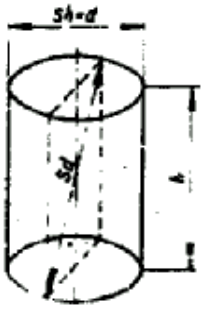
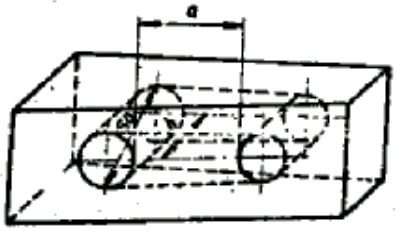
a) Upper allowable deviation:

Upper allowable deviation is the difference between the upper limiting dimension and nominal dimension (of casting).

b) Lower allowable deviation:

Lower allowable deviation is the difference between the bottom limiting dimension and nominal dimension (of casting).

TABLE –1: GOVERNING DIMENSIONS (S)

Sl. No.	Figure	Definition
1		If 'a', the thickness, is the nominal dimension, the corresponding governing dimension will be diagonal, 'Sa' lying in a plane perpendicular to 'a' since it is the greatest dimension in the plane.
2		If 'a' is the nominal dimension 'Sa' is the governing dimension. For the nominal dimension 'c', the governing dimension is 'Sc'. For Nominal dimension 'b', the governing dimension is 'Sb', (Diagonal of the adjacent sides for smaller thickness of the lower prism, differs very much less, from the length of adjacent sides).
3		For the nominal dimension 'd', the diagonal 'Sd' along the plane perpendicular to the nominal dimension, is the governing dimension, because it is the greatest dimension, in the plane along the axial section. For the nominal dimension 'h', the governing dimension is Sh = d. For simplicity, dimension Sd can be changed to the nearest lower measurable dimension (h or d), whichever is greater.
4		Distance of the holes 'a' in the casting, is assumed as separate part, and hence for the nominal dimension 'a', the diagonal 'Sa' will be the governing dimension, which is greater of the two holes, and which lies in the plane of 'a'. For simplicity, we can replace with the nearest lower dimension 'h', or the diameter of the bigger hole.

3.0 TOLERANCE CLASSES:

3.1 General:

Tolerance limits are given under five different classes in the light of different casting techniques and trade practices that could be followed. The numerical values of tolerances for a series of Nominal and Governing dimensions according to classes 1 to 5 are respectively given in tables 2 to 6. The manufacturing foundry shall choose to itself the proper tolerance limits on dimensions of pattern equipment in accordance with those of the castings to be adhered to. For dimensions not covered by the tables given, tolerances shall be specified separately and the mutually agreed upon.

3.2 Tolerance class 1:

Tolerance limits under class 1, according to Table 2 is for high precision castings, such as investment castings.

TABLE 2: TOLERANCE CLASS 1

Nominal dimension (rough casting), mm		Governing Dimension, mm							
		From							
			6	10	18	30	80	180	315
		To							
From	To	6	10	18	30	80	180	315	500
	6	± 0.08	± 0.10	± 0.12	± 0.12	± 0.15	± 0.15	± 0.20	± 0.25
6	10	± 0.10	± 0.12	± 0.12	± 0.15	± 0.15	± 0.20	± 0.25	± 0.30
10	18	± 0.12	± 0.12	± 0.15	± 0.15	± 0.20	± 0.25	± 0.30	± 0.30
18	30	± 0.12	± 0.15	± 0.15	± 0.20	± 0.25	± 0.30	± 0.40	± 0.40
30	80		± 0.15	± 0.20	± 0.25	± 0.30	± 0.40	± 0.40	± 0.50
80	180			± 0.20	± 0.25	± 0.30	± 0.40	± 0.50	± 0.50
180	315			± 0.25	± 0.25	± 0.30	± 0.40	± 0.50	± 0.60
315	500			± 0.25	± 0.30	± 0.40	± 0.50	± 0.60	± 0.60

3.3 Tolerance class 2:

Tolerance limits under class 2, according to Table 3 is for precision castings (e.g. castings from metal patterns, shell moulding or gravity die castings).

TABLE 3: TOLERANCE CLASS 2

Nominal dimension (rough casting), mm		Governing Dimension, mm							
		From							
			6	10	18	30	80	180	315
		To							
From	To	6	10	18	30	80	180	315	500
	6	± 0.20	± 0.25	± 0.30	± 0.30	± 0.35	± 0.40	± 0.50	± 0.60
6	10	± 0.25	± 0.30	± 0.30	± 0.35	± 0.40	± 0.50	± 0.60	± 0.80
10	18	± 0.30	± 0.30	± 0.35	± 0.40	± 0.50	± 0.60	± 0.80	± 0.80
18	30	± 0.30	± 0.35	± 0.40	± 0.50	± 0.60	± 0.80	± 1.00	± 1.00
30	80	± 0.35	± 0.40	± 0.50	± 0.60	± 0.80	± 1.00	± 1.00	± 1.20
80	180			± 0.50	± 0.60	± 0.80	± 1.00	± 1.20	± 1.20
180	315			± 0.60	± 0.60	± 0.80	± 1.00	± 1.20	± 1.40
315	500			± 0.60	± 0.80	± 1.00	± 1.20	± 1.40	± 1.60

3.4 Tolerance class 3:

Tolerance limits under class 3, according to Table 4 is for mass or series production of castings requiring high degree of dimensional accuracy.

TABLE 4: TOLERANCE CLASS 3

Nominal dimension (rough casting), mm		Governing Dimension, mm							
		From							
			18	30	80	180	315	500	800
		To							
From	To	18	30	80	180	315	500	800	1250
	6	± 0.5	± 0.5	± 0.5	± 0.6	± 0.8	± 1.0	± 1.2	± 1.5
6	10	± 0.5	± 0.5	± 0.6	± 0.8	± 1.0	± 1.2	± 1.5	± 2.0
10	18	± 0.5	± 0.6	± 0.8	± 1.0	± 1.2	± 1.2	± 1.5	± 2.0
18	30	± 0.6	± 0.8	± 1.0	± 1.2	± 1.5	± 1.5	± 2.0	± 2.5
30	80	± 0.8	± 1.0	± 1.2	± 1.5	± 1.5	± 2.0	± 2.0	± 2.5
80	180	± 0.8	± 1.0	± 1.2	± 1.5	± 2.0	± 2.0	± 2.5	± 2.5
180	315	± 1.0	± 1.0	± 1.2	± 1.5	± 2.0	± 2.5	± 2.5	± 2.5
315	500	± 1.0	± 1.2	± 1.5	± 2.0	± 2.0	± 2.5	± 2.5	± 3.0
500	800	± 1.2	± 1.2	± 1.5	± 2.0	± 2.5	± 2.5	± 3.0	± 3.0
800	1250	± 1.2	± 1.5	± 2.0	± 2.5	± 2.5	± 3.0	± 3.0	± 3.5

3.5 Tolerance class 4:

Tolerance limits under class 4, according to Table 5 is for series or mass production of castings Employing hand moulding with match plate patterns.

TABLE 5: TOLERANCE CLASS 4

Nominal dimension (rough casting), mm		Governing Dimension, mm									
		From									
			18	30	80	180	315	500	800	1250	2000
		To									
From	To	18	30	80	180	315	500	800	1250	2000	3150
	6	± 0.6	± 0.8	± 0.8	± 0.8	± 1.0	± 1.5	± 1.5	± 2.0	± 2.5	± 3.0
6	10	± 0.8	± 0.8	± 0.8	± 1.0	± 1.5	± 1.5	± 2.0	± 2.5	± 3.5	± 4.0
10	18	± 0.8	± 1.0	± 1.2	± 1.5	± 1.5	± 2.0	± 2.5	± 3.5	± 4.0	± 4.0
18	30	± 0.8	± 1.2	± 1.5	± 1.5	± 2.0	± 2.5	± 3.5	± 4.0	± 4.5	± 5.0
30	80	± 1.0	± 1.2	± 1.5	± 2.0	± 2.5	± 3.0	± 3.5	± 4.0	± 4.5	± 5.0
80	180	± 1.0	± 1.5	± 2.0	± 2.5	± 3.0	± 3.5	± 4.0	± 4.5	± 5.0	± 5.0
180	315	± 1.2	± 1.5	± 2.0	± 2.5	± 3.0	± 3.5	± 4.0	± 4.5	± 5.0	± 5.5
315	500	± 1.5	± 1.5	± 2.5	± 3.0	± 3.5	± 4.0	± 4.5	± 5.0	± 5.0	± 6.0
500	800	± 2.0	± 2.0	± 2.5	± 3.5	± 4.0	± 4.5	± 5.0	± 5.0	± 5.5	± 6.0
800	1250	± 2.0	± 2.5	± 3.5	± 4.0	± 4.0	± 4.5	± 5.0	± 5.5	± 6.0	± 6.0
1250	2000	± 2.5	± 3.5	± 4.0	± 4.0	± 4.5	± 5.0	± 6.0	± 6.0	± 7.0	± 7.0
2000	3150	± 3.5	± 4.0	± 4.5	± 4.5	± 5.0	± 6.0	± 6.0	± 7.0	± 8.0	± 8.0

3.6 Tolerance class 5:

Tolerance limits under class 5, according to table 6 is for piece production of castings by employing hand moulding including pit, sweep and skeleton moulds.

TABLE 6: TOLERANCE CLASS 5

Nominal dimension (rough casting), mm		Governing Dimension, mm											
		From											
			18	30	80	180	315	500	800	1250	2000	3150	5000
		To											
From	To	18	30	80	180	315	500	800	1250	2000	3150	5000	8000
	6	± 0.8	± 1.0	± 1.2	± 1.2	± 1.5	± 2.0	± 2.5	± 3.5	± 4.0	± 5.0	± 6.0	± 7.0
6	10	± 1.0	± 1.0	± 1.2	± 1.5	± 2.0	± 2.5	± 3.5	± 4.0	± 5.0	± 6.0	± 6.0	± 7.0
10	18	± 1.0	± 1.2	± 1.5	± 2.0	± 2.5	± 3.5	± 4.0	± 5.0	± 6.0	± 6.0	± 7.0	± 8.0
18	30	± 1.2	± 1.5	± 2.0	± 2.5	± 3.0	± 4.0	± 5.0	± 6.0	± 7.0	± 7.0	± 8.0	± 9.0
30	80	± 1.2	± 2.0	± 2.5	± 3.0	± 3.5	± 4.0	± 5.0	± 6.0	± 7.0	± 8.0	± 9.0	± 10
80	180	± 1.5	± 2.5	± 3.0	± 3.5	± 4.0	± 5.0	± 6.0	± 7.0	± 8.0	± 8.0	± 9.0	± 10
180	315	± 2.0	± 2.5	± 3.0	± 3.5	± 4.5	± 5.0	± 6.0	± 7.0	± 8.0	± 9.0	± 10	± 11
315	500	± 2.5	± 3.0	± 3.5	± 4.5	± 5.0	± 6.0	± 7.0	± 8.0	± 8.0	± 9.0	± 10	± 11
500	800	± 3.0	± 3.5	± 4.0	± 5.0	± 6.0	± 7.0	± 7.0	± 8.0	± 9.0	± 10	± 11	± 12
800	1250	± 3.5	± 4.5	± 5.0	± 6.0	± 6.0	± 7.0	± 8.0	± 9.0	± 9.0	± 10	± 11	± 12
1250	2000	± 4.0	± 5.0	± 6.0	± 6.0	± 7.0	± 8.0	± 8.0	± 9.0	± 10	± 11	± 12	± 12
2000	3150	± 5.5	± 6.0	± 7.0	± 8.0	± 8.0	± 9.0	± 9.0	± 10	± 11	± 12	± 13	± 14
3150	5000	± 7.0	± 8.0	± 8.0	± 9.0	± 9.0	± 10	± 11	± 12	± 13	± 14	± 15	± 16
5000	8000	± 8.0	± 9.0	± 9.0	± 10	± 10	± 11	± 12	± 13	± 14	± 15	± 16	± 18

4.0 TOLERANCES ON THICKNESS OF WALLS OR RIBS AND WIDTH OF GROOVES OR CHANNELS:

For deviations on thickness of walls or ribs and width of grooves or channels, the values given in Table 7 are applicable.

In these cases, the wall thickness is the nominal dimension and related maximum dimension (length, height or diagonal) shall be taken as the governing dimension.

TABLE 7: Permissible Tolerances on Thickness of walls or ribs and width of grooves or channels.

Max. overall dimension of casting,	Thickness of wall or rib/width of groove or channel, mm		Permissible Tolerances, mm Tolerance class		
mm	Over	Upto & incl.	1 & 2	3 & 4	5
UP TO 500		6	± 0.2	± 0.4	± 0.8
	6	10	± 0.3	± 0.5	± 1.0
	10	18	± 0.5	± 0.8	± 1.5
	18	30	± 0.8	± 1.0	± 1.5
	30	50	± 0.8	± 1.2	± 2.0
	50	80	± 1.0	± 1.5	± 2.5
	80	120	± 1.0	± 1.8	± 2.5
ABOVE 500 UP TO 1250		10	± 0.3	± 0.8	± 1.2
	10	18	± 0.5	± 1.2	± 1.5
	18	30	± 0.8	± 1.5	± 2.0
	30	50	± 1.0	± 1.8	± 2.0
	50	80	± 1.2	± 2.0	± 2.5
	80	120	± 1.5	± 2.5	± 3.0
ABOVE 1250 UP TO 2500		10	± 0.5	± 1.2	± 1.5
	10	18	± 0.8	± 1.5	± 2.0
	18	30	± 1.0	± 2.0	± 2.5
	30	50	± 1.2	± 2.5	± 3.0
	50	80	± 1.8	± 2.5	± 3.0
	80	120	± 2.0	± 3.0	± 3.5
ABOVE 2500 UP TO 4000		18	± 1.0	± 1.5	± 2.0
	18	30	± 1.2	± 2.0	± 2.5
	30	50	± 1.5	± 2.5	± 3.0
	50	80	± 2.0	± 3.0	± 3.5
	80	120	± 2.5	± 3.5	± 4.0
ABOVE 4000		18	--	± 2.0	± 3.0
	18	30	--	± 2.5	± 3.5
	30	50	--	± 3.0	± 4.0
	50	80	--	± 3.5	± 4.5
	80	120	--	± 4.0	± 5.0

5.0 GUIDELINES FOR SELECTION OF TOLERANCE CLASS:

Given in Table 8 for information.

Material	Technology	Tolerance Class				
		1	2	3	4	5
Non-ferrous metals	Metallic dies, Shell moulds, High precision moulds	Precision work in mass production	Precision work in mass production	Large batch production	--	--
	Sand cast, Centrifugally cast	--	--	Large batch production	Piece to batch production	Piece to small batch production
GCI, Malleable and SG iron	Expandable pattern (Investment process)	Most precision work	--	--	--	--
	Metallic dies, CO2, shell moulds, High precision moulds	--	Precision work in mass production	Large batch production	Piece to batch production	--
	Sand cast, Centrifugally cast		Sample castings in mass production	Large batch production	Piece to batch production	Piece to small batch production
Cast steel	Expandable pattern	Most precision work	--	--	--	--
	Metallic dies, CO2, Shell moulds, High precision moulds and Ceramic moulds	--	Precision work in mass production	Large batch production	Piece to batch production	--
	Sand cast, Centrifugally cast	--	--	Large batch production	Piece to batch production	Piece to small batch production

6.0 SPECIFYING OF TOLERANCE CLASS:

The tolerance class required shall be specifically mentioned in the casting drawing.

NOTE: If required, BHEL may specify closer or liberal tolerance, other than the ones specified above, which may be indicated in the drawing/order.

HOT ROLLED / FORGED CARBON STEEL BARS, Gr: 40 C8-NORMALISED

1.0 GENERAL

This specification governs the quality requirements of Hot Rolled / forged Carbon Steel Bars, Normalised.

2.0 APPLICATION

Production of machined parts for general engineering purposes.

3.0 CONDITION OF DELIVERY

Hot Rolled / forged and Normalised.

Note: Sizes upto 100mm in hot rolled
>100 to 180mm in hot rolled or forged
abov 180mm in forged.

Bars shall be supplied in straight lengths with ends square and true.

4.0 COMPLIANCE WITH NATIONAL STANDARDS:

Material shall comply with the requirements of the following National Standards and also meet the requirements of this specification.

IS : 1570-Part II, Section 1-1979 : Schedule for wrought Steels-Carbon steels
Gr:40C8 (C40), Normalised : (Unalloyed Steels)

5.0 DIMENSION AND TOLERANCES

5.1 Sizes

Bars shall be supplied to the dimensions in BHEL order.

5.2 Length:

Unless otherwise specified, hot rolled bars shall be supplied in 3 to 6 metres length and forged bars shall be supplied in lengths of 1.5 to 3 metres

5.2 Tolerances:

5.2.1 For Forged bars: The tolerances shall be as per Cl 5.2.2 for bars ≤100mm.
The tolerances shall be +8 mm -0 mm for bars > 100 mm

5.2.2 Tolerances on hot rolled bars shall comply with those of Grade 2 of IS:3739: Dimensional Tolerances for Carbon and Alloy Constructional Steel Products, reproduced below:

5.2.2.1 Round Square Bars:

Nominal Size mm		Tolerances, mm	
Over	Up to & Including	Permissible deviation	Out of round / square
--	25	± 0.50	0.50
25	50	± 0.75	0.75
50	80	± 1.00	1.00
80	100	± 1.25	1.25
> 100		± 1.6% of diameter or width of side	75 % of total tolerance (+ and -)

5.2.2.2 Flats:

Nominal width, mm			Tolerance, mm		
Over	Up to & Including	On width	On thickness		
			6 to 13	Over 13 to 25 including	Over 25 to 50 including
--	50	± 1.0	± 0.5	± 0.8	± 1.0
50	100	± 2.0	± 0.5	± 1.0	± 1.5
100	150	± 3.0	---	---	± 2.0

5.2.3 Straightness:

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

6.0 MANUFACTURE:

Material shall be manufactured from fully killed steel.

7.0 FREEDOM FROM DEFECTS :

The bars shall be sound, straight and free from internal and surface defects such as seams, laps, cracks or any other defects which may impair the end use.

Bars shall be free from twists and bends.

8.0 HEAT TREATMENT :

The bars shall be normalised at a temperature of 830 - 860^{0}C

9.0 CHEMICAL COMPOSITION :

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

Element	Melt analysis, percnt Min.	Max.	Permissible Variation, percent
Carbon	0.35	0.45	± 0.02
Silicon	0.10	0.35	± 0.03
Manganese	0.60	0.90	± 0.04
Sulphur	---	0.035	+ 0.005
Phosphorus	---	0.035	+0.005

10.0 TEST SAMPLES :

10.1 One sample shall be taken from each melt for chemical analysis.

10.2 One sample shall be taken from each heat treatment batch for testing of mechanical properties. Test pieces for mechanical tests shall be taken in the longitudinal direction of the piece.

10.3 For ruling section upto & including 40mm, the test piece shall be machined coaxially from the test bars. For ruling section above 40mm the longitudinal axis shall be atleast 12.5 mm from surface of the test bars.

Test methods for determining mechanical properties shall be as per IS:1608 (For tensile test).

11.0 MECHANICAL PROPERTIES (IN NORMALISED CONDITION) :

Mechanical properties of the material shall be as follows:

Tensile strength : 580 - 680 N/mm^2

Yield strength : 320 N/mm^2, min

Elongation on 5.65 √So : 18%, min.

12.0 ULTRASONIC TEST:

12.1 Each bar above 100 mm shall be tested ultrasonically in accordance with BHEL standard AA 085 01 18 to ensure freedom from internal defects. The norms of acceptance shall be as per category 2 of the above standard.

12.2 **Optional tests:** If specified on order, each bar > 40 to 100mm shall be tested ultrasonically in accordance with BHEL standard AA 085 01 18 to ensure freedom from internal defects and the norms of acceptance shall be as per category 2.

13.0 TEST CERTIFICATES :

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 the test certificate along with their despatch documents to facilitate quick clearance of the material.

The test certificate shall bear the following information :

AA 102 08; Rev. No. 07: Hot rolled /forged carbon steel bars, Gr.:40 Normalised
BHEL order No,
Supplier's Reference :
Name
Identification No.
Melt No.
Details of heat treatment.
Results of Tests :
Results of Dimensional inspection.
Results of chemical analysis, mechanical tests & Ultrasonic test.

14.0 PACKING AND MARKING :

The material shall be suitably packed in bundles-hessian wrapped to prevent sagging, corrosion and damage during transit. A suitable clear temporary rust preventive shall be applied on all the bars. Each bar of 50 mm and above shall be stamped with AA 102 08, melt no, BHEL order no, at one end or on the end face.

Bars below 50mm shall be bundled together and tied with wire at 3 to 4 places along the length of the bars.

A metal label shall be securely attached to each bundle and shall bear the following information :

AA 102 08 : Hot Rolled / Forged Carbon Steel Bars, 40C8-Normalised.
BHEL Order No.
Consignment/Identification No.
Melt No.
Size and Weight.
Supplier's Name.

15.0 REFERRED STANDARDS (Latest Publications Including amendments):

1. IS : 1570 Part II 2. IS : 1608 3. IS : 3739 4. AA 085 01 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.

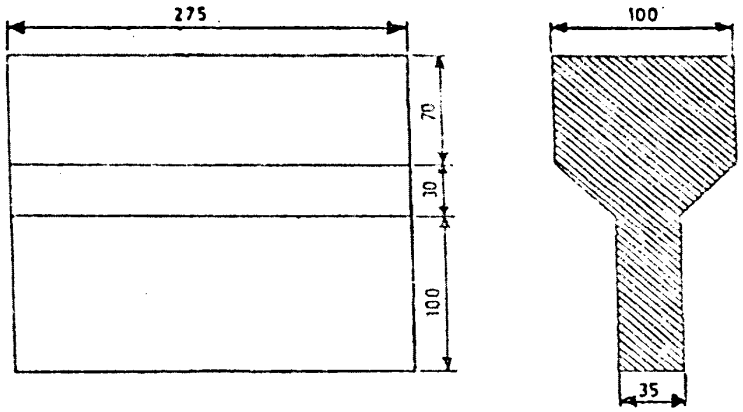
11.1 Unless otherwise specified for castings weighting up to 500 kg. piece weight one keel block, separately cast per melt per heat treatment batch shall be supplied according to the sketch given below:

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.

TDC FOR CRITICAL STEEL CASTINGS OF BOWL MILLS

1. **GENERAL** :

1.1 SCOPE AND FIELD OF APPLICATION

The purpose of this specification is to define the required quality and the general manufacturing and inspection conditions for critical steel castings of bowl mills.

2. CHEMICAL ANALYSIS AND MECH. PROPERTIES

The Chemical composition and Mechanical properties should be as per AA19511. (Latest Edition)

NOTE:

- The dimensions and number of test ingots shall be sufficient to allow specimens to be taken for test, retests and, if necessary, reworking.
- For each unsatisfactory test, 2 retests shall be performed. In the event that one of the retests is not satisfactory, reworking by new heat treatment is possible.

3. GENERAL MANUFACTURING CONDITIONS:

3.1 GENERAL

Execution of the items shall be in compliance with drawings and bills of material and with this specification.

To meet the dimensional accuracy, soundness and surface condition requirements for the items, pouring shall be done in a rigid mould.

The temperatures and durations of these treatments shall be recorded and the recordings shall include the references of the items to ensure their traceability.

3.2 REPAIRS

a) SURFACE DEFECTS

Surface defects detected on the items in the rough machined state during the non destructive inspections (visual examination, magnetic particle inspection) can be eliminated by grinding within the limit of the dimensional tolerances indicated on the drawings.

There shall be a gradual transition between these excavations and the surrounding surface. A magnetic particle or liquid penetrant inspection shall be performed to demonstrate the accordance with the same criteria as for the initial inspections (see annexure A). No surface excavation after final machining is accepted.

b) REPAIR WELDING:

Other defects outside the criteria can be repaired by welding to bring the items into compliance with the inspection criteria.

A qualified repair welding procedure must previously have been drawn, up in accordance with ASME IX.

A map of major defects as per Annexure B shall be drawn up.

Repaired and neighboring zones shall be given the same inspection as before (see Annexure A), together with an ultrasonic inspection with separate angle probe and transceptor (or with a suitable close field) to detect any planar defect.

c) POST WELD STRESS – RELIEVING TREATMENT:

After welding, the items shall be given stress relieving heat treatment in the oven for all major and minor excavations as defined in Annexure B. The temperature of this heat treatment shall be less than the quality heat treatment one (less than 20 º C)
Repairs after surface excavations (see Annexure B) can be locally stress relieved provided that no minor or major excavations has been performed on that item, only for the heads welded on the shell.

3.3. MARKING:

The material attestation details shall be hard punched with 10 mm punch (min) at a place remaining as-cast unless otherwise specified in the drawing.

The following indications shall be included:

a) Pattern or drawing number.
b) BHEL vendor code.
c) Heat number (to be quoted on all inspection documents)
d) Material specification BA75020+AA19511 REV...
e) Manufacturer monogram/initials shall not be cast on the casting.

The marking shall be surrounded by yellow paint to make it clearly visible.

4. GENERAL INSPECTION CONDITIONS:

4.1 GENERAL

The first time a type of item is made, the first casting shall be considered a prototype, but it will not be necessary to wait for the results of the inspections at the rough-machined stage before continuing with the manufacture of the other item.

The Quality Control Plan or manufacturing and associated inspection programme shall be drawn up. It shall indicate all the manufacturing operations in chronological order and all the inspections.

4.2 TESTS AND INSPECTIONS

The tests and inspections to be performed on the castings are defined in Annexure A.

5**. DOCUMENTS**:

To be submitted to BHEL after manufacture and before shipment:

a. Chemical analysis certificates
b. Mechanical test certificates
c. Heat treatment certificates
d. Map of major excavations
e. Dimensional records
f. Non-destructive inspection certificates.

All of these documents shall be gathered together to form the constructor file, with a table of contents and cover pages.

6. ENCLOSED.

The following Annexure's are enclosed to this specification:

Annexure A - Test & Inspection
Annexure B - Cut out- defect diagrams
Annexure C - Magnetic particle test criteria
Annexure D - Liquid penetration test criteria

7. PACKING AND TRANSPORT

The castings shall be packed suitably and transported to avoid transit damage

ANNEXURE –A

TEST AND INSPECTION

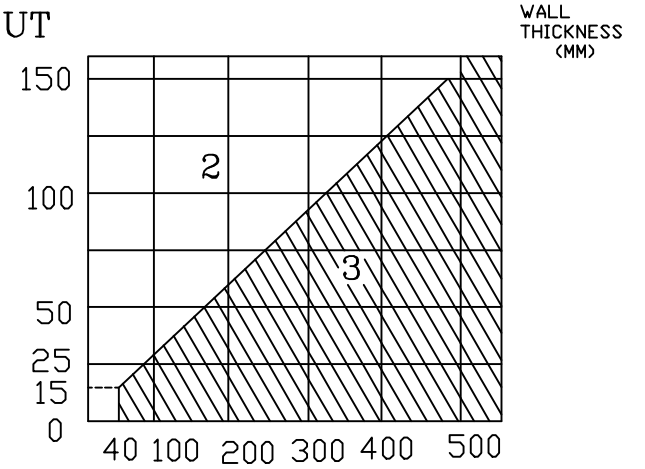
Type of Inspection	Ref	Method of Inspection	Acceptance Level/Criteria	Inspection Frequency	Support Document
a.Dimensions	IS	Dimensional	1.As per drg.	Each casting	Dimensional report
b. Surface		Visual	The surface shall be free from the defects like cracks or other defects detrimental to the item.	Each casting	
c. Chemical analysis	AA19511	Standard	The result shall comply the spec	Each item	Certificates
d. Mechanical	AA19511	Standard	The result shall comply the spec.	Each item	Certificates
e. Ultrasonic (Rough machined condition)	AA08501 04	AA085010 4	Level II	Each item	Certificates
f. MPI (In rough machined condition)	AA08501 33	AA085013 4	1.Transition radii linear & aligned defect level 01 2. Non-linear defect level 2 3. All rest level 2 4. Planar defects after repair by welding are not permissible	Each casting -do-	Certificate -do-
g.Liquid penetration test (For heads delivered with fully machined condition)	AA08501 31	Annexure D AA085013 1	Defect level 01 of Annexure D.	Each head on zone shown	Certificate

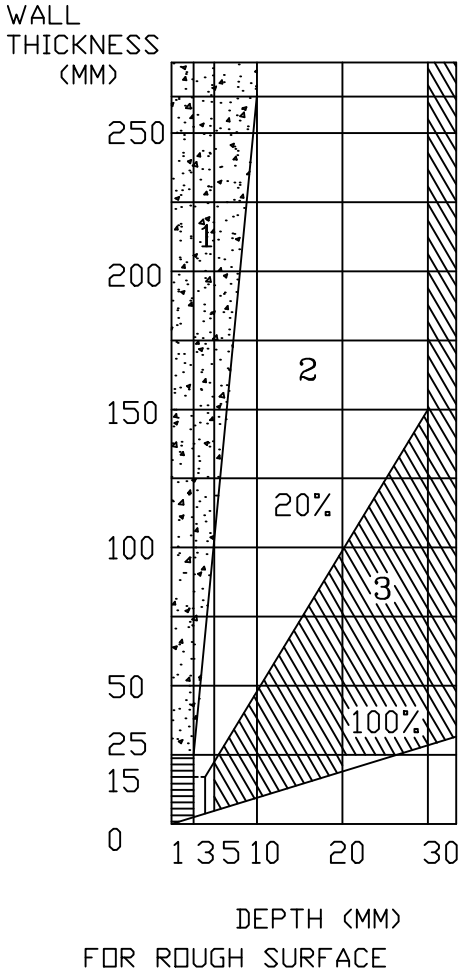
ANNEXURE B
CUT OUT

1 ZONE
SUPERFICIAL CUT-OUTS

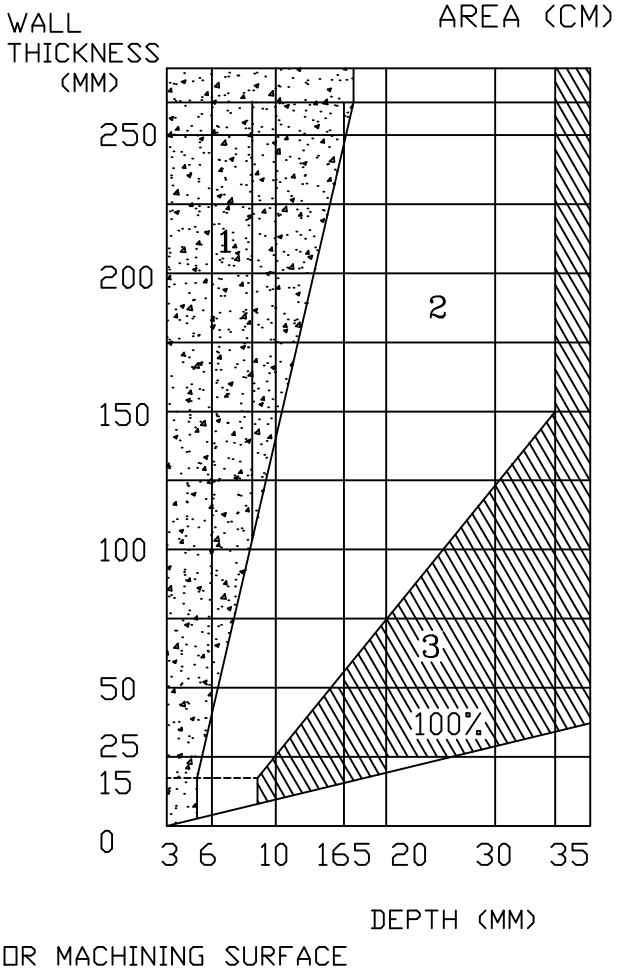
2 ZONE
MINOR CUT-OUTS

3 ZONE EDS
MAJOR CUT-OUTS





FOR ROUGH SURFACE



FOR MACHINING SURFACE

ANNEXURE C (MAGNETIC PARTICLE TEST CRITERIA –STEEL CASTINGS

Equivalence ASTM E 125					1		2		3		4		5	
LEVEL			001	01	1		2		3		4		5	
Size of the indication taken into account			0.3		1.5		2		3		4		5	
SM (2) Non-linear indications		(1) Maximal whole area (sq. mm)			10		35		70		200		500	
		Maximal individual size (mm)	1	1	2 (4)		4 (4)		6 (4)		10 (4)		16 (4)	
LM (2)		Ordering of indications	Isolated or cumulated		Isolated	Cumulated	Isolated	Cumulated	Isolated	Cumulated	Isolated	Cumulated	Isolated	Cumulated
AM (2) Liner and aligned indications	Maximal lengths of indications (mm) (1)	"a" (3) thickness $t \leq 16$ mm	0	1	2	4	4	6	6	10	10	16	16	25
		"b" (3) thickness $16 < t \leq 50$ mm	0	1	3	6	6	10	10	16	16	25	25	40
		"c" (3) thickness $t > 50$ mm	0	2	5	10	10	16	16	25	25	40	40	63

(1) In a frame of 105 x 148 mm .
(2) The indication is liner if $L \geq 3\ I$ with L : length and 1: width of the indication.
The indications are aligned if numbering of 3 or more and if the distance between them is less than 2 mm- non linear –or if less than the greatest of the indications. The length taken into account is the distance between the beginning of the first indication and the end of the last one.
(3) Thickness of the casting (4) 2 Indications Max. for this size

ANNEXURE D (LIQUID PENETRANT TEST CRITERIA (STEEL CASTINGS) IN ACCORDANCE WITH ASTM E433

LEVELS			001	01	1		2		3		4		5	
Size of the indication taken into account (mm)			0.3		15		2						3	
SR (2) Non linear indications	(1) Maximal number of indications			5	8		8		12		16		20	
	Maximal size of indication (mm)			1	3		5		8		12		16	
AR (2) Linear and aligned indications	Ordering of indications		Isolated or cumulated		Isolated	Cumulated	Isolated	Cumulated	Isolated	Cumulated	Isolated	Cumulated	Isolated	Cumulated
	(1) Maximal lengths of indications (mm)	"a" (3) thickness $t \leq 16$ mm	0	1	2	4	4	6	6	10	10	16	16	25
		"b" (3) thickness $16 < t \leq 50$ mm	0	1	3	6	6	10	10	16	16	25	25	40
		"c" (3) thickness $t > 50$ mm	0	2	5	10	10	16	16	25	25	40	40	63

1. In a frame of 105 x 148 mm .
2. The indication is liner if $L \geq 3\ I$ with L : length and 1: width of the indication.
   The indications are aligned if numbering of 3 or more and if the distance between them is less than 2 mm- non linear –or if less than the greatest of the indications. The length taken into account is the distance between the beginning of the first indication and the end of the last one.
3. Thickness of the casting .

PRODUCT STANDARD
PULVERISERS
HYDERABAD

RECORD OF REVISIONS

REV. NO	DATE	REVISION DETAILS	REVISED	APPROVED
01	18.8.06	Common clauses with AA19511 deleted.	AMAN	SG
02	27.06.07	For MPI ref.- AA0850133 And Method of Inspection- AA0850134 were ASTM E-125 and Annexure-C of ASTM E-125 respectively in Annexure-A	AMAN	SG

BHEL-HERP,VARANASI

QUALITY PLAN

Fully M/cd journal Head Casting as per AA19511/09
(With UT, DP AND MPI Test)

Sl.No.	Component/ Operation	Characteristic Checked	Type/Method of Check	Extent of Check	Reference Documents	Acceptance Norm	Format of Record	Agency P	Agency W	Agency V	Remarks
1.0	Material	i. Composition	Chemical Analysis	1 Sample per melt	AA19511/09	AA19511/09	T.C.	3	-	2	
		ii. Heat Treatment	H.T.Chart	1 Sample per H.T.Batch	AA19511/09	AA19511/09	HT Chart/	3	-	2	
		iii. Mechanical Properties	Mechanical Test	1 Sample per H.T.Batch	AA19511/09	AA19511/09	T.C.	3	-	2	
2.0	After rough machining	i. Soundness of casting	Ultrasonic test	100%	BA75020/02 Annexure-A	BA75020/02 Annexure-A	T.C.	3	2	-	100% UT , MPI and DP test to be witnessed by BHEL / Nominated Inspection Agency
		ii. Surface defects	D.P.Test	100%	BA75020/02 Annexure-A	BA75020/02 Annexure-A	T.C.	3	2	-	
		iii. Surface Cracks	M.P.I.Test	100%	BA75020/02 Annexure-A	BA75020/02 Annexure-A	T.C.	3	2	-	
3.0	Final Inspection	i. Cleanliness	Visual	100%	----	----	I.R.	3	2	-	
		ii. Dimensions	Measurement	20% on random sample basis by BHEL and 100% by Vendor	Drawing	Drawing	Dimension Report	3	2	-	For 100% random sample qty, BHEL Inspector shall check taper bore with approved taper shaft gauge for blue matching and Line bore with approved cylindrical shaft gauge.
		iii. Identification & Marking	Punching Heat No.Inspector Seal	100%	----	----	I.R.	3	2	-	

Q.P.No.	RV/C&F/112 Rev.01	Approved by	A. Shah
Date	13-07-23	Signature & Date	
Page No.	1 of 1	BHEL	

Abhishek 13/7/23

Legend

P=Perform
W=Witness
V=Verify
2=BHEL
3=Vendor/Supplier

TC=Test Certificate
HT=Heat Tratment
DR=Dimension Report
IR=Inspection Report