

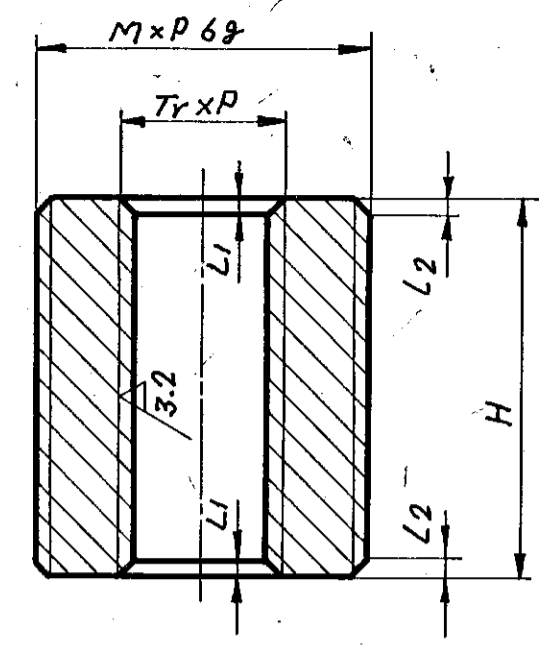
FOR TOLERANCES OF UNTOLERANCED DIMENSIONS DURING MANUFACTURE REFER RELEVANT QCP/QP

55620-0000 A 2
DRAWING

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

SLNO	REVISED DRG. NO.	OLD DRG. NO.	MATERIAL SPECN.	RAW MATL. SIZE	MATERIAL CODE	NET WT GROSS WT	SCRAP SORT	M x P -6g	T x P	H	L1	L2	COMP. CODE
1	2.V.2301.02955	2.V.2301.01817	IS 305 Gy AB1	φ 30 x 22	16006357	0.05 0.11	60	24x19	12x3	18	2	1.9	93 059 075
2	2.V.0231.02955	2.V.0231.01817	"	φ 40 x 30	16006356	0.13 0.30	60	30x19	14x2	28	2	1.9	
3	2.V.2252.02955	2.V.2252.01817	"	φ 40 x 35	16006356	0.12 0.35	60	30x19	16x4	32	2.5	1.9	
4	2.V.0203.02955	2.V.0203.01817	"	φ 40 x 45	16006356	0.12 0.44	60	30x19	20x4	40	2.5	1.9	93 060 169
5	2.V.2251.02955	2.V.2251.01817	"	φ 50 x 45	16006198	0.19 0.69	60	39x19	22x9	41	3.5	1.9	93 061 200 0000
6	2.V.2257.02955	2.V.2257.01817	"	φ 50 x 45	16006198	0.20 0.69	60	42x2	24x9	40	3.5	2	93 102 033 0000
7	2.V.0206.02955	2.V.0206.01817	"	φ 50 x 55	16006198	0.45 0.85	60	45x19	24x5	48	3.5	1.9	93 060 115 0000
8	2.V.0207.02955	2.V.0207.01817	"	φ 50 x 55	16006198	0.55 0.85	60	45x15	26x5	52	3.5	1.9	93 102 032 0000
9	2.V.2247.02955	2.V.2247.01817	"	φ 50 x 55	16006198	0.25 0.85	60	48x2	28x9	50	3.5	2	93 006 532 0000
10	2.V.0208.02955	2.V.208.01817	"	φ 50 x 60	16006198	0.55 0.93	60	48x2	28x9	56	3.5	2	93 060 911 0000
11	2.V.2258.02955	2.V.2258.01817	"	φ 70 x 60	16006354	1.20 1.81	60	60x2	32x6	57	4.0	2	93 061 201 0000
12	2.V.0210.02955	2.V.0210.01817	"	φ 70 x 75	16006354	0.73 2.26	60	50x19	32x6	71	4.0	1.9	93 060 910 0000
13	2.V.2476.02955	2.V.2476.01817	"	φ 50 x 55	16006198	0.46 0.85	60	45x2	24x3	50	3.5	2	93 058 447 0000
14	2.V.2478.02955	2.V.2478.01817	"	φ 50 x 65	16006198	0.55 1.00	60	48x2	28x3	60	3.5	2	93 058 684 0000
15	2.V.2480.02955	2.V.2480.01861	"	φ 70 x 95	16006354	1.15 2.63	60	60x4	36x3	88	3.5	3	93 060 619 0000
16	2.V.2481.02955	2.V.2481.01861	"	φ 70 x 102	16006354	1.34 2.83	60	64x4	40x3	95	3.5	3	
17	2.V.2670.02955	2.V.2670.01861	"	φ 80 x 120	16006349	1.47 4.73	60	64x4	44x4	115	3.5	3	93 101 379 0000
18	2.V.2477.02955	-	SA 439 TYPE-D2	φ 50 x 55	-	0.46 0.85	20	45x2	24x3	50	3.5	2	93 105 485 0000
19	2.V.2685.02955	-	"	φ 50 x 65	-	0.55 1.00	20	48x2	28x3	60	3.5	2	93 105 486 0000
20	2.V.2690.02955	-	"	φ 55 x 70	92 200 055	0.55 1.33	30	48x2	28x3	60	3.5	2	93 105 644
21	2.V.2928.02955	-	"	φ 70 x 110	92 018 063	1.15 3.62	30	60x4	36x3	88	3.5	3	93 105 645
22	2.V.M416-02955	-	"	φ 70 x 60	-	1.20 1.81	30	60x2	32x6	55	4.0	2	93 106 960 0000
23	2.V.M420-02955	-	IS 5305 Gy AB1	φ 50 x 45	16006198	0.40 0.70	60	48x2	28x5	39	3.5	2	93 107 037 0000
24	2.V.M418-02955	-	IS 5305 Gy AB1	φ 50 x 45	16006198	0.40 0.80	60	45x15	24x5	30	3.5	1.9	93 107 098 0000
25	2.V.P338-02955	-	SA 439 TYPE-D2	φ 82 x 120	-	1.47 4.73	60	64x4	44x4	115	3.5	3	93 108 211 0000

CERTIFY



6.3 / 3.2

REV. DATE	ALTD. T.C.C.	REV. DATE	ALTD. T.C.C.
08 23.7.97	CHD & APPD	07 11.9.96	CHD & APPD
SL. No. 25 INCLUDED.		DIMN. H = 30 WAS 40 REFER DCN. CS:0607	

BHARAT HEAVY ELECTRICALS LTD.,
BOILER PLANT UNIT, TIRUCHIRAPALLI-620 014

DEPT VL 320 SCALE NTS WEIGHT (KGF) REF. TO ASSY. DRG IT NO.

YOKE BUSH

DRAWN K.N. SIGN DATE 29/6
CHECKED M.R.K. SIGN DATE 30/6/97
APPROVED S.KUMAR SIGN DATE 7/7/97

DIMENSIONS TO BE CONTROLLED WITHIN LIMITS AS SHOWN. MACHINING TOLERANCE ± 0.15 UNLESS OTHERWISE SHOWN. NON-MACHINING TOLERANCE ±

1 4 DRAWING NO. 2-V-0000-02955

REV. DATE	ALTD. T.C.C.	REV. DATE	ALTD. T.C.C.	REV. DATE	ALTD. T.C.C.	REV. DATE	ALTD. T.C.C.
06 27.08.96	CHD & APPD	05 07.08.96	CHD & APPD	04 17.7.96	CHD & APPD	03 7.4.95	CHD & APPD
SL. NO. 24 INCLUDED		SL. NO. 23 INCLUDED.		SL. NO. 22 INCLUDED.		SL. NO. 20 & 21 INCLUDED	



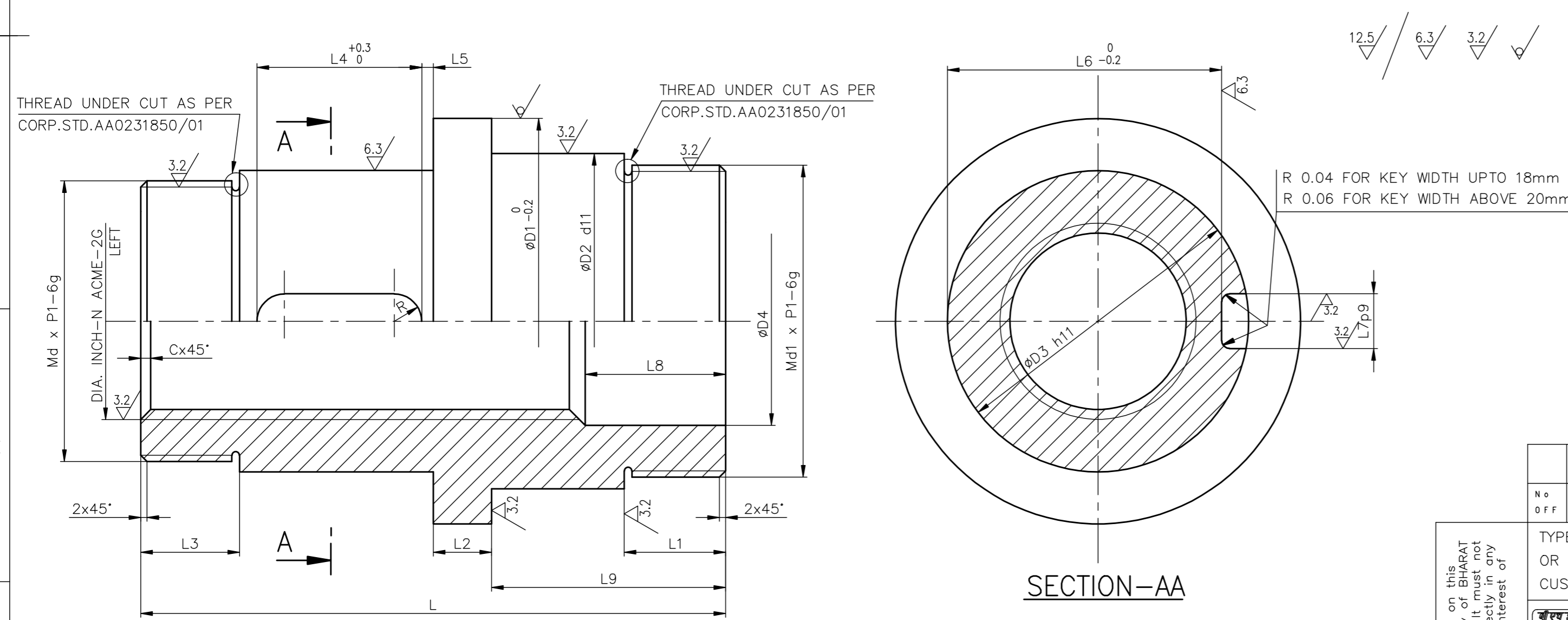
00540 1068

203307-0000-V-2

ON 9NIMV9D

ALL DIMENSIONS ARE IN MILLIMETRES. FOR TOLERANCES OF UNTOLERANCED DIMENSIONS DURING MANUFACTURE REFER RELEVANT QCP / QP

S.No	DRAWING NO	COMP. CODE	SPECN	SUGG SIZE	MATL CODE	GROSS	NET	Md x P	Md1xP1	ØD1	ØD2	ØD3	ØD4	R	L	L1	L2	L3	L4	L5	L6	L7	L8	L9	Cx45	DIA INCH-NACME	SCRAP	SIZE/RATING
1	2.V.N001.03307/04	931021040000	IS 305 GrAB1	--	--	--	1.65	52x2	60x2	70	62	52	31	8	118	20	10	26	36	0	46	16	52	45	3	1.125"-5ACME	60	6"-150C
2	2.V.N009.03307/04	931025430000	IS 305 GrAB1	--	--	--	2.92	60x2	68x2	80	70	60	34	9	158	22	12	26	40	0	53	18	85	79	3	1.250"-4ACME	60	8"-150C
3	2.V.N017.03307/04	931025680000	IS 305 GrAB1	--	--	--	1.81	52x2	60x2	70	62	52	34	8	135	20	10	26	36	0	46	16	62	62	3	1.250"-4ACME	60	6"-300C
4	2.V.N033.03307/04	931026410000	IS 305 GrAB1	--	--	--	1.03	36x2	48x2	63	50	40	28	6	105	18	8	20	20	3	35	12	57	52	3	1.000"-5ACME	60	4"-150C&300C
5	2.V.N041.03307/04	931026420000	IS 305 GrAB1	--	--	--	4.1	60x2	68x2	86	70	60	40	9	153	21.5	34	28	40	0	53	18	73	49	3.5	1.500"-4ACME	60	12"-150C
6	2.V.N073.03307/03	931040140000	IS 305 GrAB1	Ø63x110	16006340	2.69	0.95	36x2	42x2	55	45	40	21	6	97	15	8	20	20	3	35	12	49	44	2	0.750"-6ACME	60	2"-150C&300C
7	2.V.N025.03307/03	931040150000	IS 305 GrAB1	--	--	--	1.10	36x2	48x2	63	50	40	24	6	105	18	8	20	20	3	35	12	57	52	3	0.875"-5ACME	60	3"-150C&300C
8	2.V.N057.03307/04	931040160000	IS 305 GrAB1	Ø90xØ24-165	16024004	7.65	4.26	60x2	68x2	86	70	60	37	9	153	21.5	34	29	40	0	53	18	75	49	3.5	1.375"-4ACME	60	10"-150C
9	2.V.N089.03307/03	931040170000	IS 305 GrAB1	Ø90xØ24-165	16024004	7.65	3.15	60x2	68x2	80	70	60	37	9	158	22	12	26	40	0	53	18	53	79	3	1.375"-4ACME	60	8"-300C
10	2.V.K385.03307/02	931040670000	ASTM A439 D2	Ø65x110	--	3.26	1.03	36x2	48x2	63	50	40	28	6	105	18	8	20	20	3	35	12	57	52	3	1.000"-5ACME	30	4"-150C&300C
11	2.V.K386.03307/02	931040680000	ASTM A439 D2	Ø72x140	--	5.1	1.89	52x2	60x2	70	62	52	34	8	135	20	10	26	36	0	46	16	62	62	3	1.250"-4ACME	30	6"-300C
12	2.V.K387.03307/02	931040690000	ASTM A439 D2	Ø82x165	--	7.8	3.15	60x2	68x2	80	70	60	37	9	158	22	12	26	40	0	53	18	53	79	3	1.375"-4ACME	30	8"-300C
13	2.V.K388.03307/03	931040700000	ASTM A439 D2	Ø90x160	--	9.1	4.26	60x2	68x2	86	70	60	37	9	153	21.5	34	29	40	0	53	18	75	49	3.5	1.375"-4ACME	30	10"-150C
14	2.V.N201.03307/03	931046570000	ASTM A439 D2	Ø55x100	92201676	2.7	0.95	36x2	42x2	55	45	40	21	6	97	15	8	20	20	3	35	12	49	44	2	0.750"-6ACME	30	2"-150C&300C
15	2.V.N202.03307/02	931046580000	ASTM A439 D2	Ø63x110	92200056	1.8	1.1	36x2	48x2	63	50	40	24	6	105	18	8	20	20	3	35	12	57	52	3	0.875"-5ACME	30	3"-150&300C
16	2.V.N204.03307/02	931046590000	ASTM A439 D2	Ø80x145	92018087	5.7	1.65	52x2	60x2	70	62	52	31	8	118	20	10	26	36	0	46	16	52	45	3	1.125"-5ACME	30	6"-150C
17	2.V.N205.03307/02	931046600000	ASTM A439 D2	Ø85x170	92200057	7.6	2.92	60x2	68x2	80	70	60	34	9	158	22	12	26	40	0	53	18	85	79	3	1.250"-4ACME	30	8"-150C
18	2.V.N207.03307/02	931056460000	ASTM A439 D2	Ø90x160	--	9.1	4.1	60x2	68x2	86	70	60	40	9	153	21.5	34	28	40	0	53	18	73	49	3.5	1.500"-4ACME	30	12"-150C
19	2.V.N277.03307/02	931079650000	ASTM A439 D2	Ø55x100	92201676	1.8	0.91	36x2	42x2	55	45	40	21	6	92	10	8	20	20	3	35	12	52	39	2	0.750"-6ACME	30	2"-150C
20	2.V.N298.03307/01	931079660000	IS 305 GrAB1	Ø63x110	16006340	2.7	0.91	36x2	42x2	55	45	40	21	6	92	10	8	20	20	3	35	12	52	39	2	0.750"-6ACME	60	2"-150C
21	2.V.NC38.03307/01	932011760000	IS 305 GrAB1	Ø90xØ24-165	16024004	7.65	3.15	60x2	68x2	80	70	60	37	9	158	22	12	26	40	0	53	18	78	79	3	1.375"-4ACME	60	8"-300C



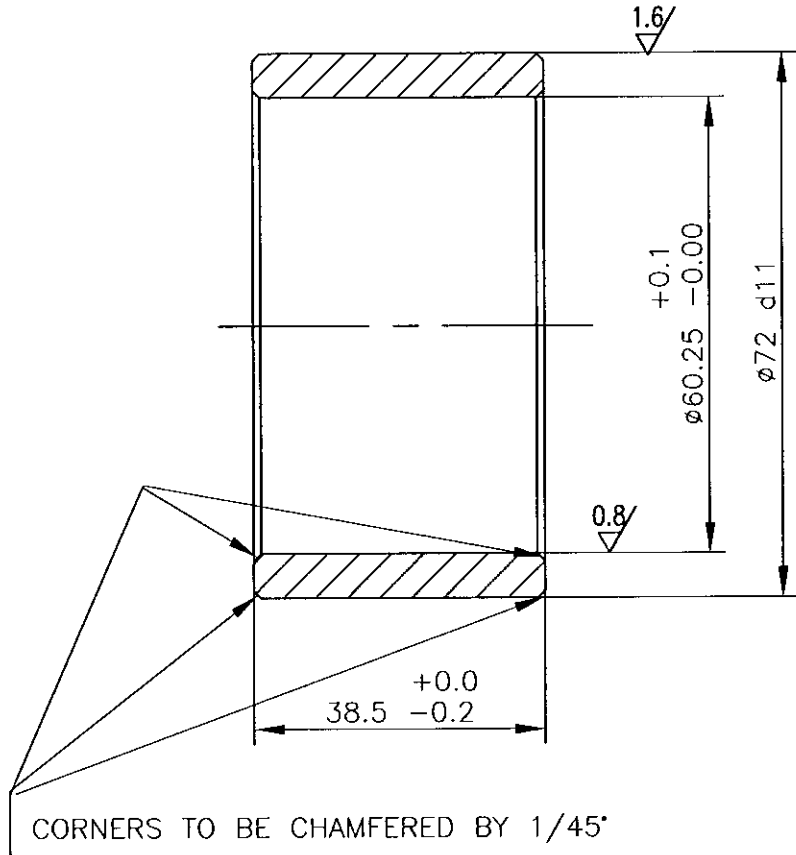
DIMENSION		d11	h11	p9
OVER	TO			
Ø80	Ø120	-0.120	0	-
		-0.340	-0.220	-
Ø50	Ø80	-0.100	0	-
		-0.290	-0.190	-
10	18	-	-	-0.018
				-0.061
18	30	-	-	-0.022
				-0.074
30	50	-0.080	0	-0.026
		-0.240	0.160	-0.088

No OFF	DESCRIPTION	MATL CODE	MATL SPECN	HEAT TREATMENT	SCRAP SORT	NET WT (kg)	GROSS WT (kg)	DRAWING No	ITEM No
	TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT								
	CS								
	DRAWING REDRAWN WITH REV. 15 ON 21.01.2008 (REFER DCN:HM 0043, CV 0059, CS 0292 & CS 0653)								
	BHARAT HEAVY ELECTRICALS LTD., UNIT: HIGH PRESSURE BOILER PLANT, TIRUCHIRAPALLI -620014.		DRN	T.R.RAMAMURTHY	SIGN	DATE	NO.OF VAR.		
			CHD	T.R.RAMAMURTHY		21.01.08			
			APPD	P.Boomnathan		21.01.08			
	DEPT VL	SCALE	WEIGHT (KG)	REFERENCE INFORMATIONS					
	320	N T S	---	CAD REF : C203307					
	TITLE		CARD CODE	DRAWING NO.					
	YOKE BUSH		U 01	2-V-0000-03307					

REV	DATE	ALTERED	T.R.RAMAMURTHY	REV	DATE	ALTERED	T.R.RAMAMURTHY	REV	DATE	ALTERED	T.R.RAMAMURTHY
16	17.02.09	CHD & APPD	P.Boomnathan	15	21.01.08	CHD & APPD	P.Boomnathan	14	29.08.07	CHD & APPD	P.Boomnathan
DIMN.L3 ARROW MARK POSITION CHANGED TO INCLUDE RELIEF GROOVE.			SL.No.21 INCLUDED			IN SL.Nos.-14&19 RAWMATERIAL SIZE Ø63x110 REVISED TO Ø55x100 WITH REVISED MATL.CODE.			REFER DCP.800720		
REFER DCP:-800913											

REV	DATE	ALTERED
05	11.06.01	CHD & APPD
DRG.UPDATED AND REDRAWN.		
DCN: SB: 1298		

CAUTION: 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.



NOTES: -
1. FOR QUALITY REQUIREMENTS REFER APPLICABLE LATEST QUALITY PROCEDURE.

PART CODE : 160134080000

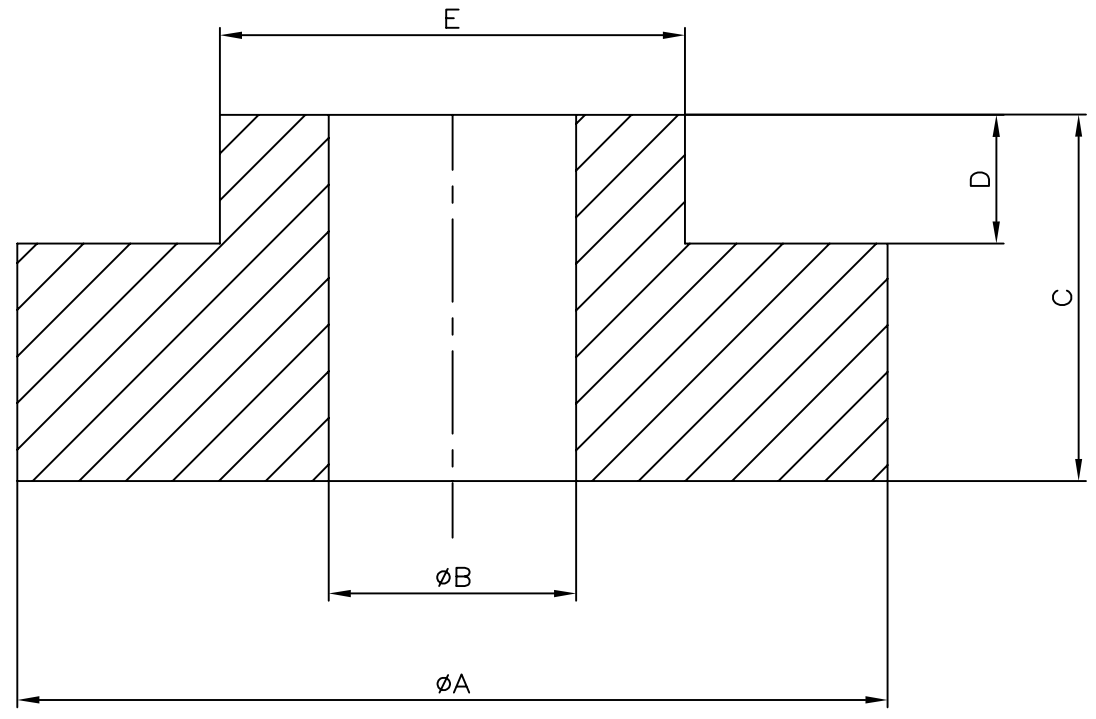
01		IS 318 Gr2			0.43				01	
NO OFF	DESCRIPTION	MATL CODE	MATL SPECN	HEAT TREATMENT	SCRAP SORT	NET WT (kg)	GROSS WT (kg)	DRAWING No	ITEM No	
BHARAT HEAVY ELECTRICALS LTD., UNIT: HIGH PRESSURE BOILER PLANT. TIRUCHIRAPALLI 620014.					DRN	NAME V.ARUMUGAM		SIGN	DATE	NO.OF VAR
					CHD	K.SRIDHARAN				
					APPD	S.NATARAJAN				
DEPT SB		SCALE	WEIGHT (KG).	REFERENCE INFORMATIONS					NO. OF ITEMS	
CODE 330		NTS	0.430	-						
TITLE					CARD CODE	DRAWING NO.			REV	
BUSHING (TRAVELLING CARRIAGE)					U 01	4-20-001-00077			05	

ALL DIMENSIONS ARE IN MILLIMETRES.
DURING MANUFACTURE REFER RELEVANT QCP/QP


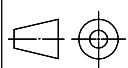
FOR TOLERANCES OF UNTOLERANCED DIMENSIONS

REV	DATE	ALTERED
		CHD & APPD

CAUTION: 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.



03	160134140000	IS 305 Gr AB1	86	25	27	9	57
02	160134050000	IS 305 Gr AB1	49	13	31	16	34
01	160134040000	IS 305 Gr AB1	84	17	27	9	47
VAR NO.	PART CODE	SPECIFICATION	phi A	phi B	C	D	E
			DIMENSION				

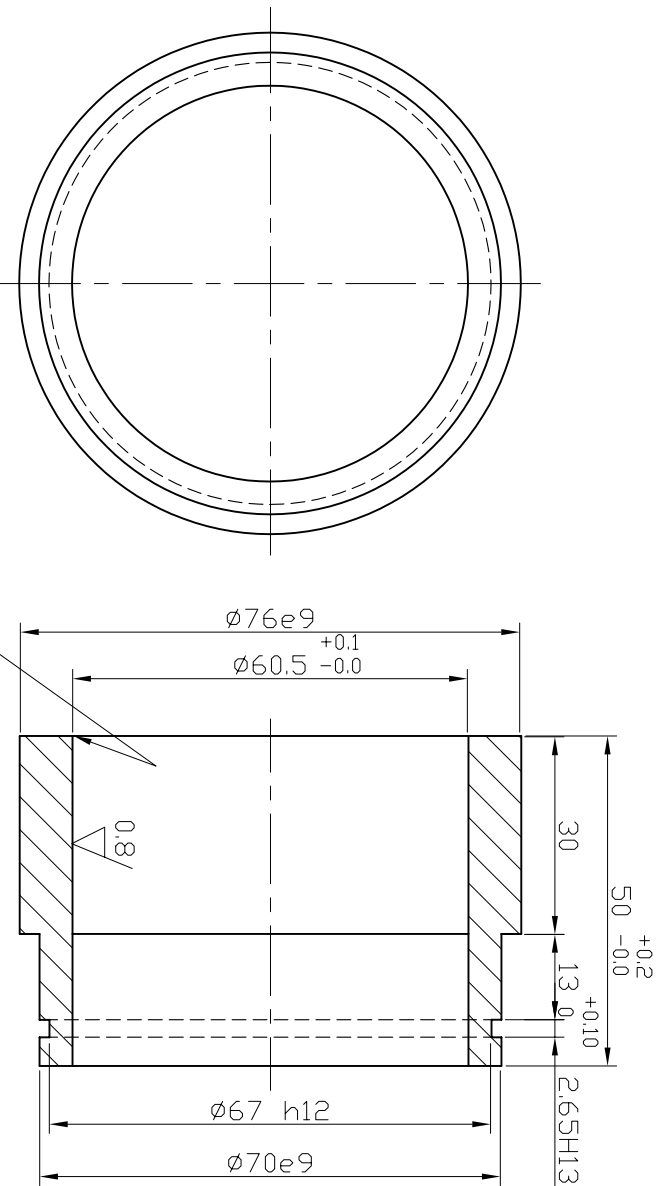
NO OFF	DESCRIPTION	MATL CODE	MATL SPECN	HEAT TREATMENT	SCRAP SORT	NET WT (kg)	GROSS WT (kg)	DRAWING No	ITEM No
	 BHARAT HEAVY ELECTRICALS LTD., UNIT: HIGH PRESSURE BOILER PLANT. TIRUCHIRAPALLI 620014. 365-122								
		DRN	S.MURUGA VALLI	S.M	SIGN	DATE	NO.OF VAR		
		CHD	K.SRIDHARAN	K.S		10.12.05			
		APPD	K.NAGARAJAN	K.N	10.12.05				
DEPT SB			SCALE N.T.S	WEIGHT (KG).	REFERENCE INFORMATIONS			NO. OF ITEMS	
CODE 330	TITLE GEAR BLANK CASTING (PROOF MACHINED)			CARD CODE U 01	DRAWING NO. 4-20-001-03122		REV 00		

FOR TOLERANCES OF UNTOLERANCED DIMENSIONS DURING MANUFACTURE REFER RELEVANT QCP/QP
ALL DIMENSIONS ARE IN MILLIMETRES.

REV	DATE	ALTERED	V.A
03	10.06.06	CHD & APPD	K.S
DRG. UPDATED AND REDRAWN.			
DCN NO: 800547 Dt.02.01.06.			

3.2 / 0.8 /

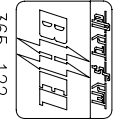
2.65 H13	+0.14 0.0
Ø67 h12	0.0 -0.3
Ø70 e9	-0.06 -0.134
Ø76 e9	-0.06 -0.134



CAUTION: 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.

PART CODE: 160133990000

D85/D50-L-60	160133990000	IS318 GR 2		0.65					
NO OFF	DESCRIPTION	MATL CODE	MATL SPECN	HEAT TREATMENT	SCRAP	NET	GROSS	DRAWING No	ITEM No
					SORT	WT (kg)	WT (kg)		
					NAME	SIGN	DATE	NO.OF VAR	
					DRN	V.A	10.06.06		
					CHD	K.S	10.06.06		
					APPD	S.N	10.06.06		



BHARAT HEAVY ELECTRICALS LTD.,
UNIT: HIGH PRESSURE BOILER PLANT.
TIRUCHIRAPALLI 620014.

365-122

DEPT VL	SCALE N.T.S	WEIGHT (KG). 0.65	REFERENCE INFORMATION	NO. OF ITEMS
CARD CODE 330				
TITLE GLAND	CARD CODE U 01	DRAWING NO. 4-20-201-00229	REV 03	

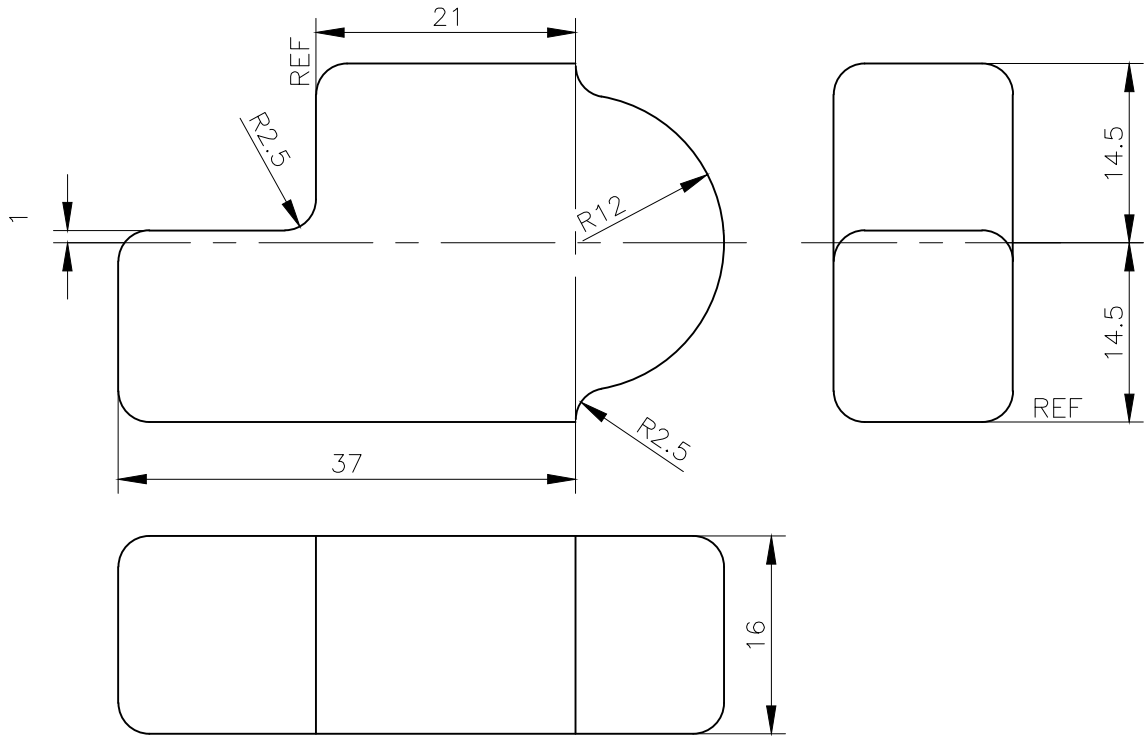
ALL DIMENSIONS ARE IN MILLIMETRES.

FOR TOLERANCES OF UNTOLERANCED DIMENSIONS DURING MANUFACTURE REFER RELEVANT QCP/QP

REV	DATE	ALTERED	J.S
02	06.01.12	CHD & APPD	K.S


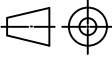
DRAWING CONVERTED AS CAD & UPDATED.

DCN:SB: 801294 / 5014784



NOTES: -

1. DIMENSIONAL DEVIATIONS FOR CASTING TO BE AS APPLICABLE FOR STEEL CASTING.
2. FOR QUALITY REQUIREMENTS REFER LATEST APPLICABLE QUALITY PROCEDURE.
3. CORNER RADII TO BE 1.5MM MAX.
4. FOR MACHING REFER DRG.NO.4-20-201-00182.

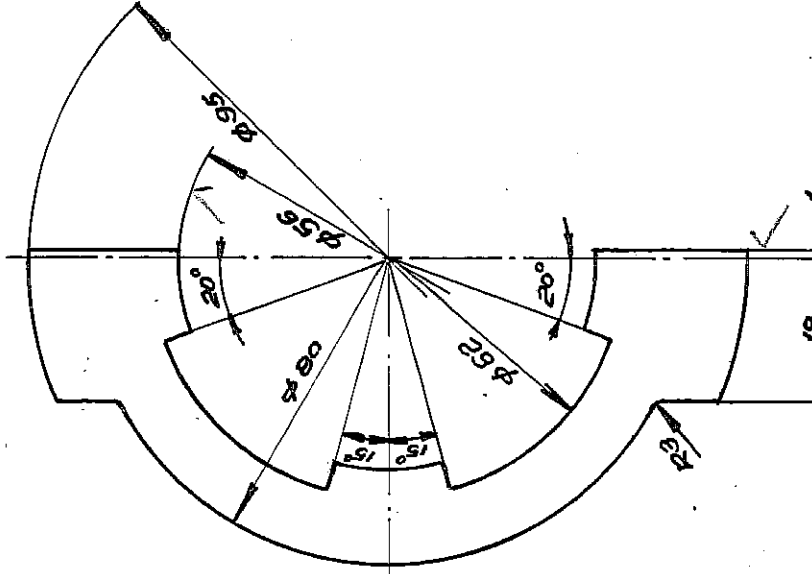
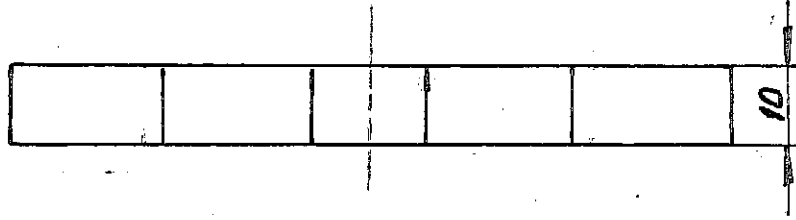
01		160062610000	IS 305 Gr.AB1				0.14			
NO OFF	DESCRIPTION	MATL CODE	MATL SPECN	HEAT TREATMENT	SCRAP SORT	NET WT (kg)	GROSS WT (kg)	DRAWING No	ITEM No	
 BHARAT HEAVY ELECTRICALS LTD., UNIT: HIGH PRESSURE BOILER PLANT. TIRUCHIRAPALLI 620014.						DRN	NAME	SIGN	DATE	NO.OF VAR
						CHD	J.SANKAR	J.S	06.01.12	
						APPD	K.SRIDHARAN	K.S	06.01.12	
DEPT SB	/		SCALE	WEIGHT (KG).	REFERENCE INFORMATIONS				NO. OF ITEMS	
CODE 330			NTS	0.14	—					
TITLE					CARD CODE	DRAWING NO.			REV	
ARM BRACKET CASTING					U 01	4-20-201-00710 02			02	

CAUTION: 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.

NOTE:

ALL DIMENSION IN MM. FOR UNTOLERANCED DIMENSIONS REFER APPLICABLE QUALITY PROCEDURES.

01	DATE	ALTERED BY
	8.1.01	APR
ZONE	15305 GRABI WAS	CHECKED & APPROVED
	ASTM B148 9A. NOTE 1 & 3 DELETED. NOTE ADDED.	
	DCN No SB 1293	



MICROFILMED ON
ROLL 022833 FRAME 2157

1. DIMENSIONAL BEHAVIORS FOR CASTING (SEE SPECIFICATION AS PER TABLE IN CASTER'S DRAWING) OF GSN-044-470.
2. FOR MACHINE DRG. REFER DRG. NO. 4-20-201-00179.
3. PROCESS: ~~ENE-CASTING~~.
4. \checkmark INDICATES THE SURFACES TO BE MACHINED FURTHER.

15	STYLE NO.	17	20	21	REF. DRG./BFS No.	34	MATERIAL CODE	56	57	A	COMP. GROUP	63	UNIT wt. (k.g)	68	70	No. OFF	75	76	20	DESCRIPTION/REMARKS
							15305 GRABI			C										CARD TYPE 2

DRAWN		SCALE		DATE	
CHECKED		APPROVED		TOTAL wt. (k.g)	
APPROVED		DATE		TYPE	
DATE		DATE		NEW/OLD DRG. No.	

CAUTION

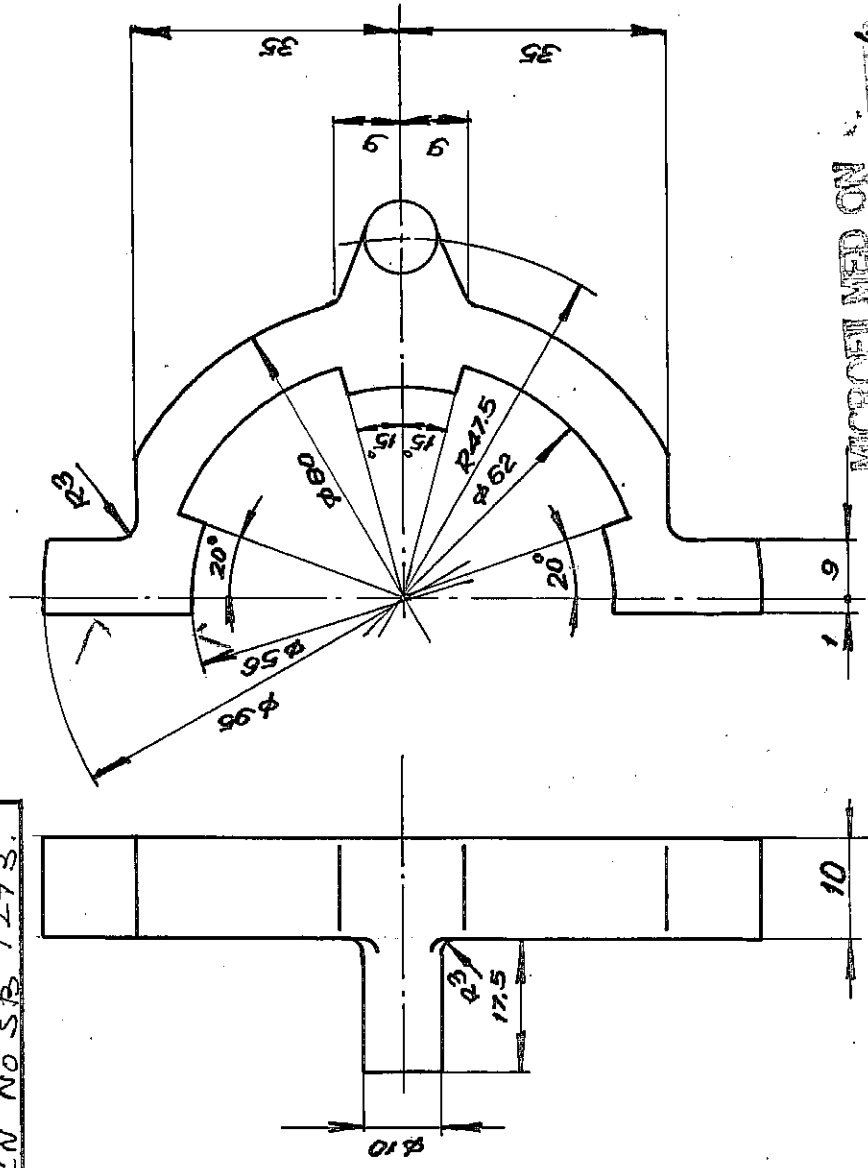
THE INFORMATION CONTAINED IN THIS DRAWING IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED, BOILER PLANT UNIT, TIRUCHY-620 014, AND SHALL NOT BE USED WITHOUT THEIR EXPRESS WRITTEN PERMISSION IN ANY FORM OR PART THEREOF FOR ANY OTHER PURPOSE THAN FOR WHICH IT IS SENT TO YOU.

CAM CASTING

CARD CODE	DRAWING No.	REVISION
U01	4-20-201-00737	01

01	DATE	ALTERED	Y. S. Kumar
ZONE	8/1/01	CHECKED	By: [Signature]
	IS 305 GR AB1 WAS ASTM B1489A. NOTE 1 & 3 DELETED. NOTE ADDED.		
	DCN NO S/B 1293.		

NOTE:- ALL DIMENSIONS IN MM. FOR UNTOLERANCED DIMENSIONS REFER APPLICABLE QUALITY PROCEDURES.



- 1) DIMENSIONAL DEVIATIONS FOR CASTING TO BE STRICTLY AS PER TABLE IV (DEGREE OF ACCURACY 0.3) OF IS 10442.
- 2) FOR MACHINE DRG. REFER DRG. NO. 4-20-201-00179.
- 3) PROCESS: DIE CASTING.
- 4) V INDICATES THE SURFACES TO BE MACHINED FURTHER.

15	ITEM No.	RVN	34	MATERIAL CODE	56	57	COMP. GROUP	63	UNIT wt. (kg)	68	75	76	20	DESCRIPTION/REMARKS
17	BPS	21	REF. DRG./BPS No.	16 006 260	IS 305 GR AB1	1		0	10					
20	STL													
41														

FIRST ANGLE		SCALE	DRAWN		CHECKED		APPROVED		DATE		TOTAL wt. (kg)		TYPE	
[Symbol]		[Symbol]	off. [Signature]		[Signature]		[Signature]		29 July, 1976		0.10		0.10	
ALL DIMENSIONS IN MILLIMETRES										NEW/OLD DRG. No.		DATE		
										29 July, 1976				

19 CARD TYPE 1
19 CARD TYPE 2

CAUTION

THE INFORMATION CONTAINED IN THIS DRAWING IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED, BOILER PLANT UNIT, THIRUCHY-620 014. AND SHALL NOT BE USED WITHOUT THEIR EXPRESS WRITTEN PERMISSION IN ANY FORM OR PART THEREOF FOR ANY OTHER PURPOSE THAN FOR WHICH IT IS SENT TO YOU.

CAVIT

CAM CASTING

CARD CODE U01

DRAWING No. 4-20-201-00738

REVISION 01

Product: **NON FERROUS CASTINGS (VALVES)**Document No.: **TDC:0:413**Rev. No.: **01**Effective date: **31/01/2001**

Page 1 of 2

Revision Record: Rev:00:01/07/94; Rev:01:Text rewritten, Cl.5.0 modified.

1.0 MATERIAL

Specification:ASTM:{Latest on date of Purchase Order (PO)}:

Monel "S" (Monel 505) : ASTM A494 Gr. M25S

Nickel Bronze : ASTM B584 C97800

Aluminium Bronze : IS 305 Gr. AB1

Stellite : G-Co65Cr27W6

Supernickron :

Additional Requirement:As listed below (supplementary to Specification)

Size, Qty.,Grade/Class: As per Purchase order & Drawing / Pattern.

2.0 CHEMICAL COMPOSITION & PROCESS

Chemical composition requirements are as below:

Element	Monel S	Al. Bronze	Ni.Bronze	Supernickron	Stellite
C	0.15 max.	--	--	0.35 max.	0.90-1.40
Mn	1.50 max.	1.0 max.	1.0 max.	1.0 max.	1.0 max.
Al	--	8.5-10.5	0.005 max.	--	--
Zn	--	0.5 max.	1.0-4.0	--	--
Sn	--	0.1 max.	4.0-5.5	--	--
Pb	--	0.05 max.	1.0-2.5	--	--
Mg	--	0.05 max.	--	--	--
Si	3.50-4.50	0.25 max.	0.15 max.	5.0 max.	1.5 max.
P	0.03 max.	--	0.05 max.	--	--
S	0.03 max.	--	0.08 max.	--	--
Fe	2.50 max.	1.5-3.5	1.5 max.	10.0 max.	3.0 max.
Ni	60 min.	1.0 max.	24 - 27	65 - 70	3.0 max.
Cu	27 - 33	Remainder	64 - 67	10 - 20	--
Cr	--	--	--	5.0 max.	27 - 31
Mo	--	--	--	--	1.5 max.
W	--	--	--	--	3.5-5.5
Co	--	--	--	--	Remainder

The total of Sn, Pb, Si & Mg shall not exceed 0.30% in the case of Aluminium bronze.

Aluminium bronze castings shall be made in chill moulds only. Stellite castings to be manufactured by investment casting (Lost wax) process.

3.0 DIMENSIONS AND TOLERANCES

Tolerances as per Drawing. Untoleranced dimensions for valve components: VL:STDC:023(latest).

4.0 HEAT TREATMENT (HT)

Monel castings: Solution annealed at 870 deg.C / 30 min / Oil quench. Additionally the test bars to be age hardened at 560 deg.C / 2 hours / air cool.

Supernickron castings: Age hardening to be done in electric furnace at 640 deg.C for a period of not less than 4 hours and then cooled in furnace or in air.

Aluminium bronze, Nickel bronze and Stellite castings can be supplied in the as cast condition, without heat treatment.

5.0 MECHANICAL TESTS

Test bars to be cast integral with the casting or separately. If cast separately, they shall be cast at the same time, same mould type as the castings & from the same ladle. A metal strip with heat number stamped to be fused with the test bar during casting, to maintain traceability. The test bars to be heat treated together with the castings they represent. If 1 casting is made from more than 1 heat, separate test bars for each cast to be poured & all test bars shall satisfy the requirements.

Product: **NON FERROUS CASTINGS (VALVES)**Document No.: **TDC:0:413**Rev. No.: **01**Effective date: **31/01/2001**

Page 2 of 2

Following tests to be conducted per heat / HT batch, as per ASTM A370.

Acceptance as shown:

Test	Monel S	Al. Bronze	Ni. Bronze	Supernickron	Stellite
Hardness	32-42 HRC	135 BHN min.	--	320-380 BHN	38-42 HRC
Tensile strength	--	55 Kg/sq.mm (min)	35.2 Kg/sq.mm (min)	60 Kg/sq.mm (min)	--
0.2% proof strength	--	21 Kg/sq.mm (min)	15.5 Kg/sq.mm (min) (05% proof)	--	--
% Elongation	--	18 min.	10 min.	--	--

6.0 FETTLING, DRESSING & CLEANING

Dressing of castings, free from risers, ingates, notches, under cuts, deep marks etc. Gas cutting if any to be done before HT. Castings to be sand/shot blasted both inside and outside for removal of fused sand, scales, etc. Fused wires, parting line fins, chills etc. to be removed by grinding. Visual inspection of castings for surface quality as per MSS-SP-55. Items to be proof machined wherever required.

7.0 NON DESTRUCTIVE TESTING (NDT) AFTER HEAT TREATMENT

Castings to be free from surface and internal defects like porosity, shrinkage, sand inclusion, crack, cold shut and other harmful defects.

Liquid Penetrant Inspection (LPI): As per ASTM E165 on all castings.

Acceptance: (ANSI B16.34): Cracks are not permitted. For rounded indications (circular or elliptical with length < 3 times width), 4 or more indications in a line separated by 3mm or less edge to edge are not acceptable. Maximum allowable diameter of the indication: 5mm for materials upto 13mm thick & 8mm for materials above 13mm thick.

8.0 REPAIR

Repairs involving fusion welding is prohibited.

9.0 MARKING AND PACKING

Details to be marked on each casting, using low stress stamps / etching / engraving:

1. Foundry code, 2. Specification, grade ("SINK" in the case of supernickron) & Melt number,
2. Other details as per drawing.

10.0 INSPECTION AND CERTIFICATION

Test certificate for each product with following details shall accompany the product & shall be countersigned by inspection agency nominated by BHEL, if specified in PO.

1. Purchase Order No. (BHEL), TDC No., Drawing & Test certificate number.
2. Specification and Grade with applicable year of code, Heat Number, Quantity & Size
3. Melting & Casting process, Chemistry including incidental elements - Heat wise.
4. Heat treatment details of the material and test bars.
5. Mechanical test results, NDE test results with reference & acceptance standard.
6. Dimensional Inspection Report where applicable.

11.0 AUDIT CHECKS AT BHEL

BHEL reserves the right to carry out audit checks for chemistry, HT condition, mechanical test and NDT on representative test bars or job. Items found defective during check or subsequent processing at BHEL are liable for rejection..

S.Lakshmi
Prepared

R.Sasikumar(QA)
Revised

S.Kumar(Engg)

K.Rengachari
Approved