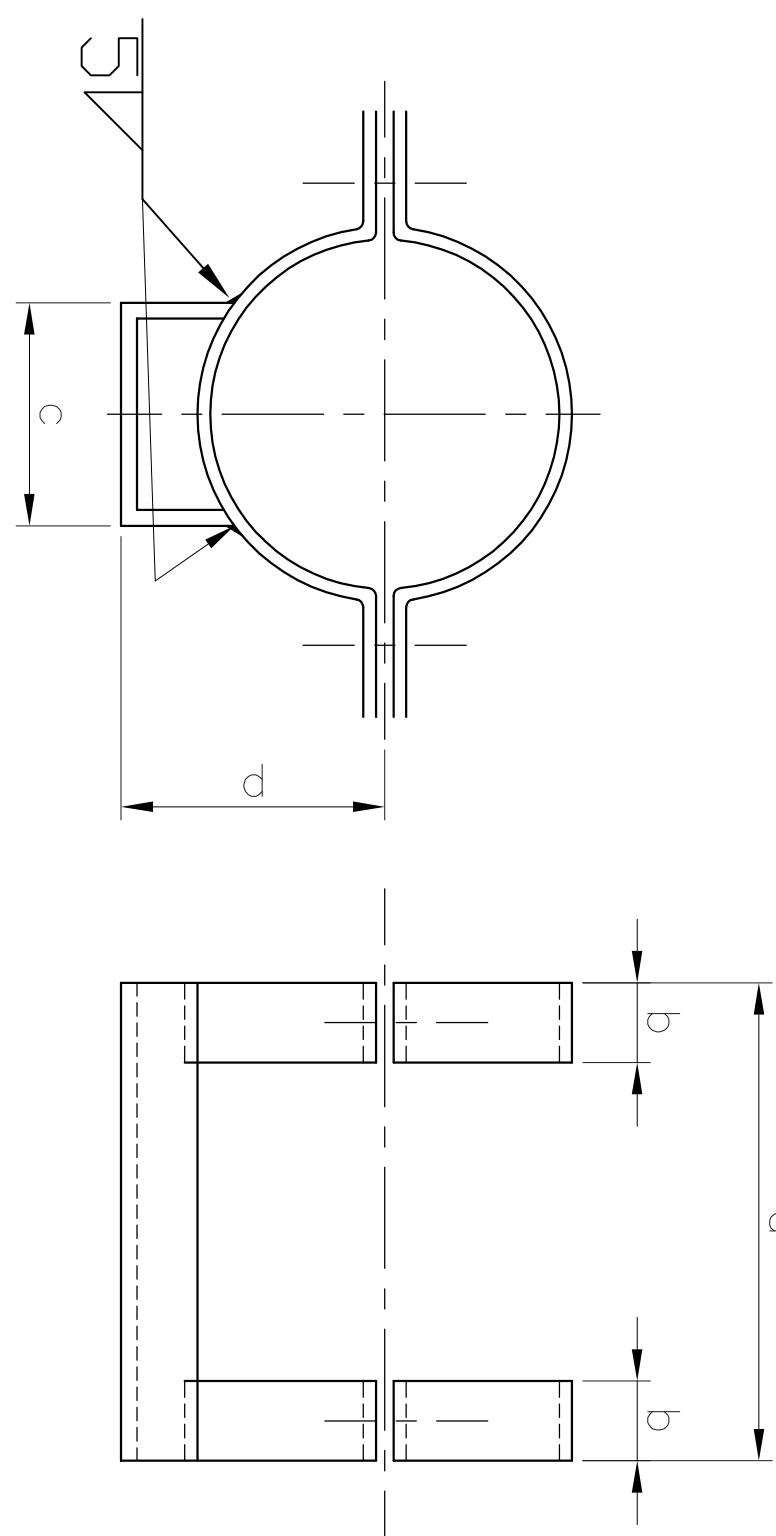
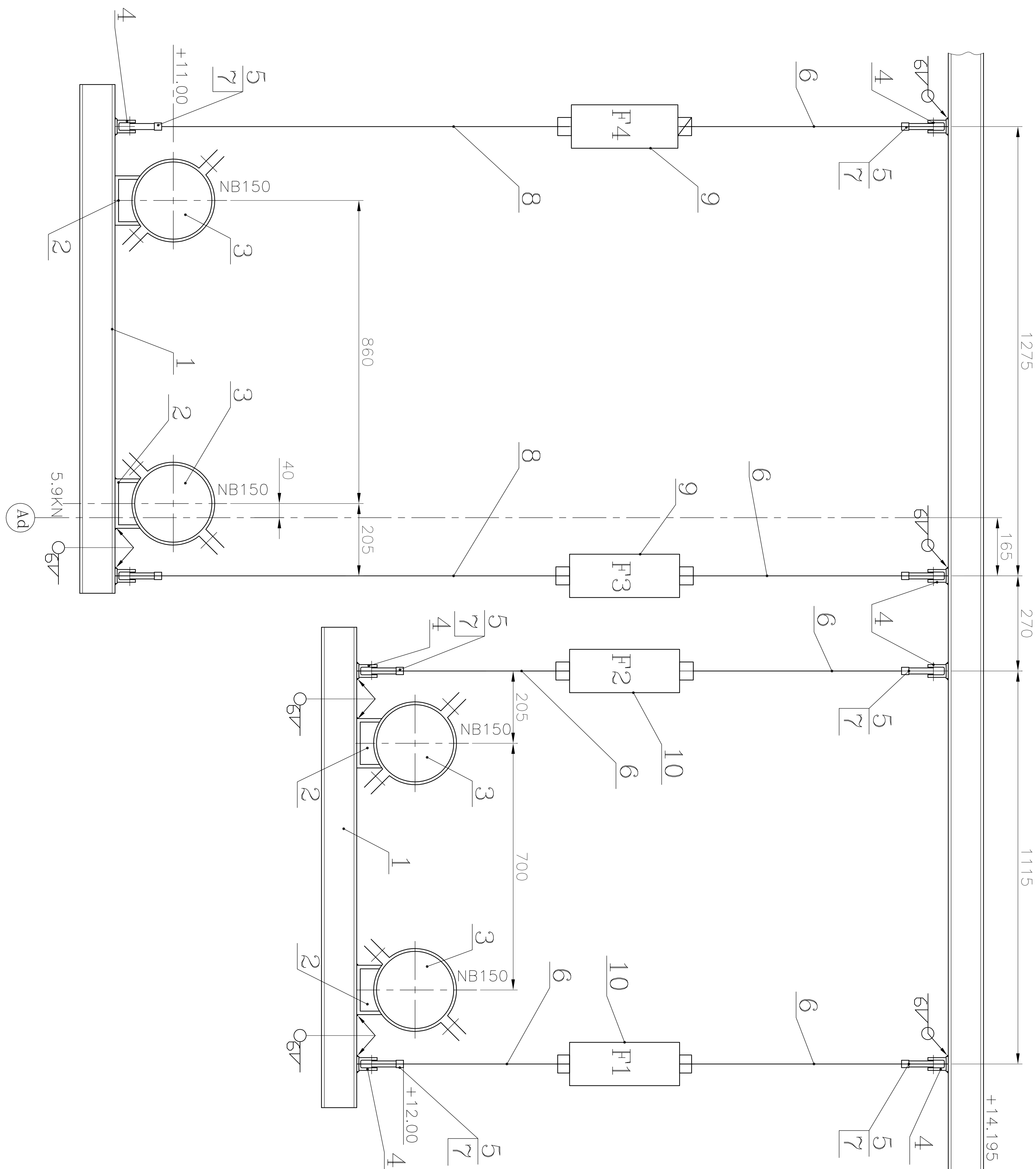


1. ALL THE BUTT JOINTS TO BE AS PER HW 0620.599.
2. QUALITY OF WELD SEAM TO BE AS PER 0620.039 BS/BK.
3. TEST SCOPE AS PER HW 0650.139 EXAMINATION GR.4.
4. IDENTIFICATION AS PER HW 0400.397.
5. ITEMS AS PER BILL OF MATERIAL ARE TO BE SUPPLIED LOOSE
6. ALL ASSEMBLY & WELDING WORK TO BE DONE AT SITE.
7. DESIGN OF THE SUPPORT IS FOR THE GUIDANCE OF SITE MODIFICATIONS CAN BE DONE TO SUIT SITE CONVENIENCE.



ITEM	DESCRIPTION	DRAWING	VAR	QTY	MATERIAL SPEC	C	UNIT WEIGHT
010	SPRING HANGER	4-150--00-01199	00	2	W66415002450		13.500
009	SPRING HANGER	4-150--00-01198	00	2	W66415002425		6.500
008	TEE ROD M20X200	4-150--00-01176	00	2	W66415002281		5.600
007	TURN BUCKLE M20	4-150--00-01103	04	8	W66415001434		0.800
006	THREADED ROD M20X15	4-150--00-01131	02	8	W66415001913		2.080
005	ECE BOL M20	4-150--00-01099	04	8	W67415000099		0.300
000	BEAM ATTACHMENT M20	4-150--00-01101	04	8	W66415001469		1.800
003	PIPE CLAMP NB150	2-150--00-01026	10	1	W66415001884		2.400
002	CHANNEL ISMC 150X75			1.2M	IS200C2 E250BR		16.800
001	PIPE JOINT BLANK			3M	IS200C2 E250BR		201.400
000	ITEM NO						

ITEM	DESCRIPTION	DRAWING	VAR	QTY	MATERIAL SPEC	C	UNIT WEIGHT
010	SPRING HANGER	4-150--00-01199	00	2	W66415002450		13.500
009	SPRING HANGER	4-150--00-01198	00	2	W66415002425		6.500
008	TEE ROD M20X200	4-150--00-01176	00	2	W66415002281		5.600
007	TURN BUCKLE M20	4-150--00-01103	04	8	W66415001434		0.800
006	THREADED ROD M20X15	4-150--00-01131	02	8	W66415001913		2.080
005	ECE BOL M20	4-150--00-01099	04	8	W67415000099		0.300
000	BEAM ATTACHMENT M20	4-150--00-01101	04	8	W66415001469		1.800
003	PIPE CLAMP NB150	2-150--00-01026	10	1	W66415001884		2.400
002	CHANNEL ISMC 150X75			1.2M	IS200C2 E250BR		16.800
001	PIPE JOINT BLANK			3M	IS200C2 E250BR		201.400
000	ITEM NO						



Et1-19255 INVENTORY NO.	10/2/97 SIGN & DATE	REF. DRG NO.
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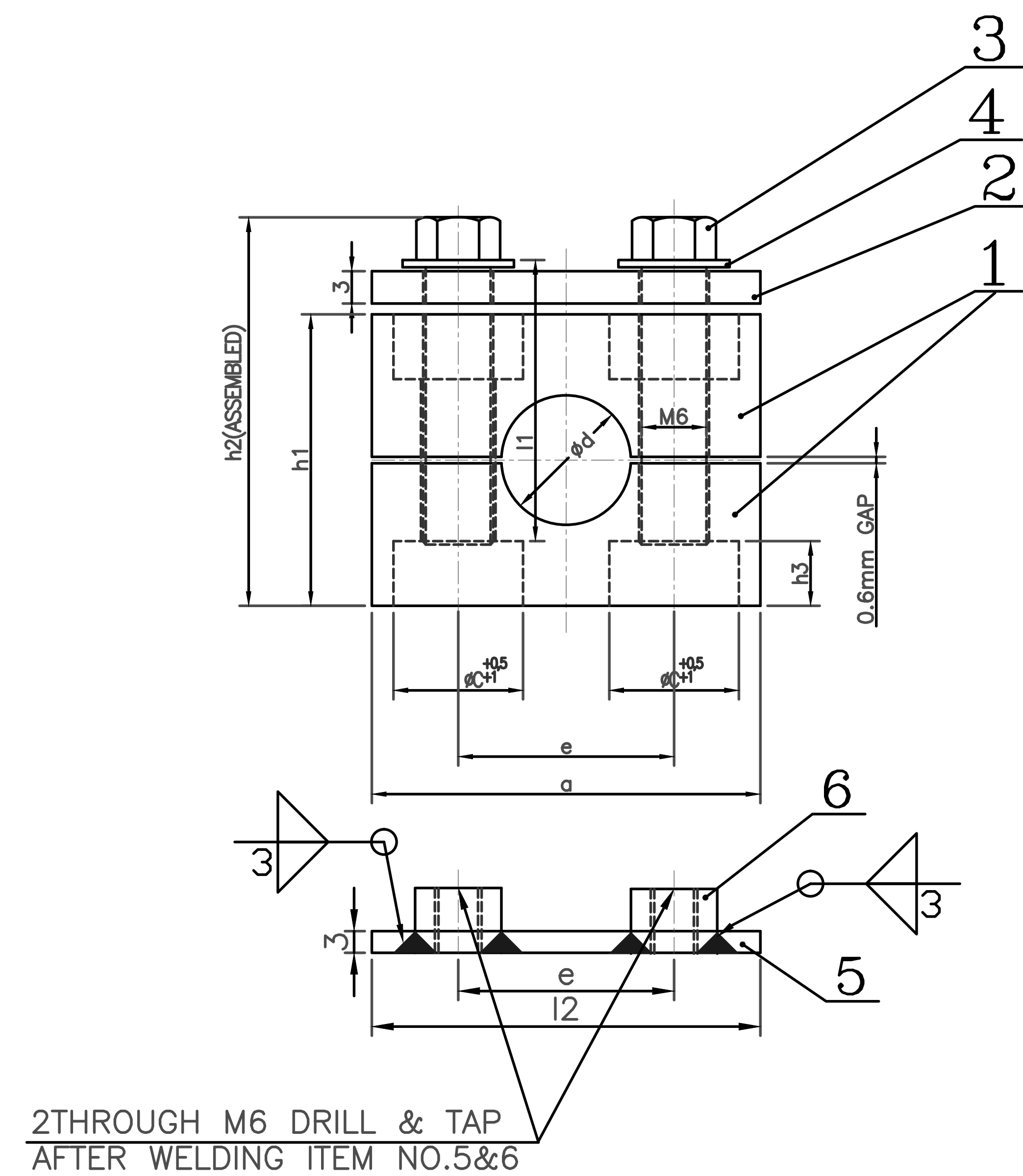
SIZE A1

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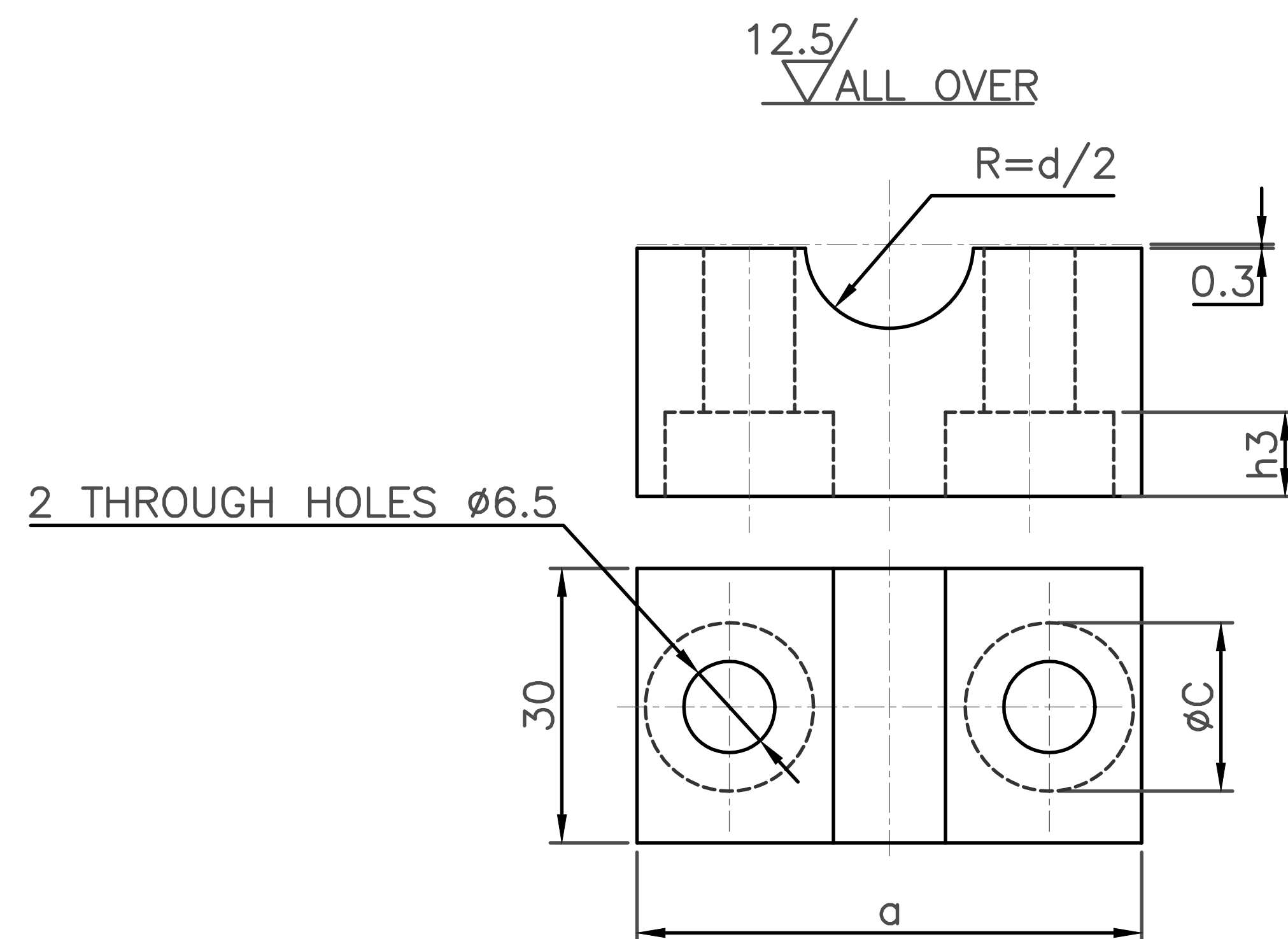
Et1-16322 INVENTORY NO.	22/8/92 SIGN & DATE	REF. DRG NO.
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22/8/92
SIGN & DATE

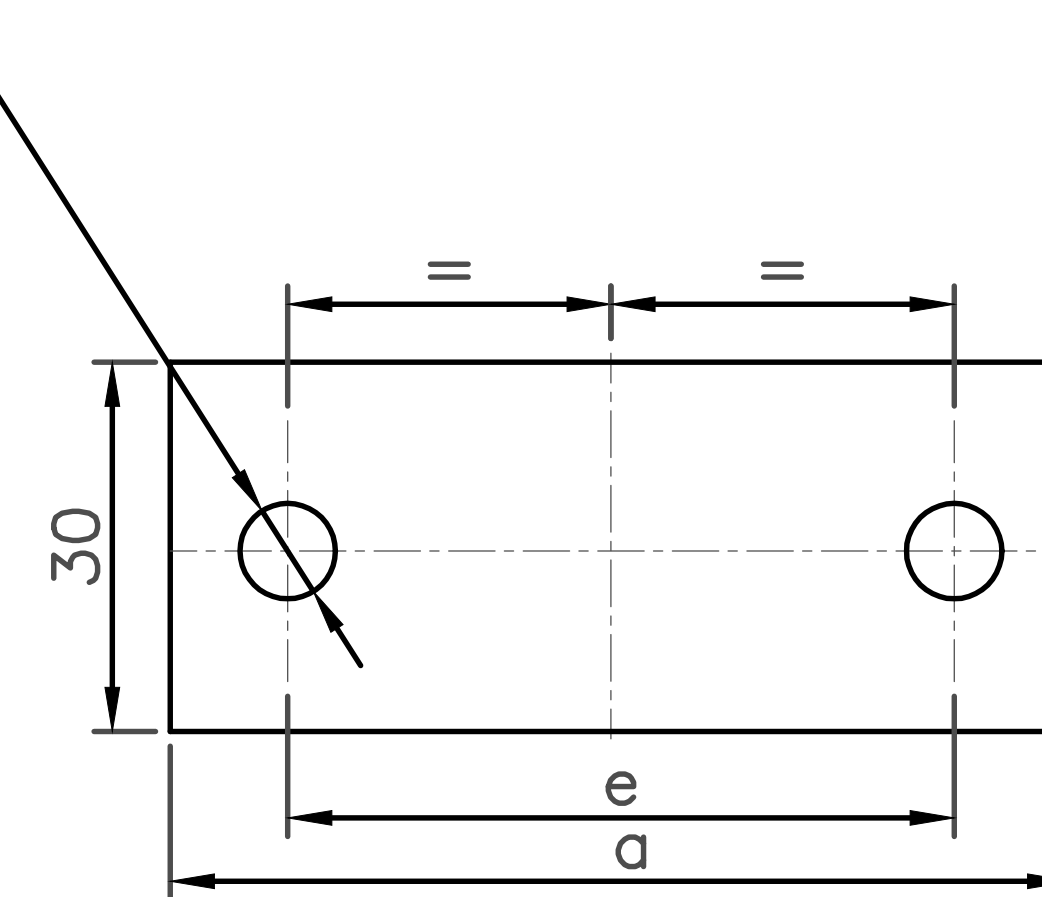
Et1-16322
INVENTORY NO.



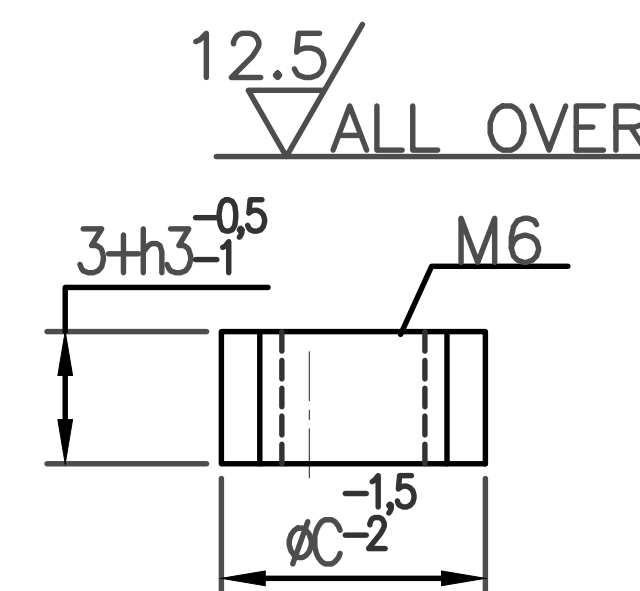
DETAILS OF ITEM NO.-1



DETAILS OF ITEM NO.-2



DETAILS OF ITEM NO.-6



VAR	d	NB	a	e	h1	h2	l1	l2	c	h3	Wt. Kg.	MATERIAL CODE
00	12	6	36	20	27	36	30	54	12	5	0.10	W96415001701
01	13.5	8	42	26	33	43	35	62	12	8	0.12	W96415001710
02	17.2	10	42	26	33	43	35	62	12	8	0.12	W96415001728
03	21.3	12	50	33	35	45	40	69	12	8	0.13	W96415001736
04	26.9	15	59	40	42	52	45	76	15	12	0.16	W96415001744
05	33.7	25	72	52	58	68	60	88	15	12	0.22	W96415001752
06	42.4	32	72	52	58	68	60	88	15	12	0.22	W96415001760
07	48.3	40	86	66	66	82	60	110	15	12	0.26	W96415001779

1. PIPE CLAMPS SHALL BE SUPPLIED IN ASSEMBLED CONDITION.
2. IDENTIFICATION SHALL BE DONE BY ATTACHING A TAG.
3. FOR MATERIAL CODE REFER VARIANT TABLE.
4. MATERIAL OF CLIP ITEM NO.1 SHALL BE POLYAMIDE.

006	NUT	SEE DETAIL			STEEL A8.8	01	--
005	SUPPORT PLATE L2X30	-			CS-IS2062E250BR	01	--
004	WASHER M6	-			CS-IS2062E250BR	01	--
003	BOLT HEX.M6XL1	SEE DETAIL			STEEL A8.8	01	--
002	COVER PLATE	SEE DETAIL			CS-IS2062E250BR	01	--
001	CLIP	SEE DETAIL			POLYAMIDE		--
ITEM NO.	DESCRIPTION	DRAWING	THIS	VAR	MATERIAL CODE MATERIAL SPEC.	C	UNIT WEIGHT

			CBOM NO. 0-150-00-01125		STATUS OF DRG.		TYPE OF PRODUCT OR NAME OF CUSTOMER/ PROJECT							
GRADE OF UNTOL. DIM.:—			AGREED DEPT. W.T	NAME ROY	SIGN sd/-	DATE 3.2.92								
M/CG— 4 /C/ M / F AA 0230208							 BHARAT HEAVY ELECTRICALS LTD. HARDWAR		NAME		SIGN	DATE	NO.OF VAR.	
WELDING— A / B / C / D —AA0621104									DRN	KAPOOR	sd/-	19.1.92		
GAS CUTTING T3 AA0621101									CHD	K.R.G	sd/-	19.1.92		
REV.	DATE	ALTERED CHECKED	REV.	DATE 04.06.18	ALTERED KM CHECKED MA	DEPT. EME			SCALE N.T.S	WEIGHT(Kg.) SEE TABLE	REF. TO ASSY. DRG. 0-150-00-01125		ITEM NO.	NO.OF ITEMS
			REVISION MARKED			CODE 4133								
						PIPE CLAMP				DRAWING NO. 2-150-00-01023				
										SHEET NO. 01		NO.OF SHEETS 01		

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KUN 633.03
REF. DRG NO.

22/8/92
SIGN & DATE

Et1-16321
INVENTORY NO.

2-150-00-01024
DRAWING NO.

A
B
C
D
E
F

8

7

6

5

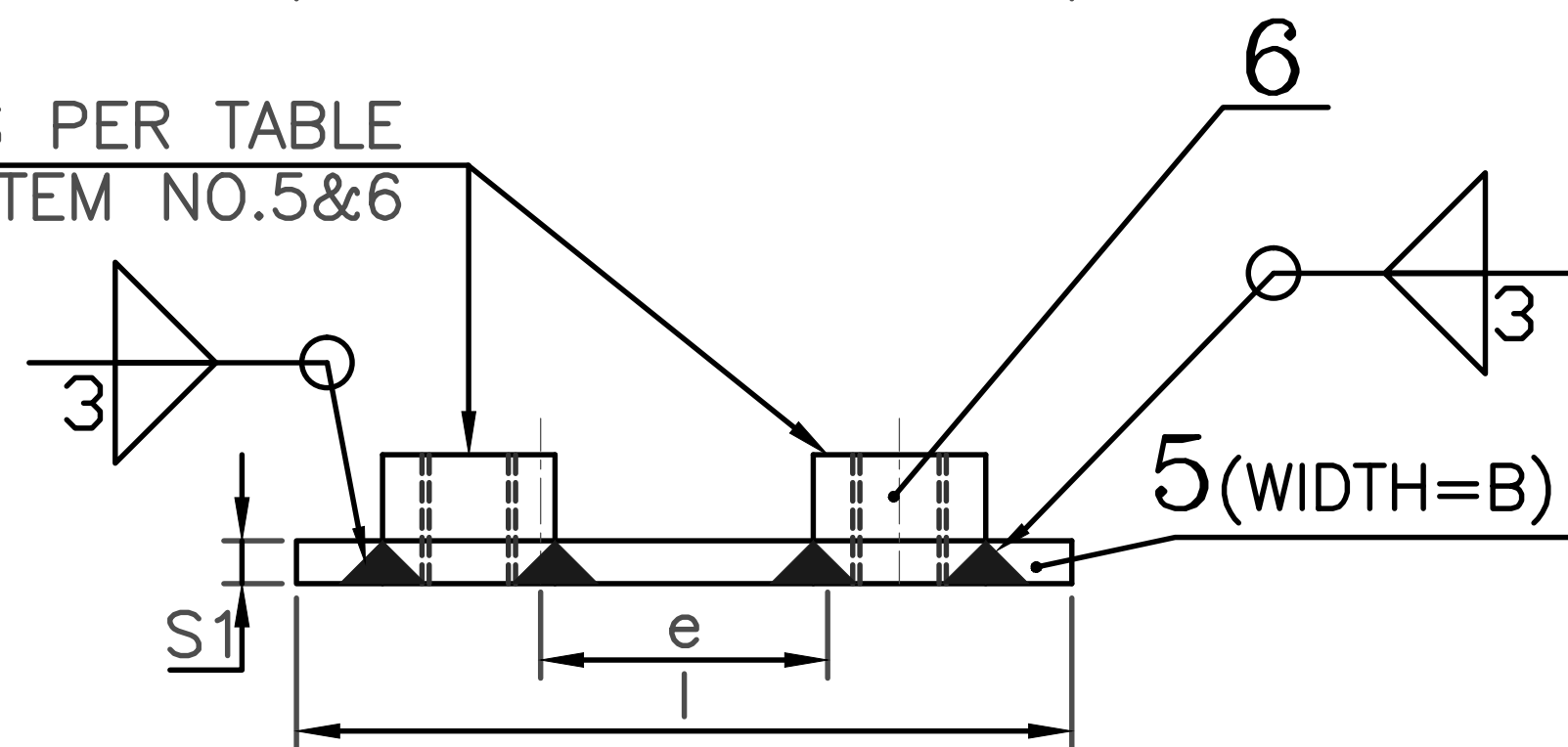
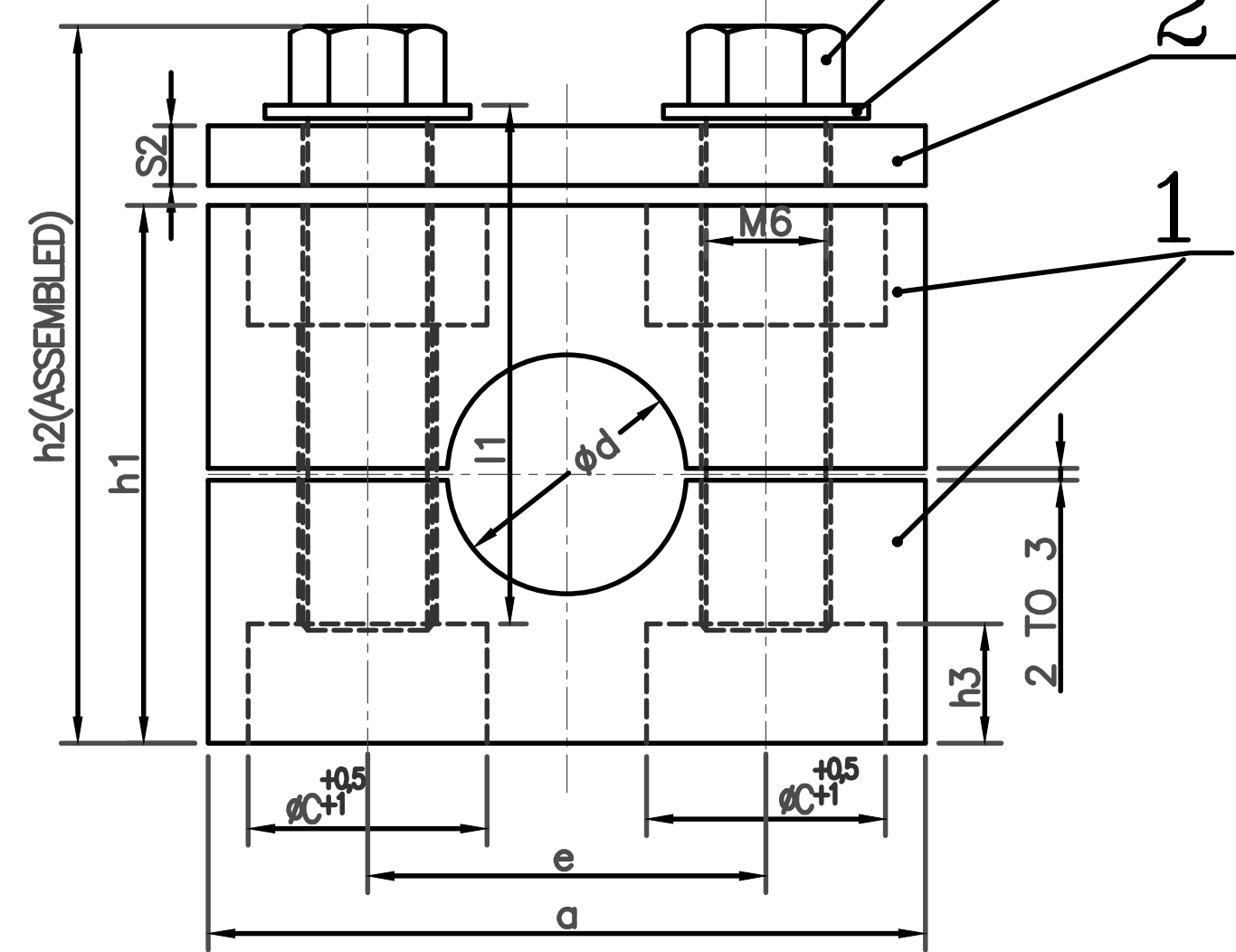
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3

DETAILS OF ITEM NO.-1

2THROUGH M10 OR M5 AS PER TABLE
AND TAP AFTER WELDING ITEM NO.5&6

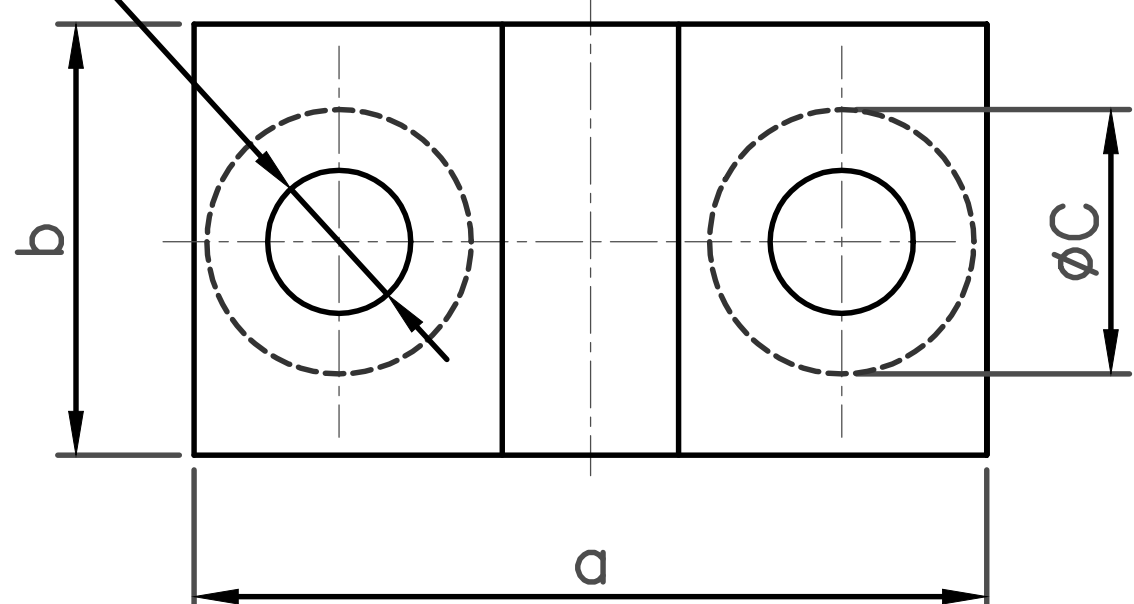
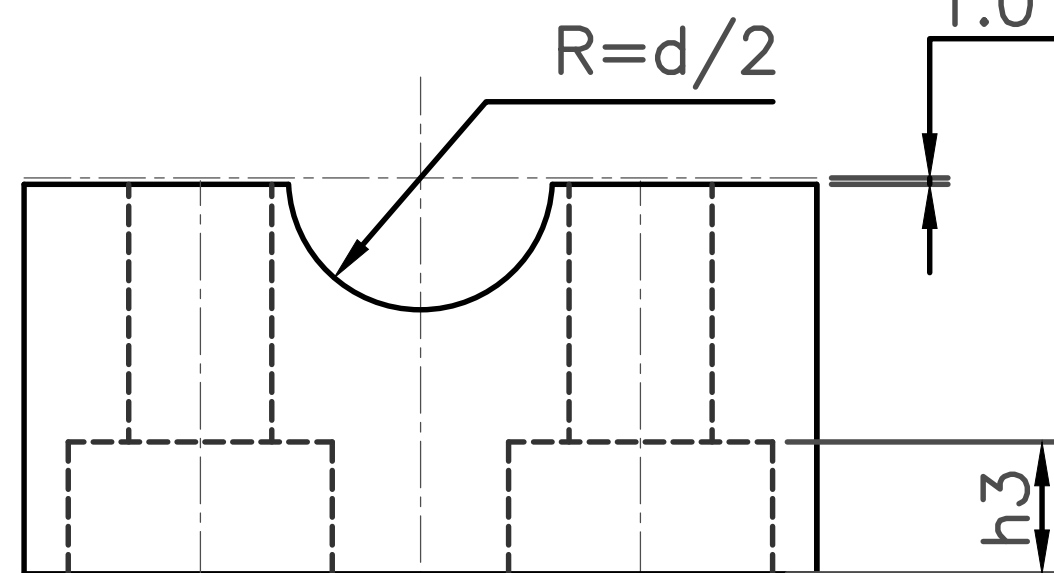
2 THROUGH HOLES $\phi d1$



12.5/
▽ALL OVER

R=d/2

1.0 TO 1.5



3

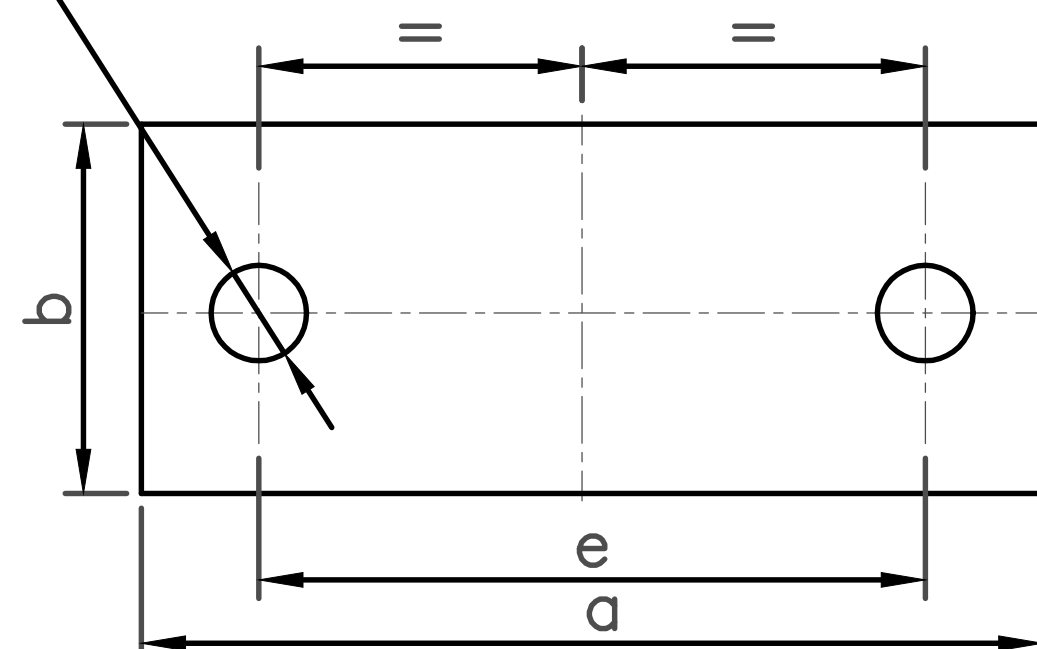
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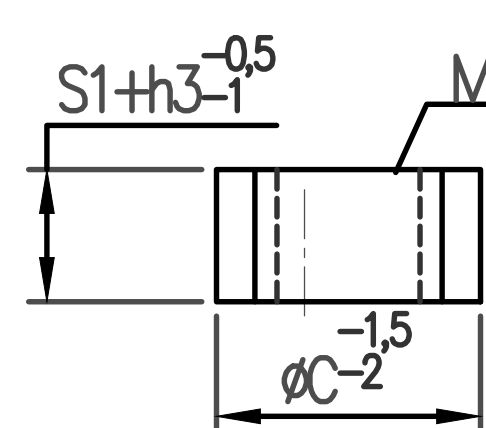
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2 THROUGH HOLES $\phi d1$

DETAILS OF ITEM NO.-2



12.5/
▽ALL OVER



M6 OR M12 AS PER TABLE

DETAILS OF ITEM NO.-6

VARIANT TABLE

VAR	b	d	PIPE NB	a	e	h1	h2	d1	l	c	h3	Wt. Kg.	MATERIAL CODE	S1	S2	BOLT SIZE
00	30	12	6	55	33	32	48	10.5	73	18	12	0.34	W96415001617	8	8	M10X45
01	30	13.5	8	55	33	32	48	10.5	73	18	12	0.34	W96415001625	8	8	"
02	30	17.2	10	55	33	32	48	10.5	73	18	12	0.34	W96415001633	8	8	"
03	30	21.3	15	70	45	48	64	10.5	85	20	15	0.44	W96415001641	8	8	M10X60
04	30	26.9	20	70	45	48	64	10.5	85	20	15	0.44	W96415001655	8	8	"
05	30	33.7	25	84	60	60	76	10.5	100	20	15	0.54	W96415001663	8	8	M10X70
06	30	42.4	32	84	60	60	76	10.5	100	20	15	0.54	W96415001671	8	8	"
07	45	48.3	40	115	90.5	90	111	13	140	25	20	1.36	W96415001680	10	10	M12X100
08	45	60.3	50	115	90.5	90	111	13	140	25	20	1.31	W96415001698	10	10	"

TECHNICAL REQUIREMENTS

- PIPE CLAMPS SHALL BE SUPPLIED IN ASSEMBLED CONDITION.
- IDENTIFICATION SHALL BE DONE BY ATTACHING A TAG.
- FOR MATERIAL CODE REFER VARIANT TABLE.
- MATERIAL OF CLIP ITEM NO.1 SHALL BE POLYAMIDE.

006	NUT	SEE DETAIL			STEEL A8.8	01		--
005	SUPPORT PLATE	-			CS-IS2062E250BR	01		--
004	WASHER	-			CS-IS2062E250BR	01		--
003	BOLT HEX.M6XL1	SEE DETAIL			STEEL A8.8	01		--
002	COVER PLATE	SEE DETAIL			CS-IS2062E250BR	01		--
001	CLIP	SEE DETAIL			POLYAMIDE			--
ITEM NO.	DECEIPTION	DRAWING	1/2	VAR	MATERIAL CODE	A	UNIT WEIGHT	
					MATERIAL SPEC.	C		

GRADE OF UNTOL. DIM.:--
M/CG- ~~4~~/C/~~M~~/~~F~~ AA 0230208
WELDING-~~A~~/~~B~~/C/~~D~~-AA621104
GAS CUTTING-~~T3~~/AA0621101

REV. DATE ALTERED
CHECKED

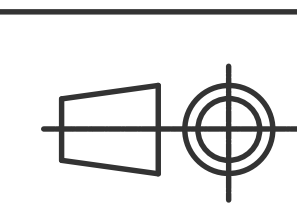
CBOM NO.
0-150-00-01125
STATUS OF DRG.
AGREED DEPT. NAME SIGN DATE
WTK SC GOYAL sd/- 23.7.92

REV. DATE ALTERED KM
01 04.06.18 CHECKED MA
REVISION MARKED

TYPE OF PRODUCT
OR
NAME OF CUSTOMER/ PROJECT

BHARAT HEAVY ELECTRICALS LTD.
HARDWAR

DEPT. EME
CODE 4133



SCALE
N.T.S

WEIGHT(Kg.)
SEE TABLE

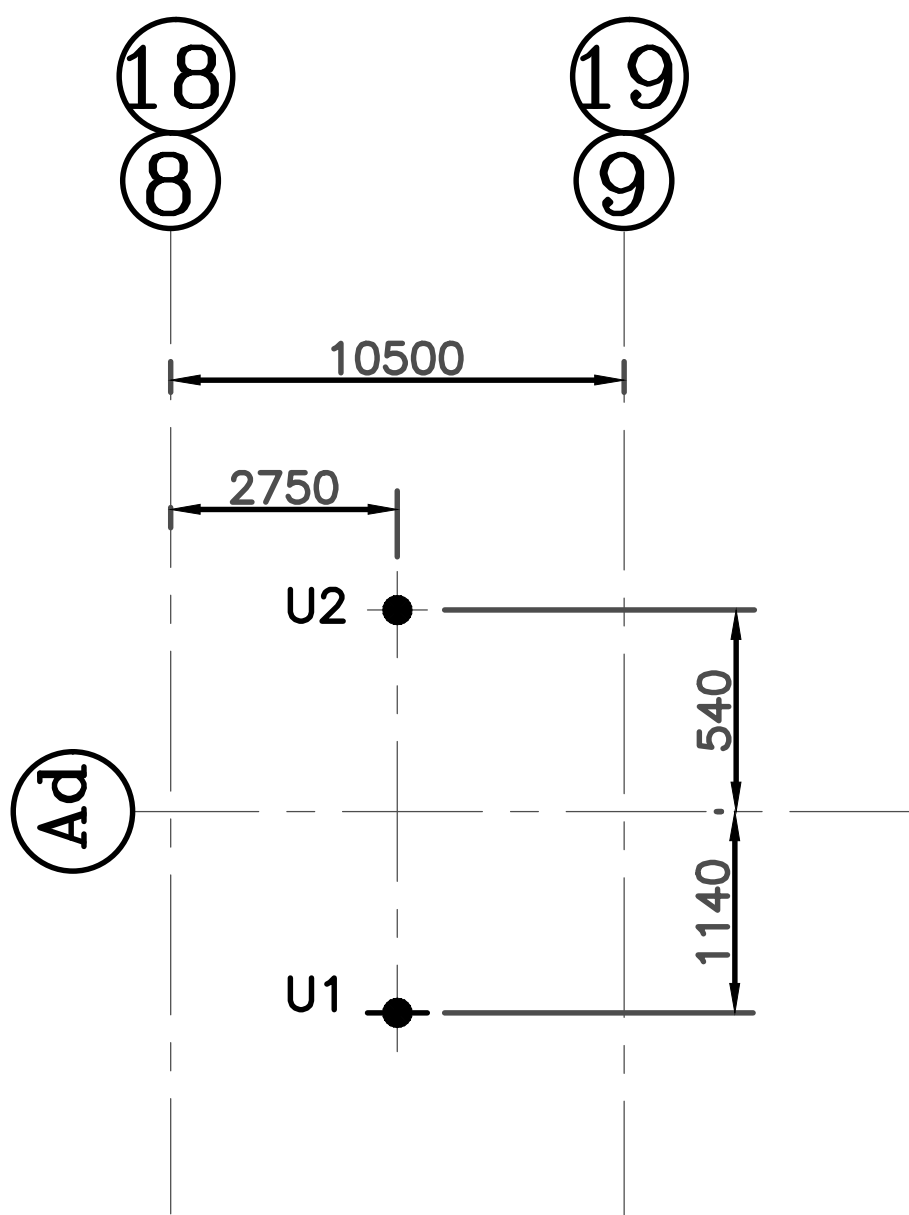
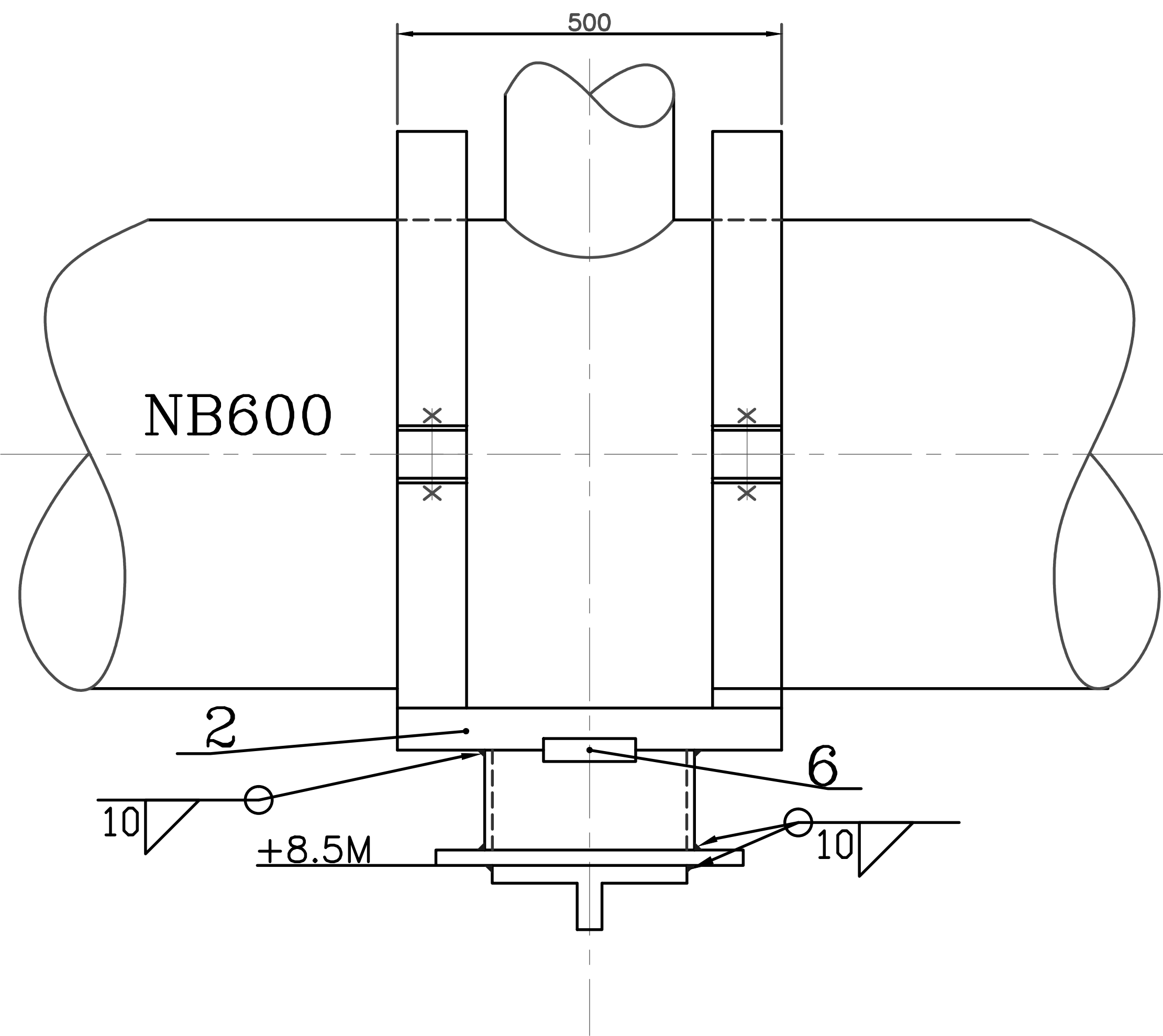
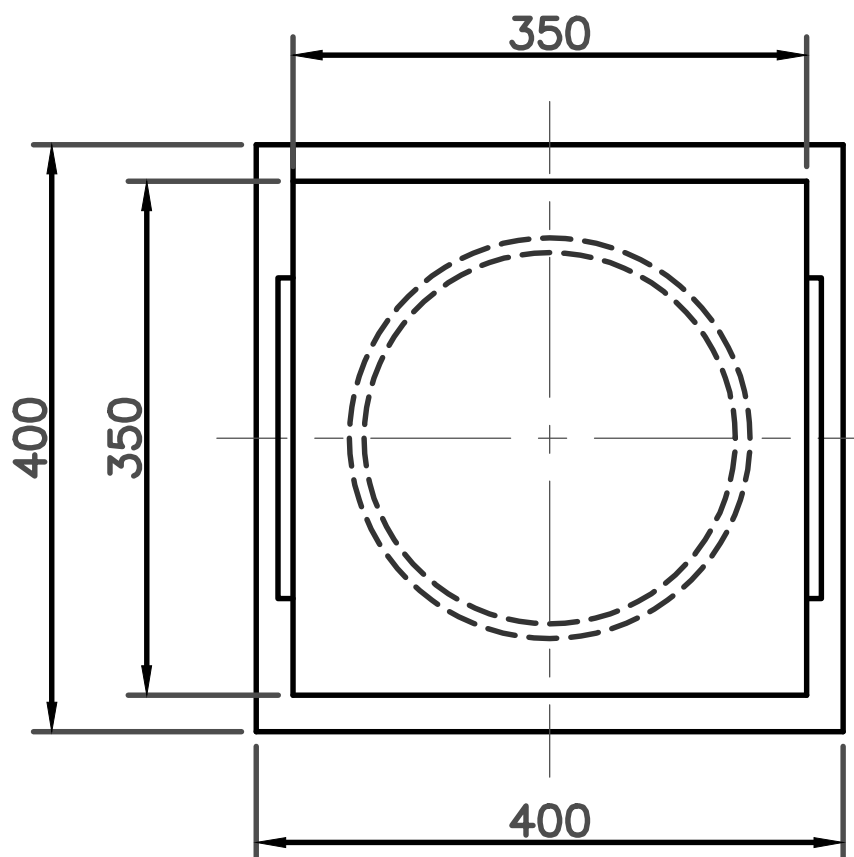
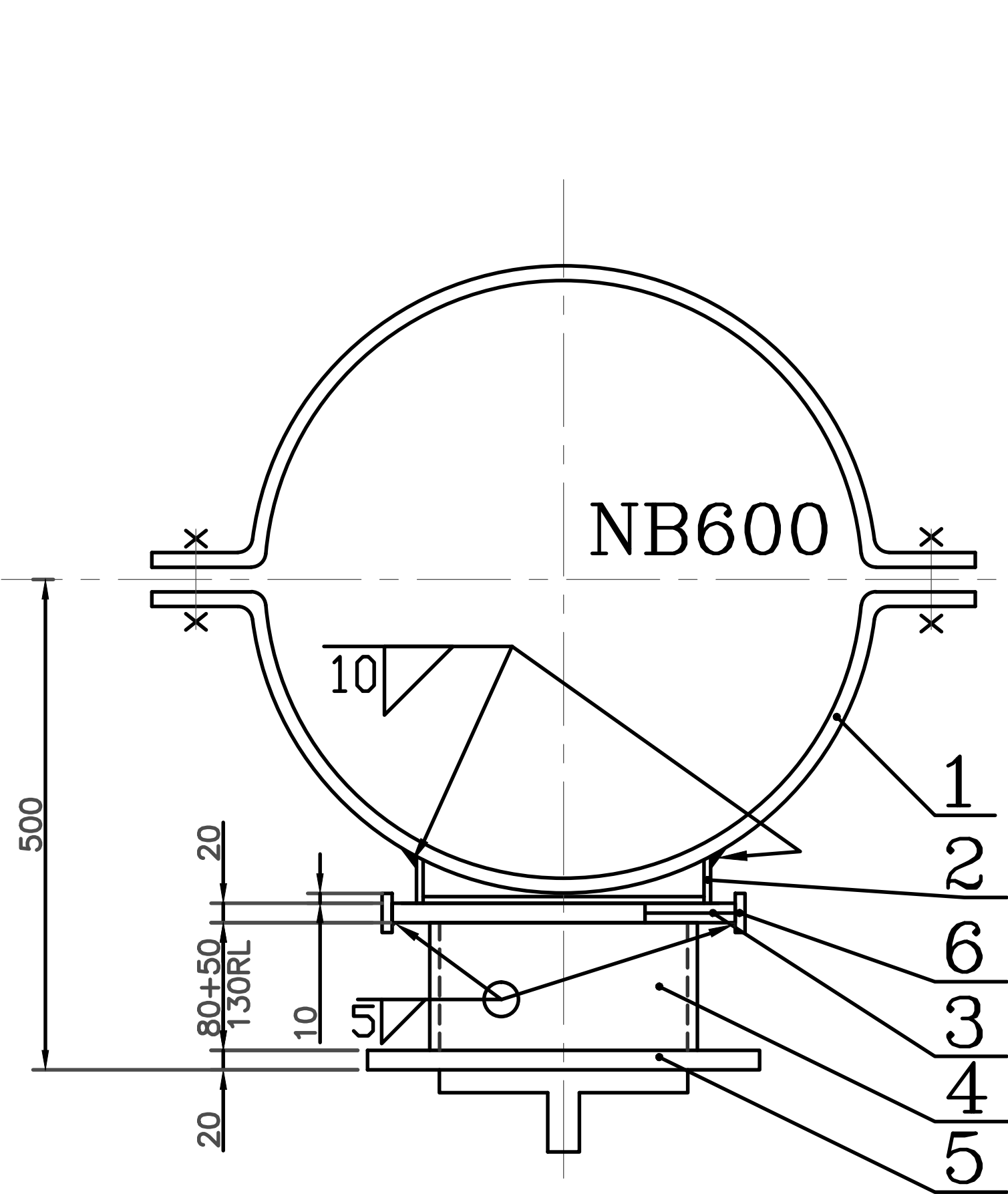
NAME SIGN DATE
DRN KAPOOR sd/-
CHD K.R.G sd/- 19.1.92
APD G.M.K sd/- 10.8.92

REF. TO ASSY. DRG.
0-150-00-01125

TITLE
PIPE CLAMP
DRAWING NO.
2-150-00-01024
SHEET NO. 01 NO.OF SHEETS 01

SIZE A2

DRAWING NO. 2-150-00-01041



TECHNICAL REQUIREMENTS

1. ALL THE WELD JOINT TO BE AS PER HW 0620.599.
2. QUALITY OF WELD SEAM TO BE AS PER 0620.099 BS/BK.
3. TEST SCOPE AS PER HW 0850.199 EXAMINATION GR.4.
4. IDENTIFICATION AS PER HW 0400.397.
5. ITEMS AS PER BILL OF MATERIAL ARE TO BE SUPPLIED LOOSE ALL ASSEMBLY & WELDING WORK TO BE DONE AT SITE.
6. DESIGN OF THE SUPPORT IS FOR THE GUIDANCE OF SITE. MODIFICATIONS CAN BE DONE TO SUIT SITE CONVENIENCE.

001		006	FLAT40X10, L=1350	-		AA1010308580	IS2062E250BR	4	240
002		005	PLATE 400X400X20	-		AA1011808137	IS2062E250BR	25	120
001		004	PIPE Ø273X10,L=300	-		AA1041155409	IS2062E250BR	19	470
004		003	PLATE 350X350X20	-		AA1011808137	IS2062E250BR	19	200
001		002	CHANNEL ISMC 300X90,L=1000	-		AA1012708179	IS2062E250BR	36	300
004	VAR	001	PIPE CLAMP NB600	2-150-00-01026	13	W96415001914		26	000
PURCHASED		ITEM NO.	DESCRIPTION	DRAWING	VAR	MATERIAL CODE	MATERIAL SPEC.	UNIT	WEIGHT

TYPE OF PRODUCT NATIONAL THERMAL POWER LTD VINDHYACHAL
OR SUPER THERMAL POWER PROJECT
NAME OF CUSTOMER/ PROJECT STAGE -II (2X500MW)-UNIT-7&8

DRN	AEDD	NAME	SIGN	DATE	NO.OF VAR.
CHD	K.R.G	sd/-	sd/-	19.1.97	
APD	G.GUPTA	sd/-	sd/-	05.2.97	73, 74

DEPT. EME	SCALE	WEIGHT(Kg.)	REF. TO ASSY. DRG.	ITEM NO.	NO.OF ITEMS
CODE 4133	1:10	321.950	0-150-00-01212	051	75, 77

TITLE	DRAWING NO.	SHEET NO. 01	NO.OF SHEETS 01
SUPPORT U1, U2	2-150-00-01041		

CBOM NO.		STATUS OF DRG.	
0-150-00-01212			
AGREED DEPT.	NAME	SIGN	DATE
GRADE OF UNTOL. DIM.:-			
M/CG- V/C/M/F AA 0230208			
WELDING- A/B/C/D-AA621104			
GAS CUTTING-T3'AA0621101			
REV.	DATE	ALTERED	REV.
		CHECKED	01 04.06.18
		REVISION MARKED	

REV.	DATE	ALTERED	REV.
		CHECKED	01 04.06.18
		REVISION MARKED	

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REF. DRG NO.

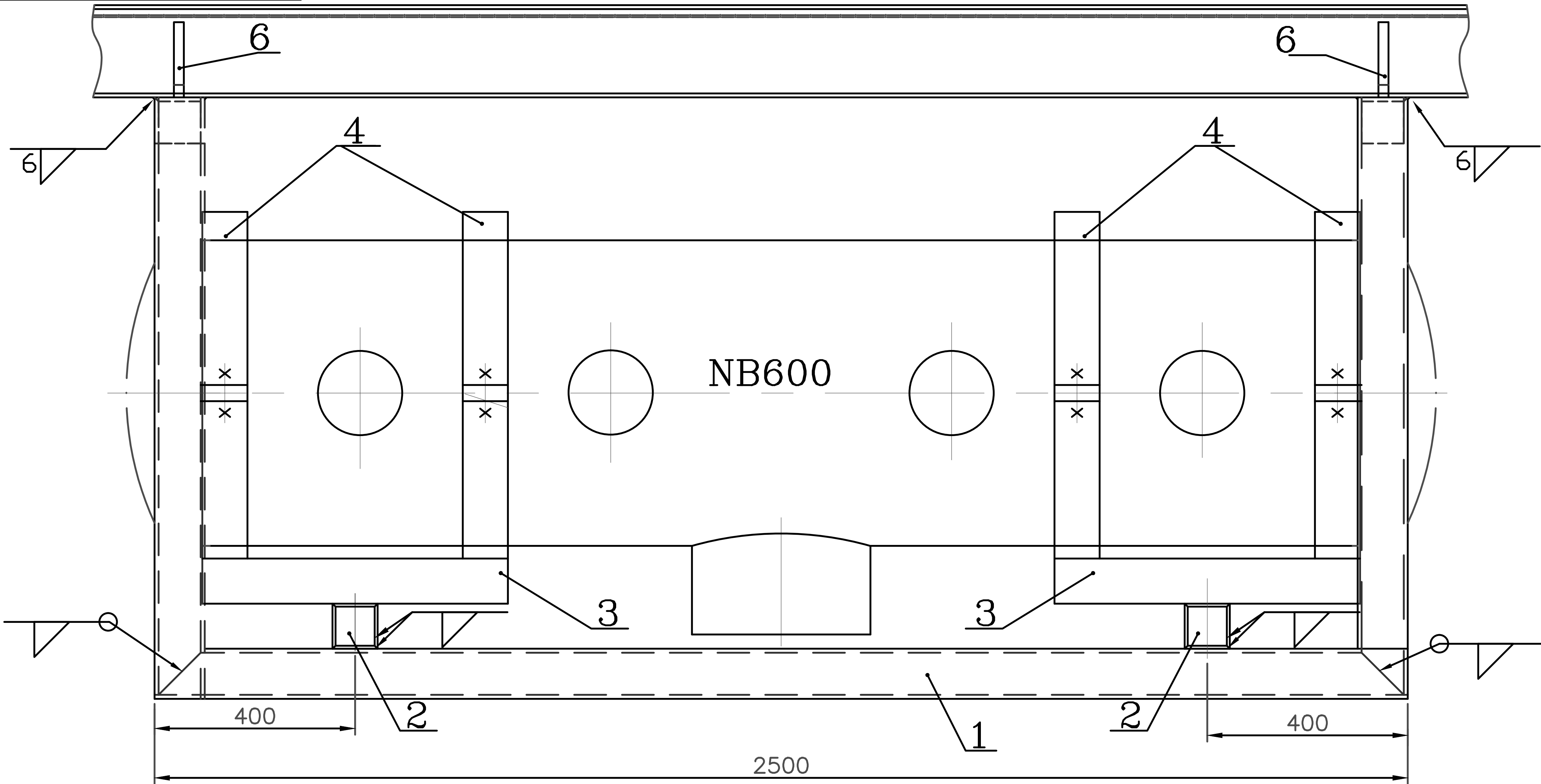
SIGN & DATE

INVENTORY NO.

10/2/97

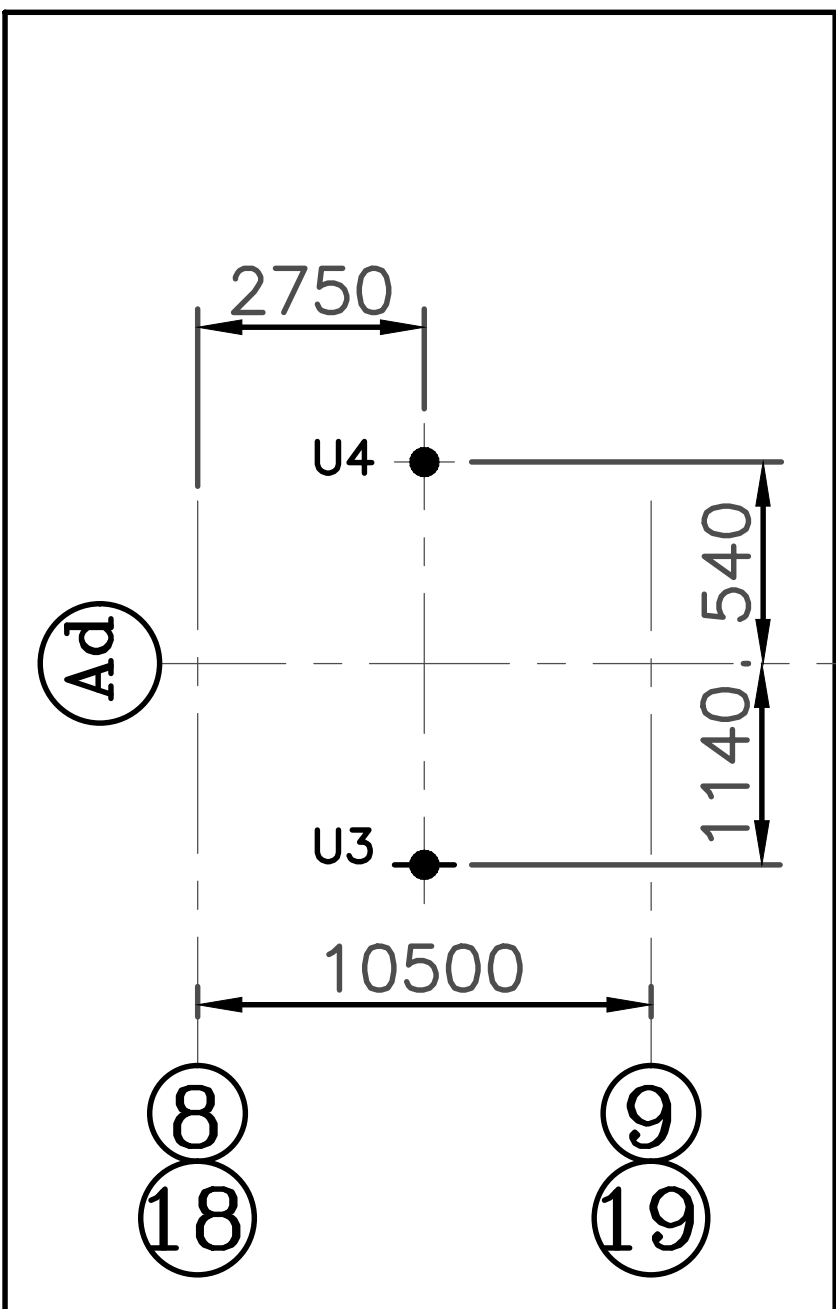
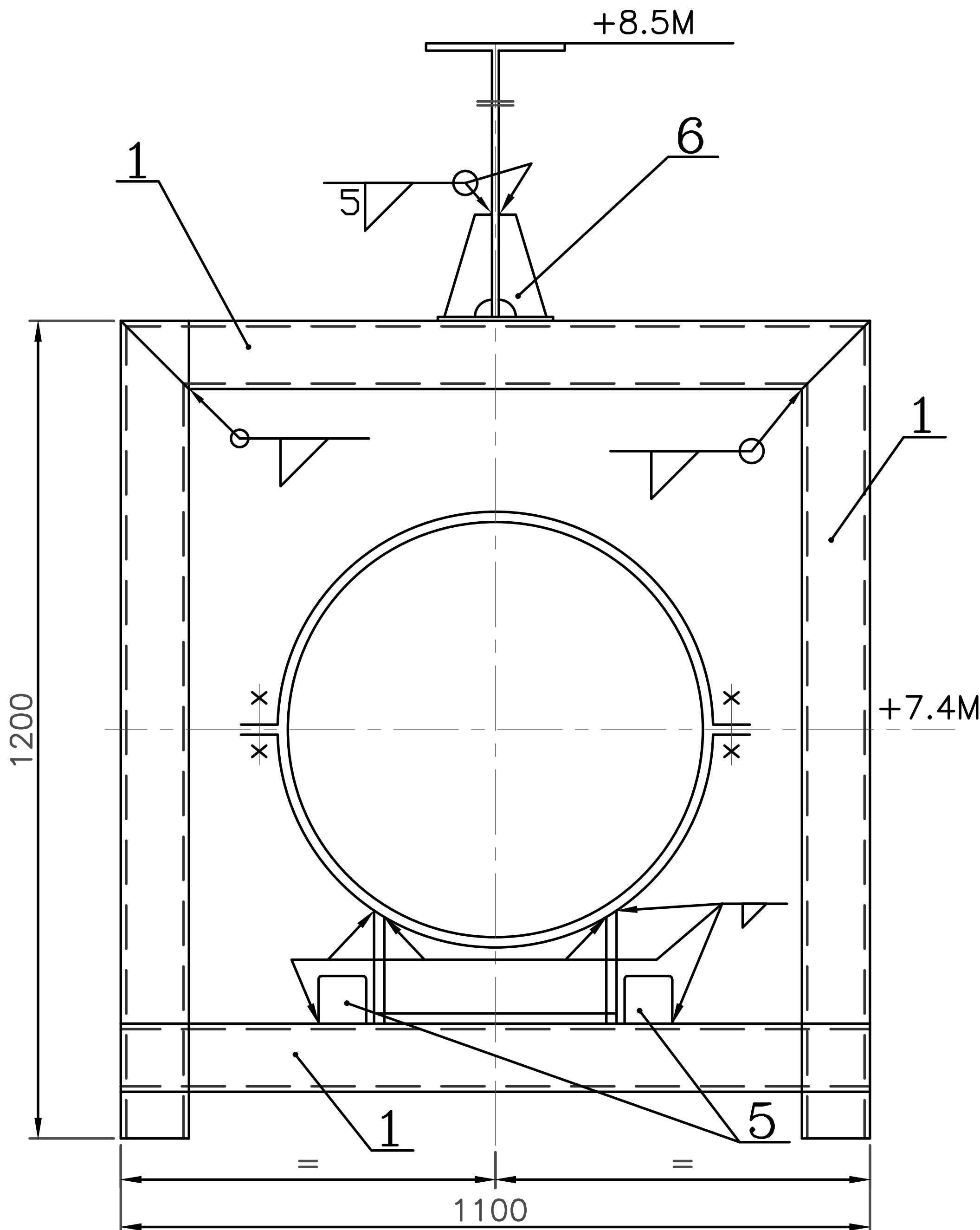
Et1-19256

DRAWING NO.
2-150-00-01042



TECHNICAL REQUIREMENTS

1. ALL THE BUTT JOINT TO BE AS PER HW 0620.599.
2. QUALITY OF WELD SEAM TO BE AS PER 0620.099 BS/BK.
3. TEST SCOPE AS PER HW 0850.199 EXAMINATION GR.4.
4. IDENTIFICATION AS PER HW 0400.397.
5. ITEMS AS PER BILL OF MATERIAL ARE TO BE SUPPLIED LOOSE ALL ASSEMBLY & WELDING WORK TO BE DONE AT SITE.
6. DESIGN OF THE SUPPORT IS FOR THE GUIDANCE OF SITE. MODIFICATIONS CAN BE DONE TO SUIT SITE CONVENIENCE.



004	BOR01500001205	006	RIB	4-150-00-01175		AA1011808137	1	100
	MS					IS2062E250BR		
004		005	PLATE 70X70X20	-		AA1011808137	0	770
						IS2062E250BR		
004	BOR01500001125	004	PIPE CLAMP NB600	2-150-00-01026		W96415001914	26	000
	MS				13			
001		003	CHANNEL ISMC 300X90,L=1000	-		AA1012708179	36	300
						IS2062E250BR		
004		002	PLATE 90X90X6	-		AA1011808030	0	380
						IS2062E250BR		
001		001	ANGLE 100X100X8 L=15000	-		AA1012508226	181	500
						IS2062E250BR		
VAR	PURCHASED	ITEM NO.	DESCRIPTION	DRAWING	IS	MATERIAL CODE	UNIT	WEIGHT
						MATERIAL SPEC.		

TYPE OF PRODUCT NATIONAL THERMAL POWER LTD VINDHYACHAL
OR SUPER THERMAL POWER PROJECT
NAME OF CUSTOMER/ PROJECT STAGE -II (2X500MW)-UNIT-7&8

DRN	NAME	SIGN	DATE	NO.OF VAR.
CHD	K.R.G	sd/-	19.1.97	
APD	G.GUPTA	sd/-	05.2.97	73, 74

DEPT. EME	SCALE	WEIGHT(Kg.)	REF. TO ASSY. DRG.	ITEM NO.	NO.OF ITEMS
CODE 4133	1:10	330.800	0-150-00-01212	052	75, 77

TITLE	DRAWING NO.	SHEET NO. 01	NO.OF SHEETS 01
SUPPORT U3 U4	2-150-00-01042		

GRADE OF UNTOL. DIM.:--
M/CG- X/C/M/F AA 0230208
WELDING-X/B/C/D-AA621104
GAS CUTTING-T3'AA0621101

REV.	DATE	ALTERED
		CHECKED

CBOM NO.	STATUS OF DRG.
0-150-00-01212	
AGREED DEPT.	NAME SIGN DATE

REV.	DATE	ALTERED KM
01	04.06.18	CHECKED MA

REVISION	MARKED
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REF. DRG NO.

10/2/97
SIGN & DATE

Et1-19254
INVENTORY NO.

DRAWING NO. 2-150-00-01043

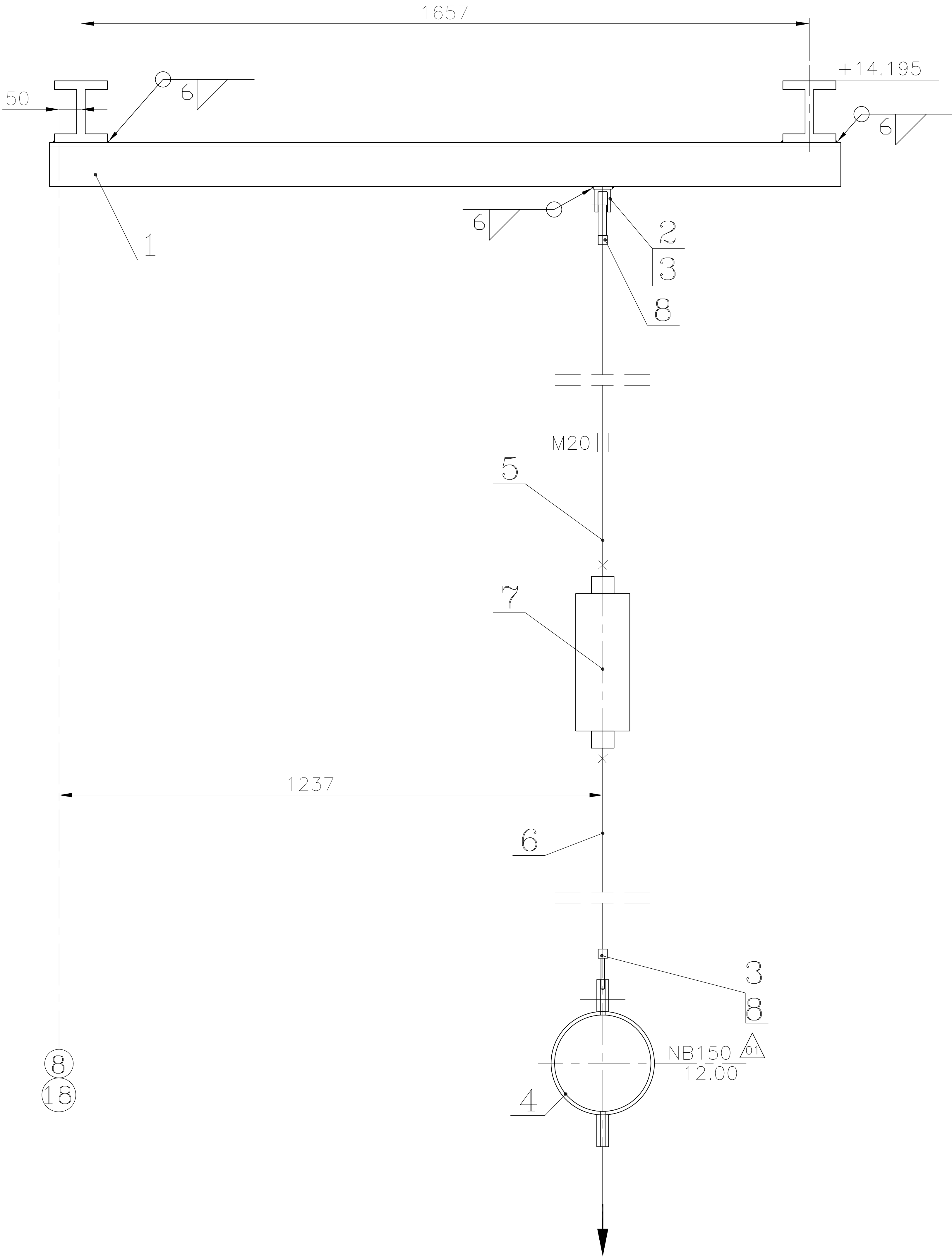
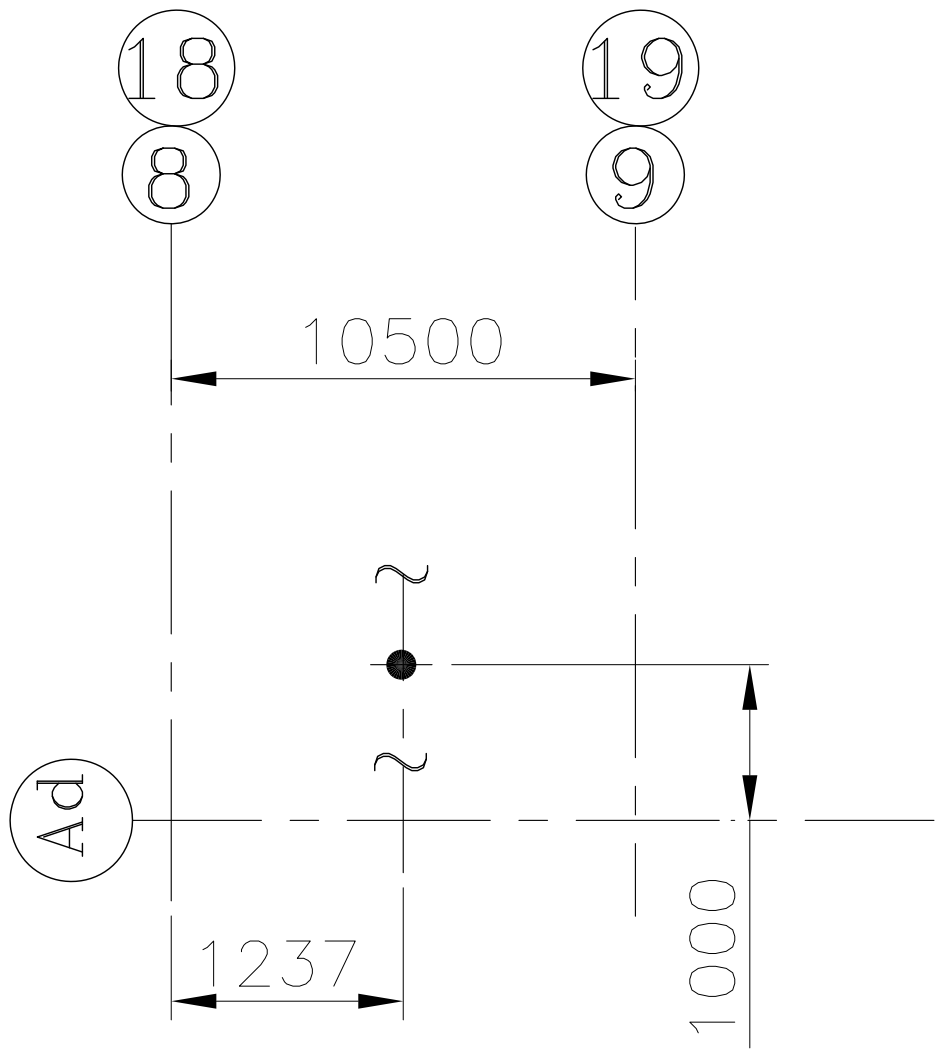
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REF. DRG NO.

10/2/97
SIGN & DATE

E1-19255
INVENTORY NO.

A



TECHNICAL REQUIREMENTS

1. ALL THE BUTT JOINTS TO BE AS PER HW 0620.599.
2. QUALITY OF WELD SEAM TO BE AS PER 0620.099 BS/BK.
3. TEST SCOPE AS PER HW 0850.199 EXAMINATION GR.4.
4. IDENTIFICATION AS PER HW 0400.397.
5. ITEMS AS PER BILL OF MATERIAL ARE TO BE SUPPLIED LOOSE
6. DESIGN OF HANGER ASSEMBLY IS FOR THE GUIDANCE OF SITE MODIFICATIONS CAN BE DONE TO SUIT SITE CONVENIENCE.

002	BOR.01500001205 GMS	008	TURN BUCKLE M20	4-150-00-01103	3	04	W96415001434			0.800
001		007	SPRING HANGER	4-150-00-01199	3		W96415002341			12.800
001	BOR.01500001205 GMS	006	TIE ROD M20X2000	4-150-00-01176	3		W96415002325			5.600
001	BOR.01500001125 GMS	005	THREADED ROD M20X1.5	4-150-00-01131	3	02	W96415001973			2.080
001	BOR.01500001125 GMS	004	PIPE CLAMP NB150	2-150-00-01026	3	10	W96415001892			2.400
002	BOR.01500001151 GMS	003	EYE BOLT M20	4-150-00-01099	3	04	W97415000099			0.300
001	BOR.01500001151 GMS	002	BEAM ATTACHMENT M20	4-150-00-01101	3	04	W96415001469			1.800
001		001	PARALLEL BEAM IPB100,L=1800	-	3		HW1013360897 AA10108			36.720
VAR	PURCHASED	ITEM NO.	DESCRIPTION	DRAWING	3	05	VAR	MATERIAL CODE MATERIAL SPEC.	A C	UNIT WEIGHT

CBOM NO. 0-150-00-01212			STATUS OF DRG.
AGREED DEPT.	NAME	SIGN	DATE

GRADE OF UNTOL. DIM.:-			
M/CG- X/C/M/F AA 0230208			
WELDING-A/B/C/D-AA621104			
GAS CUTTING-T3'AA0621101			
REV.	DATE	ALTERED CHECKED	ALTERED KM CHECKED MA
01	04.06.18		
REVISION MARKED			

TYPE OF PRODUCT NATIONAL THERMAL POWER LTD VINDHYACHAL
OR SUPER THERMAL POWER PROJECT
NAME OF CUSTOMER/ PROJECT STAGE -II (2X500MW)-UNIT-7&8

	NAME		SIGN	DATE	NO.OF VAR.
	AEDD		sd/-	19.1.97	
	K.R.G.		sd/-	19.1.97	
DRN	G.GUPTA		sd/-	05.2.97	73, 74
CHD					
APD					

DEPT. EME		SCALE	WEIGHT(Kg.)	REF. TO ASSY. DRG.	ITEM NO.	NO.OF ITEMS
CODE 4133		1:10	64.160	0-150-00-01212	054	008 75, 77

TITLE			1	3	DRAWING NO.
HANGER ASSEMBLY F-5					2-150-00-01043
					22 23, 24
					SHEET NO. 01
					NO.OF SHEETS 01

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN mm)

F4010-00-051-2
DRAWING ON GINWARD

7

6

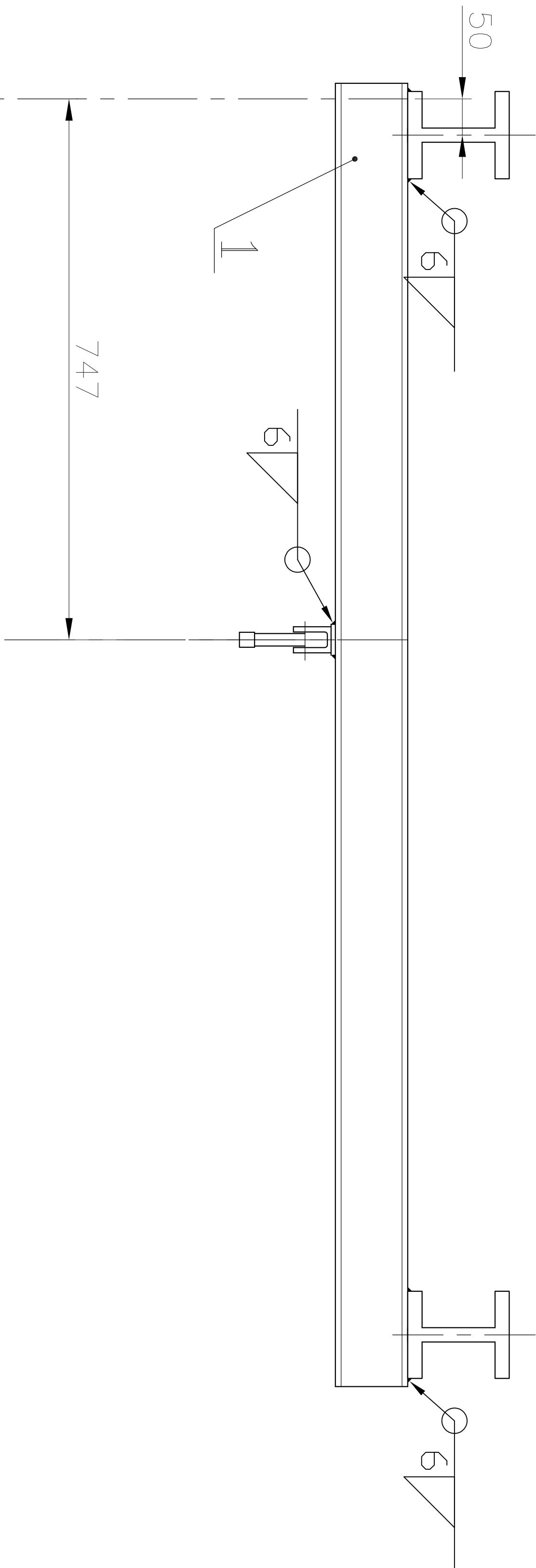
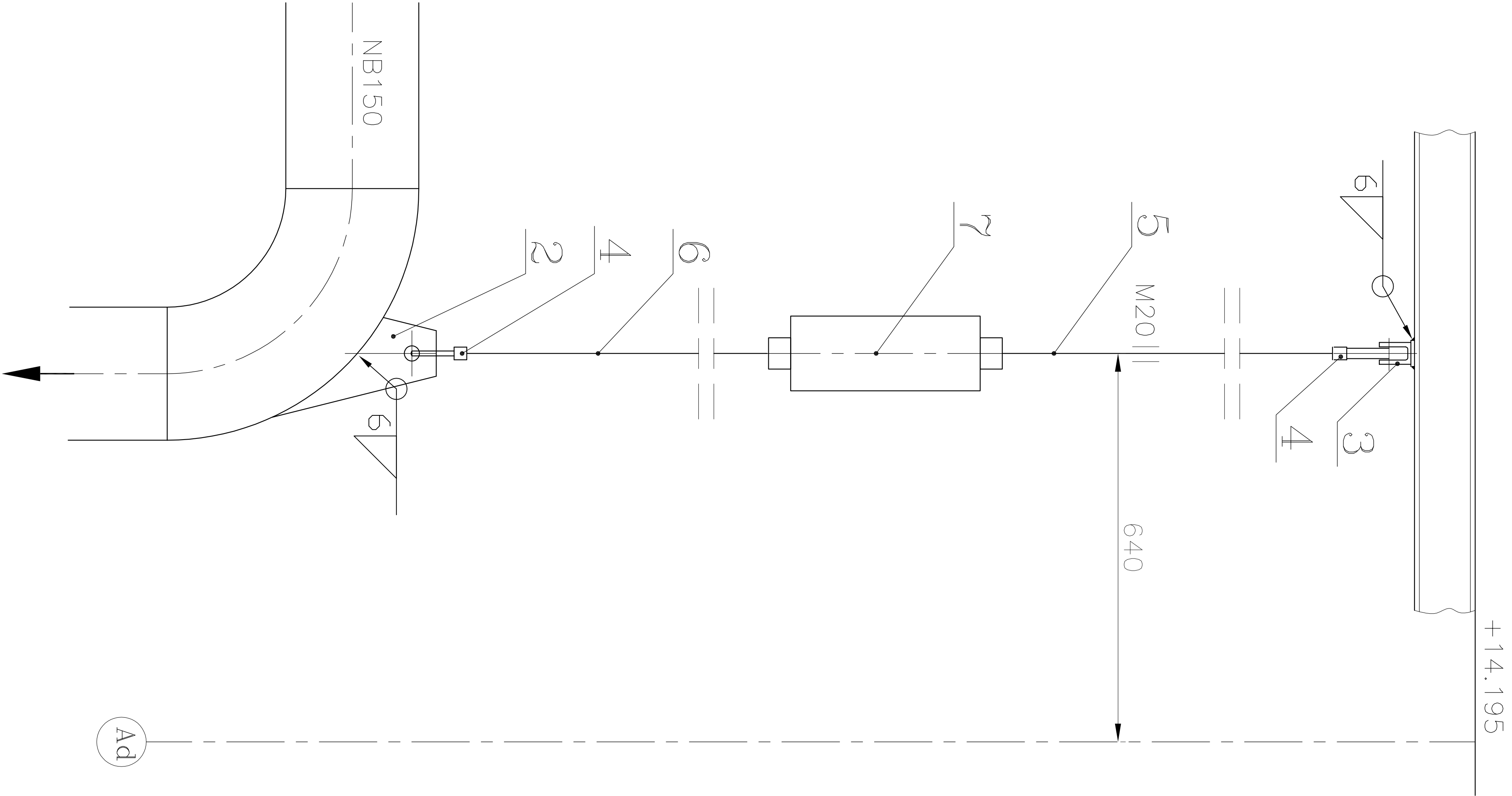
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4

3

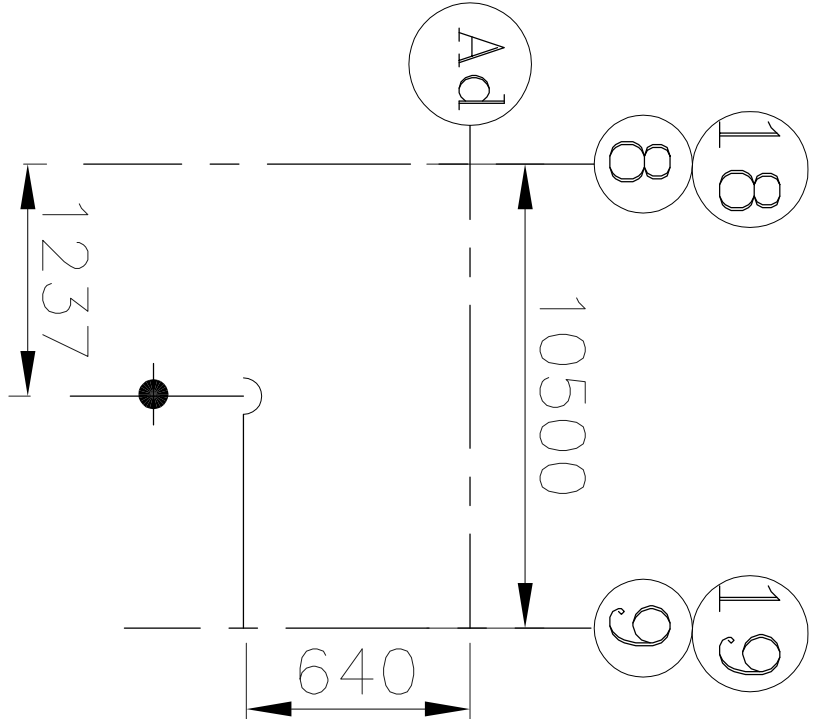
2

1



TECHNICAL REQUIREMENTS

1. ALL THE BUTT JOINTS TO BE AS PER HW 0620.599.
2. QUALITY OF WELD SEAM TO BE AS PER 0620.099 BS/BK.
3. TEST SCOPE AS PER HW 0850.199 EXAMINATION GR.4.
4. IDENTIFICATION AS PER HW 0400.397.
5. ITEMS AS PER BILL OF MATERIAL ARE TO BE SUPPLIED LOSE
6. ALL ASSEMBLY & WELDING WORK TO BE DONE AT SITE.
7. DESIGN OF HANGER ASSEMBLY IS FOR THE GUIDANCE OF SITE
8. MODIFICATIONS CAN BE DONE TO SUIT SITE CONVENIENCE.



001		007	SPRING HANGER	4-150-00-01199	3		W96415002490		121.800
001		006	TIE ROD M20X2000	4-150-00-01176	3		W96415002325		5.600
001	B060150001205	005	THREADED ROD M20X1.5	4-150-00-01131	3	02	W96415001973		2.080
001	-10-	004	EYE BOLT M20	4-150-00-01099	3	04	W97415000099		0.300
002	B060150001151	003	BEAM ATTACHMENT M20	4-150-00-01101	3	04	W96415001469		1.800
001	GAS	002	PLATE	4-150-00-01177			W96415002508R		1.500
001		002	PARALLEL BEAM	-			W96415002508R		36.700
001		001	IPB100,L=1800				W96415002508R		36.700
VAR PURCHASED	ITEM NO.	DESCRIPTION	DRAWING	VAR	MATERIAL SPEC	C	UNIT	WEIGHT	

TYPE OF PRODUCT	NATIONAL THERMAL POWER LTD VINDHYACHAL
OR	SUPER THERMAL POWER PROJECT
NAME OF CUSTOMER/ PROJECT STAGE	- II (2X500MW) - UNIT-7&8

GRADE OF UNTOL. DIM:-	M/CG- X/Y/Z/M/F AA 0230208
WELDING-A/B/C/D-AA621104	
GAS CUTTING-T3AA0621101	

REV.	DATE	ALTERED KM	AGREED DEPT	NAME	SIGN	DATE
01	04.06.18	CHECKED MA				
REVISION	MARKED					

DEPT. EME	SCALE	WEIGHT(Kg.)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF
CODE 4133	1:10	62.580	0-150-00-01212	055	007

TITLE	DRAWING NO.	2-150-00-01044
HANGER ASSEMBLY F-6		

REV.	DATE	ALTERED KM	AGREED DEPT	NAME	SIGN	DATE
01	04.06.18	CHECKED MA				
REVISION	MARKED					

DEPT. EME	SCALE	WEIGHT(Kg.)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF
CODE 4133	1:10	62.580	0-150-00-01212	055	007

TITLE	DRAWING NO.	2-150-00-01044
HANGER ASSEMBLY F-6		

REV.	DATE	ALTERED KM	AGREED DEPT	NAME	SIGN	DATE
01	04.06.18	CHECKED MA				
REVISION	MARKED					

DEPT. EME	SCALE	WEIGHT(Kg.)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF
CODE 4133	1:10	62.580	0-150-00-01212	055	007

TITLE	DRAWING NO.	2-150-00-01044
HANGER ASSEMBLY F-6		

REV.	DATE	ALTERED KM	AGREED DEPT	NAME	SIGN	DATE
01	04.06.18	CHECKED MA				
REVISION	MARKED					

DEPT. EME	SCALE	WEIGHT(Kg.)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF
CODE 4133	1:10	62.580	0-150-00-01212	055	007

TITLE	DRAWING NO.	2-150-00-01044
HANGER ASSEMBLY F-6		

REV.	DATE	ALTERED KM	AGREED DEPT	NAME	SIGN	DATE
01	04.06.18	CHECKED MA				
REVISION	MARKED					

DEPT. EME	SCALE	WEIGHT(Kg.)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF
CODE 4133	1:10	62.580	0-150-00-01212	055	007

TITLE	DRAWING NO.	2-150-00-01044
HANGER ASSEMBLY F-6		

REV.	DATE	ALTERED KM	AGREED DEPT	NAME	SIGN	DATE
01	04.06.18	CHECKED MA				
REVISION	MARKED					

DEPT. EME	SCALE	WEIGHT(Kg.)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF
CODE 4133	1:10	62.580	0-150-00-01212	055	007

TITLE	DRAWING NO.	2-150-00-01044
HANGER ASSEMBLY F-6		

REV.	DATE	ALTERED KM	AGREED DEPT	NAME	SIGN	DATE
01	04.06.18	CHECKED MA				
REVISION	MARKED					

DEPT. EME	SCALE	WEIGHT(Kg.)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF
CODE 4133	1:10	62.580	0-150-00-01212	055	007

TITLE	DRAWING NO.	2-150-00-01044
HANGER ASSEMBLY F-6		

REV.	DATE	ALTERED KM	AGREED DEPT	NAME	SIGN	DATE
01	04.06.18	CHECKED MA				
REVISION	MARKED					

DEPT. EME	SCALE	WEIGHT(Kg.)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF
CODE 4133	1:10	62.580	0-150-00-01212	055	007

TITLE	DRAWING NO.	2-150-00-01044
HANGER ASSEMBLY F-6		

REV.	DATE	ALTERED KM	AGREED DEPT	NAME	SIGN	DATE
01	04.06.18	CHECKED MA				
REVISION	MARKED					

DEPT. EME	SCALE	WEIGHT(Kg.)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF
CODE 4133	1:10	62.580	0-150-00-01212	055	007

TITLE	DRAWING NO.	2-150-00-01044
HANGER ASSEMBLY F-6		

REV.	DATE	ALTERED KM	AGREED DEPT	NAME	SIGN	DATE
01	04.06.18	CHECKED MA				
REVISION	MARKED					

DEPT. EME	SCALE	WEIGHT(Kg.)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF
CODE 4133	1:10	62.580	0-150-00-01212	055	007

TITLE	DRAWING NO.	2-150-00-01044
HANGER ASSEMBLY F-6		

REV.	DATE	ALTERED KM	AGREED DEPT	NAME	SIGN	DATE
01	04.06.18	CHECKED MA				
REVISION	MARKED					

DEPT. EME	SCALE	WEIGHT(Kg.)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF
CODE 4133	1:10	62.580	0-150-00-01212	055	007

TITLE	DRAWING NO.	2-150-00-01044
HANGER ASSEMBLY F-6		

REV.	DATE	ALTERED KM	AGREED DEPT	NAME	SIGN	DATE
01	04.06.18	CHECKED MA				
REVISION	MARKED					

DEPT. EME	SCALE	WEIGHT(Kg.)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF
CODE 4133	1:10	62.580	0-150-00-01212	055	007

TITLE	DRAWING NO.	2-150-00-01044
HANGER ASSEMBLY F-6		

REV.	DATE	ALTERED KM	AGREED DEPT	NAME	SIGN	DATE
01	04.06.18	CHECKED MA				
REVISION	MARKED					

DEPT. EME	SCALE	WEIGHT(Kg.)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF
CODE 4133	1:10	62.580	0-150-00-01212	055	007

TITLE	DRAWING NO.	2-150-00-01044
HANGER ASSEMBLY F-6		

REV.	DATE	ALTERED KM	AGREED DEPT	NAME	SIGN	DATE
01	04.06.18	CHECKED MA				
REVISION	MARKED					

DEPT. EME	SCALE	WEIGHT(Kg.)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF
CODE 4133	1:10	62.580	0-150-00-01212	055	007

TITLE	DRAWING NO.	2-150-00-01044
HANGER ASSEMBLY F-6		

REV.	DATE	ALTERED KM	AGREED DEPT	NAME	SIGN	DATE
01	04.06.18	CHECKED MA				
REVISION	MARKED					

DEPT. EME	SCALE	WEIGHT(Kg.)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF
CODE 4133	1:10	62.580	0-150-00-01212	055	007

TITLE	DRAWING NO.	2-150-00-01044
HANGER ASSEMBLY F-6		

REV.	DATE	ALTERED KM	AGREED DEPT	NAME	SIGN	DATE
01	04.06.18	CHECKED MA				
REVISION	MARKED					

DEPT. EME	SCALE	WEIGHT(Kg.)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF
CODE 4133	1:10	62.580	0-150-00-01212	055	007

TITLE	DRAWING NO.	2-150-00-01044
HANGER ASSEMBLY F-6		

REV.	DATE	ALTERED KM	AGREED DEPT	NAME	SIGN	DATE
01	04.06.18	CHECKED MA				
REVISION	MARKED					

DEPT. EME	SCALE	WEIGHT(Kg.)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF
CODE 4133	1:10	62.580	0-150-00-01212	055	007

TITLE	DRAWING NO.	2-150-00-01044
HANGER ASSEMBLY F-6		

REV.	DATE	ALTERED KM	AGREED DEPT	NAME	SIGN	DATE
01	04.06.18	CHECKED MA				
REVISION	MARKED					

DEPT. EME	SCALE	WEIGHT(Kg.)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF
CODE 4133	1:10	62.580	0-150-00-01212	055	007

TITLE	DRAWING NO.	2-150-00-01044
HANGER ASSEMBLY F-6		

REV.	DATE	ALTERED KM	AGREED DEPT	NAME	SIGN	DATE
01	04.06.18	CHECKED MA				
REVISION	MARKED					

DEPT. EME	SCALE	WEIGHT(Kg.)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF
CODE 4133	1:10	62.580	0-150-00-01212	055	007

TITLE	DRAWING NO.	2-150-00-01044
HANGER ASSEMBLY F-6		

REV.	DATE	ALTERED KM	AGREED DEPT	NAME	SIGN	DATE
01	04.06.18	CHECKED MA				
REVISION	MARKED					

DEPT. EME	SCALE	WEIGHT(Kg.)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF
CODE 4133	1:10	62.580	0-150-00-01212	055	007

TITLE	DRAWING NO.	2-150-00-01044
HANGER ASSEMBLY F-6		

REV.	DATE	ALTERED KM	AGREED DEPT	NAME	SIGN	DATE
01	04.06.18	CHECKED MA				
REVISION	MARKED					

DEPT. EME	SCALE	WEIGHT(Kg.)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF
CODE 4133	1:10	62.580	0-150-00-01212	055	007

TITLE	DRAWING NO.	2-150-00-01044
HANGER ASSEMBLY F-6		

REV.	DATE	ALTERED KM	AGREED DEPT	NAME	SIGN	DATE
01	04.06.18	CHECKED MA				
REVISION	MARKED					

DEPT. EME	SCALE	WEIGHT(Kg.)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF
CODE 4133	1:10	62.580	0-150-00-01212	055	007

TITLE	DRAWING NO.	2-150-00-01044
HANGER ASSEMBLY F-6		

REV.	DATE	ALTERED KM	AGREED DEPT	NAME	SIGN	DATE
01	04.06.18	CHECKED MA				
REVISION	MARKED					

DEPT. EME	SCALE	WEIGHT(Kg.)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF
CODE 4133	1:10	62.580	0-150-00-01212	055	007

TITLE	DRAWING NO.	2-150-00-01044
HANGER ASSEMBLY F-6		

REV.	DATE	ALTERED KM	AGREED DEPT	NAME	SIGN	DATE
01	04.06.18	CHECKED MA				
REVISION	MARKED					

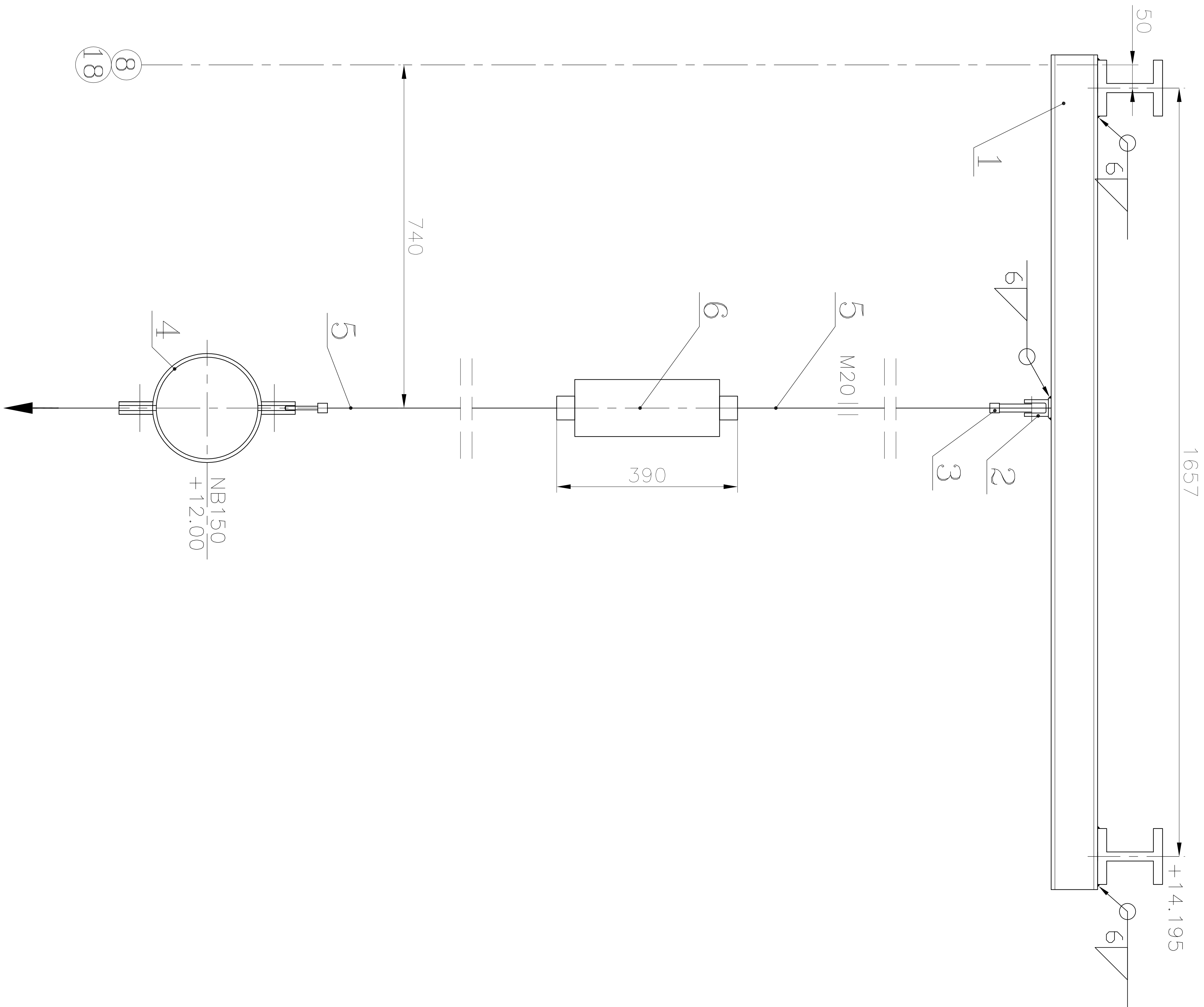
DEPT. EME	SCALE	WEIGHT(Kg.)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF
CODE 4133	1:10	62.580	0-150-00-01212	055	007

TITLE	DRAWING NO.	2-150-00-01044
HANGER ASSEMBLY F-6		

REV.	DATE	ALTERED	CHECKED	REV.	DATE	ALTERED KM	CHECKED MA
				01	04.06.18		
				REVISION MARKED			
5				4			
				3			

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN mm)

57010-00-051-2
DRAWING ON GINIVARD



TECHNICAL REQUIREMENTS

1. ALL THE BUTT JOINTS TO BE AS PER HW 0620.599.
2. QUALITY OF WELD SEAM TO BE AS PER 0620.099 BS/BK.
3. TEST SCOPE AS PER HW 0850.199 EXAMINATION GR.4.
4. IDENTIFICATION AS PER HW 0400.397.
5. ITEMS AS PER BILL OF MATERIAL ARE TO BE SUPPLIED LOOSE
6. ALL ASSEMBLY & WELDING WORK TO BE DONE AT SITE.
- DESIGN OF HANGER ASSEMBLY IS FOR THE GUIDANCE OF SITE MODIFICATIONS CAN BE DONE TO SUIT SITE CONVENIENCE.

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REF. DRG NO.

15/2/97
SIGN & DATE

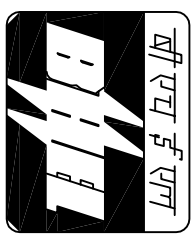
Et1-19253
INVENTORY NO.

A		B		C		D		E		F	
8		7		6		5		4		3	

GRADE OF UNTOL. DIM:-		CBOM NO.		STATUS OF DRG.	
M/CG- x/C/M/F AA 0230208		0-150-00-01212			
WELDING-A/B/C/D-AA621104		NAME		SIGN	
GAS CUTTING-13AA0621101		DATE			

REV. DATE		ALTERED KM	
01 040618		CHECKED MA	
REVISION		MARKED	

TYPE OF PRODUCT		NATIONAL THERMAL POWER LTD VINDHYACHAL	
OR		SUPER THERMAL POWER PROJECT	
NAME OF CUSTOMER/ PROJECT STAGE -II (2X500MW) - UNIT-7&8			
DEPT. EME		SCALE	
CODE 4133		1:10	
WEIGHT(Kg.)		59.040	
DRAWING NO.		2-150-00-01045	
SHEET NO. 01		NO.OF SHEET501	

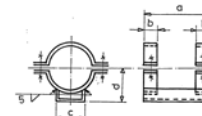
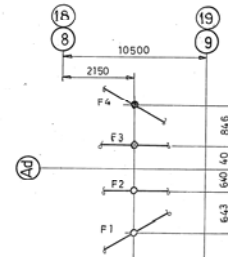
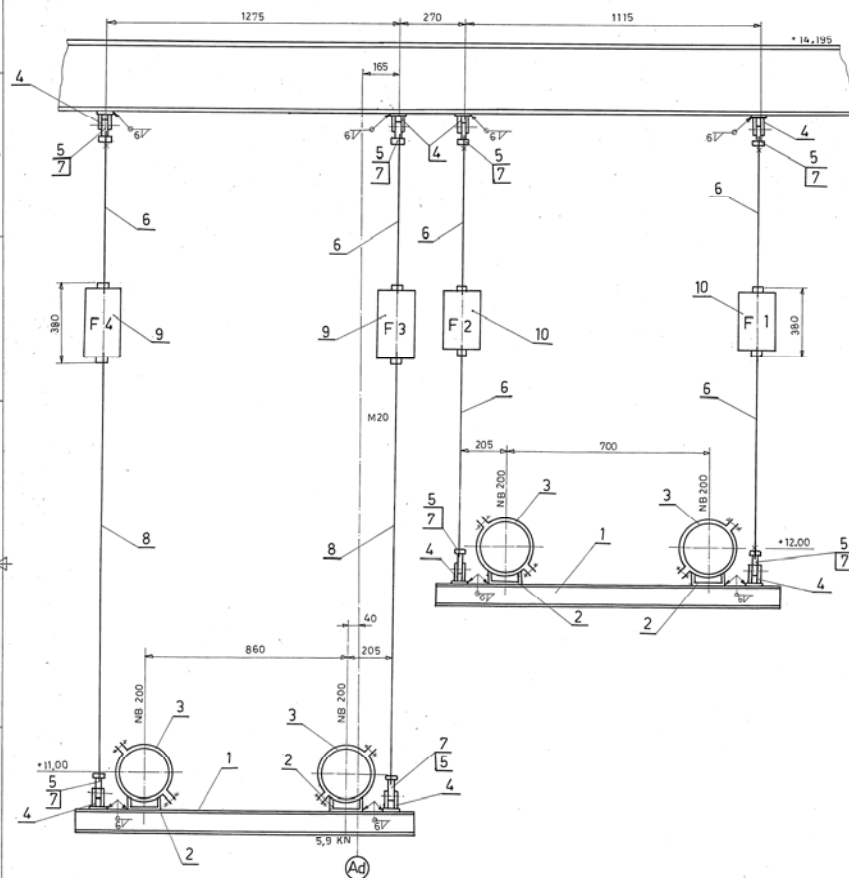


BHARAT HEAVY ELECTRICALS LTD.
HARDWAR

DRN	AEDD	SIGN	DATE
CHD	K.R.G	sd/-	19.1.97
APD	G.GUPTA	sd/-	05.2.97

VAR	PURCHASED	ITEM NO.	DESCRIPTION	DRAWING	VAR	MATERIAL	SPEC.	UNIT	WEIGHT
001	BGR01500001151	005	SPRING HANGER	4-150-00-01199	3	W96415002490		12L	800
001	BGR01500001151	005	THREADED ROD	4-150-00-01178	3	W96415002333		4L	160
001	BGR01500001151	004	PIPE CLAMP NB150	2-150-00-01026	3	W96415001892		2L	960
002	BGR01500001151	003	EYE BOLT M20	4-150-00-01099	3	W97415000099		0L	300
001	BGR01500001151	002	BEAM ATTACHMENT	4-150-00-01101	3	W96415001469		1L	800
001	BGR01500001151	001	PARALLEL BEAM	-	3	W96415001469		36L	720
001	IPB100.L=1800				3	HW1013360897		36L	720

1-150-00-051-1



NB	a	b	c	d
200	300	50	-140	158

TECHNICAL REQUIREMENTS:

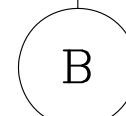
1. ALL THE BUTT JOINTS TO BE PER HW 0620.599.
2. QUALITY OF WELD SEAM TO BE AS PER HW 0620.099 BS/BK
3. TEST SCOPE AS PER HW 0850.199 EXAMINATION GR. 4.
4. IDENTIFICATION AS PER HW 0400.397.
5. ITEMS AS PER BILL OF MATERIAL ARE SUPPLIED LOOSE ALL ASSEMBLY & WELDING WORK TO BE DONE AT SITE.
6. DESIGN OF THE SUPPORT IS FOR THE GUIDANCE OF SITE. MODIFICATIONS CAN BE DONE TO SUIT SITE CONVENIENCE.

002	010	SPRING HANGER	3	41500001199	—	W96415002390	NC	6 000	
002	009	SPRING HANGER	3	41500001198	—	W96415002341	NC	12 800	
002	BORROWED 01500001195 GMS	008	TIE ROD M20 X200	3	4-150-00-01176	—	W96415002325	NC	5 600
008	BORROWED 01500001195 GMS	007	TURN BUCKLE M 20	3	4-150-00-01103	04	W96415001434	NC	0 800
008	BORROWED 01500001195 GMS	006	THREADED ROD M 20 X1.5	3	4-150-00-01131	02	W96415001973	NC	2 080
008	BORROWED 01500001195 GMS	005	EYE BOLT M20	3	4-150-00-01099	04	W97415000013	NC	0 800
008	BORROWED 01500001195 GMS	004	BEAM ATTACHMENT M20	3	4-150-00-01101	04	W96415001469	NC	1 800
008	BORROWED 01500001195 GMS	003	PIPE CLAMP NB200	3	2-150-00-01026	04	W96415001892	NC	2 860
001	002	CHANNEL ISMC 140 X60 L1200	—	—	—	11	HW1012708993	NC	16 000
001	001	PARALLEL BEAM IPB 100 L 3000	—	—	—	—	AA10108	NC	63 000
VAR. 00	REMARKS	ITEM NO.	DESCRIPTION	CHG NO.	DRAWING NO.	MATERIAL CODE	MATERIAL SPEC.	UNIT WEIGHT	QTY

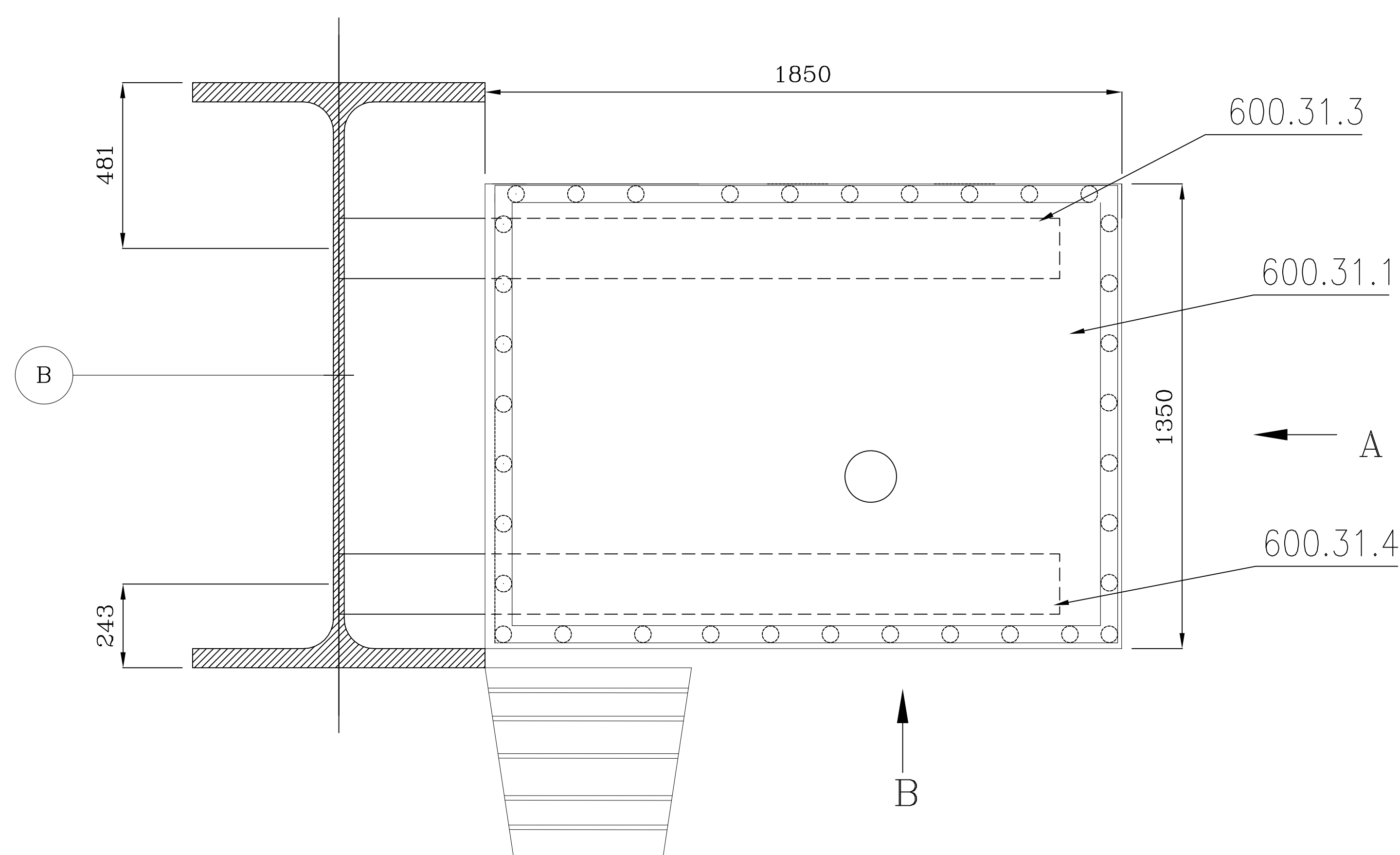
CARD TYPE 3		28	26	CARD TYPE-1	28	CARD TYPE-2
GMS NO./GR. SP. NO.		STATUS		TYPE OF PRODUCT		
0-150-00-01212		CUG		NATIONAL THERMAL POWER CORPORATION LTD.		
NAME		SIGN		OR		
DATE		DATE		WINDHYACHAL SUPER THERMAL POWER PROJECT		
				STAGE-II (2 X 500 MW) UNITS-748		

GRADE OF UNTOL. DIM. —	REF ID	NAME	SIGN	DATE	NAME OF	STAGE-II (2X 500 MW) UNITS-748			
M/CB-C/M/F AA 0230208					 BHARAT HEAVY ELECTRICALS LTD. HARDWAR	NAME	SIGN	DATE	N
WELDING - A/C/B AA0621104						DRN A.E.D.	R.SINGH		
GAS CUTTING - T3 AA0621101						CHD K.R.G.	<i>[Signature]</i>	21/2	
						APD G.G.UPTA	<i>[Signature]</i>	22/2	

REV DATE	ALTERED	REV DATE	ALTERED	DEPT TGE	SCALE	WEIGHT (kg)	REF TO ASSY. DRG	ITEM NO
CHECKED		BY	DATE	CODE	N.T.S.		1-150-00-01212	53
2046		2046						
CH AD N/A TGE-00-245 				TITLE HANGER ASSEMBLY F1, F2, F3, F4		DRAWING NO 1-150-00-01019 SHEET NO 01 NO OF SHEETS 02		

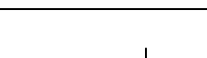


VIEW-A

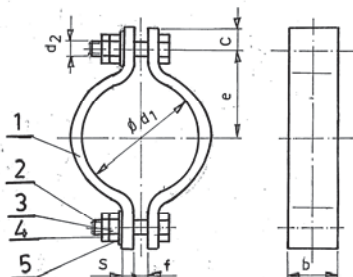


NOTE

1. ALL THE ITEMS OF THE PW TANK SUPPORTS ARE TO BE SUPPLIED IN DIS-ASSEMBLED CONDITION BY THE VENDOR TO SITE AS PER BOM TGE-3321 OR BOM TGE-3629.

				CBOM NO.		STATUS OF DRG.		TYPE OF PRODUCT OR NAME OF CUSTOMER/ PROJECT				THDF 125/67																					
AGREED DEPT.		NAME		SIGN		DATE																											
GRADE OF UNTOL. DIM.:—																																	
M/CG— V/C/M/F AA 0230208								भारत भारती  BHARAT HEAVY ELECTRICALS LTD. HARDWAR				NAME		SIGN		DATE		NO. OF VAR															
WELDING—A/B/C/D—AA621104												DRN PG		sd/—		02.04.15																	
GAS CUTTING—T3'AA0621101												CHD RLV		sd/—		02.04.15																	
REV.		DATE		ALTERED CHECKED		REV.		DATE		ALTERED CHECKED		DEPT.				SCALE		WEIGHT(Kg.)		REF. TO ASSY. DRG.		ITEM NO.		75, 7									
																CODE												75, 7					
																TITLE		1		3		DRAWING NO.		1-150-00-01097		71		22		23		2	
5								4								3								SUPPORT FOR PW TANK				SHEET NO.		NO. OF SHEETS			

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13	600	609.6	90	45	375	25	15	M 30 X 120	26-00	W9615001914
12	300	323.9	60	30	205	14	8	M 20 X 75	5.04	W9615001906
11	200	219.1	50	24	145	11	8	M 16 X 65	2.96	W 96415001892
10	150	168.3	50	24	120	11	8	M 16 X 65	2.40	W96415001884
09	125	139.7	50	24	105	11	8	M 16 X 65	2.15	W96415001876
08	100	114.3	50	24	90	11	8	M 16 X 65	1.95	W96415001868
07	80	88.9	40	18	70	9	6	M 12 X 50	0.88	W96415001850
06	65	76.1	40	18	60	9	6	M 12 X 50	0.79	W96415001841
05	50	60.3	40	18	55	9	6	M 12 X 50	0.71	W96415001833
04	40	48.3	30	15	45	7	5	M 10 X 40	0.31	W96415001825
03	32	42.4	30	15	41	7	5	M 10 X 40	0.28	W96415001817
02	25	33.7	30	15	36	7	5	M 10 X 40	0.25	W96415001809
01	20	26.9	30	15	33	7	5	M 10 X 40	0.23	W96415001795
00	15	21.3	30	15	30	7	5	M 10 X 40	0.21	W96415001787
VAR00	NB	d ₁	b	c	e	f	s	d ₂	WT. IN Kgs.	MATERIAL CODE

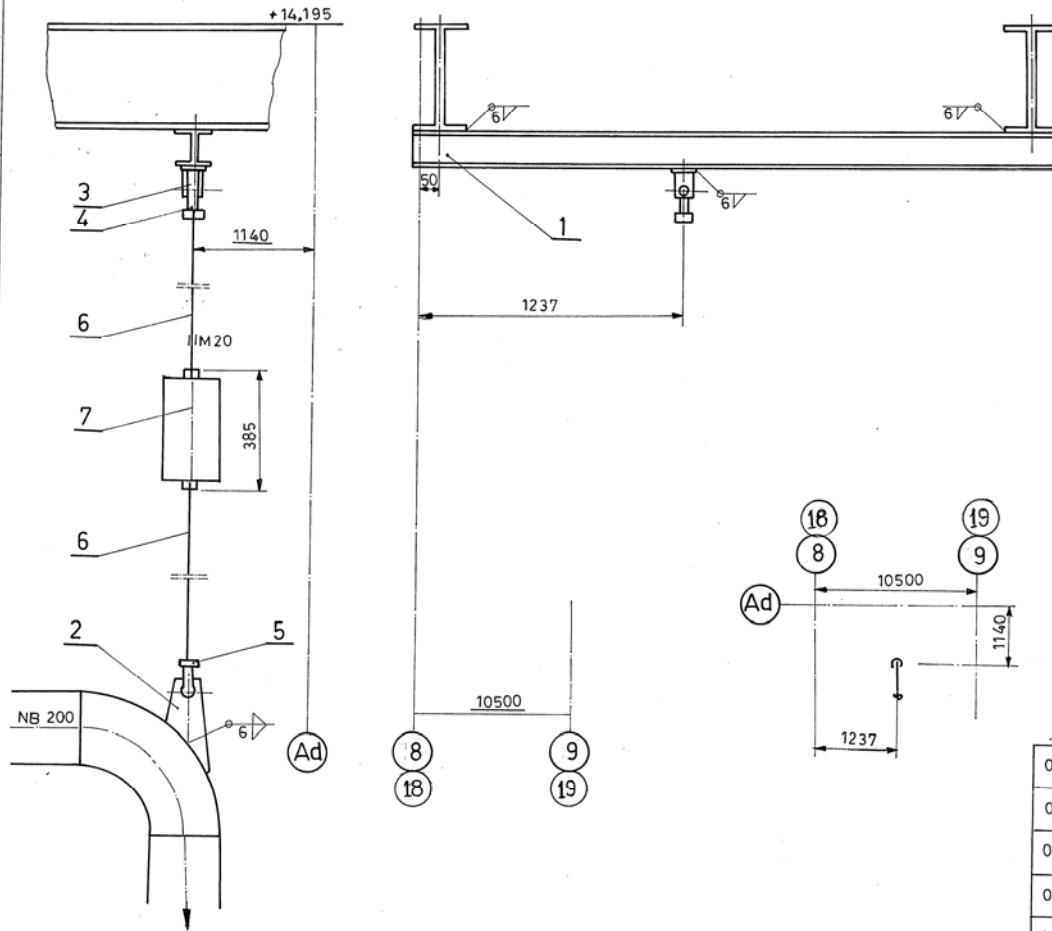
1. PIPE CLAMPS SHALL BE SUPPLIED IN ASSEMBLED CONDITION.
2. IDENTIFICATION SHALL BE DONE BY ATTACHING A TAG.
3. MATERIAL CODE REFER VARIAT TABLE.
4. FOR MATERIAL CODE REFER VARIANT TABLE.

0 0 2		0 0 5	WASHER	—		CS-IS2062E250BR			—	
0 0 2		0 0 4	LOCK NUT	—		STEEL A8.8			—	
0 0 2		0 0 3	NUT	—		STEEL A8.8			—	
0 0 2		0 0 2	BLOT HEX.	—		STEEL A8.8			—	
0 0 2		0 0 1	CLAMP	—		CS-IS2062E250BR			—	
VAR 00	REMARKS	ITEM No.	DESCRIPTION	S/D	DRAWING No.	MATERIAL CODE	UNIT	UNIT WEIGHT	GS	ZONE
59	64 65	75 25 27 29	28	58 59 60	77	31 32 33 34	45 55	58 65	71	72
CARD TYPE-3				CARD TYPE-1		CARD TYPE-2				

GMS No./Gr-SP-No. 0150 000125				STATUS OF DRG.		CARD TYPE-1				CARD TYPE-2									
AGREED DEPT		NAME		SIGN		DATE													
GTY		SCGYVAL		23/9/79															
 BHARAT HEAVY ELECTRICALS LTD. HARDWAR						NAME		SIGN		DATE		No. Of VAR							
						DRN. Karpoor		<i>[Signature]</i>		13/9/79		73.75							
						CHD K.R.G		<i>[Signature]</i>				No. Of ITEM							
						APPD G.M.K		<i>[Signature]</i>		10/9/79		73.75							
REV		DATE		ALTERED CHECKED		DEPT TGE				SCALE N.T.S		WEIGHT (KG)		REF. TO ASSY. DRG. 0-150-00-01125		ITEM No.		No. Of ITEM	
ZONE						CODE 6003										73.75			
TITLE: PIPE CLAMP						CARD CODE		DRAWING No. 2-150-00-01026		REV									
4																			

97010-00-091-2

DRAWING NO.

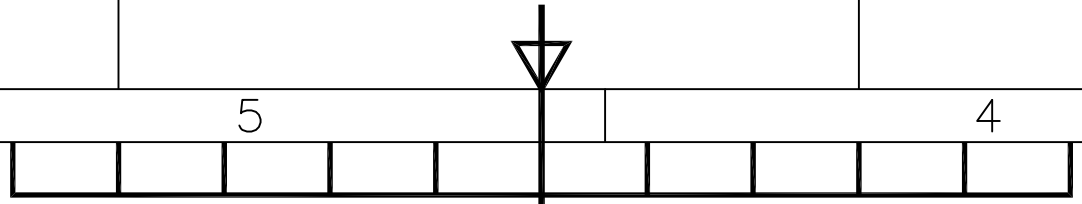


TECHNICAL REQUIREMENTS :-

1. ALL THE BUTT JOINTS TO BE AS PER HW 0620.599.
2. QUALITY OF WELD SEAM TO BE AS PER HW 0620 099 BS/BK
3. TEST SCOPE AS PER HW 0850 199 EX GR.4
4. IDENTIFICATION AS PER HW 0400 397.
5. ITEMS AS PER BILL OF MATERIAL ARE SUPPLIED LOOSE ALL ASSEMBLY & WELDING WORK TO BE DONE AT SITE.
6. DESIGN OF HANGER ASSEMBLY IS FOR THE GUIDANCE OF SITE. MODIFICATIONS CAN BE DONE TO SUIT SITE CONVENIENCE.

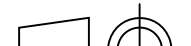
001		006	SPRING HANGER	3	41500001199	W96415002341	NO	12	800	
001	BORROWED 01500001205	005	THEREADED ROD M 20x 200	3	4-150-00-01178	W96415002333	NO	4	160	
001	- 00 -	004	EYE BOLT M20	3	4-150-00-01099	W97415000099	NO	0	300	
002	BORROWED 01500001151 GMS	003	BEAM ATTACHMENT M20	3	4-150-00-01101	W96415001469	NO	1	800	
001		002	PLATE		4-150-00-01177	AA1011808137 AA10108	NO	1	500	
001		001	PARALLEL BEAM IPB 100, L= 1800			HW101360897 AA10108	NO	36	720	
VAR.00	REMARKS	ITEM	DESCRIPTION	STD	DRAWING NO.	29,31	MATERIAL CODE	UNIT WEIGHT	ZONE	
59	64 65	75 25 27	29	58 59 60	77	VAR. 32 33 46	MATERIAL SPEC.	54 55 56 57 66	71 72	
CARD TYPE - 3 → 28					28 → CARD TYPE - 1					
GMS NO. / GR. SP. NO. 0-150-00-01212					STATUS OF DRG. U					
AGREED DEPT					NAME					SIGN
DATE					DATE					
TYPE OF PRODUCT NATIONAL THERMAL POWER CORPORATION LTD. OR VINDHYACHAL SUPER THERMAL POWER PROJECT NAME OF CUSTOMER / PROJECT STAGE II (2X 500 MW) - UNITS - 7 & 8										
GRADE OF UNTOL. DIM. :- M / CG / L / M / P AA 0230208 WELDING - A/B/C/D-AA 0621104 GAS CUTTING - T3' AA 0621101					Bharat Heavy Electricals Ltd. HARDWAR					
REV. DATE ALTERED CHECKED					DRN A EDD CHD K.R.GUPTA APD G.GUPTA					
ZONE					DEPT. TGE CODE 4033					
SCALE N.T.S.					WEIGHT (kg.) 59.080					
TITLE HANGER ASSEMBLY F8					REF. TO ASSY. DRG. 0-150-00-01212					
DRAWING NO. 2-150-00-01046					ITEM NO. 057					
SHEET NO.					NO. OF SHEET					
SIZE A2										

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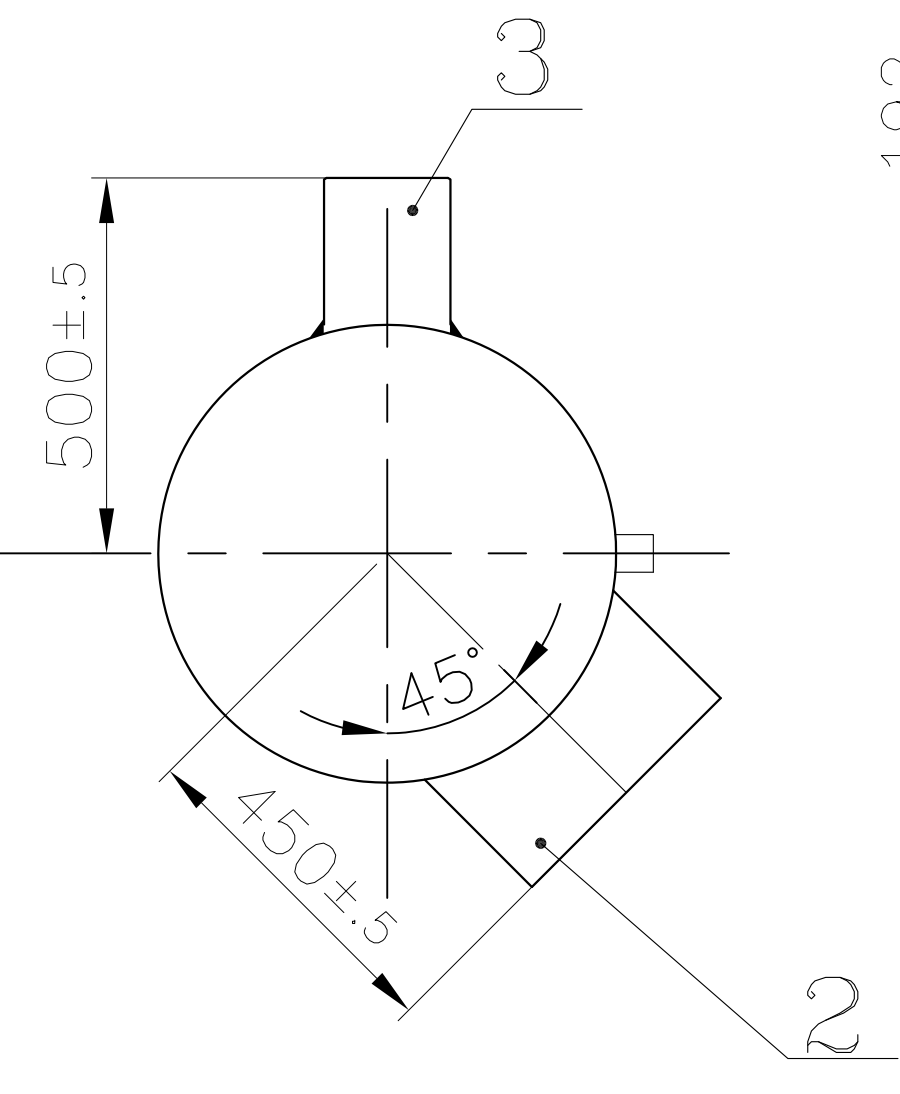


ITEM NO.	ITEM DETAIL	UNIT WT.(KG)	QTY.
1	CYLINDER	390	1
2	CONNECTION	14.2	1
3	CONNECTION	6.08	4
4	CONNECTION	0.5	3
5	CONNECTION	0.08	1
6	CAP	50	2

↓	

TYPE OF PRODUCT OR NAME OF CUSTOMER/ PROJECT				THDF 115/67 (NUCLEAR)				
 BHARAT HEAVY ELECTRICALS LTD. HARDWAR					NAME	SIGN	DATE	NO. OF VAR.
				DRN	KUNAL MISHRA	sd/-	27.07.15	
				CHD	KUNAL MISHRA	sd/-	27.07.15	
				APD	R.L.VYAS	sd/-	27.07.15	
DEPT. EME		SCALE 1:20	WEIGHT (Kg.) 536	REF. TO ASSY. DRG.			ITEM NO.	73, 74 NO. OF ITEMS
CODE 4133								75, 77
TITLE INLET HEADER				1	3	DRAWING NO. 21500001127		101
						SHEET NO. 01		22 23 24 NO. OF SHEETS 01

DRAWING NO. 215000001129



Technical drawing of a mechanical part, likely a piston, showing dimensions: 215, 168.4, 7.11, 100, and R305.

Technical drawing of a mechanical part (Fig. 1) showing a front view. The part is a long, narrow component with rounded ends. Key features and dimensions include:

- Overall Dimensions:** Total length is 2280. A section line is indicated by a horizontal line with the number 4 on both ends.
- Section Lines:** Section lines are shown at the ends of the part, labeled with the number 6.
- Internal Features:**
 - A central cylindrical feature is shown with a dashed outline, labeled with the Roman numeral III.
 - Two circular features are shown on the left side, labeled with the Roman numeral II.
 - Two circular features are shown on the right side, labeled with the Roman numeral I.
- Dimensions:**
 - Top dimensions: (630) and (980).
 - Bottom dimensions: 300, 500, 340, 340, 500, 300.
- Labels:**
 - 1: Points to the right end of the part.
 - 2: Points to the top surface of the part.
 - 3: Points to the right circular feature.
 - 4: Section line indicator.
 - 5: Points to the right circular feature.
 - 6: Section line indicator.

Technical drawing of a semi-circular arch structure. The arch has a base width of 584 and a height of 111. The base is divided into two sections of 13 and 74 ± 2. The arch is defined by a radius of R610 and a base radius of R61. A 30° angle is indicated at the base.

300 500 680 500 300

4 HOLES $\phi 168.28$

$\phi 609.6$

12.7

SECTION A-A

30°

Technical drawing of a rectangular plate with the following dimensions and features:

- Overall width: 2280
- Overall height: 609.6
- Four circular holes with diameters of 13.5 and 28 units.
- Two rectangular holes with diameters of 13.5 and 28 units.
- Dimensions between features: 650, 980, 300, 500, 680, 500, 300.

ITEM NO.-1

HOLES $\phi 324$

1140

ITEM NO.—1

GRADE OF UNTOL. DIM.:—		
M/CG— V/C/M/F AA 0230208		
WELDING—A/B/C/D—AA621104		
GAS CUTTING—'T3'AA0621101		
REV.	DATE	ALTERED
		CHECKED

TYPE OF PRODUCT
OR
NAME OF CUSTOMER/ PROJECT

THDF 115/67

सी एच ई लिम



BHARAT HEAVY ELECTRICALS LTD.
HARDWAR

DRN

ALOK AGARWAL

sd/-

16.01.16

CHD

KUNAL MISHRA

sd/-

16.01.16

APD

R.L.VYAS

sd/-

16.01.16

NO.OF
VAR.

73 | 74

75 | 77

DEPT. EME



SCALE

WEIGHT(Kg.)

REF. TO ASSY. DRG.

ITEM NO.

NO.OF
ITEMS

CODE 4133

1:20

536.0

TITLE

DRAWING NO.

215000001129

R01

22 | 23 | 24

SHEET NO. 01

NO.OF SHEETS 01

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INVENTORY NO.

SIGN & DATE

REF. DRG NO.

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

FORM: DG-38(B)

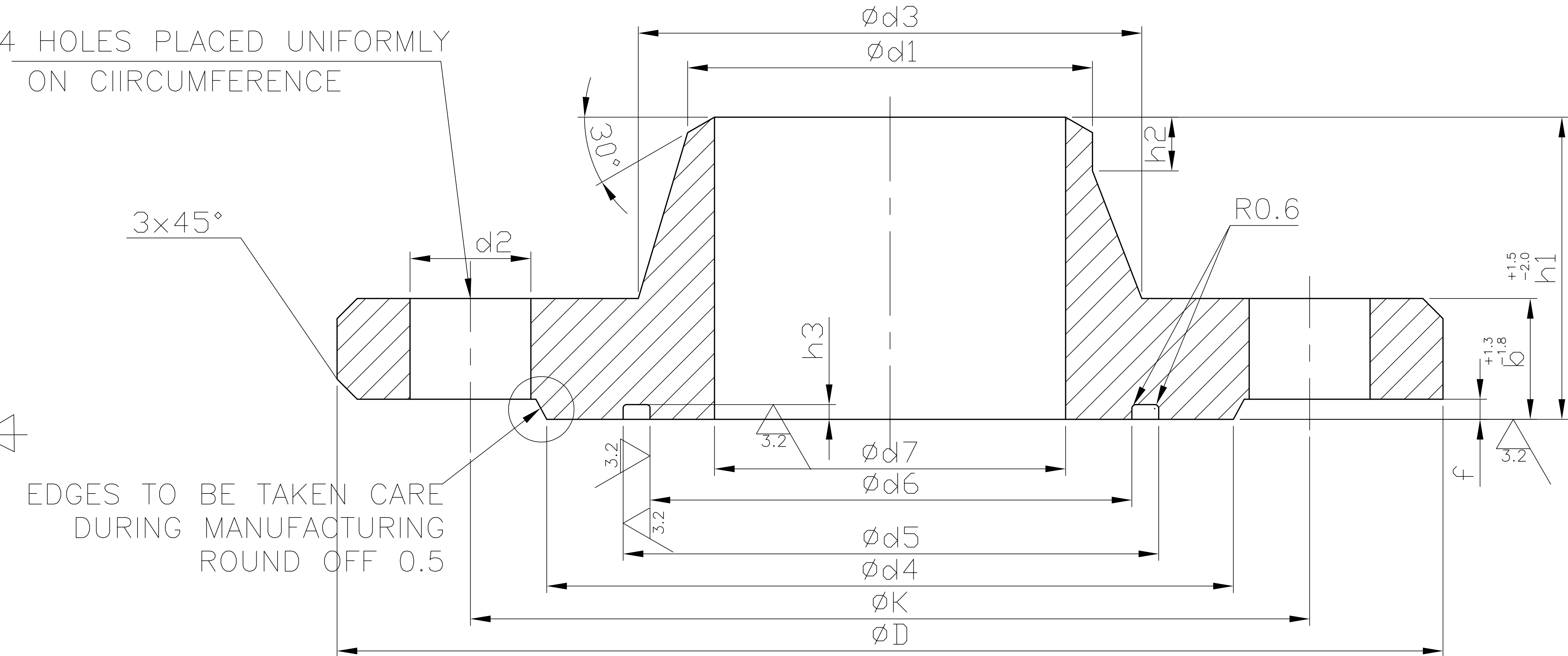
31492501005

DRAWING NO.

VAR NO.	d1	D	k	h1	d3	h2	d4	^{+2.0} _{-2.0} d2	^{+2.0} _{-2.0} d5	^{+2.0} _{-2.0} d6	^{+0.05} _{-0.05} h3	^{+0.2} _{-0.7} f	b	d7
00	60.3	165	125	45	75	8	102	18	79.5	71.5	2.2	3	18	52.3
01	26.9	105	75	38	40	6	58	14	39.5	31.5	2.2	2	16	22.3
02	33.7	115	85	38	45	6	68	14	45.5	37.5	2.2	2	16	28.5
03	60.3	152.4	120.6	45	75	8	92.1	19	79.5	71.5	2.2	3	15.9	52.3

12.5

THE REST



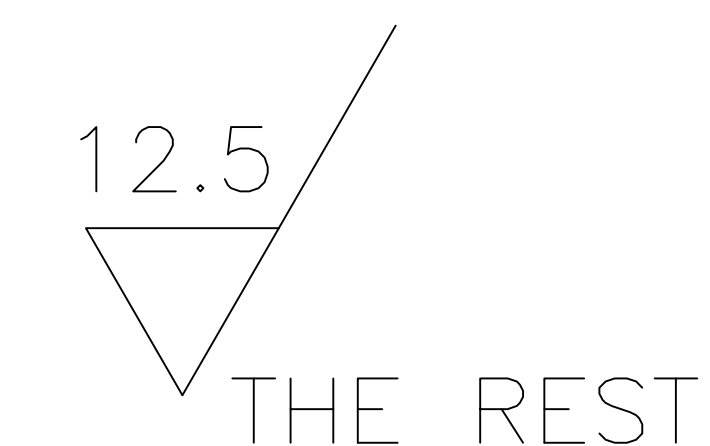
				CBOM NO. 0-149-25-01000			STATUS OF DRG.	
				AGREED DEPT.	NAME	SIGN	DATE	
GRADE OF UNTOL. DIM.:-				EMT	S.CHANDRA	SD- /	15/1/82	
M/CG- ✓/C/M/✓ AA 0230208				WT	S.CHANDRA	SD- /	14/6/82	
WELDING-A/B/C/D-AA621104-								
GAS CUTTING-'T3'AA0621101								
REV.	DATE	ALTERED PG sd/-		REV.	DATE	ALTERED PG sd/-		
04	06.12.11	CHECKED RLV sd/-		03	15/09/10	CHECKED RLV sd/-		
CAF NO TGE-111-F0396				CAF NO TGE-10-F0255				
				17				

TYPE OF PRODUCT OR NAME OF CUSTOMER/ PROJECT					
TG-HW-0500-2					
Bharat Heavy Electricals Ltd. Hardwar					
DEPT. TGE	SCALE	WEIGHT(Kg)	REF. TO ASSY. DRG.	ITEM NO.	NO.OF ITEMS
CODE 42/33	NTS	SEE TABLE	0-149-25-01000		
TITLE			DRAWING NO.		
FLANGE			31492501005		
SHEET NO.			NO.OF SHEETS		
1			1		

SIZE A3

EDGES TO BE TAKEN CARE
DURING MANUFACTURING
ROUND OFF 0.5

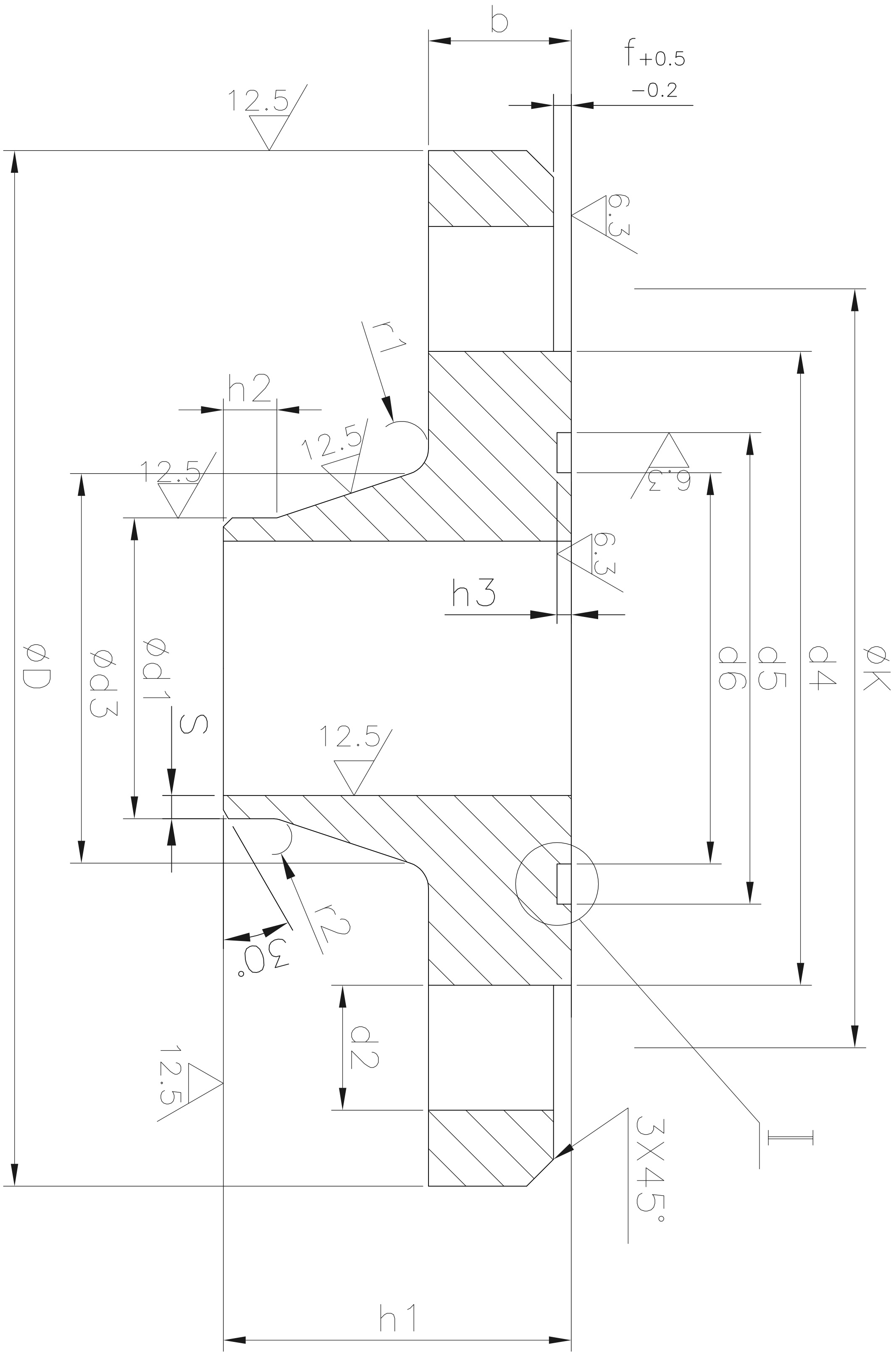
VAR NO.	d1	D	k	h1	d3	h2	d4	d2 ^{+2.0}	h3 ^{+0.05}	f ^{+0.2 -0.7}	b	d5
00	60.3	165	125	45	75	8	102	18	2.2	3	18	52.3
01	26.9	105	75	38	40	6	58	14	2.2	2	16	22.3
02	33.7	115	85	38	45	6	68	14	2.2	2	16	28.5
03	60.3	152.4	120.6	45	75	8	92.1	19	2.2	3	15.9	52.3



SERRATION ON FLANGE FACE – FLANGES SHALL HAVE A CONTINUOUS SPIRAL GROOVE PRODUCED BY A 1.5 MM RADIUS ROUND-NOSED TOOL AT A FEED OF APPROXIMATELY 0.8MM PER REVOLUTION.

CBOM NO.				STATUS OF DRG.				TYPE OF PRODUCT OR NAME OF CUSTOMER/ PROJECT				THDF 115/67			
AGREED DEPT.		NAME		SIGN		DATE									
GRADE OF UNTOL. DIM.:-															
M/CG- ✓/C/M/F AA 0230208															
WELDING-A/B/C/D-AA621104															
GAS CUTTING-'T3'AA0621101															
REV.		DATE		ALTERED		CHECKED		REV.		DATE		ALTERED		CHECKED	
DEPT. TGE				CODE 4133				TITLE				DRAWING NO.			
				BHARAT HEAVY ELECTRICALS LTD.				FLANGE				31492501055			
SCALE				NTS				WEIGHT(Kg)				SHEET NO.			
SEE TABLE				1				3				NO.OF SHEETS			
REF. TO ASSY. DRG.				ITEM NO.				73, 74				22, 23, 24			
73, 74				75, 76				77, 78				79, 80			

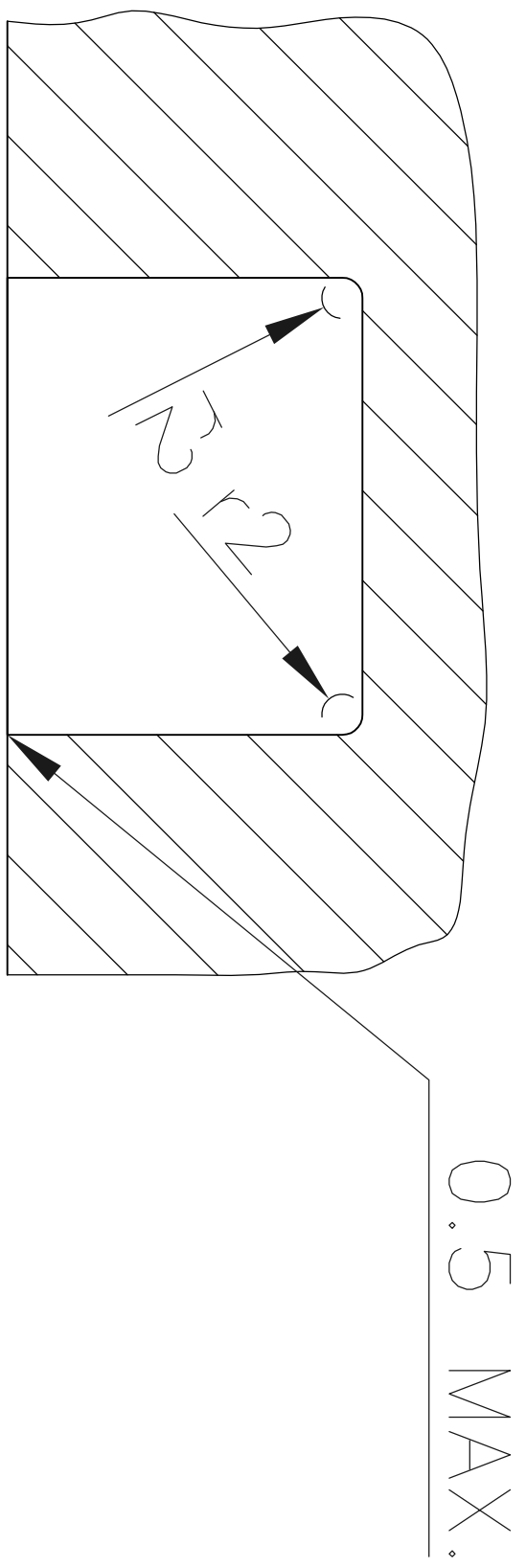
52110-32-641-3
DRAWING NO



VAR	NB	d1	D	b	K	h1	d3	s	r1	h2	d4	f+0.2 -0.7	N HOLE	d2	d5 ^{+0.2} -0.4	d6 ^{+0.4} -0.2	h3	r2
00	25	33.7	115	16 ^{+1.3} -1.8	85	38	45	2.6	4	6	68	2	4	13.5	41.3	33.3	1.85 ^{+0.1} 0.6	
01	40	48.3	150	16 ^{+1.3} -1.8	110	42	64	2.6	6	7	88	3	4	17.5	59.6	49.6	2.5 ^{+0.2} 1.2	
02	50	60.3	165	18 ^{+1.3} -1.8	125	45	75	4	6	8	102	3	4	17.5	69.6	59.6	2.5 ^{+0.2} 1.2	
03	65	76.1	185	18 ^{+1.3} -1.8	145	45	90	4	6	10	122	3	4	17.5	86.6	76.6	2.5 ^{+0.2} 1.2	
04	80	88.9	200	20 ^{+1.3} -1.8	160	50	105	4	8	10	138	3	8	17.5	96.6	86.6	2.5 ^{+0.2} 1.2	
05	20	26.9	105	16 ^{+1.3} -1.8	75	38	40	2.3	4	6	58	2	4	13.5	34.8	26.9	1.85 ^{+0.1} 0.6	
06	25	33.7	115	16 ^{+1.3} -1.8	85	38	45	2.6	4	6	68	2	4	13.5	59.1	49.1	2.5 ^{+0.2} 0.6	
07	50	60.3	165	18 ^{+1.3} -1.8	125	45	75	4	6	6	102	3	4	18	86.1	76.1	2.5 ^{+0.2} 0.6	

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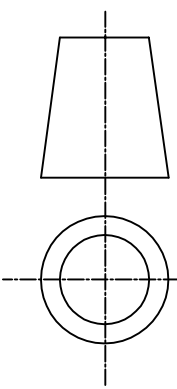
DETAIL-I



TECHNICAL REQUIREMENTS
IDENTIFICATION AS PER HW0400.397

Et1-12219 INVENTORY NO.	19/11/87 SIGN & DATE	KUN673.42(PART-2) REF. DRG NO.
----------------------------	-------------------------	-----------------------------------

CBOM NO. 0-149-32-01003				STATUS OF DRG.	
AGREED DEPT.	NAME	SIGN	DATE		
GTX	S.C.GOYAL	sd/-	10.11.87		
WT				B.CHOUDHARY	sd/-
GRADE OF UNTOL. DIM.:-				31.11.87	
M/CG- V/C/M/F AA 0230208					
WELDING-A/B/C/D-AA621104					
GAS CUTTING-T3'AA0621101					
REV.	DATE	ALTERED CHECKED	REV.	DATE	ALTERED CHECKED

TYPE OF PRODUCT OR NAME OF CUSTOMER/ PROJECT				TG-HH-210MW				
भारत भारती BHARAT HEAVY ELECTRICALS LTD. HARDWAR								
DEPT. TGE		SCALE	WEIGHT(Kg.)	DRN	NAME	SIGN	DATE	NO.OF VAR.
CODE 4233		N.T.S.		CHD	KB. MUKHERJEE	sd/-	07.03.87	
				APD	K.R.G./G.GUPTA	sd/-	06.07.87	
					A.C.C	sd/-	13.11.87	73, 74
					REF. TO ASSY. DRG.		ITEM NO.	NO.OF ITEMS
TITLE				1	3			75, 77
FLANGE								
DRAWING NO.				7, 3-149-32-01125				
SHEET NO.				NO.OF SHEETS				
				01				
				22, 23, 24				

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KUN673.41
REF. DRG NO.

25/11/86
SIGN & DATE

Et1-11527
INVENTORY NO.

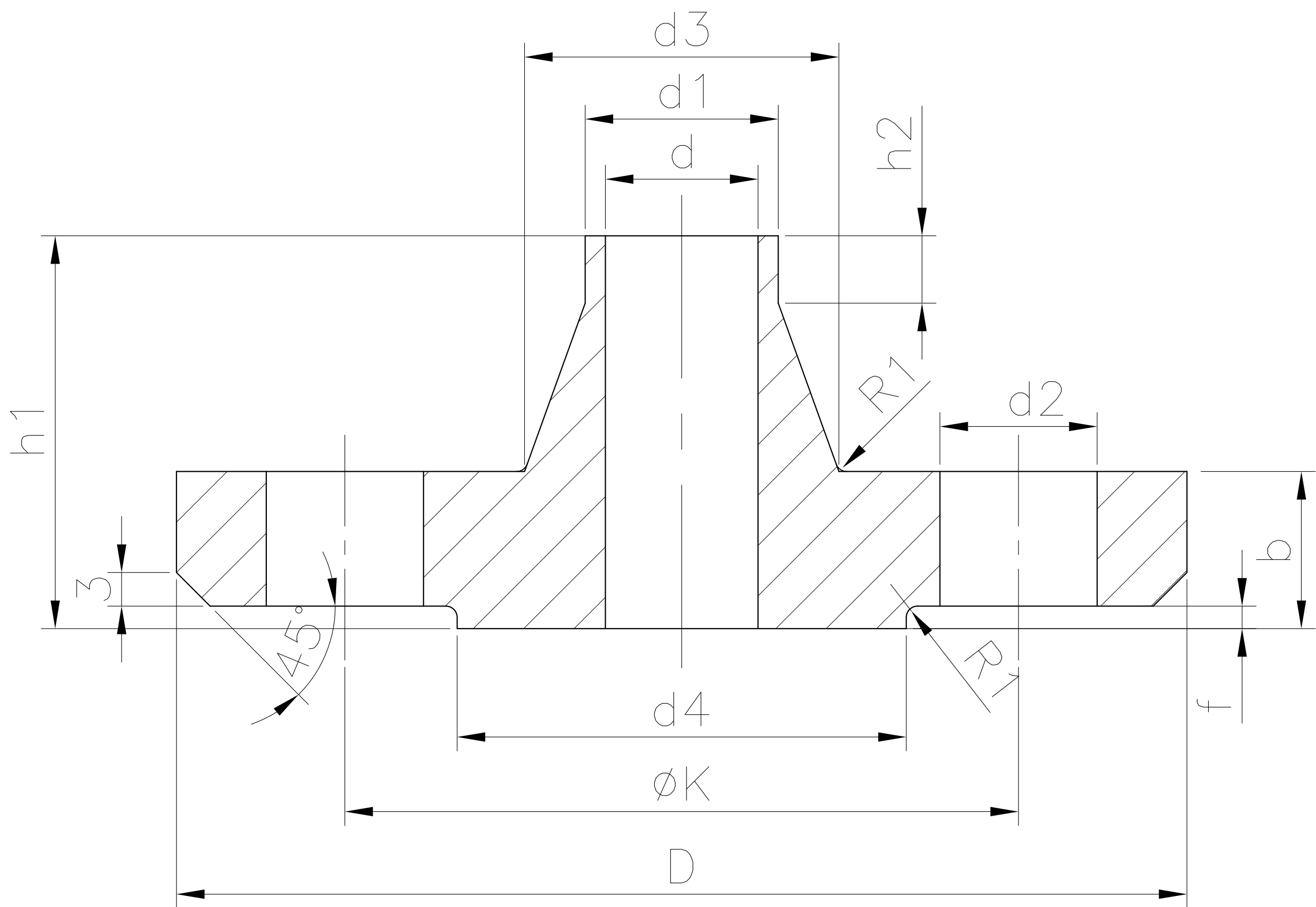
FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

FORM: DG-38(B)

00010-00-0913
DRAWING NO.

12.5/
ALL OVER



SERRATION ON FLANGE FACE – FLANGES SHALL HAVE A CONTINUOUS SPIRAL GROOVE PRODUCED BY A 1.5 MM RADIUS ROUND-NOSED TOOL AT A FEED OF APPROXIMATELY 0.8MM PER REVOLUTION.

VAR	D	K	d	d1	d2	d3	d4	h1	h2	f	b	N HOLES
00	90	60	13.6	17.2	14	28	40	35	6	2	14	4
01	95	65	19.3	21.3	14	32	45	35	6	2	14	4
02	115	85	28.5	33.7	14	45	68	38	6	2	16	4
03	150	110	43.1	48.3	18	64	88	42	7	3	16	4
04	165	125	52.3	60.3	18	75	102	45	8	3	18	4
05	200	160	80.9	88.9	18	105	138	50	10	3	20	8
06	220	180	106.3	114.3	18	131	158	52	12	3	20	8
07	185	145	68.1	76.1	18	90	122	45	10	3	18	4
08	340	295	206.5	219.1	23	235	268	62	16	3	24	12

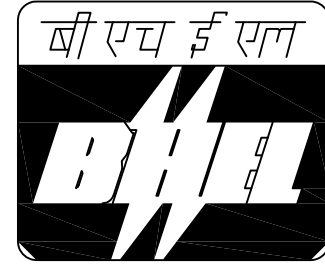
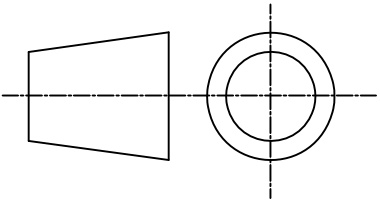
		009	FLANGE	3-150-00-01000		08	MATERIAL AS PER BOM			6.200
		008	FLANGE	3-150-00-01000		07				3.060
		007	FLANGE	3-150-00-01000		06				5.880
		006	FLANGE	3-150-00-01000		05				3.700
		005	FLANGE	3-150-00-01000		04				2.530
		004	FLANGE	3-150-00-01000		03				1.840
		003	FLANGE	3-150-00-01000		02				1.130
		002	FLANGE	3-150-00-01000		01				0.630
		001	FLANGE	3-150-00-01000		00				0.580
VAR	REMARKS	ITEM NO.	DECRPTION	DRAWING	STD	VAR	MATERIAL CODE A			UNIT WEIGHT
							MATERIAL SPEC. C			

CBOM NO. 0-150-00-01090		STATUS OF DRG.	
AGREED DEPT.	NAME	SIGN	DATE
GTX	S.C.GOYAL	sd/-	29.10.86
W.T	S.C.C	sd/-	29.11.86

GRADE OF UNTOL. DIM.:—		
M/CG- X/C/M/F AA 0230208		
WELDING-A/B/C/D-AA621104		
GAS CUTTING-'T3'AA0621101		

REV.	DATE	ALTERED CHECKED

REV.	DATE	ALTERED CHECKED

TYPE OF PRODUCT OR NAME OF CUSTOMER/ PROJECT		TG-HW-0500-2				
 BHARAT HEAVY ELECTRICALS LTD. HARDWAR		DRN	K B MUKHER JEE	sd/-	17.7.86	73, 74 NO.OF ITEMS
DEPT. EME		SCALE	N.T.S	WEIGHT(Kg.)	SEE TABLE	
CODE 4133						
TITLE FLANGE		1	3	DRAWING NO. 3-150-00-01000		22 23 24
		SHEET NO. 1		NO.OF SHEETS 1		

SIZE A3

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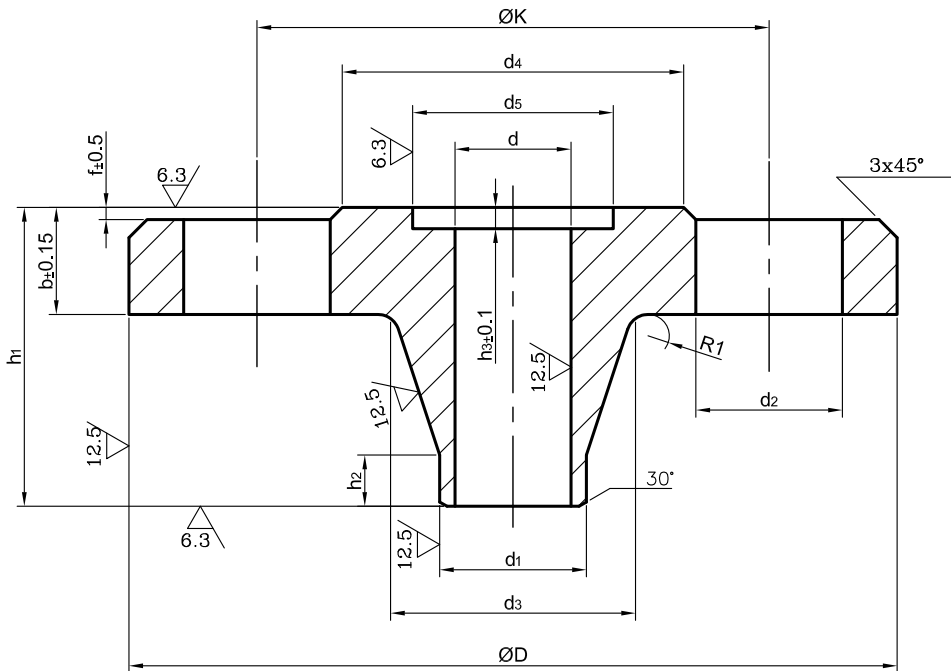
REF. DRG NO.
SIGN & DATE
INVENTORY NO.

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

FORM: DG-38(B)

3-150-00-01001
DRAWING NO.



VAR.	D	K	d	d ₁	d ₂	d ₃	d ₄	d ₅	h ₁	h ₂	h ₃	f	b	N HOLE
00	90	60	13.6	17.2	14	28	40	23.5	35	6	2.4	2	14	4
01	95	65	19.3	21.3	14	32	45	27.5	35	6	2.4	2	16	4
02	115	85	28.5	33.7	14	45	68	39.5	38	6	2.4	2	16	4
03	150	110	43.1	48.3	18	64	88	55.5	42	7	2.4	3	16	4
04	165	125	52.3	60.3	18	75	102	65.5	45	8	2.4	3	18	4
05	185	145	68.1	76.1	18	90	122	79.5	45	10	2.4	3	18	4
06	200	160	80.9	88.9	18	105	138	97.5	50	10	3.2	3	20	8
07	220	180	106.3	114.3	18	131	158	122.5	52	12	3.2	3	20	8

		008	FLANGE	3-150-00-01001	07	AA1041801238			4.	580	
		007	FLANGE	3-150-00-01001	06	AA1041801238			3.	660	
		006	FLANGE	3-150-00-01001	05	AA1041801211			3.	020	
		005	FLANGE	3-150-00-01001	04	AA1041801211			2.	500	
		004	FLANGE	3-150-00-01001	03	AA1041801203			1.	840	
		003	FLANGE	3-150-00-01001	02	AA1041801203			1.	130	
		002	FLANGE	3-150-00-01001	01	AA1041801190			0.	950	
		001	FLANGE	3-150-00-01001	00	AA1041801190			0.	580	
VAR. 00	REMARKS	KEY NO.	DESCRIPTION	STD	DRAWING NO.	29 31 VAR 32 33 46	MATERIAL CODE MATERIAL SPECN	A/C H/Z	UNIT WEIGHT 58 65 70	59 64 65 75 25 27 29 58 69 60 77	28 → CARD TYPE-2

CBOM NO. 0-150-00-01090				STATUS OF DRG.				TYPE OF PRODUCT OR NAME OF CUSTOMER/ PROJECT				TG-HW-0500-2						
AGREED DEPT.	NAME			SIGN			DATE											
GRADE OF UNTOL. DIM.:-																		
M/CG- V/C/M/F AA 0230208																		
WELDING-A/B/C/D-AA621104																		
GAS CUTTING-'T3'AA0621101																		
REV.	DATE	ALTERED		REV.	DATE	ALTERED		A/OK	DEPT.	EME	SCALE	WEIGHT(Kg.)	REF. TO ASSY. DRG.	ITEM NO.	NO.OF ITEMS			
		CHECKED		03	11.07.12	CHECKED		ANUBHAV	CODE	4133	N.T.S.	SEE TABLE			73, 74			
CHANGES DONE AS PER CHANGE AD. NO. TGE-12-F0265								TITLE FLANGE								DRAWING NO. 3-150-00-01001		75, 77
																SHEET NO. 01		NO.OF SHEETS 01

SIZE A3

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REF. DRG NO.

SIGN & DATE

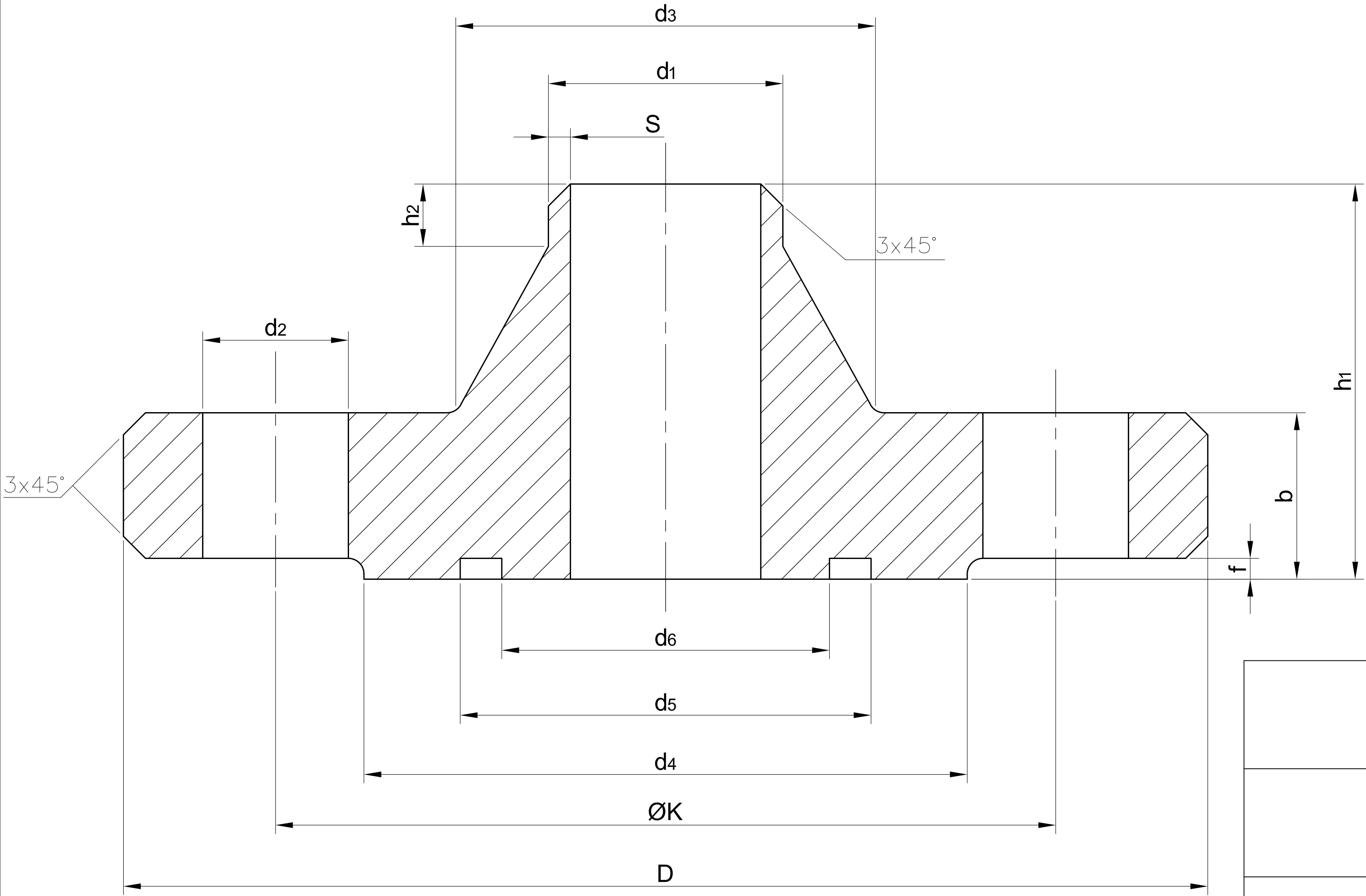
INVENTORY NO.

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

FORM: DG-38(B)

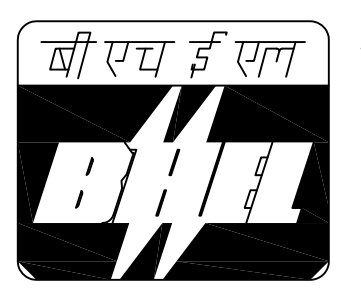
3-150-00-01027
DRAWING NO.

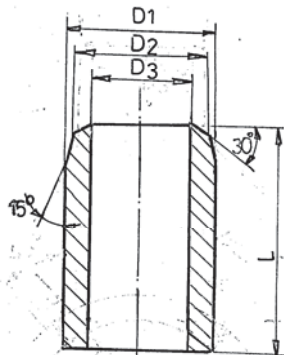


VAR.	D	d ₁	d ₂	d ₃	d ₄	d ₅	d ₆	h ₁	h ₂	ØK	b	S	f	N HOLE
00	105	26.9	14	40	58	39.5	31.5	38	6	75	16	2.3	2	4
01	200	88.9	18	105	138	99.5	91.5	50	10	160	20	3.2	3	8
02	220	114.3	18	131	158	136.5	123.5	52	12	180	20	3.6	3	8
03	90	17.2	14	28	40	30.5	22.5	35	6	60	14	1.8	2	4
04	95	21.3	14	32	45	35.5	27.5	35	6	65	14	2	2	4
05	115	33.7	18	45	68	45.5	37.5	38	6	85	16	2.6	2	4
06	150	48.3	18	64	88	64.5	56.5	42	7	110	16	2.6	3	4
07	165	60.3	18	75	102	79.5	71.5	45	8	125	18	2.9	3	4

VAR.	b ₁	
	DEPTH	TOL.
00	2.2	+0.1
01	2.2	+0.1
02	2.8	+0.1
03	2.2	+0.1
04	2.2	+0.1
05	2.2	+0.1
06	2.2	+0.1
07	2.2	+0.1

		008	FLANGE	3-150-00-01027	07	AA1041801211			2	530
		007	FLANGE	3-150-00-01027	06	AA1041801203			1	860
		006	FLANGE	3-150-00-01027	05	AA1041801203			1	140
		005	FLANGE	3-150-00-01027	04	AA1041801190			1	000
		004	FLANGE	3-150-00-01027	03	AA1041801190			0	580
		003	FLANGE	3-150-00-01027	02	AA1041801238			4	580
		002	FLANGE	3-150-00-01027	01	AA1041801238			3	660
		001	FLANGE	3-150-00-01027	00	AA1041801203			1	000
VAR. 00	REMARKS	ITEM NO.	DESCRIPTION	STD	DRAWING NO.	29 31 VAR 32 33 46	MATERIAL CODE MATERIAL SPECN	A C Z C	UNIT WEIGHT	58 65 70
CARD TYPE-3			CARD TYPE-1			CARD TYPE-2				

CBOM NO. 0-150-00-01090				STATUS OF DRG.				TYPE OF PRODUCT OR NAME OF CUSTOMER/ PROJECT																			
AGREED DEPT.				NAME				SIGN				DATE				TG-HW-0500-2											
GRADE OF UNTOL. DIM.:—								 BHARAT HEAVY ELECTRICALS LTD. HARDWAR								DRN		NAME		SIGN		DATE		NO.OF VAR.			
M/CG- X/C/M/F AA 0230208																CHD		A.AGARWAL		SD/		10.07.12		73 74			
WELDING-A/B/C/D-AA621104																APD		A.JAIN		SD/		10.07.12					
GAS CUTTING-'T3'AA0621101								DEPT. EME								SCALE N.T.S.		WEIGHT(Kg.) SEE TABLE		REF. TO ASSY. DRG.				ITEM NO.		NO.OF ITEMS	
REV.		DATE		ALTERED CHECKED		REV.																					
CHANGES DONE AS PER CHANGE AD. NO. TGE-12-F0266								TITLE FLANGE								1 3		DRAWING NO. 3-150-00-01027									
																		SHEET NO. 01 NO.OF SHEETS 01									

3-150-00-01190
DRAWING NO.12.5/
✓ ALL OVER
EXCEPT OTHER
WISE STATED

03	50	25	012	36.5	33.7	28.5	011	MATERIAL	-0142
03	100	50	011	60.3	52.3		10	AS PER BOM	-0560
03	50	15	010	25.3	21.3	16.7	09		0100
04	50	25	009	36.5	33.7	28.5	08		0142
03	50	20	008	30.5	26.9	21.7	07		0115
	50	8	007	17.5	13.5	8.3	06		0060
03	50	15	006	25.3	21.3	16.7	05		-0100
03	50	20	005	30.5	26.9	21.7	04		-0115
	50	20	004	30.5	26.9	21.7	03		0115
	50	15	003	25.3	21.3	16.7	02		0100
	100	50	002	60.3	52.3		01		0560
	50	10	001	21.2	17.2	13.6	00		0080
L	N B	SL No.		Ø D1	Ø D2	Ø D3			
59	64	65	75	25	27	29	58		
CARD TYPE-3				CARD TYPE-1			CARD TYPE-2		
29	31	34	45	55	58	65	71	72	
MATERIAL CODE				MATERIAL SPECN.				UNIT WEIGHT	
VAR				C				G	

MATERIAL
AS PER
BOM

NOTE:

WELDING TO BE DONE AT SITE

REV	DATE	ALTERED P.A.B.
05	4.9.99	CHECKED R.L.V.

CH. ADVICE No.
TGE-99-327GMS No./GR-SP. No.
01500001125STATUS
OF DRG

AGREED DEPT	NAME	SIGN	DATE
GTK	SCGOYAL		23/1/97

TYPE OF PRODUCT
OR03-NUCLER POWER CORPORATION
(500 MW)

NAME OF CUSTOMER/PROJECT TARAPUR ATOMIC POWER PROJECT-4

BHARAT HEAVY ELECTRICALS LTD.

HARDWARE

DRN	NAME	SIGN	DATE	No. OF VAR
KADDOOR				
CHD	K.R.G.		13.1.92	
APPD	G.M.K.		10.9.92	73, 74

DEPT
TGE
CODE
2033SCALE
N.T.SWEIGHT (KG)
SEE TABLEREF. TO ASSY. DRG.
0-150-00-01125ITEM
No.
75 77TITLE :
CONNECTIONCARD
CODEDRAWING No.
3-150-00-01190

SHEET No. 01 No. OF SHEETS 01

REV	DATE	ALTERED KBM
04	10.1.97	CHECKED KRG

GRADE OF UNTOL. DIM:-

MCG. :- C/M/F/ AA 023 0208

WELDING :- 'T1' O 610.003

GAS CUTTING :- 'T3' AA 0621101

REV	DATE	ALTERED P.A.B.
03	11.9.96	CHECKED KRG

CH. AD. NO. TGE-96-325

REV	DATE	ALTERED KBM
02	30.5.96	CHECKED R.L.V.

CH. AD. NO. TGE-96-161

REV	DATE	ALTERED KBM
01	18.11.95	CHECKED KRG

CH. AD. NO. TGE-95-445

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REF. DRG NO.

SIGN & DATE

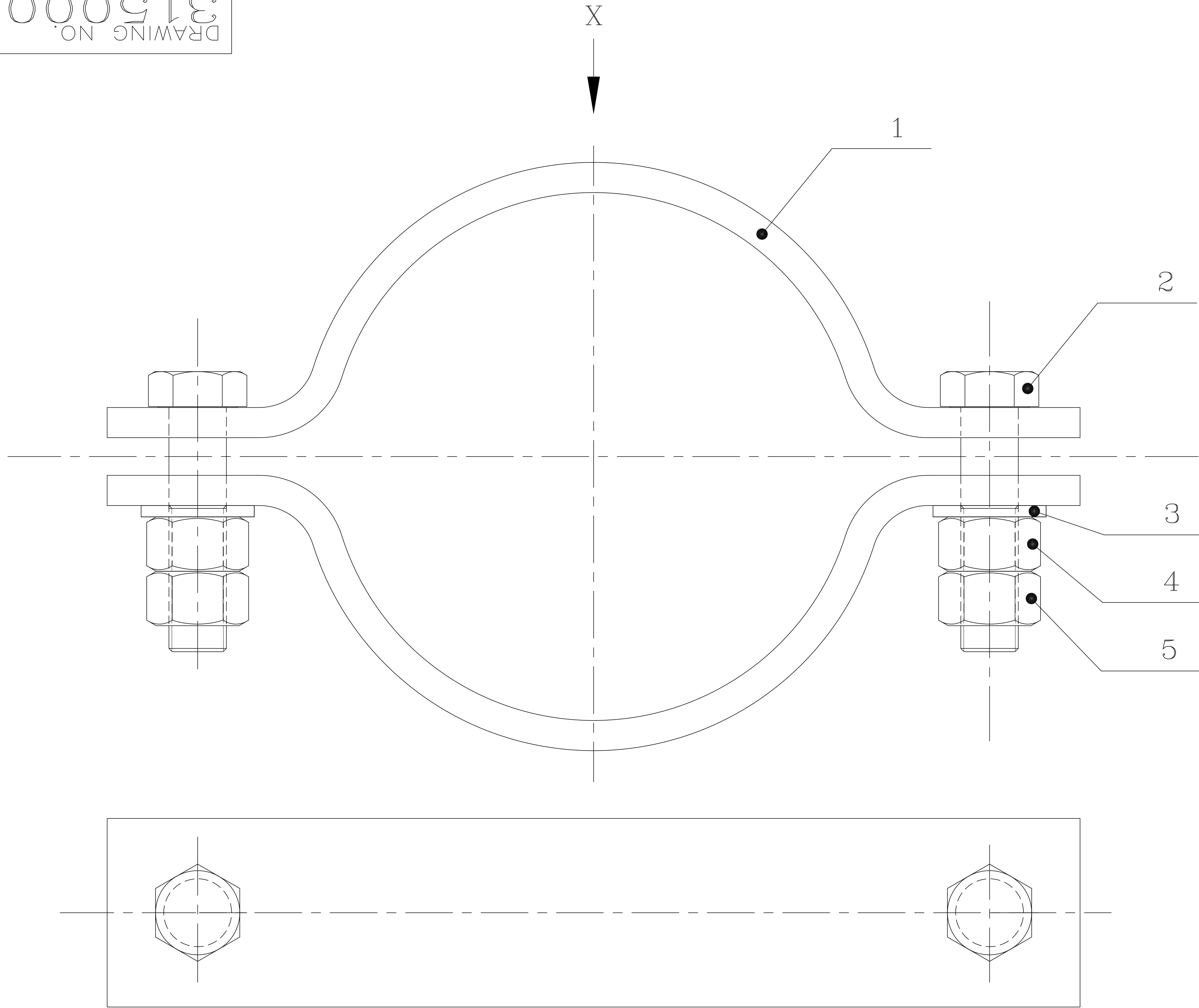
INVENTORY NO.

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

FORM: DG-38(B)

31500001237
DRAWING NO.



VAR	SIZE(NB)	WT.(Kg)	PART DRG FOR ITEM NO.1
00	125	2.15	31500001238,VAR00
01	150	2.40	31500001238,VAR01

VIEW-X

GRADE OF UNTOL. DIM.:—			CBOM NO. 31500001237		STATUS OF DRG.		TYPE OF PRODUCT OR NAME OF CUSTOMER/ PROJECT						THDF 115/67										
M/CG— V/C/M/F AA 0230208—			AGREED DEPT.		NAME		SIGN		DATE		DRN		NAME		SIGN		DATE		NO.OF VAR.				
WELDING—A/B/C/D—AA621104—			EMT		AEMTAKG		AEMTAKG		30-10-2013				CHD		STGEPG		STGEPG		26-10-2013				
GAS CUTTING—'T3'AA0621101—													APD		ATGEAKM		ATGEAKM		27-12-2013				
REV.		DATE		ALTERED CHECKED		REV.		DATE		ALTERED CHECKED		DEPT. TGE		SCALE		WEIGHT(Kg.)		REF. TO ASSY. DRG.		ITEM NO.		NO.OF ITEMS	
												CODE 4133		05-01		8251400001009		21		75, 77			
												TITLE PIPE CLAMP ASSEMBLY						DRAWING NO. 31500001237					
																		SHEET NO.1		NO.OF SHEETS 1			

SIZE A3

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REF. DRG NO.

SIGN & DATE

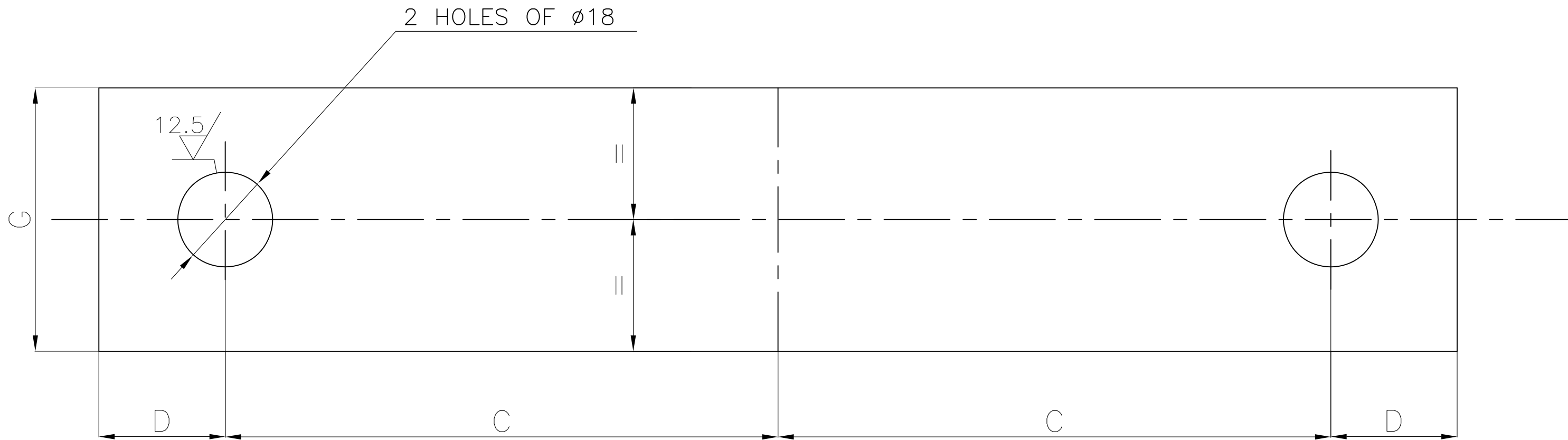
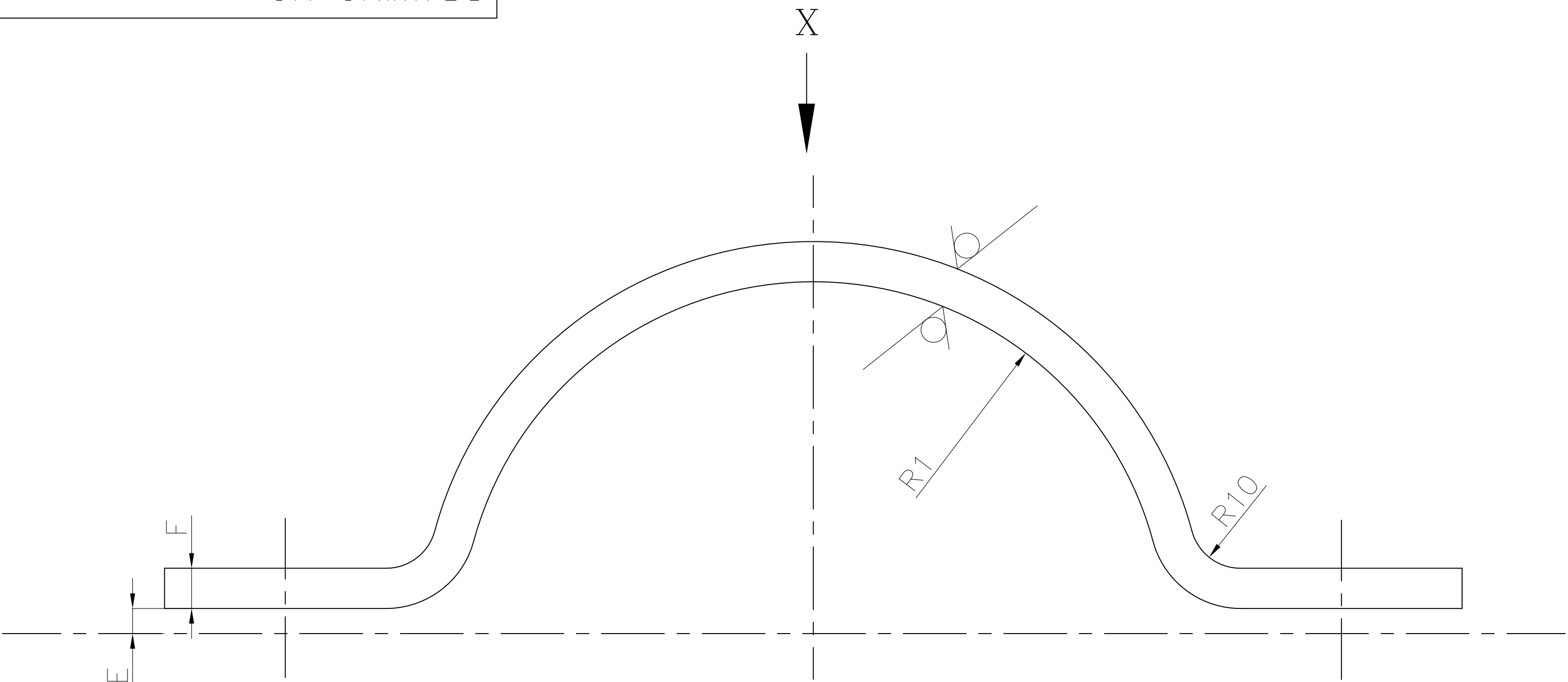
INVENTORY NO.

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

FORM: DG-38(B)

882100001238
DRAWING NO.



VIEW-X

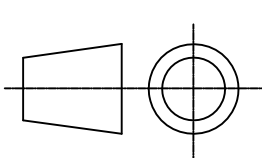
50
✓ ALONG CONTOUR

VAR	SIZE(NB)	WT.(Kg)	R1	C	D	E	F	G	STRETCHED LENGTH
00	125	2.15	70	105	24	5	8	50	318
01	150	2.40	85	120	24	5	8	50	365

TECHNICAL REQUIEMENTS

- IDENTIFICATION ACCORDING TO HW 0400397.
- ROUND-OFF SHARP EDGES.

GRADE OF UNTOL. DIM.:—			CBOM NO. 31500001237		STATUS OF DRG.	
M/CG— v/c/M/AA 0230208	WTX	AWTXRR	AWTXRR	15/11/2013		
WELDING=A/B/C/D=AA621104						
GAS CUTTING—'T3'AA0621101						
REV.	DATE	ALTERED	REV.	DATE	ALTERED	
		CHECKED			CHECKED	

TYPE OF PRODUCT OR NAME OF CUSTOMER/ PROJECT				THDF 115/67				
बी एच ई एल BHEL BHARAT HEAVY ELECTRICALS LTD. HARDWAR					NAME	SIGN	DATE	NO.OF VAR.
				DRN	STGEKM	STGEKM	28/10/2013	
				CHD	STGEPG	STGEPG	28/10/2013	
				APD	ATGEAKM	ATGEAKM	27/12/2013	73 74
DEPT. TGE		SCALE	WEIGHT(Kg.)	REF. TO ASSY. DRG.			ITEM NO.	NO.OF ITEMS
CODE 4133		1:1.5	0.30					75 77
TITLE			1	3	DRAWING NO.			
PIPE CLAMP					315000001238			
				SHEET NO.1			NO.OF SHEETS 1	

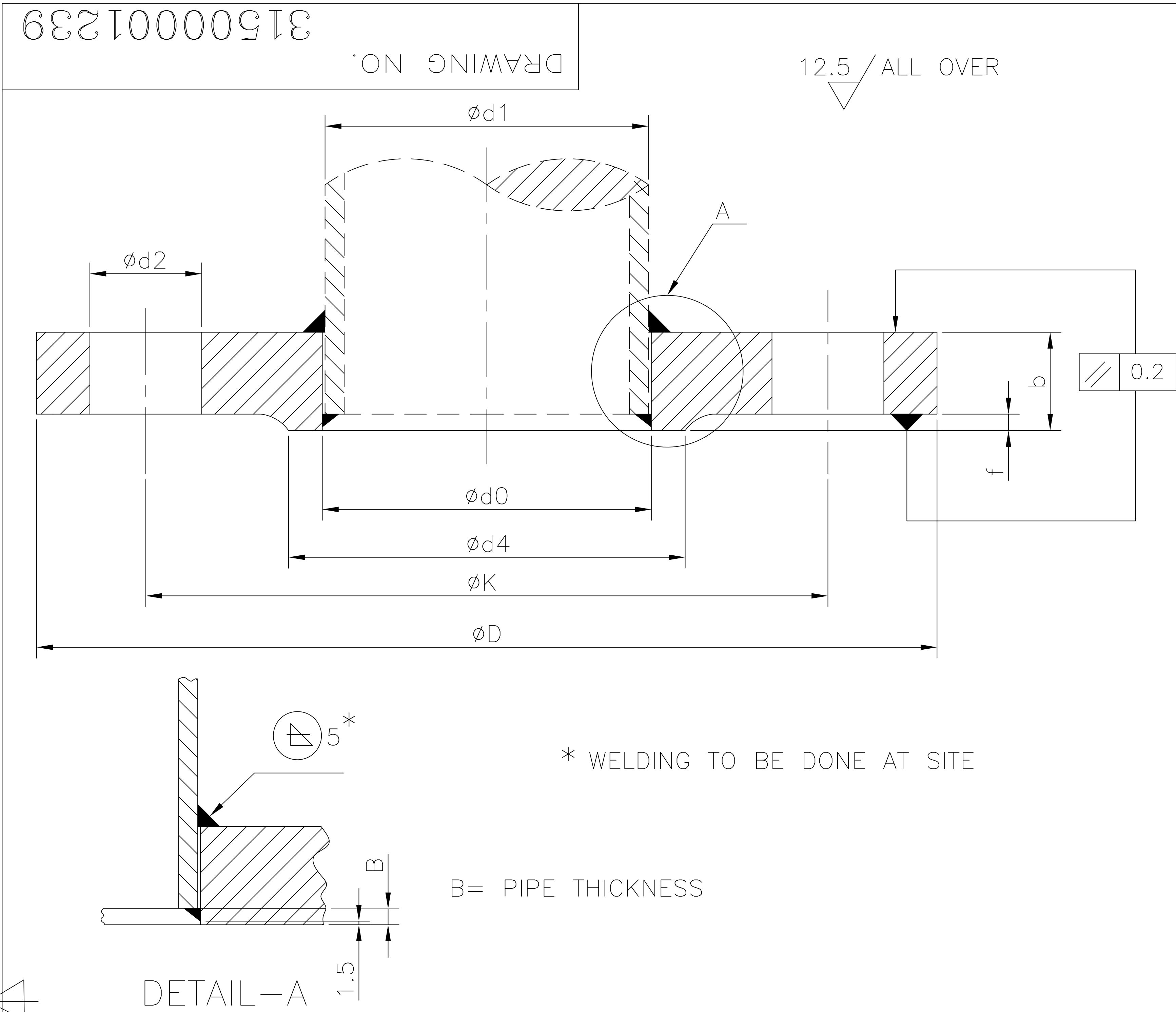
SIZE A3

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FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

FORM: DG-38(B)



VARIANT	NOM. SIZE (NB)	CONNEC- TING PIPE O.D.	FLANGE DIMENSIONS									BOLTING DETAILS					Wt/ PIECE IN kg
			d0		D		b		RAISED FACE			BOLT SIZE	HOLES		K		
			NOM.	TOL.	NOM.	TOL.	NOM.	TOL.	d4		f						
									NOM.	TOL.							
		d1											NO	d2			
01	10	17.2	17.7	+0.5 +0.0	90	±1	14	+3 -0	40	+0.0 -1.0	2	M12	4	14	60	0.53	
02	15	21.3	21.8		95		14		45		2	M12	4	14	65	0.59	
03	20	26.9	27.4		105		16		58		2	M12	4	14	75	0.73	
04	25	33.7	34.2		115		16		68		2	M12	4	14	85	1.02	
05	32	42.4	42.9		140		16		78		2	M16	4	18	100	1.47	
06	40	48.3	48.8		150		16		88		3	M16	4	18	110	1.77	
07	50	60.3	60.8		165		18		102		3	M16	4	18	125	2.18	
08	65	76.1	76.6		185		18		122		3	M16	4	18	145	2.67	
09	80	88.9	89.9		200		20		138		3	M16	8	18	160	3.28	
10	100	114.3	115.3	+1.0 +0.0	220	±1.5	20	+3 -0	158	+0.0 -2.0	3	M16	8	18	180	3.62	
11	125	139.7	140.7		250		22		188		3	M16	8	18	210	4.99	
12	150	168.3	169.3		285		22		212		3	M20	8	22	240	6	
13	175	193.7	194.7		315	±2.0	24		242		3	M20	8	22	270	7.82	
14	200	219.1	221.1		340		24		268		3	M20	12	22	295	8.31	
15	250	273	275		405		26		320		3	M24	12	26	355	11.9	
16	300	323.9	325.9		460		28		378		4	M24	12	26	410	14.7	
17	350	355.6	357.6		520	±1.5	32			438	+0.0 -3.0	4	M24	16	26	470	24.3
18	125	139.7	140.7		270		22			188	+0.0 -2.0	3	M24	8	26	220	5.0
19	100	114.3	115.3		235		24			162	3	M20	8	22	190	3.8	

TECHNICAL REQUIREMENTS

1. RIMS SHALL BE TURNED OR BURRS SHALL BE REMOVED ALONG WITH MACHINING OF CENTER HOLE. ALL BOLT HOLES SHALL BE DRILLED, EQUALLY SPACED ON THE PITCH CIRCLE DIAMETER AND SPOT FACED.
2. MATERIAL : CARBON STEEL AS PER IS-2062E250BR.
3. PRESERVATION : BEFORE DESPATCH, THE FLANGES SHALL BE DRIED AND CLEANED, AND THE ENTIRE SURFACE SHALL BE WELL COVERED WITH GOOD QUALITY RUST PREVENTIVE MATERIAL THAT WILL NOT BECOME FLUID AND RUN OFF AT 65 °C.
4. SERRATION ON FLANGE FACE – FLANGES SHALL HAVE A CONTINUOUS SPIRAL GROOVE PRODUCED BY A 1.5 MM RADIUS ROUND-NOSED TOOL AT A FEED OF APPROXIMATELY 0.8MM PER REVOLUTION.

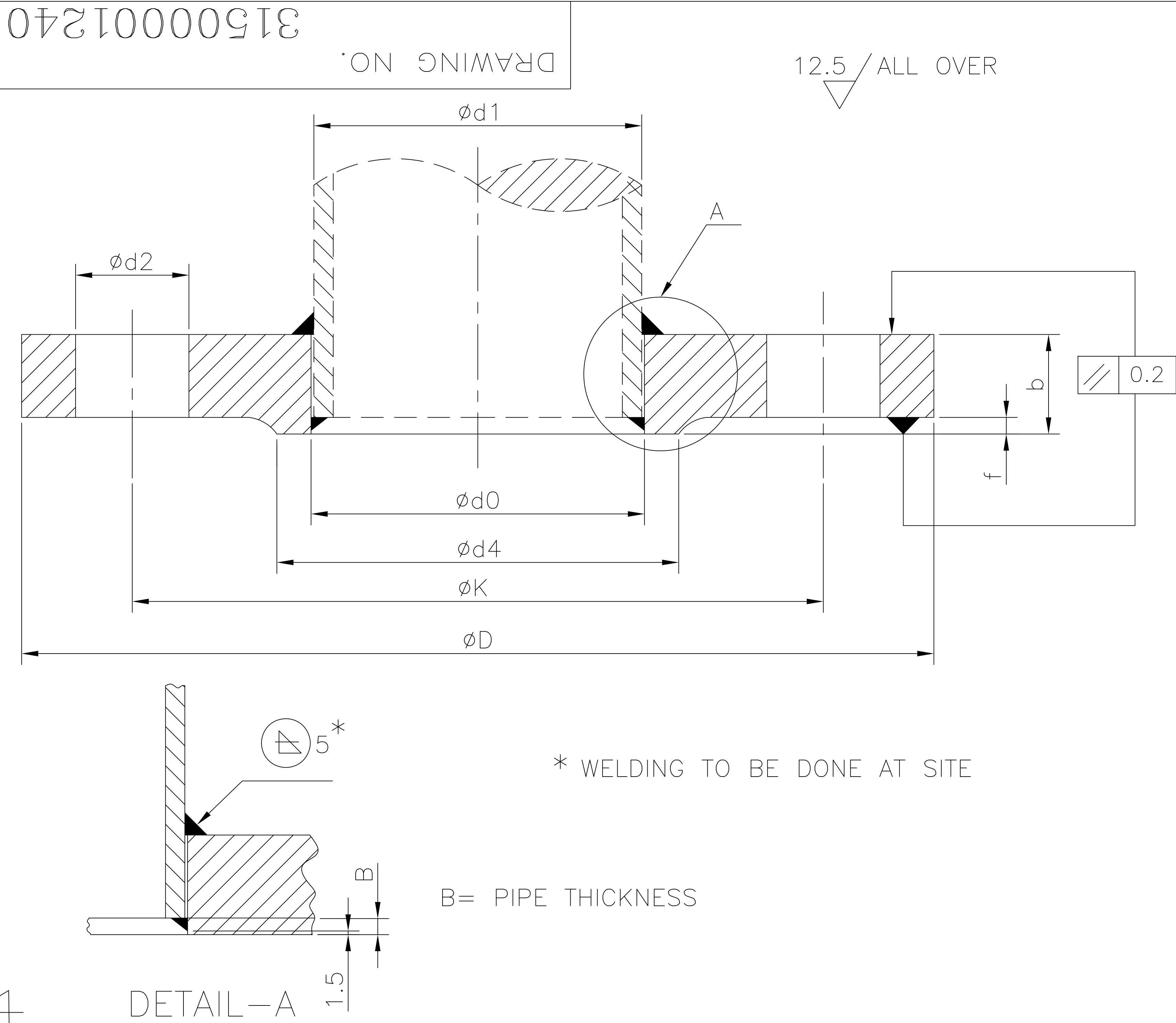
PURCHASED

CBOM NO.			STATUS OF DRG.		TYPE OF PRODUCT OR NAME OF CUSTOMER/ PROJECT																					
AGREED DEPT.			NAME		SIGN		DATE		THDF 115/67																	
GRADE OF UNTOL. DIM.:—					DRN		NAME		SIGN		DATE		NO.OF VAR.													
M/CG- X/Ø/M/Ø AA 0230208							ALOK AGARWAL		SD/—		25.03.14															
WELDING A/B/C/D AA621104							KUNAL MISHRA		SD/—		25.03.14															
GAS CUTTING-’T3’AA0621101							RAKESH KUMAR		SD/—		25.03.14		73, 74													
REV.			DATE		ALTERED		REV.		DATE		ALTERED KM		DEPT. TGE		SCALE		WEIGHT(Kg.)		REF. TO ASSY. DRG.		ITEM NO.		NO.OF ITEMS			
					CHECKED		01		15.12.17		CHECKED MA		CODE 4133		NTS		SEE TABLE				—		75, 77			
1. VARIANT 19 IS ADDED. 2. TR NO. 4 IS ADDED.					TITLE										FLANGE PN16 (CARBON STEEL)		1		3		DRAWING NO. 315000001239		71, 72, 23, 24			
																					SHEET NO. 1		NO.OF SHEETS 1			

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

FORM: DG-38(B)



VARIANT	NOM. SIZE (NB)	CONNEC- TING PIPE O.D.	FLANGE DIMENSIONS								BOLTING DETAILS						Wt/ PIECE IN kg
			d0		D		b		RAISED FACE			BOLT SIZE	HOLES		K		
			NOM.	TOL.	NOM.	TOL.	NOM.	TOL.	d4		f						
									NOM.	TOL.			NO	d2			
01	10	17.2	17.7	+0.5 +0.0	90	±1	14	+3 -0	40	+0.0 -1.0	2	M12	4	14	60	0.53	
02	15	21.3	21.8		95		14		45		2	M12	4	14	65	0.59	
03	20	26.9	27.4		105		16		58		2	M12	4	14	75	0.73	
04	25	33.7	34.2		115		16		68		2	M12	4	14	85	1.02	
05	32	42.4	42.9		140		16		78		2	M16	4	18	100	1.47	
06	40	48.3	48.8		150		16		88		3	M16	4	18	110	1.77	
07	50	60.3	60.8		165		18		102		3	M16	4	18	125	2.18	
08	65	76.1	76.6		185		18		122		3	M16	4	18	145	2.67	
09	80	88.9	89.9	200	20	138	3	M16	8	18	160	3.28					
10	100	114.3	115.3	+1.0 +0.0	220	±1.5	20	+3 -0	158	+0.0 -2.0	3	M16	8	18	180	3.62	
11	125	139.7	140.7		250		22		188		3	M16	8	18	210	4.99	
12	150	168.3	169.3		285		22		212		3	M20	8	22	240	6	
13	175	193.7	194.7		315	24	242		3		M20	8	22	270	7.82		
14	200	219.1	221.1		340	±2.0	24		268		3	M20	12	22	295	8.31	
15	250	273	275		405	26	320		3		M24	12	26	355	11.9		
16	300	323.9	325.9		460	28	378		4		M24	12	26	410	14.7		
17	350	355.6	357.6		520	32	438		+0.0 -3.0		4	M24	16	26	470	24.3	
18	125	139.7	140.7		270	±1.5	22		188		+0.0 -2.0	3	M24	8	26	220	5.0
19	100	114.3	115.3	235	±1.5	24	162	+0.0 -2.0	3	M20	8	22	190	3.8			

TECHNICAL REQUIREMENTS

1. RIMS SHALL BE TURNED OR BURRS SHALL BE REMOVED ALONG WITH MACHINING OF CENTER HOLE. ALL BOLT HOLES SHALL BE DRILLED, EQUALLY SPACED ON THE PITCH CIRCLE DIAMETER AND SPOT FACED.
2. MATERIAL : STAINLESS STEEL AS PER ASTM A182 F321.
3. PRESERVATION : BEFORE DESPATCH, THE FLANGES SHALL BE DRIED AND CLEANED, AND THE ENTIRE SURFACE SHALL BE WELL COVERED WITH GOOD QUALITY RUST PREVENTIVE MATERIAL THAT WILL NOT BECOME FLUID AND RUN OFF AT 65 °C.
4. SERRATION ON FLANGE FACE – FLANGES SHALL HAVE A CONTINUOUS SPIRAL GROOVE PRODUCED BY A 1.5 MM RADIUS ROUND-NOSED TOOL AT A FEED OF APPROXIMATELY 0.8MM PER REVOLUTION.

CBOM NO.				STATUS OF DRG.	
AGREED DEPT.	NAME	SIGN	DATE		
GRADE OF UNTOL. DIM.:—					
M/CG- X/Ø/M/Ø AA 0230208					
WELDING A/B/C/D AA621104-					
GAS CUTTING-'T3'AA0621101					
REV.	DATE	ALTERED	REV.	DATE	ALTERED KM
		CHECKED	01	15.12.17	CHECKED MA
			1. VARIANT 19 IS ADDED. 2. TR NO. 4 IS ADDED.		

TYPE OF PRODUCT
OR
NAME OF CUSTOMER/ PROJECT

THDF 115/67

DRN

CHD

APD

BHARAT HEAVY ELECTRICALS LTD.

HARDWAR

NAME

SIGN

DATE

ALOK AGARWAL

SD/-

25.03.14

KUNAL MISHRA

SD/-

25.03.14

RAKESH KUMAR

SD/-

25.03.14

DEPT. TGE

CODE 4133

TITLE
FLANGE
(STAINLESS STEEL)

SCALE
NTS

WEIGHT(Kg.)
SEE TABLE

REF. TO ASSY. DRG.
—

ITEM NO.
—

NO.OF VAR.
73, 74

NO.OF ITEMS
75, 77

DRAWING NO.
31500001240

SHEET NO. 1

NO.OF SHEETS 1

SIZE A3

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REF. DRG NO.

SIGN & DATE

INVENTORY NO.

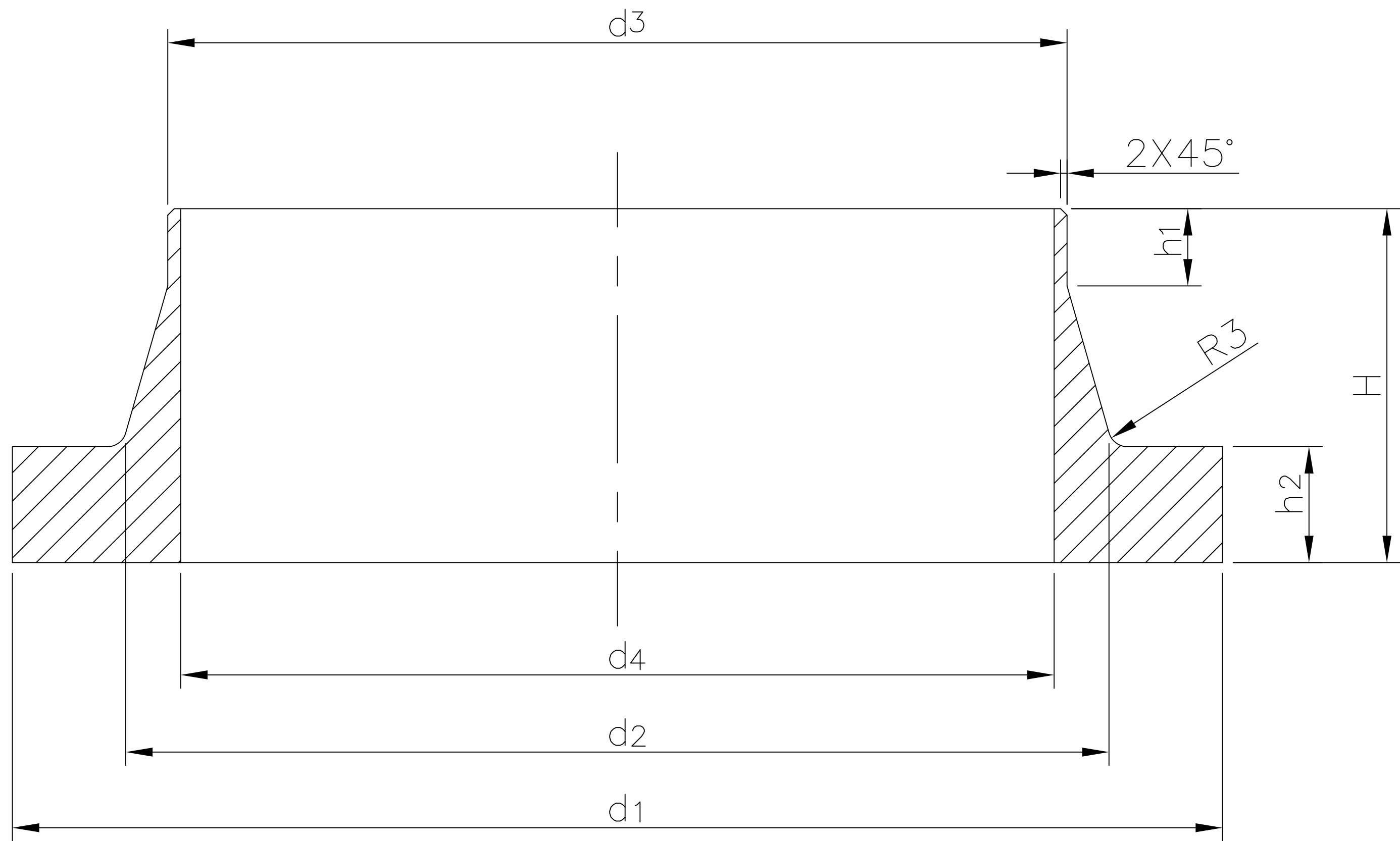
FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

FORM: DG-38(B)

31531401088
DRAWING NO.

12.5/
ALL OVER

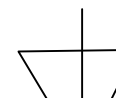


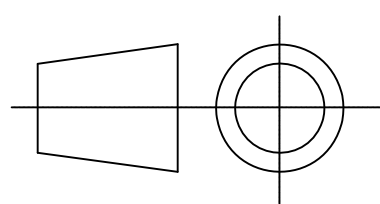
REF.ASSLY	ITEM	VAR.	NB	d1	d2	d3	d4	h1	h2	H	WT.
31531401076	01	00	125	188	158	139.7	131.7	12	22	68	3.95
31531401071	01	01	150	218	188	168.3	159.3	12	22	75	5.20

TECHNICAL REQUIREMENTS

- EDGE PREPARATION AS PER HW0620.599.
- MATERIAL OF THE NECK SHALL BE STAINLESS STEEL AS PER BHEL CORPORATE STD NO.AA10725.
- MATERIAL TEST CERTIFICATES SHALL BE SUPPLIED.
- SERRATION ON NECK FACE – FLANGES SHALL HAVE A CONTINUOUS SPIRAL GROOVE PRODUCED BY A 1.5 MM RADIUS ROUND-NOSED TOOL AT A FEED OF APPROXIMATELY 0.8MM PER REVOLUTION.

PURCHASED

				CBOM NO. 01531401007			STATUS OF DRG.	
				AGREED DEPT.	NAME		SIGN	DATE
GRADE OF UNTOL. DIM.:—				EMT	AEMTNCG		AEMTNCG	18/05/2007
M/CG— X /C/ M / F AA 0230208								
WELDING—A/B/C/D—AA621104—								
GAS CUTTING—'T3'AA0621101								
REV. 03	DATE 17.05.16	ALTERED AKA2 SD/—		REV. 02	DATE 01.08.14	ALTERED PKM SD/—		
		CHECKED AJ SD/—				CHECKED PG SD/—		
CHANGES ARE DONE AS PER C/A NO.— TGE—16—F0176				CHANGES ARE DONE AS PER C/A NO.— TGE—14—F0234				
								

TYPE OF PRODUCT OR NAME OF CUSTOMER/ PROJECT				THDF 125/67					
बी एच ई एल BHEL BHARAT HEAVY ELECTRICALS LTD. HARDWAR					NAME	SIGN	DATE	NO.OF VAR.	
				DRN	STGEPNM	STGEPNM	27/04/2007		
				CHD	STGEKN	STGEKN	12/05/2007		
				APD	ATGEKRG	ATGEKRG	24/07/2007		
DEPT. TGE		SCALE	WEIGHT(Kg.)	REF. TO ASSY. DRG.			ITEM NO.	NO.OF ITEMS	
CODE 4133		1:5	3.26	31531401071			01		
TITLE				1	3	DRAWING NO. 31531401088			
				SHEET NO.1			NO.OF SHEETS 1		

SIZE A3

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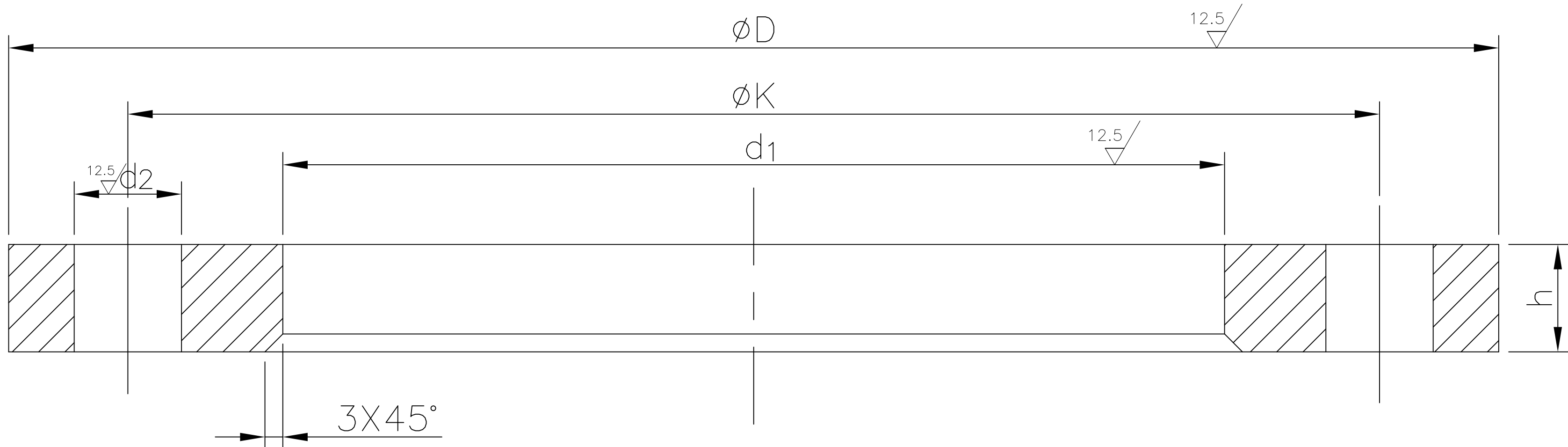
OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY.

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

FORM: DG-38(B)

31531401089
DRAWING NO.



VAR.	NB	D	d1	d2	K	NO.OF HOLES	h	WT.
00	125	270	164	22	220	8	24	6.45
01	150	300	194	26	250	8	24	7.59
02	125	250	164	18	210	8	24	6.45
03	125	270	164	26	220	8	24	7.00

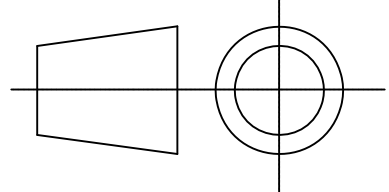
FOR COOLER

TECHNICAL REQUIREMENTS

1. EDGE PREPARATION AS PER HW0620.599.

SUPERSEEDS OLD DRAWING
UNDER THE SAME NUMBER

			CBOM NO. 01531401007			STATUS OF DRG.	
			AGREED DEPT.	NAME		SIGN	DATE
			—	—		—	—
GRADE OF UNTOL. DIM.:—							
M/CG— V/C/M/F AA 0230208							
WELDING—A/B/C/D—AA621104							
GAS CUTTING—'T3'AA0621101							
REV.	DATE	ALTERED	REV.	DATE	ALTERED AKA2	sd/—	
		CHECKED	06	22.02.18	CHECKED PG	sd/—	
			CHANGES DONE AS PER CHANGE NO. TGE—18—F0034.				

TYPE OF PRODUCT OR NAME OF CUSTOMER/ PROJECT					THDF 125/67				
बी एच ई एल  BHARAT HEAVY ELECTRICALS LTD. HARDWAR						NAME	SIGN	DATE	NO.OF VAR.
					DRN	STGEKBM	STGEPNM	27/04/2007	
					CHD	STGERLV	STGEKN	12/05/2007	
					APD	ATGEKRG	ATGEKRG	24/07/2007	73 74
DEPT. TGE		SCALE	WEIGHT(Kg.)	REF. TO ASSY. DRG.			ITEM NO.	NO.OF ITEMS	
CODE 4133		1:5	4.64	31531401071			06		
TITLE			1	3	DRAWING NO.				
FLANGE PN40					31531401089				
			SHEET NO.1			NO.OF SHEETS 1			

SIZE A3

REV	DATE	ALTERED	KM	REV	DATE	ALTERED	KM	CBOM No.			STATUS OF DRG
02	29.12.17	CHECKED	MA	01	17.05.17	CHECKED	MA	—			
VARIANT TABLE ADDED.				DIMENSION CORRECTED.				AGREED DEPT.	NAME	SIGN	DATE
GRADE OF UNTOL.DIM.M/CG-✓/C/M/F.AA0230208						WELDING A/B/C/D AA0621104		GAS CUTTING-T3 AA0621104			



VARIANT TABLE

VARIANT	D1 (MM)	D2 (MM)
00	74.0	3.0
01	123	4.0
02	34	3.0

TECHNICAL REQUIREMENT

1. THE 'O' RING MATERIAL SHOULD CONFORM TO SPEC. HW59870.



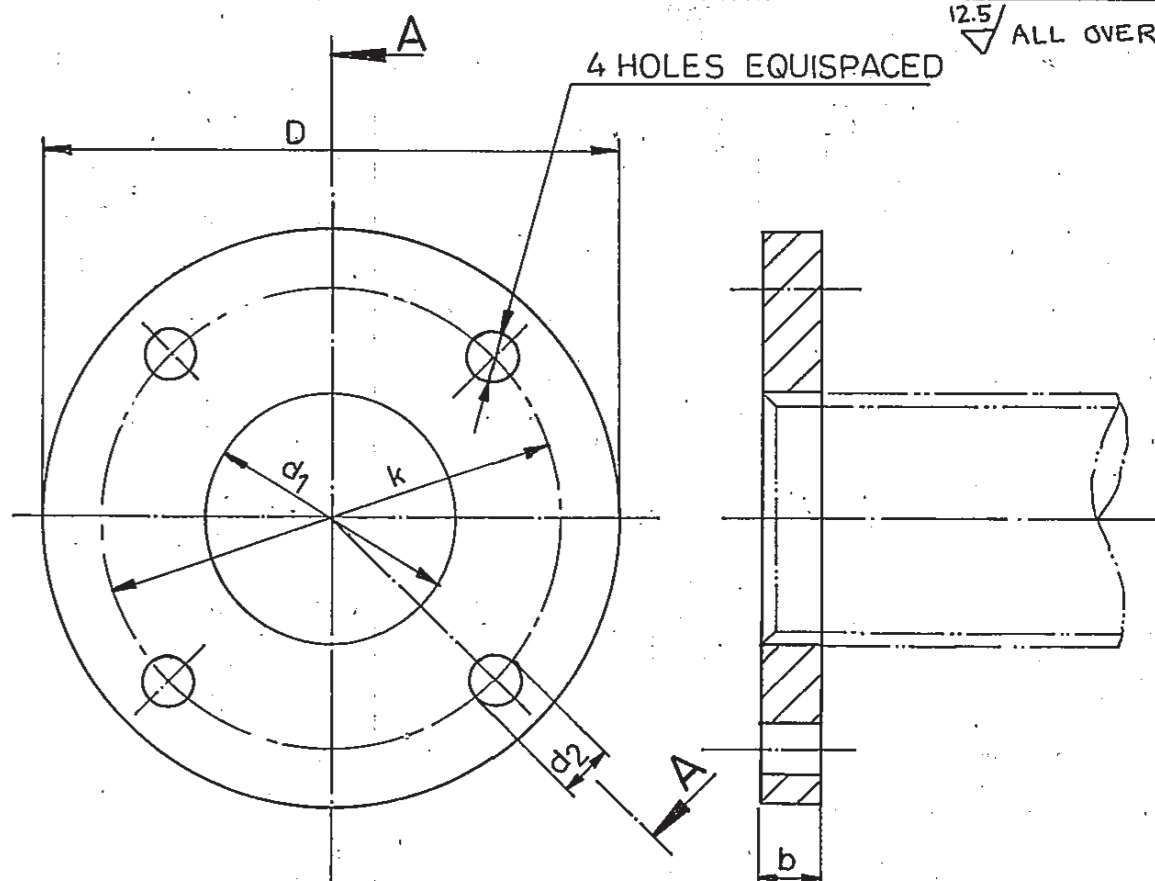
BHARAT HEAVY ELECTRICALS LTD
HARDWAR

	NAME	SIGN	DATE	NO. OF VAR
DRN	KM	—SD—	30/04/2014	
CHD	KM	—SD—	30/04/2014	
APD	RLV	—SD—	30/04/2014	

DEPT.TGE		SCALE	WEIGHT(Kg)	REF.TO ASSY.DRG.	ITEM No.	No OF ITEMS
CODE 4133		1:1	0.01	_____		—
TITLE				DRAWING No.		
O—RING				41492501071		
				SHEET No.1	No.OF SHEETS 1	

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REV	DATE	ALTERED	REV	DATE	ALTERED	GMS NO./GR. SP. NO.		STATUS OF DRG.	
		CHECKED			CHECKED	0-150-00-01090			
						AGREED DEPT.	NAME	SIGN	DATE
						GTY	S.C. GOYAL	<i>[Signature]</i>	29.10.86
						W.T.	S.K.C.	<i>[Signature]</i>	29.10.86



SECTION A-A

VAR	D	d ₁	k	b	d ₂
00	144	90	118	20	9.5
01	200	90	160	20	18



	002	FLANGE		01	CS-IS2062E250BR		3908
	001	FLANGE		00	CS-IS2062E250BR		1548
REMARKS	KEY NO.	DESCRIPTION	STD	29 31	MATERIAL CODE	45 A	UNIT WEIGHT
65	75 25 27	29	58 59	32 33 46	VAR. MATERIAL SPECN	54 55 56 57 66	71

CARD TYPE-3

28

28

CARD TYPE-1

28

CARD TYPE-2



BHARAT HEAVY ELECTRICALS LTD.
HARDWAR

DRN.	NAME	SIGN	DATE	NO. OF VAR.
CHD.	KB MUKHERJEE	<i>[Signature]</i>	17.7.86	
APPD.	G. GUPTA	<i>[Signature]</i>	17.7.86	
	A.C.C.	<i>[Signature]</i>	17.11.86	73 74

DEPT. TGE	GRADE OF UNTO: DIM.	SCALE	WEIGHT (KG)	REF. TO ASSY DRG.	ITEM NO.	NO. OF ITEMS
CODE 4233	C/M/F	N.T.S.	SEE TABLE	3-150-00-01037	4 5	-
TITLE			1 CARD CODE	DRAWING NO.		
FLANGE			3	4-150-00-01011		
			7	SHEET NO. 1		
			22	NO. OF SHEETS. 1		

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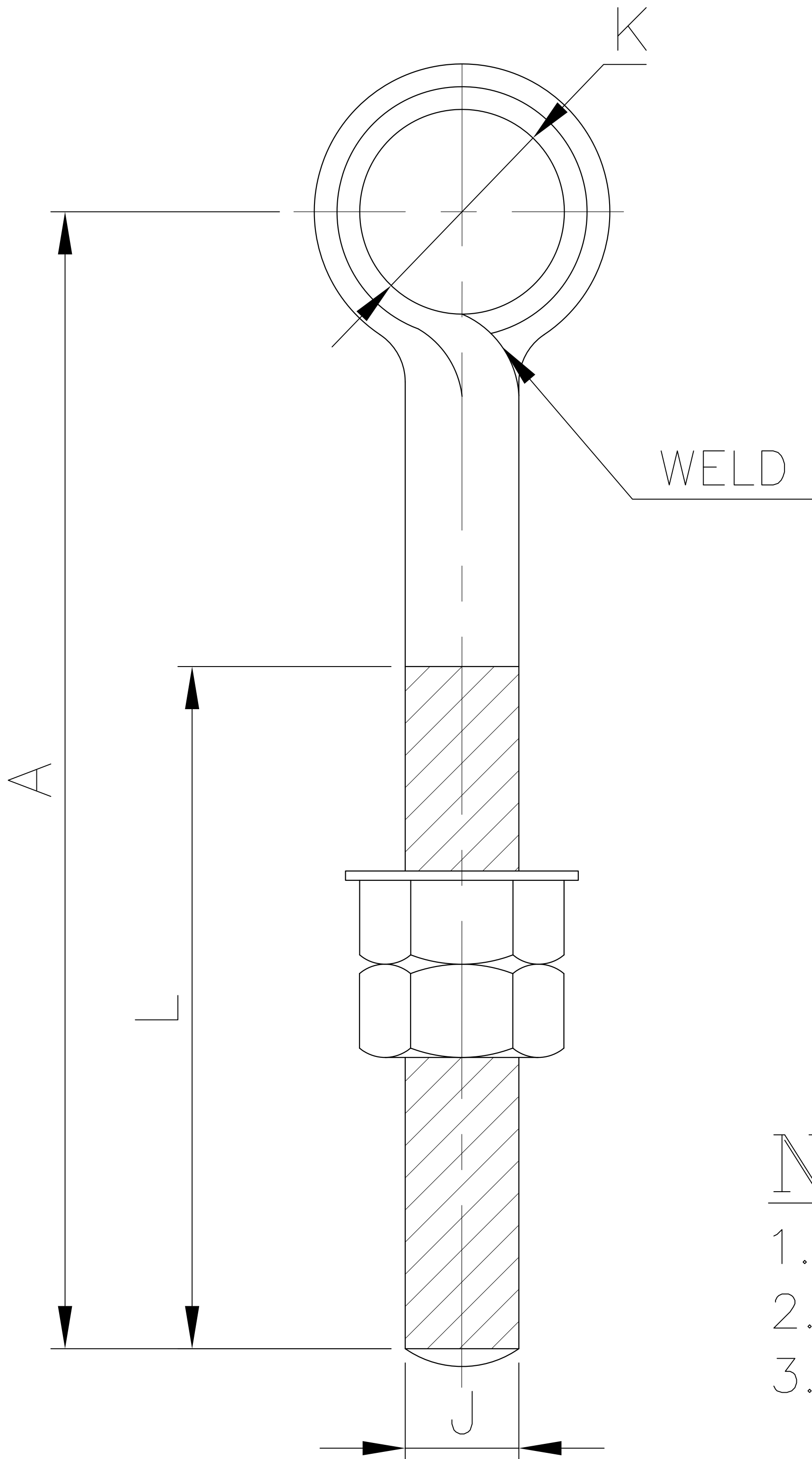
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FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm) FORM DG 39(B)

REV 05	DATE 04.06.18	ALTERED CHECKED	KM MA	REV 04	DATE 25.12.02	ALTERED CHECKED	PAB RLV	CBOM No. 0-150-00-01151		STATUS OF DRG	
REVISION MARKED				CH.AD.NO.TGE-02-F2274				AGREED DEPT.	NAME	SIGN	DATE

GRADE OF UNTOL.DIM.M/CG-V/C/M/F.AA0230208 WELDING A/B/C/D AA0621104 GAS CUTTING-T3 AA0621101



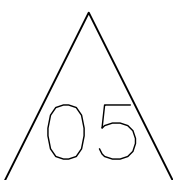
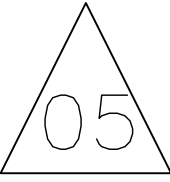
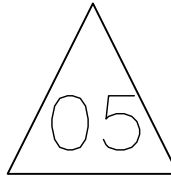
TESTING:-

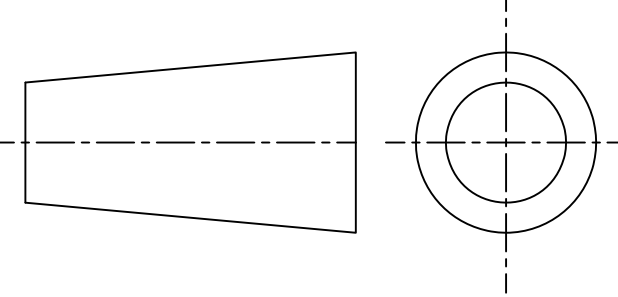
VAR.	A	L	K	d	F
01	100	60	18	M10	5
02	120	65	22	M12	8
03	130	65	26	M16	12.5
04	140	75	31	M20	20

F-AXIAL PROOF FORCE (KU)

NOTE:-

- 1.ALL DIMENSIONS ARE IN mm.
- 2.ALL STEEL MATERIAL SHALL BE AS PER IS:2062E250BR.
- 3.ALL BOLTS SHALL HAVE NUTS, LOCK NUTS & PLAIN WASHER AS SHOWN.
- 4.BOLT & NUT SHALL CONFORM TO IS : 1364.
- 5.SIZE TOLERANCE AS PER AA0230208 CLASS-COARSE.



REF.DRG.No.		004	EYE BOLT		04	W97415000013			0.30	
		003	EYE BOLT		03	W97415000056			0.20	
		002	EYE BOLT		02	W97415000048			0.15	
		001	EYE BOLT		01	W97415000030			0.10	
SIGN & DATE	REMARKS	ITEM NO.	DECRPTION	STD	VAR	MATERIAL CODE	A	UNIT WEIGHT		
						MATERIAL SPEC.	C			
	BHARAT HEAVY ELECTRICALS LTD HARDWAR					NAME	SIGN	DATE	NO. OF VAR	
						DRN	BEDD	sd/-		15.6.93
						CHD	K.R.GUPTA	sd/-		19.6.93
					APD	G.GUPTA	sd/-	19.6.93		
INVENTORY No.	DEPT. EME		SCALE	WEIGHT(Kg)		REF.TO ASSY.DRG.			ITEM	No OF ITEMS
	CODE 4133		1:1	SEE TABLE		0-150-00-01151			No. -	
	TITLE EYE BOLT					DRAWING No.				
	RAPP 3,4 : KAIGA1,2					4-150-00-01099				
						SHEET No. 1		No.OF SHEETS		1

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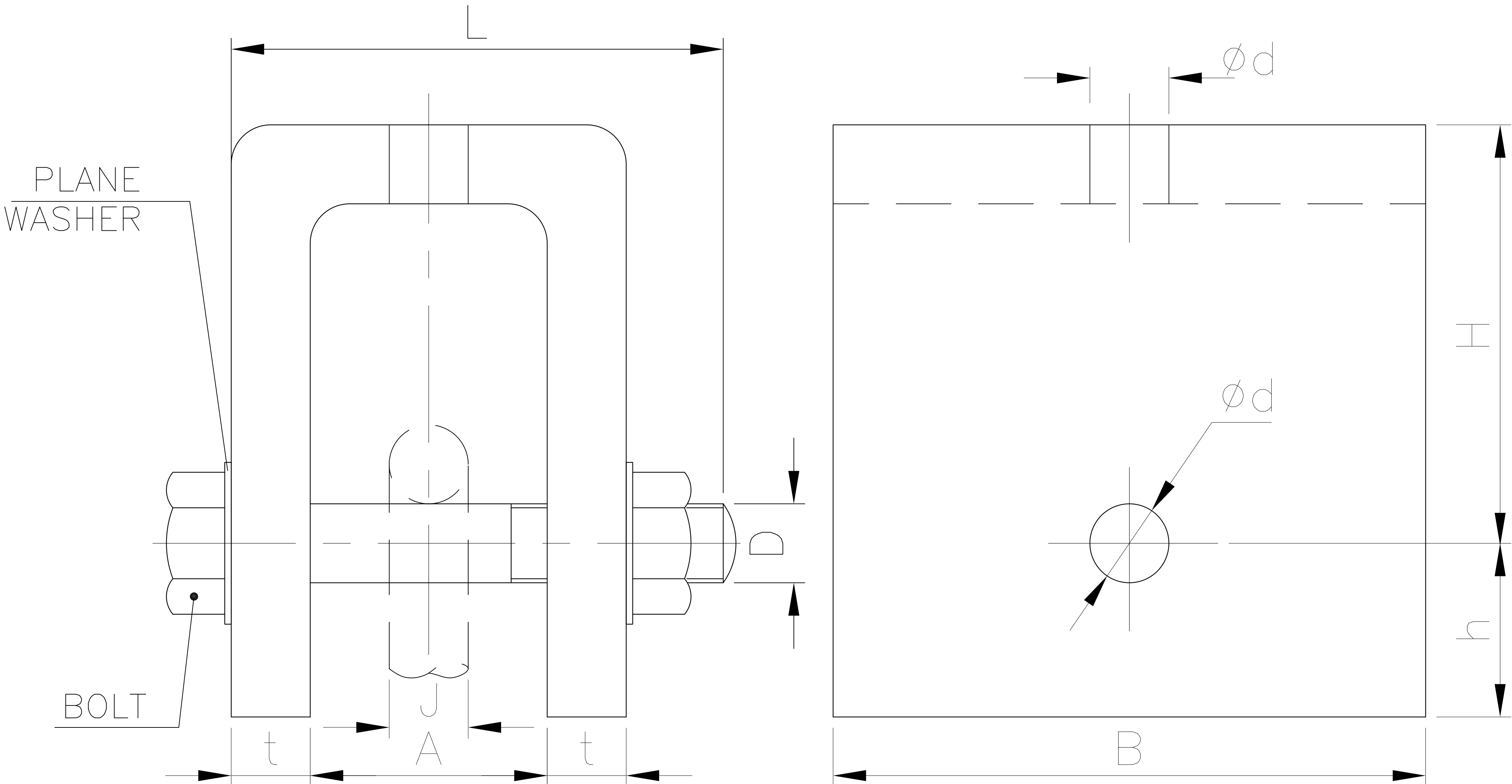
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FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm) FORM DG 39(B)

REVDATE	ALTERED	REVDATE	ALTERED	CBOM No.			STATUS OF DRG
	CHECKED		CHECKED	0-150-00-01151			
				AGREED DEPT.	NAME	SIGN	DATE
GRADE OF UNTOL.DIM.M/CG-V/C/M/F.AA0230208		WELDING A/B/C/D AA0621104			GAS CUTTING-T3 AA0621101		

GRADE OF UNTOL.DIM.M/CG-V/C/M/F.AA0230208WELDING A/B/C/D AA0621104GAS CUTTING-T3 AA0621101

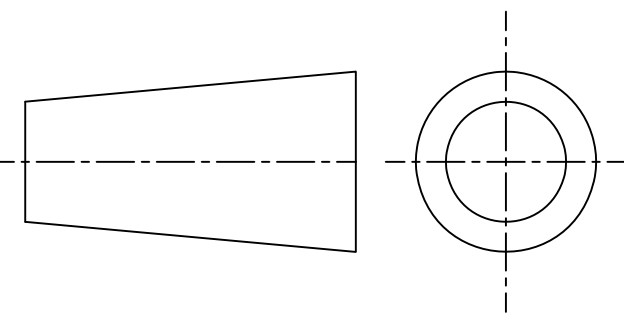


VAR.	ROD J SIZE	A	B	H	t	h	d	BOLT SIZE DXL
01	M-10	30	75	53	10	22	14	M12X75
02	M-12	30	75	53	10	22	18	M16X80
03	M-16	32	75	53	10	25	22	M20X85
04	M-20	40	75	53	10	30	24	M22X90

MATERIAL:- IS-2062 E250BR

NOTE:-

1.BEAM ATTACHMENT SHALL BE SUPPLIED COMPLETE WITH BOLT, NUT & PLANE WASHERS (2NOS)

REF.DRG.No.		004	BEAM ATTACHMENT		04	W96415001469			1.80		
		003	BEAM ATTACHMENT		03	W96415000969			1.41		
		002	BEAM ATTACHMENT		02	W96415000950			1.25		
		001	BEAM ATTACHMENT		01	W96415000942			1.15		
SIGN & DATE	REMARKS	ITEM NO.	DECRPTION	STD	VAR	MATERIAL CODE	A	UNIT WEIGHT			
						MATERIAL SPEC.	C				
	 BHARAT HEAVY ELECTRICALS LTD HARDWAR						NAME	SIGN	DATE	NO. OF VAR	
						DRN	AEDD	sd/-	09.04.91		
						CHD	K.R.GUPTA	sd/-	09.04.91		
						APD	G.GUPTA	sd/-	12.04.91		
INVENTORY No.	DEPT. EME		SCALE	WEIGHT(Kg)		REF.TO ASSY.DRG.			ITEM	No OF ITEMS	
	CODE 4133		N.T.S	SEE TABLE		0-150-00-01151			No.		
	TITLE BEAM ATTACHMENT					DRAWING No.					
	RAPP 3,4 : KAIGA1,2					4-150-00-01101					
						SHEET No. 1		No.OF SHEETS		1	

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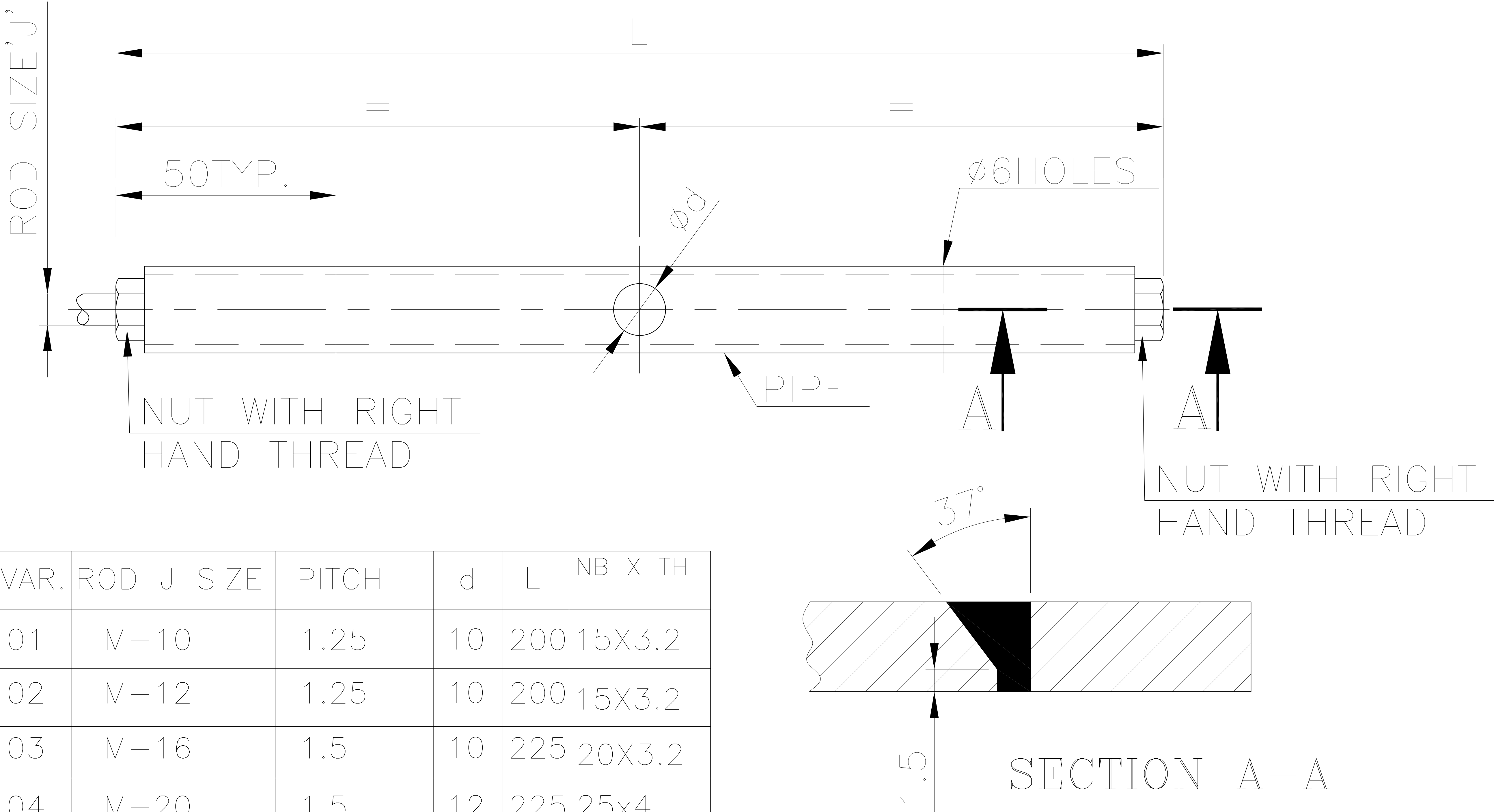
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FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm) FORM DG 39(B)

REV	DATE	ALTERED	REV	DATE	ALTERED	PAB	CBOM No.			STATUS OF DRG
		CHECKED	01	17.11.99	CHECKED	KRG	0-150-00-01151			
						AGREED DEPT.	NAME	SIGN	DATE	

GRADE OF UNTOL.DIM.V/C/M/F.AA0230208				WELDING A/B/C/D AA0621104				GAS CUTTING T3 AA0621104			
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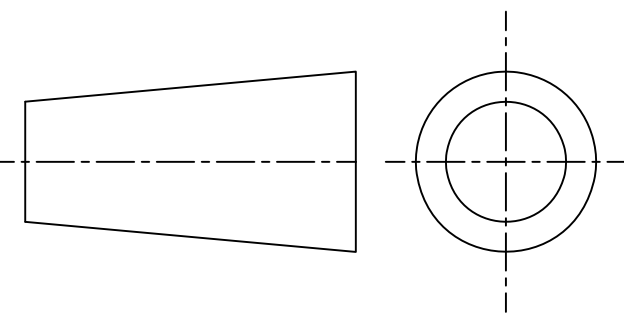


VAR.	ROD J SIZE	PITCH	d	L	NB X TH
01	M-10	1.25	10	200	15X3.2
02	M-12	1.25	10	200	15X3.2
03	M-16	1.5	10	225	20X3.2
04	M-20	1.5	12	225	25x4

MATERIAL:- PIPE C.S AS PER IS:1239 PART 1
NUT C.S TO IS 1364 CLASS 8.8

NOTE:-

- 1.TO BE GALVANISED AS PER IS:1367 (PART XIII), THICKNESS OF COATING 15μ.
- 2. WELD TO BE D.P. TESTED AS PER ASME SECTION VIII

24.04.91 SIGN & DATE	REF.DRG.No.		004	TURN BUCKLE		04	W96415001434			0.80			
			003	TURN BUCKLE		03	W96415000934			0.60			
			002	TURN BUCKLE		02	W96415000926			0.50			
			001	TURN BUCKLE		01	W96415000918			0.50			
		REMARKS	ITEM NO.	DECRPTION	STD	VAR	MATERIAL CODE	A	UNIT WEIGHT				
					MATERIAL SPEC.	C							
Et1-15373 INVENTORY No.	DEPT. EME		SCALE N.T.S	WEIGHT(Kg) SEE TABLE	REF.TO ASSY.DRG. 0-150-00-01151				ITEM No. -	No OF ITEMS			
	CODE 4133												
	TITLE TURN BUCKLE RAPP 3,4 : KAIGA1,2				DRAWING No. 4-150-00-01103								
					SHEET No. 1 No.OF SHEETS 1								
 BHARAT HEAVY ELECTRICALS LTD HARDWAR					DRN	AEDD	sd/-	09.04.91	NO. OF VAR				
					CHD	K.R.GUPTA	sd/-	09.04.91					
					APD	G.M.K	sd/-	12.04.91					

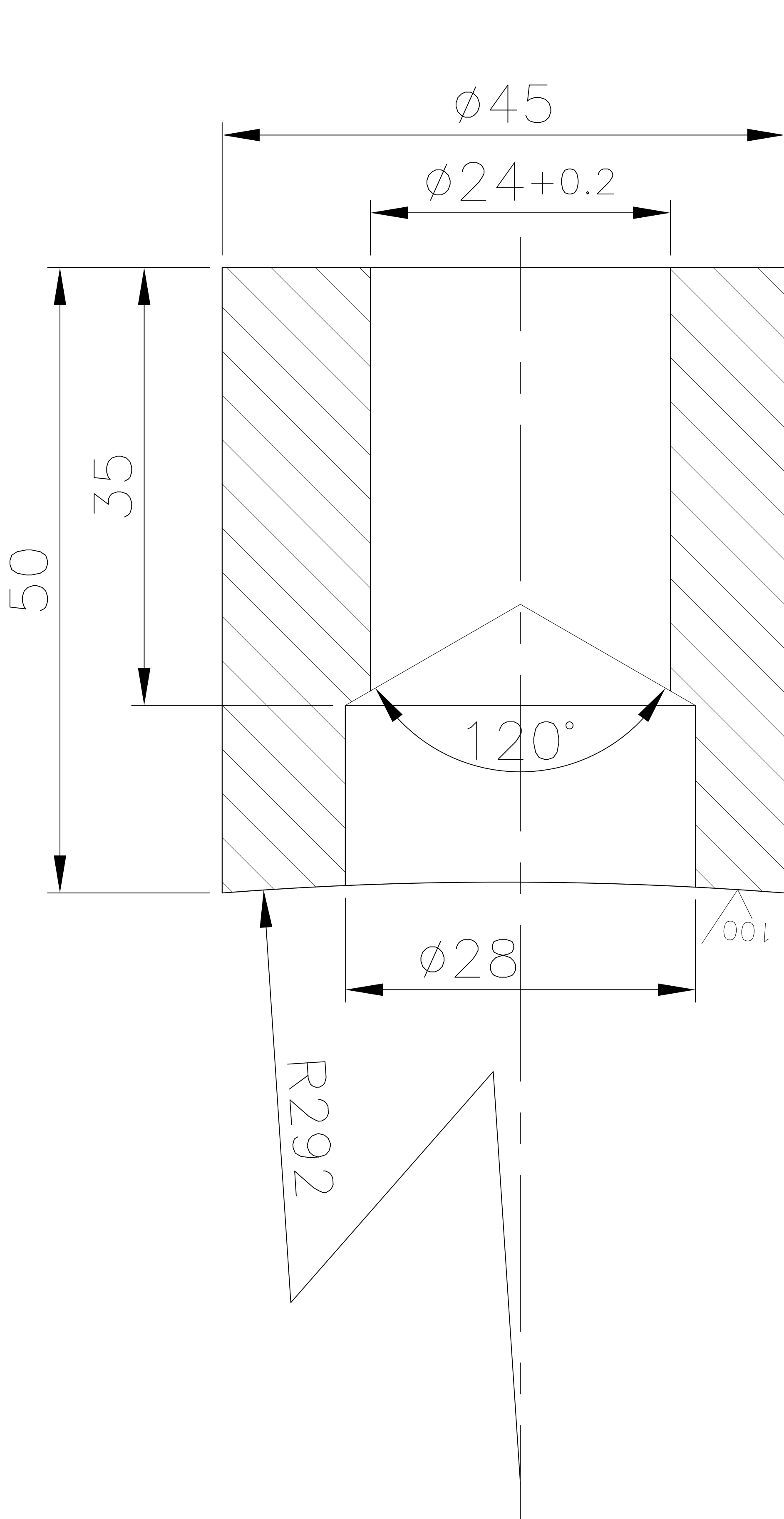
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FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm) FORM DG 39(B)

REV	DATE	ALTERED	REV	DATE	ALTERED	CBOM No.			STATUS OF DRG
		CHECKED	02	13.12.08	CHECKED	KBM NV			
			CH.AD.NO.TGE-08-F0330			AGREED DEPT.	NAME	SIGN	DATE
						W.T	ROY	sd/-	3.2.92
GRADE OF UN					TOL.DIM.M/CG- x /C/ x / f .AA0230208		WELDING A/B/C/D AA0621104		GAS CUTTING-T3 AA0621101



T.R

1. IDENTIFICATION AS PER HW0400397.
2. RADIUS R-292 SHOULD BE MADE DURING ASSLY. MATCHING WITH THE JOB.

PURCHASED	001	CONNECTION			MATERIAL AS PER BOM			0.500	
				00					
REMARKS	ITEM NO.	DECRPTION	STD	VAR	MATERIAL CODE	A		UNIT WEIGHT	
					MATERIAL SPEC.	C			
बी एच ई एल BHARAT HEAVY ELECTRICALS LTD HARDWAR					NAME	SIGN	DATE	NO. OF VAR	
				DRN	KAPOOR	sd/-	12.08.91		
				CHD	K.R.GUPTA	sd/-	12.08.91		
				APD	G.M.K	sd/-	16.04.92		
DEPT. EME		SCALE	WEIGHT(Kg)		REF.TO ASSY.DRG.			ITEM	No OF ITEMS
CODE 4133		1:1	0.500		3-150-00-01185			No. 006	
TITLE					DRAWING No.				
CONNECTION					4-150-00-01118				
					SHEET No. 1		No.OF SHEETS		1

RIGHT HAND THREAD

LEFT HAND THREAD

12.5 / ALL OVER

d1

d2

l2

l3

l1

VAR	d1	d2	PITCH	l1	l2	l3	wt.in Kg	MATERIAL CODE
00	M12	M12	1.25	250	80	130	0.200	W96415001922
01	M16	M16	1.5	250	80	130	0.300	W96415001930
02	M20	M20	1.5	250	80	130	0.500	W96415001949

1.TIE ROD TO BE GALVANISED WITH MIN. THICKNESS 15 MICRONS.

SUPER SEEDS OLD DRAWING
UNDER SAME NUMBER

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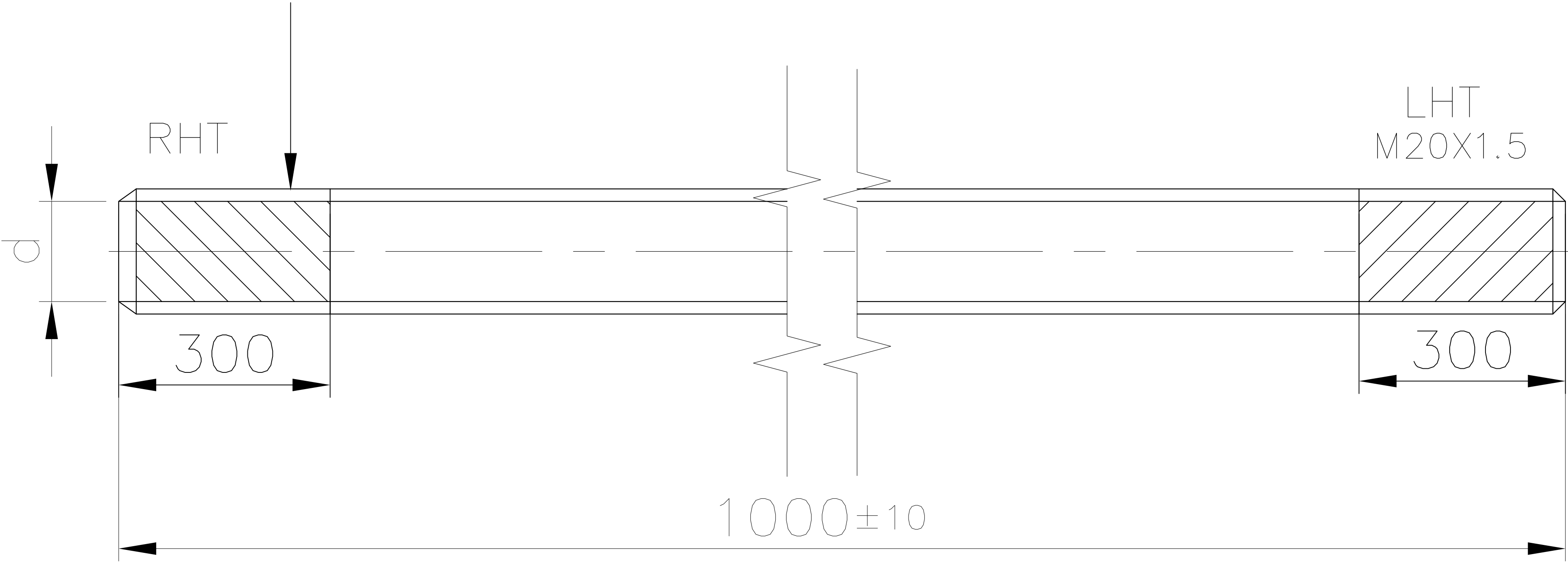
FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm) FORM DG 39(B)

REV	DATE	ALTERED	REV	DATE	ALTERED	PAB	CBOM No.			STATUS OF DRG
		CHECKED	03	20.11.01	CHECKED	RLV	0-150-00-01125			
			CH.AD.NO.TGE-01-529				AGREED DEPT.	NAME	SIGN	DATE
							GTX	SCGOYAL	sd/-	23/7/92
GRADE OF UNTOL.DIM.V/C/M/F.AA0230208				WELDING A/B/C/D-AA0621104			GAS CUTTING-T3 AA0621101			

12.5 / THE REST

THIS END IS OF M16X1.5 WHILE ASSEMBLY WITH HANGER WITH DRG NO.41500001198 AND OF M20X1.5 WHILE ASSEMBLY WITH HANGER WITH DRG NO. 41500001199.
FOR ASSEMBLY DRG. PLEASE REFER DRG NO. 11500001019, 21500001043, 21500001044, 21500001045, 21500001046

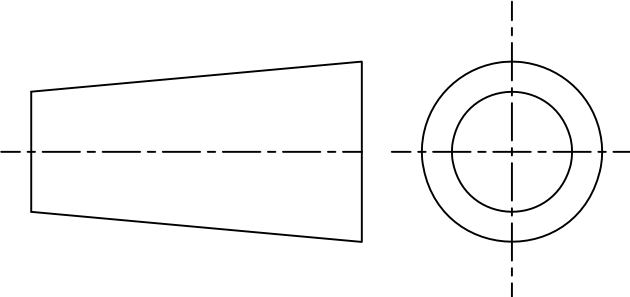


VARIANT TABLE

VAR.	SIZE d	WEIGHT (KG)	MATERIAL CODE
00	M12X1.25	0.725	W96415001957
01	M16X1.5	1.330	W96415001965
02	M20X1.5	2.080	W96415001973

TECH. REQ.

1. THREADED ROD TO BE GALVANISED AS PER IS: 1367 (PART XIII), THICKNESS OF COATING 15μ

	001	THREADED ROD			CS-IS2062E250BR		SEE	TABLE	
				01					
REMARKS	ITEM NO.	DECRPTION	STD	VAR	MATERIAL CODE	A	UNIT WEIGHT		
					MATERIAL SPEC.	C			
 BHARAT HEAVY ELECTRICALS LTD HARDWAR					NAME	SIGN	DATE	NO. OF VAR	
				DRN	KAPOOR	sd/-	13.04.92		
				CHD	K.R.GUPTA	sd/-	13.04.92		
				APD	G.M.K	sd/-	10.04.92		
DEPT. EME		SCALE	WEIGHT(Kg)		REF.TO ASSY.DRG.		ITEM	No OF	
CODE 4133		N.T.S	SEE TABLE		0-150-00-01125		No.	ITEMS	
TITLE			THREADED ROD		DRAWING No.				
					4-150-00-01131				
					SHEET No. 1		No.OF SHEETS 1		

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KUN 664.51
REF.DRG.No.

SIGN & DATE

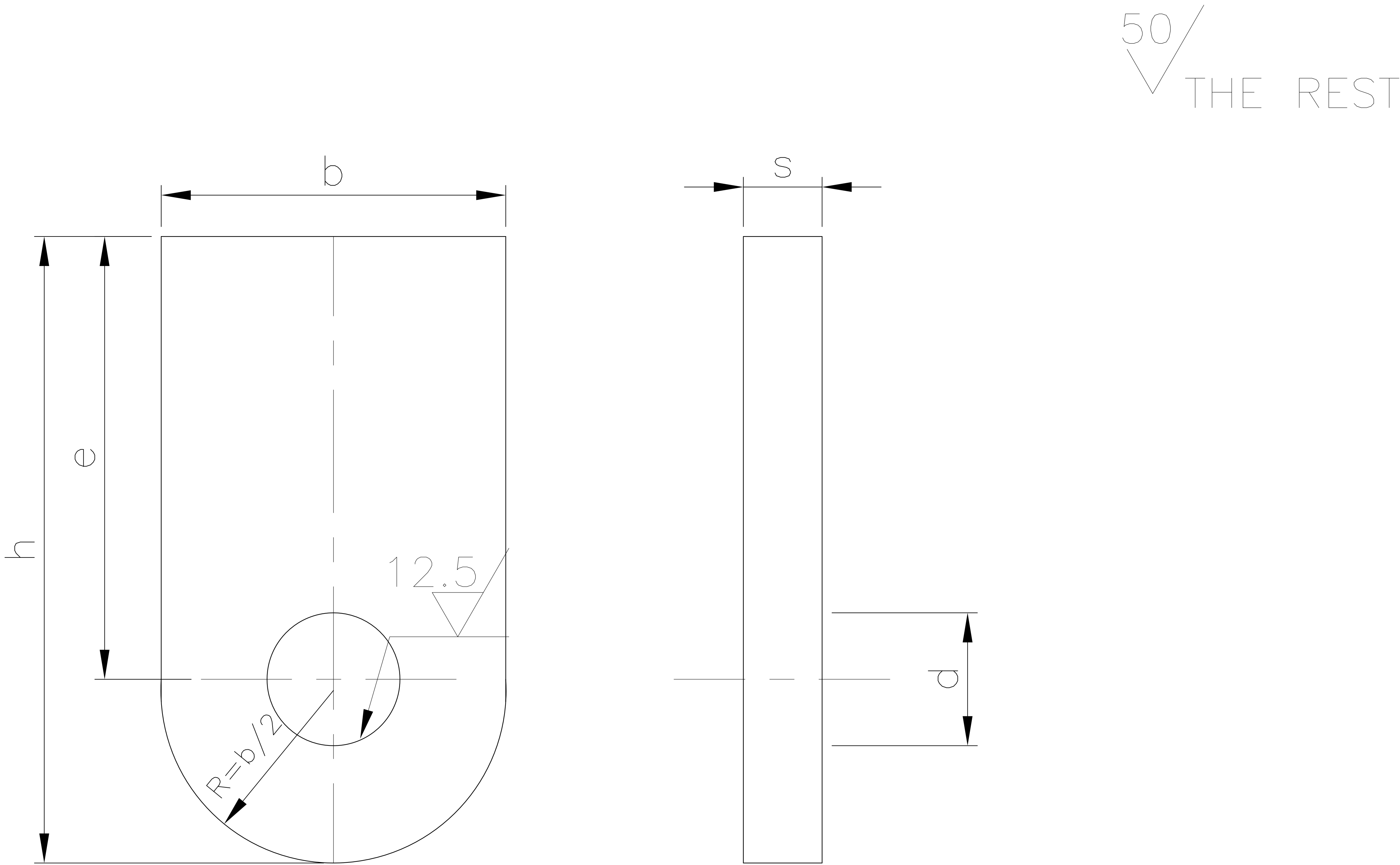
Et1-16337
INVENTORY No.

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm) FORM DG 39(B)

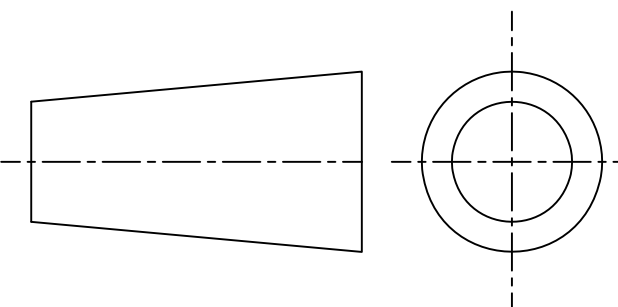
REVDATE	ALTERED	REVDATE	ALTERED	PNM	SD/-	CBOM No.			STATUS OF DRG
	CHECKED	01	1.03.07	CHECKED	KN	SD/-	0-150-00-01125		
				CHANGE ADVICE NO. TGE-07-F0043		AGREED DEPT.	NAME	SIGN	DATE
GRADE OF UNTOL.DIM.M/CG- V /C/ M /F.AA0230208				WELDING A/B/C/D AA0621104			GAS CUTTING-T3 AA0621101		

GRADE OF UNTOL.DIM.M/CG-V/C/M/F.AA0230208 | WELDING A/B/C/D AA0621104 | GAS CUTTING-T3 AA0621101



VARIANT TABLE

VAR.	SIZE	d	b	h	e	s	WT.IN Kg.	MATERIAL CODE
00	12	13.5	35	67	45	8	0.11	W96415001981
01	16	17.5	45	78	50	10	0.19	W96415001990
02	20	21.5	60	92	55	12	0.35	W96415002007

	001	WELDING EYE			CS-IS2062E250BR				
				01					
REMARKS	ITEM NO.	DECRPTION	STD	VAR	MATERIAL CODE	A		UNIT WEIGHT	
					MATERIAL SPEC.	C			
 BHARAT HEAVY ELECTRICALS LTD HARDWAR					NAME	SIGN	DATE	NO. OF VAR	
				DRN	KAPOOR	sd/-			
				CHD	K.R.GUPTA	sd/-	13.01.92		
				APD	G.M.K	sd/-	10.08.92		
DEPT. EME		SCALE	WEIGHT(Kg)		REF.TO ASSY.DRG.			ITEM No.	No OF ITEMS
CODE 4133		1:1	SEE TABLE		0-150-00-01125				
TITLE				WELDING EYE		DRAWING No.			
						4-150-00-01132			
						SHEET No. 1		No.OF SHEETS	1

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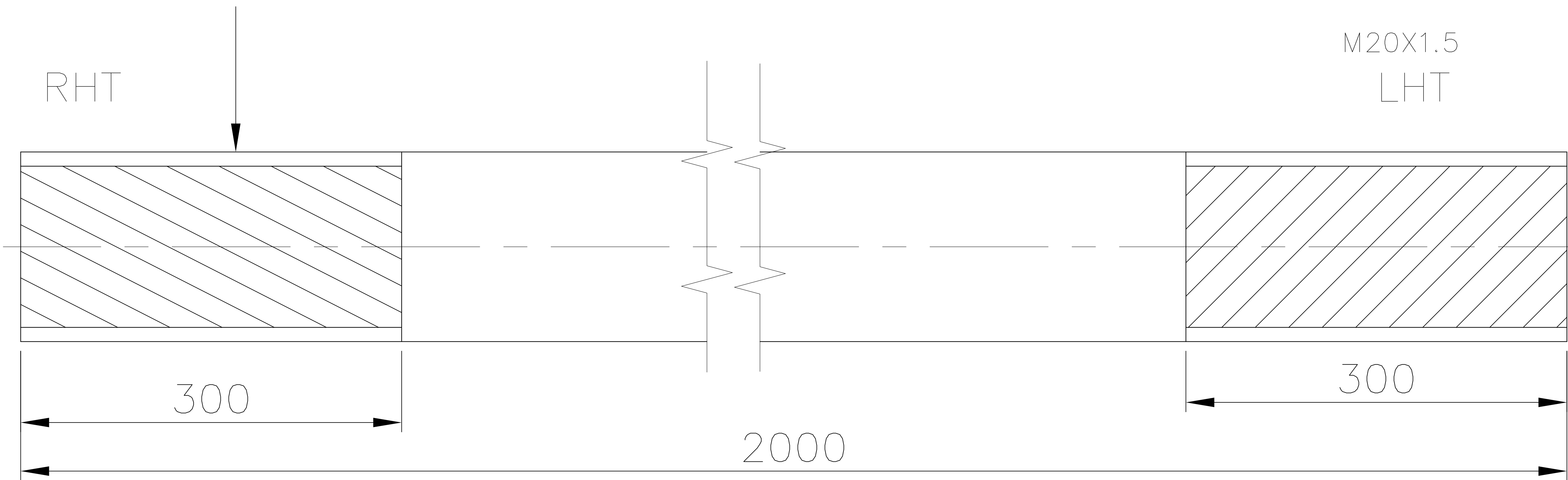
FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm) FORM DG 39(B)

REVDATE	ALTERED	K M	REVDATE	ALTERED	P A B	CBOM No.			STATUS OF DRG
02	06.04.18	CHECKED M A	01	17.11.91	CHECKED K R G	0-150-00-01205			
REVISION MARKED			CH.AD.NO.TGE-99-415			AGREED DEPT.	NAME	SIGN	DATE
GRADE OF UNTOL.DIM.M/CG- x/c /M/ f .AA0230208					WELDING A/B/C/D AA0621104		GAS CUTTING-T3 AA0621101		

GRADE OF UNTOL.DIM.M/CG-X/C/M/F.AA0230208 WELDING A/B/C/D AA0621104 GAS CUTTING-T3 AA0621104

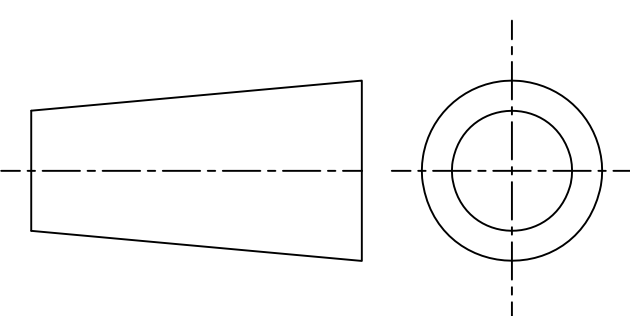
THIS END IS OF M16X1.5 WHILE ASSEMBLY WITH HANGER WITH DRG NO.41500001198 AND OF M20X1.5 WHILE ASSEMBLY WITH HANGER WITH DRG NO. 41500001199.
FOR ASSEMBLY DRG. PLEASE REFER DRG NO. 11500001019, 21500001043, 21500001044, 21500001045, 21500001046



TECH. REQ.

- 1. IDENTIFICATION AS PER HW 0400.397.
- 2. TO BE GALVANISED AS PER IS :1367 (PART XIII), THICKNESS OF COATING 15μ

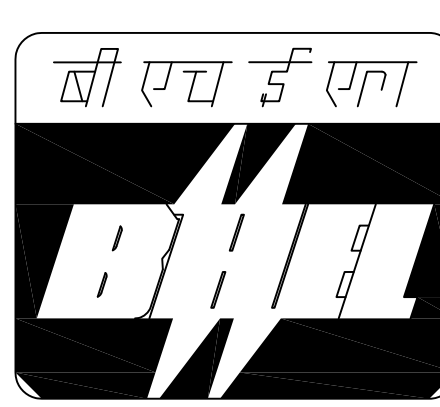
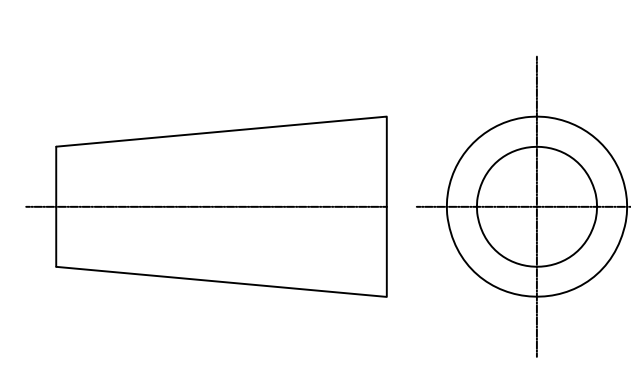
PURCHASED

PURCHASED	001	ROD (M20X2000)			W96415002325	01		5.600
				01	CS:IS2062E250BR			
REMARKS	ITEM NO.	DECRPTION	STD	VAR	MATERIAL CODE	A		UNIT WEIGHT
					MATERIAL SPEC.	C		
बी एच ई एल BHEL BHARAT HEAVY ELECTRICALS LTD HARDWAR					NAME	SIGN	DATE	NO. OF VAR
				DRN	EDC	sd/-	24.08.95	
				CHD	K.R.G/G.G	sd/-	14.09.95	
				APD	G.GUPTA	sd/-	18.10.95	
DEPT. EME		SCALE	WEIGHT(Kg)	REF.TO ASSY.DRG.			ITEM	No OF ITEMS
CODE 4133		N.T.S						
TITLE				DRAWING No.				
TIE ROD (M20X2000)				4-150-00-01176				
TG-HW-0500-2				SHEET No. 1		No.OF SHEETS		1

Technical drawing of a trapezoidal plate. The front view shows a trapezoid with a top width of 75, a bottom width of 150, and a height of approximately 120. A central circular hole has a diameter of 25. The left side is sloped with a 1:2.5 ratio. A fillet with a radius of R415 is shown at the bottom left corner. A break line is indicated at the bottom with a dimension of 100. The side view shows a rectangular profile with a width of 20 and a height of 150. A 40x40 section is detailed at the top right. A note '100/ ALL REST' is present. The text 'HOLES Ø25' is also included.

TECH. REQT.

1. IDENTIFICATION AS PER HW 0400.397

	001	PLATE			AA1011808137 CS-IS2062E250BR			1.500					
REMARKS	ITEM NO.	DESCRIPTION		VAR	MATERIAL CODE MATERIAL SPEC.	A C		UNIT WEIGHT					
 BHARAT HEAVY ELECTRICALS LTD HARDWAR						NAME	SIGN	DATE	NO. OF VAR				
					DRN	EDC	sd/-	24.8.95					
					CHD	K.R.GUPTA/G.G	sd/-	14.9.95					
					APD	G.GUPTA	sd/-	18.10.95					
DEPT. EME		SCALE	WEIGHT(Kg)		REF.TO ASSY.DRG.			ITEM	No OF ITEMS				
CODE 4133		1:5	1.500		0-150-00-01205			No 055 -02					
TITLE					DRAWING No. 4-150-00-01177								
					SHEET No. 1		No.OF SHEETS 1						

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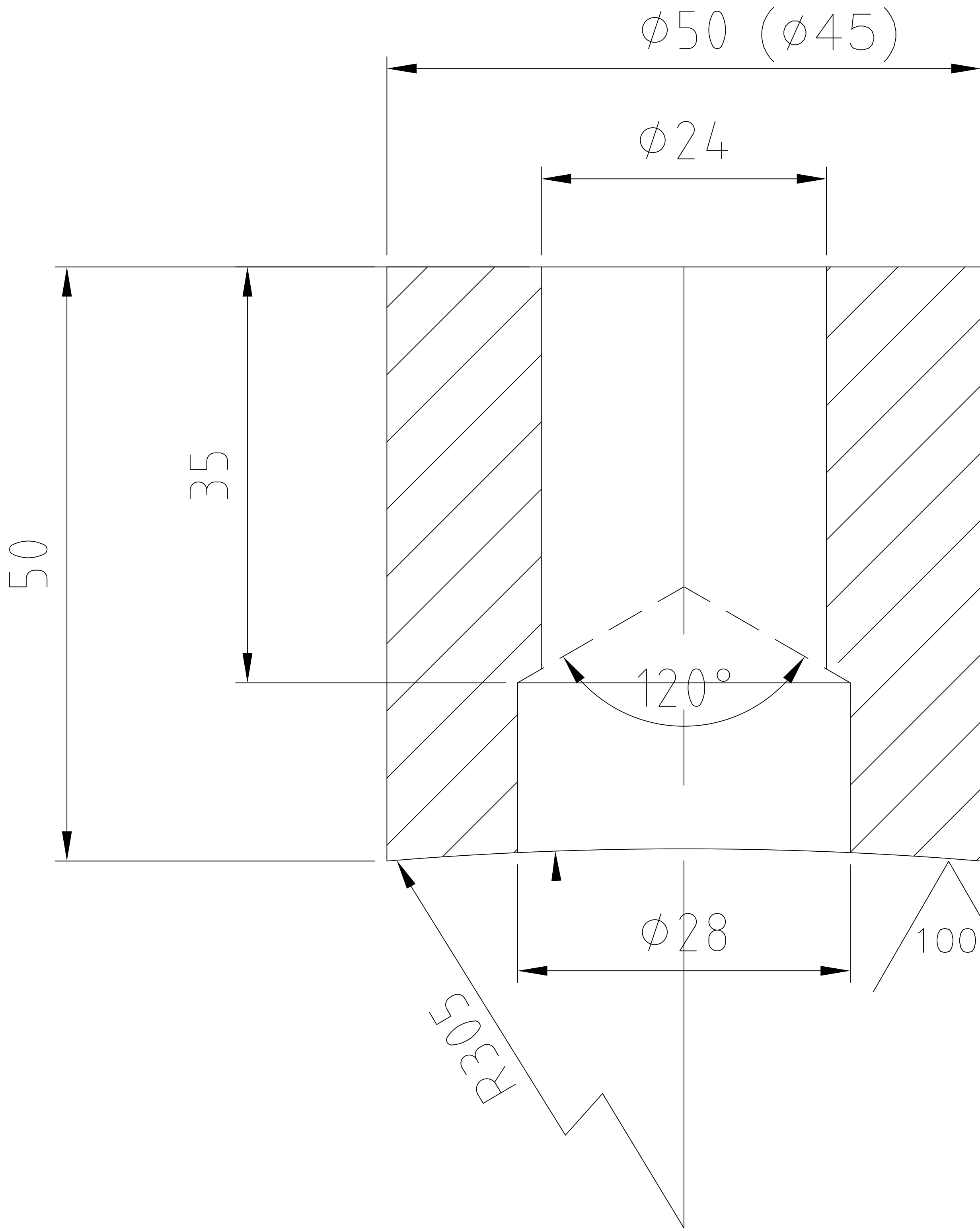
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FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm) FORM DG 39(B)

REV	DATE	ALTERED	REV	DATE	ALTERED	PNM	SD/-	CBOM No. 01500001212		STATUS OF DRG	
		CHECKED			CHECKED						KN
			02	19.05.07	CHANGE AD.NO.TGE-07-F0107			AGREED DEPT.	NAME	SIGN	DATE
								WT	RSC	SD/-	28.01.97
GRADE OF UNTOL.DIM.M/CG-V/C/M/F.AA0230208				WELDING A/B/C/D AA0621104				GAS CUTTING-T3 AA0621101			

12.5
ALL OVER

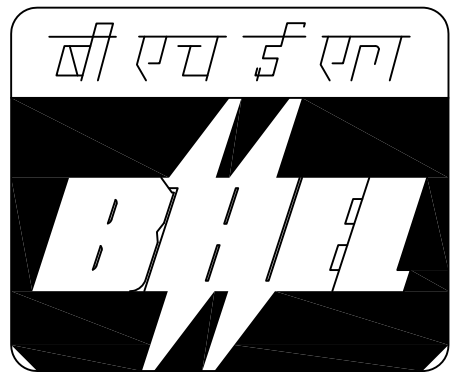


TECH.REQI.

- IDENTIFICATION ACCORDING TO HW 0400.397
- DIM. IN BRACKET ARE AFTER MACHINING.

REF.DRG.No.

SIGN & DATE

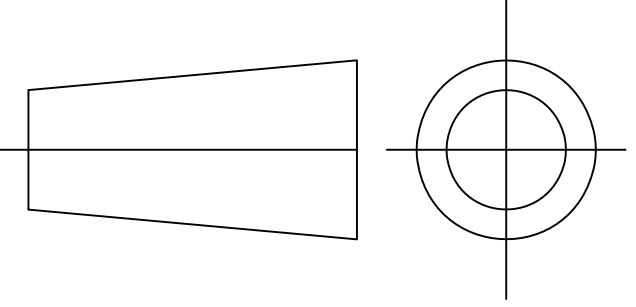


BHARAT HEAVY ELECTRICALS LTD
HARDWAR

DRN	NAME	SIGN	DATE	NO. OF VAR
	P.N.MOURYA	Sd/-	28.04.07	
	K.N	Sd/-	28.04.07	
APD	A.K.M	Sd/-	19.05.07	

INVENTORY No.

DEPT. EME
CODE 4133



SCALE
1:1

WEIGHT(Kg)
0.500

REF.TO ASSY.DRG.
21500001039

ITEM
No.
003
No OF
ITEMS

TITLE
CONNECTION

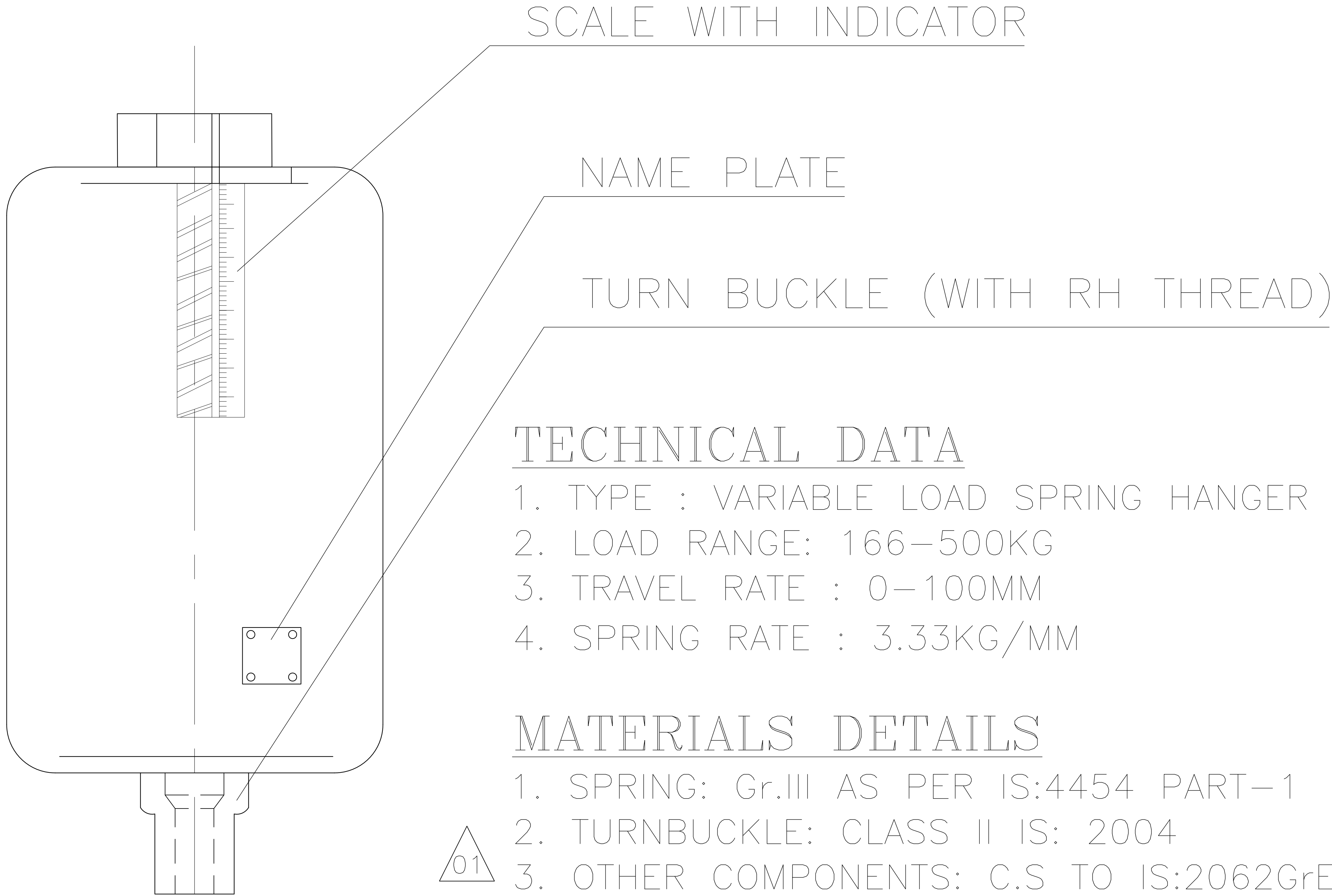
DRAWING No.
415000001182

SHEET No. No.OF SHEETS

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REV	DATE	ALTERED	REV	DATE	ALTERED	CBOM No.			STATUS
		CHECKED	01	06.04.18	CHECKED	—			OF DRG
			REVISION			MARKED	AGREED	NAME	SIGN
						DEPT.			DATE
GRADE OF UN				TOL.DIM.M/CG		WELDING A/B/C/D		GAS CUTTING-T3	



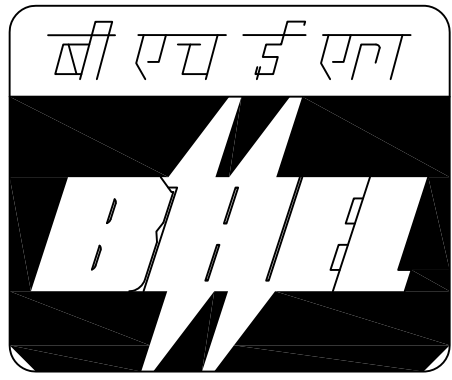
NOTE:-

THE DIMENSION 300 CORRESPONDS TO ZERO COMPRESSION OF THE SPRING.

THIS DIMENSION SHALL GET EXTENDED ACCORDING TO THE LOAD ON THE SPRING CAGE

- TESTING REQUIREMENTS
- 1. STATIC LOAD TESTING OF SPRING AS PER IS:7906 PART-II
 - 2. SPRING RATE CHECKING
 - 3. MATERIAL TEST (CHEMICAL COMP.) OF SPRING
 - 4. MATERIAL TEST FOR TURNBUCKLE
 - 5. TEST CERTIFICATES FOR 1,2,3,4 TO BE FURNISHED
- PAINTING REQUIREMENTS
- 1. ALL PARTS EXCEPT SPRING SHALL BE COATED WITH RED OXIDE PRIMER
 - 2. THE COMPLETE SPRING HANGER TO BE COATED WITH 2COATS OF DARK ADMIRALTY GREY PAINT
 - 3. SPRING SURFACE TO BE MANGANESE PHOSPHATED AND OIL DIPPED

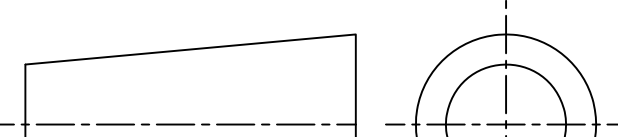
PURCHASED W96415002481



BHARAT HEAVY ELECTRICALS LTD
HARDWAR

	NAME	SIGN	DATE	NO. OF VAR
DRN	KB MUKHERJEE	sd/-	16.11.99	
CHD	K.R.GUPTA	sd/-	16.11.99	
APD	G.GUPTA	sd/-	16.11.99	

INVENTORY No.

DEPT. EME		SCALE	WEIGHT(Kg)	REF.TO ASSY.DRG.	ITEM No.	No OF ITEMS
CODE 4133		N.T.S	6.5		—	
TITLE				DRAWING No.		
SPRING HANGER				4—150—00—01198		
500MW				SHEET No. 1	No.OF SHEETS	1

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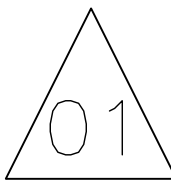
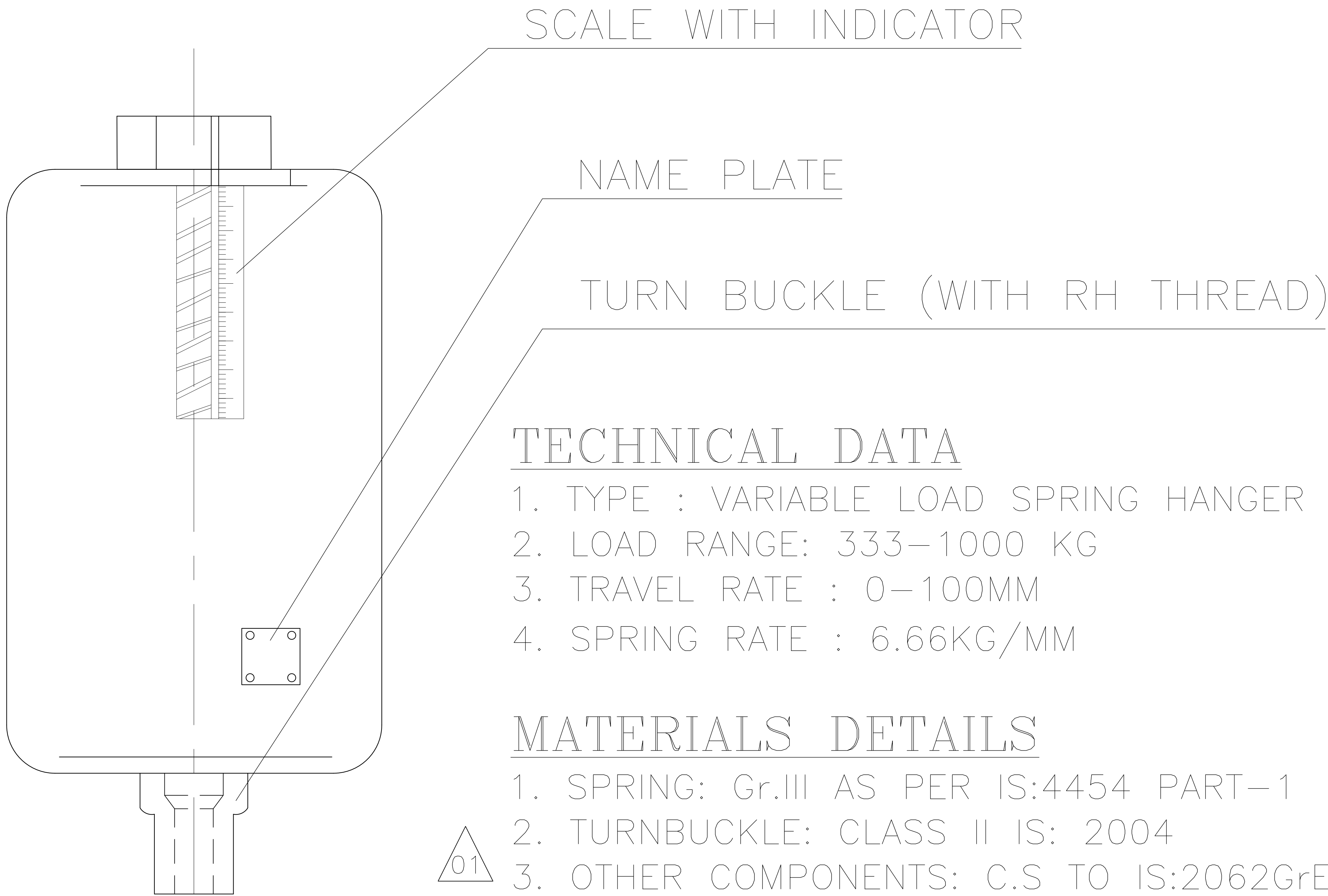
FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN mm) FORM DG 39(B)

REV	DATE	ALTERED	REV	DATE	ALTERED	CBOM No.			STATUS OF DRG
		CHECKED	01	06.04.18	CHECKED	—			
			REVISION MARKED			AGREED DEPT.	NAME	SIGN	DATE
GRADE OF UN				TOL.DIM.M/CG		WELDING A/B/C/D		GAS CUTTING	

AA0230208

AA0621104

AA0621101



NOTE:—

THE DIMENSION 300 CORRESPONDS TO ZERO COMPRESSION OF THE SPRING.
THIS DIMENSION SHALL GET EXTENDED ACCORDING TO THE LOAD ON THE SPRING CAGE

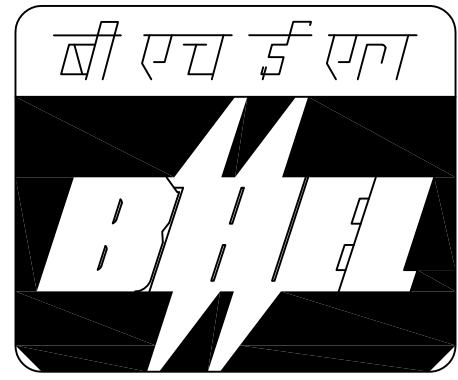
TESTING REQUIREMENTS

1. STATIC LOAD TESTING OF SPRING AS PER IS:7906 PART–II
2. SPRING RATE CHECKING
3. MATERIAL TEST (CHEMICAL COMP.) OF SPRING
4. MATERIAL TEST FOR TURNBUCKLE
5. TEST CERTIFICATES FOR 1,2,3,4 TO BE FURNISHED

PAINTING REQUIREMENTS

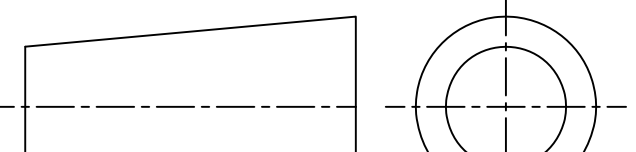
1. ALL PARTS EXCEPT SPRING SHALL BE COATED WITH RED OXIDE PRIMER
2. THE COMPLETE SPRING HANGER TO BE COATED WITH 2COATS OF DARK ADMIRALTY GREY PAINT
3. SPRING SURFACE TO BE MANGANESE PHOSPHATED AND OIL DIPPED

PURCHASED W96415002490



BHARAT HEAVY ELECTRICALS LTD
HARDWAR

	NAME	SIGN	DATE	NO. OF VAR
DRN	KB MUKHERJEE	sd/—	16.11.99	
CHD	K.R.GUPTA	sd/—	16.11.99	
APD	G.GUPTA	sd/—	16.11.99	

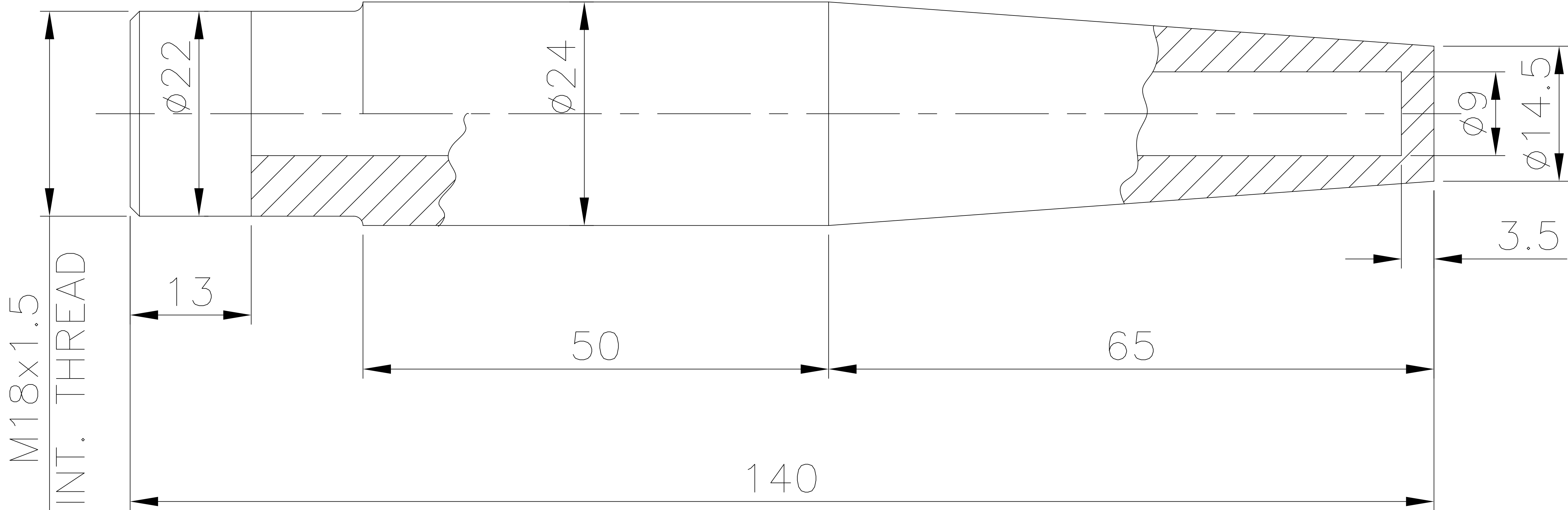
DEPT. EME		SCALE	WEIGHT(Kg)	REF.TO ASSY.DRG.	ITEM No.	No OF ITEMS
CODE 4133		N.T.S	13.5		—	
TITLE				DRAWING No.		
SPRING HANGER				4-150-00-01199		
				SHEET No. 1		No.OF SHEETS 1

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FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN mm) FORM DG 39(B)

REV	DATE	ALTERED	AKA2	sd/-	REV	DATE	ALTERED	K.B.M.	sd/-	CBOM No.			STATUS OF DRG
06	17.03.15	CHECKED	GC	sd/-	05	24.11.10	CHECKED	N.V.	sd/-	0-153-14-01001			
CHANGE ADVICE DONE AS PER CHANGE ADVICE NO. TGE-15-F0080.					CHANGE ADVICE DONE AS PER CHANGE ADVICE NO. TGE-10-F0304					AGREED DEPT.	NAME	SIGN	DATE
										EMT	SC GOYAL	sd/-	06.04.83
GRADE OF UNTO L.DIM.M/CG-V/C/M/F.AA0230208						WELDING A/B/C/D AA0621104				GAS CUTTING-T3 AA0621101			



NOTE;

1. HYDRAULIC TEST AND MATERIAL TEST CERTIFICATES SHALL BE SUPPLIED
2. VENDOR TO ENGRAVE MATERIAL CODE & DRAWING NO. WITH REV. NO. ON THE THERMOWELL

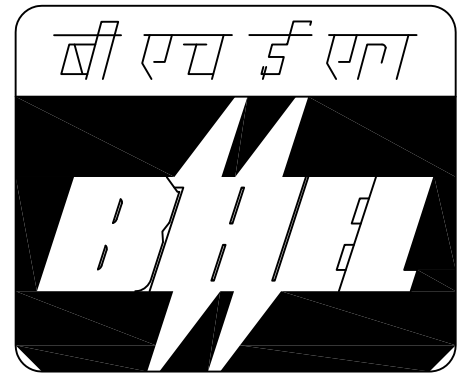
MATERIAL: AS PER BOM

TEST PRESSURE: 15 Kg/cm2, DURATION: 2 MIN.

MATERIAL CODE: W96415300814

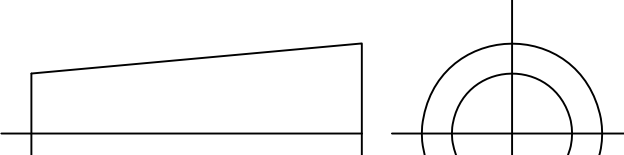
SUPERSEDES OLD DRAWING UNDER THE SAME NUMBER

PURCHASED



BHARAT HEAVY ELECTRICALS LTD
HARDWAR

	NAME	SIGN	DATE	NO. OF VAR
DRN	B.D. SINGH	sd/-	09.04.81	
CHD	G. GUPTA	sd/-	15.02.83	
APD	D.R.C./N.P.G.	sd/-	12.05.83	

INVENTORY No.	DEPT. TGE		SCALE	WEIGHT(Kg)	REF.TO ASSY.DRG.	ITEM No.	No OF ITEMS	
	CODE 4233		1:1	0.400	2-153-14-01012	008	001	
	TITLE THERMOWELL				DRAWING No.			
					4-153-14-01027			
					SHEET No.1	No.OF SHEETS 1		



CORPORATE STANDARD

AA0230208

Rev. No. 01

PAGE 1 of 3

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 tolerance 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 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 (Part 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 (Part 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.

Revisions: As per clause 17.7 of MOM of PGC-DOP+BES

APPROVED:
PROCEDURAL GUIDELINES COMMITTEE –
PGC (DOP+BES)

Rev. No. 01	Amd. No.	Reaffirmed	Prepared	Issued	Dt. of 1 st Issue
Dt: 01-12-1995	Dt:	Year: 2013	HEP, Bhopal	Corp. R&D	22-06-1978

19/3/16

CS-2/8

4.0 INDICATIONS ON DRAWINGS:

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

Example: AA0230208 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 Un-toleranced dimensions of castings" refer AA0230402.
 6.2 For "Tolerances and machining allowances for flame cutting" refer AA0621101.
 6.3 For "General tolerances for welding construction for length and angles" refer AA0621104.
 6.4 For "General tolerances for welded structures form and position" refer AA0621105.

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							
		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 1000	Over 1000 Up to 2000	Over 2000 Up to 4000
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		
		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				
		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'

19/3/16

CS-248

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 35 mm diameter could be manufactured to a high level of conformance in a workshop with "customary medium accuracy". Specifying a tolerance of ± 1 mm would be of not benefit in this particular workshop, as the general tolerance values of ± 0.3 mm 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:

- drawings are easier to read and thus communication is made more effective to the user of the drawing;
- The design draughtsman saves time by avoiding detailed tolerance calculations as it is sufficient to know that the function allows a tolerance greater than or equal to the general tolerance;
- The drawing readily indicates which feature can be produced by normal process

capability, 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 fine 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 work piece. Exceeding the general tolerance should lead to a rejection of the work piece only if the function is impaired.

CS-218 19/3/16



CORPORATE STANDARD

AA 711 51 90

Rev. No. 05

PAGE 1 OF 3

BOLTS, FOUNDATION TYPE-A, PRODUCT Gr:C, COARSE PITCH, STEEL PROPERTY CLASS 4.6 (M8 - M72)

1.0 DESIGNATION:

A product Gr:C, foundation steel bolt of thread M20 and length 250mm, coarse pitch, type-A, and conforming to property class 4.6 shall be designated as:

1.1 On drawings:

- i) Material specification column : AA 711 51 90
- ii) Description column : BOLT FDN AC M20 X 150-4.6

1.2 On indents:

Bolt foundation AC M20 x 250-4.6: AA 711 51 90.

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:5624-1993(RA 2008), Type-A.

2.2 Mechanical properties:

To conform to property class 4.6, 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 - 8g.

2.4 Identification Marking:

As stated in clause 9 of IS:1367, Part 3.

2.5 Finish: Plated as specified in BHEL order.

Revisions :

Cl. 28.2.4 of MOM of WG-F

APPROVED :

INTERPLANT
STANDARDIZATION COMMITTEE (WG-F)

Rev. No. 05

Amd.No.

Reaffirmed:

Prepared

Issued

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Dt:15.07.2010

Dt :

Year :

BHOPAL

Corp. R&D

January, 1977

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CS-0045

**3.0 NOTE:**

- 3.1** Length and diameter combination (refer Table 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** Weights given in this standard are for general reference only and are not meant for commercial transactions.
- 3.4** When fasteners are to be tested within BHEL, the sampling and acceptance plan shall be as per IS:1367, Part 17.

4.0 REFERRED STANDARDS (Latest publications including amendment):

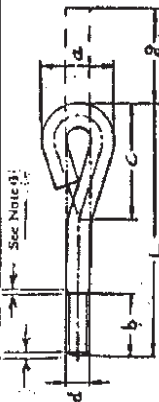
- | | | |
|------------------------|-------------------|-----------------|
| 1) AA 023 18 00 | 2) AA 023 18 50 | 3) AA 023 18 52 |
| 4) IS: 1367, Pt 3 & 17 | 5) IS: 4218, Pt.2 | 6) IS:5624 |

CS-0045



PAGE 3 OF 3

All dimensions are in mm



Thread Size <i>d</i>	Bend		Straight length <i>g</i>	Threaded length <i>b</i>	NOM. LENGTH (L)																
	<i>a</i> ± 3	<i>c</i> ± 5			80	100	125	160	200	250	320	400	500	630	800	1000	1250	1600	2000	2500	3200
M 8	24	45	30	20																	
				Sub-code																	
				Weight																	
M 10	30	65	38	25																	
				Sub-code																	
				Weight																	
M 12	36	65	45	30																	
				Sub-code																	
				Weight																	
M 16	48	85	60	40		011	020														
				Sub-code		395	475														
				Weight																	
M 20	60	105	75	50				038	046												
				Sub-code					1170												
				Weight																	
M 24	75	125	90	60				054													
				Sub-code				1050													
				Weight																	
M 30	95	155	115	75					062	070	089										
				Sub-code					2230	2800	4800										
				Weight																	
M 36	115	190	135	90																	
				Sub-code																	
				Weight																	
M 42	135	220	155	105																	
				Sub-code																	
				Weight																	
M 48	155	250	180	120																	
				Sub-code																	
				Weight																	
M 56	190	290	210	140																	
				Sub-code																	
				Weight																	
M 64	200	335	235	160																	
				Sub-code																	
				Weight																	
M 72x6	240	370	260	180																	
				Sub-code																	
				Weight																	



CORPORATE STANDARD

AA7244703

Rev No.01

PAGE 1 of 3

BLANK FLANGES, CARBON STEEL, NOMINAL PRESSURE 1.6 N/mm²

1.0 SCOPE

This standard covers the designation, material, sizes, dimensions and other requirements of carbon steel blank flanges for nominal pressure 1.6 N/mm² (16 kg/cm²) and of nominal sizes 10 to 500 mm.

2.0 DESIGNATION

A carbon steel blank flange of nominal size 50 mm shall be designated as:

2.1 On Drawings :

- i) Material specification column : AA7244703
- ii) Description Column : BLANK FLANGE CS NP 1.6 NS 50

2.2 For placing indents on purchase:

Blank Flange, Carbon Steel, Nominal Pressure 1.6 N/mm², Nominal size 50; AA7244703

2.3 For issuing enquiries and on purchase orders:

A copy of this BHEL standard shall be enclosed.

3.0 COMPLIANCE WITH NATIONAL STANDARDS

3.1 Dimensions, Tolerances and other requirements: To IS:6392-1971

3.2 Material: To IS:2002, Gr 2

4.0 MANUFACTURING DETAILS

4.1 Machining of Flanges: Rims shall be turned or burrs removed. All bolt holes shall be drilled, equally spaced on the pitch circle diameter and spot faced.

4.2 Finish of joint surfaces:

4.2.1 Flanges up-to 300 mm nominal size inclusive shall have a continuous spiral groove produced by a 1.5 mm radius round-nosed tool at a feed of approximately 0.8 mm per revolution.

4.2.2 Flanges over 300 mm nominal size shall have continuous spiral groove produced by a 3 mm radius round-nosed tool at a feed of approximately 1.2 mm per revolution.

Revisions: As per Clause 25.04 of MOM of MRC-SMC+RP

APPROVED:
INTERPLANT MATERIAL RATIONALISATION
COMMITTEE - MRC(SMC+RP)

Rev No.01

Amd No.

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Dt. of 1st Issue

Dt:15-12-2004

Dt:

Year:2013

HPEP, Hyderabad

Corp.R&D

Sept 1978

5.0 TEST CERTIFICATE

Three copies of test certificate of the material shall be furnished by the supplier.

6.0 MARKING, PRESERVATION & PACKING

6.1 Marking : The following details shall be punched on the periphery of the rim of the flanges:

AA7244703

Nominal Pressure: 1.6 N/mm²

Nominal Size

Supplier's Identification

6.2 Preservation: Before despatch, the flanges shall be dried and cleaned, and the entire surface shall be well-covered with a good quality rust preventive material that will not become fluid and run off at 65°C

6.3 Packing: The flanges shall be bundled by bolting them together or securing them with wire of suitable strength passed through the bolt holes in such a manner that the flanges are paired and no flange facings remain exposed.

7.0 NOTE

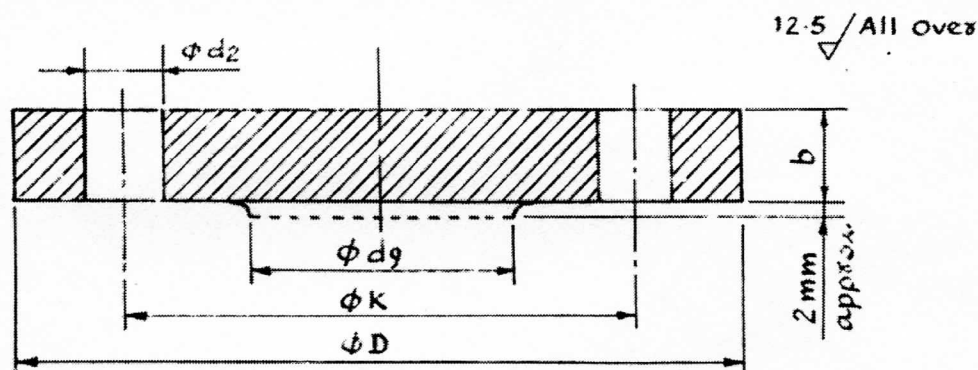
7.1 For details of the corresponding gaskets, refer BHEL standard AA7240313.

7.2 For nominal pressure/class designation with respect to service temperature, refer BHEL standard AA0233101.

7.3 For internal manufacture, refer BHEL specification AA10401, which is based on IS:2002, Gr:2

8.0 REFERRED STANDARDS (Latest publications including amendments):

1) IS:2002 2) IS:6392 3) AA0233101 4) AA7240313 5) AA10401

**NOTE:**

- 1) The provision of spigot shown in dotted line in the figure is at the option of the manufacturer.
- 2) Weights given in the table are for general reference only and are not meant for commercial transactions.
- 3) Corporate sub-codes are shown against corporate rationalised sizes.
- 4) Sizes used by individual plants are covered in the annexure along with complete code numbers.

CS-0075
19/11/13

Nom Size	Flange Dimensions				Bolting Details					Wt / piece in kg	Sub Code
	D		b		d9	Bolt Size	Holes		K		
	Nom.	Tol.	Nom.	Tol.			No.	d2			
10	90	±1	14	+3 -0	-	M 12	4	14	60	0.63	
15	95		14		-	M 12	4	14	65	0.72	
20	105		16		-	M 12	4	14	75	1.01	
25	115		16		-	M 12	4	14	85	1.23	
32	140		16		-	M 16	4	18	100	1.80	
40	150		16		-	M 16	4	18	110	2.09	
50	165		18		-	M 16	4	18	125	2.88	
65	185		18		55	M 16	4	18	145	3.66	
80	200	±1.5	20	+3 -0	70	M 16	8	18	160	4.77	112
100	220		20		90	M 16	8	18	180	5.65	
125	250		22		115	M 16	8	18	210	8.42	
150	285		22		140	M 20	8	22	240	10.4	147
175	315	±2	24	+5 -0	165	M 20	8	22	270	14	
200	340		24		190	M 20	12	22	295	16.1	
250	405		26		237	M 24	12	26	355	24.9	
300	460		28		285	M 24	12	26	410	35.1	
350	520		30		332	M 24	16	26	470	47.8	
400	580		32		380	(M 27)	16	30	525	63.5	
500	715		36		475	M 30	20	33	650	102	

NOTE: The bolt size given in bracket is of second preference

CS-0075 - 19/11/13



Generator Piping 800 MW for Double Flow Seal Oil system(MATERIAL - CARBON STEEL)

TGE-3629
REV02
DATE-31.03.2019

PIPING FOR GAS UNIT								
ITEM NO.	PART NO.	DESCRIPTION	DRG.NO./SIZE	VAR.	QTY.	UNIT	MAT. SPEC/ DIMENSION STD.	WT.(KG)
1		FROM TERM. 95 (H2 DIST.) TO 94 (GU)						
	1.1	PIPE CS	D33.4X2.90		29	Mtr.	ASTM SA106 GR.B	63.22
2		FROM TERM. 90(GU) TO 16(GEN)						
	2.1	PIPE CS	D60.3X3.91		40	Mtr.	ASTM SA106 GR.B	217.60
	2.2	ELBOW LR 90°	D60.3X3.91		10	No.	ASTM A234 WPB,ASME B16.9	6.50
		FLANGE, 50NB						
	2.3	(GU END)	31492501055	00	1	No.	IS:2062 E250 BR	2.50
	2.4	O-RING	41492501071	00	1	No.	HW59870	0.04
	2.5	SCREW HEX	A-8.8 M16X60		4	No.	IS:1364PART-2,1367PART-3	0.50
	2.6	NUT HEX	A-8.8 M16		4	No.	IS:1364PART-3,1367PART-3	0.14
	2.7	WASHER MCD-ST17.0			8	No.	IS:2016-1967, IS:2062 E250 BR	0.09
		FLANGE, 50NB						
	2.8	(GEN END)	31492501005	00	1	No.	IS:2062 E250 BR	2.50
	2.9	O-RING	41492501071	00	1	No.	HW59870	0.04
	2.10	SCREW HEX	A-8.8 M16X65		4	No.	IS:1364PART-2,1367PART-3	0.53
	2.11	NUT HEX	A-8.8 M16		4	No.	IS:1364PART-3,1367PART-3	0.14
	2.12	WASHER MCD-ST17.0			8	No.	IS:2016-1967, IS:2062 E250 BR	0.09
3		FROM TERM. 97 (CO2 DIST.) TO TERM 96 (GU)						
	3.1	PIPE CS	D60.3X3.91		23	Mtr.	ASTM SA106 GR.B	125.12
	3.2	ELBOW LR 90°	D60.3X3.91		5	No.	ASTM A234 WPB,ASME B16.9	3.25
		FLANGE, 50NB						
	3.3	(GU END)	31492501055	00	1	No.	IS:2062 E250 BR	2.50
	3.4	GASKET VITON	102X60X3		1	No.	HW59870	0.04
	3.5	O-RING	41492501071	00	1	No.	HW59870	0.04
	3.6	SCREW HEX	A-8.8 M16X60		4	No.	IS:1364PART-2,1367PART-3	0.50
	3.7	NUT HEX	A-8.8 M16		4	No.	IS:1364PART-3,1367PART-3	0.14
	3.8	WASHER MCD-ST17.0			8	No.	IS:2016-1967, IS:2062 E250 BR	0.09
		FLANGE, 50NB						
	3.9	(CO2 DIST. END)	31492501005	00	1	No.	IS:2062 E250 BR	2.50
	3.10	O-RING	41492501071	00	1	No.	HW59870	0.04
	3.11	SCREW HEX	A-8.8 M16X65		4	No.	IS:1364PART-2,1367PART-3	0.53
	3.12	NUT HEX	A-8.8 M16		4	No.	IS:1364PART-3,1367PART-3	0.14
	3.13	WASHER MCD-ST17.0			8	No.	IS:2016-1967, IS:2062 E250 BR	0.09
4		FROM TERM. 91(GU) TO 15(GEN)						
	4.1	PIPE CS	D60.3X3.91		40	Mtr.	ASTM SA106 GR.B	217.60
	4.2	ELBOW LR 90°	D60.3X3.91		9	No.	ASTM A234 WPB,ASME B16.9	5.85
		FLANGE, 50NB						
	4.3	(GU END)	31492501055	00	1	No.	IS:2062 E250 BR	2.50
	4.4	GASKET VITON	102X60X3		1	No.	HW59870	0.04
	4.5	O-RING	41492501071	00	1	No.	HW59870	0.04
	4.6	SCREW HEX	A-8.8 M16X60		4	No.	IS:1364PART-2,1367PART-3	0.50
	4.7	NUT HEX	A-8.8 M16		4	No.	IS:1364PART-3,1367PART-3	0.14
	4.8	WASHER MCD-ST17.0			8	No.	IS:2016-1967, IS:2062 E250 BR	0.09
		FLANGE, 50NB						
	4.9	(FOR GEN END)	31492501005	00	1	No.	IS:2062 E250 BR	2.50
	4.10	O-RING	41492501071	00	1	No.	HW59870	0.04
	4.11	SCREW HEX	A-8.8 M16X65		4	No.	IS:1364PART-2,1367PART-3	0.53
	4.12	NUT HEX	A-8.8 M16		4	No.	IS:1364PART-3,1367PART-3	0.14
	4.13	WASHER MCD-ST17.0			8	No.	IS:2016-1967, IS:2062 E250 BR	0.09
5		FROM TERM. 19(GEN) TO 110/113 (GAS DRIER)						
	5.1	PIPE CS	D60.3X3.91		40	Mtr.	ASTM SA106 GR.B	217.60
	5.2	ELBOW LR 90°	D60.3X3.91		7	No.	ASTM A234 WPB,ASME B16.9	4.55
	5.3	TEE	60.3x60.3x3.91		1	No.	ASTM A234 WPB,ASME B16.9	1.49
		FLANGE, 50NB						
		(FOR VLV, GAS						
		DRIER,OIL TRAP,GEN						
	5.4	END)	31492501005	00	11	No.	IS:2062 E250 BR	27.50
	5.5	O-RING	41492501071	00	11	No.	HW59870	0.39
	5.6	SCREW HEX	A-8.8 M16X65		44	No.	IS:1364PART-2,1367PART-3	5.81
	5.7	NUT HEX	A-8.8 M16		44	No.	IS:1364PART-3,1367PART-3	1.50
	5.8	WASHER MCD-ST17.0			88	No.	IS:2016-1967, IS:2062 E250 BR	0.97
	5.9	CONNECTION, 8NB	31500001190	06	1	No.	IS:2062 E250 BR	0.12

Kunal Mishra
KUNAL MISHRA
By: My-1 BHEL-HWZ (EME)

Prepared by KUNAL MISHRA

Checked by MANJU AZAD

Approved by R.L.VYAS

PAGE 1 OF 15

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Generator Piping 800 MW for Double Flow Seal Oil system(MATERIAL - CARBON STEEL)

TGE-3629
REV02
DATE-31.03.2019

PIPING FOR GAS UNIT								
ITEM NO.	PART NO.	DESCRIPTION	DRG.NO./SIZE	VAR.	QTY.	UNIT	MAT. SPEC./ DIMENSION STD.	WT.(KG)
6		FROM TERM. 111/112 (GAS DRIER) TO 20 (GEN)						
	6.1	PIPE CS	D60.3X3.91		40	Mtr.	ASTM SA106 GR.B	27.60
	6.2	ELBOW LR 90°	D60.3X3.91		5	No.	ASTM A234 WPB,ASME B16.9	3.25
	6.3	TEE	60.3x60.3x3.91		1	No.	ASTM A234 WPB,ASME B16.9	1.49
		FLANGE,50NB (FOR VLV,GAS DRIER, GEN END)	31492501005	00	9	No.	IS:2062 E250 BR	22.50
	6.5	O-RING	41492501071	00	9	No.	HW59870	0.32
	6.6	SCREW HEX	A-8.8 M16X65		36	No.	IS:1364PART-2,1367PART-3	4.75
	6.7	NUT HEX	A-8.8 M16		36	No.	IS:1364PART-3,1367PART-3	1.22
	6.8	WASHER MCD-ST17.0			72	No.	IS:2016-1967, IS:2062 E250 BR	0.79
	6.9	CONNECTION, 8NB	31500001190	06	1	No.	IS:2062 E250 BR	0.12
7		FROM TERM. 107 (GU) TO 313A/B (GAC)						
	7.1	PIPE CS	D13.7X1.85		15	Mtr.	ASTM SA106 GR.B	8.10
	7.2	TEE	13.7X13.7X1.65		1	No.	ASTM A234 WPB,ASME B16.9	0.04
TOTAL WT.								1178.93

TOTAL WEIGHT OF PIPING FOR GAS SYSTEM = 1179 KG

Kunal Mishra



Generator Piping 800 MW for Double Flow Seal Oil system(MATERIAL - CARBON STEEL)

TGE-3629
REV02
DATE-31.03.2019

PIPING FOR SEAL OIL SYSTEM								
ITEM NO.	PART NO.	DESCRIPTION OF SUB-ASSEMBLY	DRG. NO. / SIZE	VAR.	QTY.	UNIT	MAT. SPEC./ DIMENSION STD.	WT.(KG)
101		PIPE ASSEMBLY FROM 76(SOU AIR SIDE) TO TERM. 72(SOVR)						
	101.5	GASKET VITON	122X76X3		5	No.	HW59870	0.225
	101.6	SCREW HEX	A-8.8 M16X55		40	No.	IS:1364PART-2,1367PART-3	4.64
	101.7	NUT HEX	A-8.8 M16		40	No.	IS:1364PART-3,1367PART-3	1.36
	101.8	WASHER MCD-ST17.0			80	No.	IS:2016-1967, IS:2062 E250 BR	0.88
	101.10	GASKET VITON	122X76X3		1	No.	HW59870	0.045
	101.11	SCREW HEX	A-8.8 M16X55		4	No.	IS:1364PART-2,1367PART-3	0.46
	101.12	NUT HEX	A-8.8 M16		4	No.	IS:1364PART-3,1367PART-3	0.14
	101.13	WASHER MCD-ST17.0			8	No.	IS:2016-1967, IS:2062 E250 BR	0.09
102		PIPE ASSEMBLY FROM 80(SOUA) TO U-LOOP SOST						
	102.4	GASKET VITON	122X76X3		6	No.	HW59870	0.27
	102.5	SCREW HEX	A-8.8 M16X55		48	No.	IS:1364PART-2,1367PART-3	5.57
	102.6	NUT HEX	A-8.8 M16		48	No.	IS:1364PART-3,1367PART-3	1.63
	102.7	WASHER MCD-ST17.0			96	No.	IS:2016-1967, IS:2062 E250 BR	1.06
103		PIPE ASSEMBLY FROM 283 (SQUA) TO 467 (SOST)						
	103.4	GASKET VITON	122X76X3		6	No.	HW59870	0.27
	103.5	SCREW HEX	A-8.8 M16X55		48	No.	IS:1364PART-2,1367PART-3	5.568
	103.6	NUT HEX	A-8.8 M16		48	No.	IS:1364PART-3,1367PART-3	1.632
	103.7	WASHER MCD-ST17.0			96	No.	IS:2016-1967, IS:2062 E250 BR	1.056
	103.9	GASKET VITON	122X76X3		1	No.	HW59870	0.045
	103.10	SCREW HEX	A-8.8 M16X55		4	No.	IS:1364PART-2,1367PART-3	0.46
	103.11	NUT HEX	A-8.8 M16		4	No.	IS:1364PART-3,1367PART-3	0.14
	103.13	WASHER MCD-ST17.0			8	No.	IS:2016-1967, IS:2062 E250 BR	0.09
104		PIPE ASSEMBLY FROM 419(SOUA) TO TERM 294(SOST)						
	104.4	GASKET VITON	158X115X3		5	No.	HW59870	0.30
	104.5	SCREW HEX	A-8.8 M16X60		80	No.	IS:1364PART-2,1367PART-3	9.92
	104.6	NUT HEX	A-8.8 M16		80	No.	IS:1364PART-3,1367PART-3	2.72
	104.7	WASHER MCD-ST17.0			160	No.	IS:2016-1967, IS:2062 E250 BR	1.76
	104.9	GASKET VITON	158X115X3		2	No.	HW59870	0.12
	104.10	SCREW HEX	A-8.8 M16X60		16	No.	IS:1364PART-2,1367PART-3	1.98
	104.11	NUT HEX	A-8.8 M16		16	No.	IS:1364PART-3,1367PART-3	0.54
	104.12	WASHER MCD-ST17.0			32	No.	IS:2016-1967, IS:2062 E250 BR	0.35
105		PIPE ASSEMBLY FROM 70A(SOVR) TO TERM 6A/6C(GEN)						
	105.5	GASKET VITON	68X34X3		1	No.	HW59870	0.03
	105.6	SCREW HEX	A-8.8 M12X50		4	No.	IS:1364PART-2,1367PART-3	0.252
	105.7	NUT HEX	A-8.8 M12		4	No.	IS:1364PART-3,1367PART-3	0.068
	105.8	WASHER MCD-ST 13			8	No.	IS:2016-1967, IS:2062 E250 BR	0.0496
	105.10	GASKET VITON	68X34X3		5	No.	HW59870	0.15
	105.11	SCREW HEX	A-8.8 M12X50		20	No.	IS:1364PART-2,1367PART-3	1.26
	105.12	NUT HEX	A-8.8 M12		20	No.	IS:1364PART-3,1367PART-3	0.34
	105.13	WASHER MCD-ST 13			40	No.	IS:2016-1967, IS:2062 E250 BR	0.248
	105.15	GASKET VITON	88X48X3		1	No.	HW59870	0.03
	105.16	SCREW HEX	A-8.8 M16X40		4	No.	IS:1364PART-2,1367PART-3	0.37
	105.17	NUT HEX	A-8.8 M16		4	No.	IS:1364PART-3,1367PART-3	0.14
	105.18	WASHER MCD-ST17.0			8	No.	IS:2016-1967, IS:2062 E250 BR	0.09
106		BRANCH PIPE ASSEMBLY TO TERM 6C(GEN) (BRANCH OF PIPE AT SI NO. 105)						
	106.4	GASKET VITON	88X48X3		1	No.	HW59870	0.03
	106.5	SCREW HEX	A-8.8 M16X40		4	No.	IS:1364PART-2,1367PART-3	0.37
	106.6	NUT HEX	A-8.8 M16		4	No.	IS:1364PART-3,1367PART-3	0.14
	106.7	WASHER MCD-ST17.0			8	No.	IS:2016-1967, IS:2062 E250 BR	0.09
107		PIPE ASSEMBLY FROM 69A(SOVR) TO TERM 5A/5C(GEN)						
	107.6	GASKET VITON	102X60X3		1	No.	HW59870	0.128
	107.7	SCREW HEX	A-8.8 M16X55		4	No.	IS:1364PART-2,1367PART-3	0.46
	107.8	NUT HEX	A-8.8 M16		4	No.	IS:1364PART-3,1367PART-3	0.14
	107.9	WASHER MCD-ST17.0			8	No.	IS:2016-1967, IS:2062 E250 BR	0.09
	107.11	GASKET VITON	102X60X3		5	No.	HW59870	0.64
	107.12	SCREW HEX	A-8.8 M16X55		20	No.	IS:1364PART-2,1367PART-3	2.32
	107.13	NUT HEX	A-8.8 M16		20	No.	IS:1364PART-3,1367PART-3	0.68
	107.14	WASHER MCD-ST17.0			40	No.	IS:2016-1967, IS:2062 E250 BR	0.44
	107.16	GASKET VITON	88X48X3		1	No.	HW59870	0.03
	107.17	SCREW HEX	A-8.8 M16X40		4	No.	IS:1364PART-2,1367PART-3	0.37
	107.18	NUT HEX	A-8.8 M16		4	No.	IS:1364PART-3,1367PART-3	0.14
	107.19	WASHER MCD-ST17.0			8	No.	IS:2016-1967, IS:2062 E250 BR	0.09



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ITEM NO.	PART NO.	DESCRIPTION OF SUB-ASSEMBLY	DRG. NO. / SIZE	VAR.	QTY.	UNIT	MAT. SPEC./ DIMENSION STD.	WT.(KG)
108		BRANCH PIPE ASSEMBLY FROM 5C(GEN) (BRANCH OF PIPE AT SI NO. 107)						
	108.5	GASKET VITON	88X48X3		1	No.	HW59870	0.03
	108.6	SCREW HEX	A-8.8 M16X40		4	No.	IS:1364PART-2,1367PART-3	0.37
	108.7	NUT HEX	A-8.8 M16		4	No.	IS:1364PART-3,1367PART-3	0.14
	108.8	WASHER MCD-ST17.0			8	No.	IS:2016-1967, IS:2062 E250 BR	0.09
109		PIPE ASSEMBLY FROM TERM.68A (SOVR) TO 4A/4C						
	109.6	GASKET VITON	102X60X3		1	No.	HW59870	0.128
	109.7	SCREW HEX	A-8.8 M16X55		4	No.	IS:1364PART-2,1367PART-3	0.46
	109.8	NUT HEX	A-8.8 M16		4	No.	IS:1364PART-3,1367PART-3	0.14
	109.9	WASHER MCD-ST17.0			8	No.	IS:2016-1967, IS:2062 E250 BR	0.09
	109.11	GASKET VITON	102X60X3		5	No.	HW59870	0.64
	109.12	SCREW HEX	A-8.8 M16X55		20	No.	IS:1364PART-2,1367PART-3	2.32
	109.13	NUT HEX	A-8.8 M16		20	No.	IS:1364PART-3,1367PART-3	0.68
	109.14	WASHER MCD-ST17.0			40	No.	IS:2016-1967, IS:2062 E250 BR	0.44
	109.16	GASKET VITON	88X48X3		1	No.	HW59870	0.03
	109.17	SCREW HEX	A-8.8 M16X40		4	No.	IS:1364PART-2,1367PART-3	0.37
	109.18	NUT HEX	A-8.8 M16		4	No.	IS:1364PART-3,1367PART-3	0.14
	109.19	WASHER MCD-ST17.0			8	No.	IS:2016-1967, IS:2062 E250 BR	0.09
110		BRANCH PIPE ASSEMBLY TO TERM.68A(SOVR) (BRANCH OF PIPE AT SI NO. 109)						
	110.5	GASKET VITON	88X48X3		1	No.	HW59870	0.03
	110.6	SCREW HEX	A-8.8 M16X40		4	No.	IS:1364PART-2,1367PART-3	0.37
	110.7	NUT HEX	A-8.8 M16		4	No.	IS:1364PART-3,1367PART-3	0.14
	110.8	WASHER MCD-ST17.0			8	No.	IS:2016-1967, IS:2062 E250 BR	0.09
111		PIPE ASSEMBLY FROM TERM.69B (SOVR) TO 5D/5B						
	111.6	GASKET VITON	102X60X3		1	No.	HW59870	0.128
	111.7	SCREW HEX	A-8.8 M16X55		4	No.	IS:1364PART-2,1367PART-3	0.46
	111.8	NUT HEX	A-8.8 M16		4	No.	IS:1364PART-3,1367PART-3	0.14
	111.9	WASHER MCD-ST17.0			8	No.	IS:2016-1967, IS:2062 E250 BR	0.09
	111.11	GASKET VITON	102X60X3		5	No.	HW59870	0.64
	111.12	SCREW HEX	A-8.8 M16X55		20	No.	IS:1364PART-2,1367PART-3	2.32
	111.13	NUT HEX	A-8.8 M16		20	No.	IS:1364PART-3,1367PART-3	0.68
	111.14	WASHER MCD-ST17.0			40	No.	IS:2016-1967, IS:2062 E250 BR	0.44
	111.16	GASKET VITON	88X48X3		1	No.	HW59870	0.03
	111.17	SCREW HEX	A-8.8 M16X40		4	No.	IS:1364PART-2,1367PART-3	0.37
	111.18	NUT HEX	A-8.8 M16		4	No.	IS:1364PART-3,1367PART-3	0.14
	111.19	WASHER MCD-ST17.0			8	No.	IS:2016-1967, IS:2062 E250 BR	0.09
112		BRANCH PIPE ASSEMBLY TO TERM.69B(SOVR) (BRANCH OF PIPE AT SI NO. 111)						
	112.5	GASKET VITON	88X48X3		1	No.	HW59870	0.03
	112.6	SCREW HEX	A-8.8 M16X40		4	No.	IS:1364PART-2,1367PART-3	0.37
	112.7	NUT HEX	A-8.8 M16		4	No.	IS:1364PART-3,1367PART-3	0.14
	112.8	WASHER MCD-ST17.0			8	No.	IS:2016-1967, IS:2062 E250 BR	0.09
113		PIPE ASSEMBLY FROM TERM. 68B (SOVR) TO 4B/4D						
	113.6	GASKET VITON	102X60X3		1	No.	HW59870	0.128
	113.7	SCREW HEX	A-8.8 M16X55		4	No.	IS:1364PART-2,1367PART-3	0.46
	113.8	NUT HEX	A-8.8 M16		4	No.	IS:1364PART-3,1367PART-3	0.14
	113.9	WASHER MCD-ST17.0			8	No.	IS:2016-1967, IS:2062 E250 BR	0.09
	112.11	GASKET VITON	102X60X3		5	No.	HW59870	0.64
	113.12	SCREW HEX	A-8.8 M16X55		20	No.	IS:1364PART-2,1367PART-3	2.32
	113.13	NUT HEX	A-8.8 M16		20	No.	IS:1364PART-3,1367PART-3	0.68
	113.14	WASHER MCD-ST17.0			40	No.	IS:2016-1967, IS:2062 E250 BR	0.44
	113.16	GASKET VITON	88X48X3		1	No.	HW59870	0.03
	113.17	SCREW HEX	A-8.8 M16X40		4	No.	IS:1364PART-2,1367PART-3	0.37
	113.18	NUT HEX	A-8.8 M16		4	No.	IS:1364PART-3,1367PART-3	0.14
	113.19	WASHER MCD-ST17.0			8	No.	IS:2016-1967, IS:2062 E250 BR	0.09
114		BRANCH PIPE ASSEMBLY TO TERM.68B(SOVR) (BRANCH OF PIPE AT SI NO. 113)						
	114.5	GASKET VITON	88X48X3		1	No.	HW59870	0.03
	114.6	SCREW HEX	A-8.8 M16X40		4	No.	IS:1364PART-2,1367PART-3	0.37
	114.7	NUT HEX	A-8.8 M16		4	No.	IS:1364PART-3,1367PART-3	0.14
	114.8	WASHER MCD-ST17.0			8	No.	IS:2016-1967, IS:2062 E250 BR	0.09



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ITEM NO.	PART NO.	DESCRIPTION OF SUB-ASSEMBLY	DRG. NO. / SIZE	VAR.	QTY.	UNIT	MAT. SPEC./ DIMENSION STD.	WT.(KG)
119		PIPE ASSEMBLY FROM TERM 438(SOUH) TO 439(SOVR)						
	119.3	GASKET VITON	68X34X3		1	No.	HW59870	0.03
	119.4	SCREW HEX	A-8.8 M12X50		4	No.	IS:1364PART-2,1367PART-3	0.252
	119.5	NUT HEX	A-8.8 M12		4	No.	IS:1364PART-3,1367PART-3	0.068
	119.6	WASHER MCD-ST 13			8	No.	IS:2016-1967, IS:2062 E250 BR	0.0496
	119.8	GASKET VITON	68X34X3		5	No.	HW59870	0.15
	119.9	SCREW HEX	A-8.8 M12X50		40	No.	IS:1364PART-2,1367PART-3	2.52
	119.10	NUT HEX	A-8.8 M12		40	No.	IS:1364PART-3,1367PART-3	0.68
	119.11	WASHER MCD-ST 13			80	No.	IS:2016-1967, IS:2062 E250 BR	0.496
120		PIPE ASSEMBLY FROM TERM 78 (SOUH) TO 7A/7B (GEN)						
	120.6	O-RING	41492501071	01	64	No.	HW59870	2.24
	120.7	SCREW HEX	A-8.8 M16X65		64	No.	IS:1364PART-2,1367PART-3	8.45
	120.8	NUT HEX	A-8.8 M16		64	No.	IS:1364PART-3,1367PART-3	2.18
	120.9	WASHER MCD-ST17.0			132	No.	IS:2016-1967, IS:2062 E250 BR	1.45
	120.11	O-RING	41492501071	01	1	No.	HW59870	0.04
	120.12	SCREW HEX	A-8.8 M16X65		8	No.	IS:1364PART-2,1367PART-3	1.06
	120.13	NUT HEX	A-8.8 M16		8	No.	IS:1364PART-3,1367PART-3	0.27
	120.14	WASHER MCD-ST17.0			16	No.	IS:2016-1967, IS:2062 E250 BR	0.18
121		BRANCH PIPE ASSEMBLY TO TERM.78(SOUH) (BRANCH OF PIPE AT SI NO. 120)						
	121.5	O-RING	41492501071	01	2	No.	HW59870	0.07
	121.6	SCREW HEX	A-8.8 M16X65		16	No.	IS:1364PART-2,1367PART-3	2.11
	121.7	NUT HEX	A-8.8 M16		16	No.	IS:1364PART-3,1367PART-3	0.54
	121.8	WASHER MCD-ST17.0			32	No.	IS:2016-1967, IS:2062 E250 BR	0.35
	121.10	O-RING	41492501071	01	1	No.	HW59870	0.04
	121.11	SCREW HEX	A-8.8 M16X65		8	No.	IS:1364PART-2,1367PART-3	1.06
	121.12	NUT HEX	A-8.8 M16		8	No.	IS:1364PART-3,1367PART-3	0.27
	121.13	WASHER MCD-ST17.0			16	No.	IS:2016-1967, IS:2062 E250 BR	0.18
123		PIPE ASSEMBLY FROM TERM 79 (SOUH) TO 295 (SOBT)						
	123.5	GASKET VITON	158X115X3		1	No.	HW59870	0.06
	123.6	SCREW HEX	A-8.8 M16X60		8	No.	IS:1364PART-2,1367PART-3	0.99
	123.7	NUT HEX	A-8.8 M16		8	No.	IS:1364PART-3,1367PART-3	0.27
	123.8	WASHER MCD-ST17.0			16	No.	IS:2016-1967, IS:2062 E250 BR	0.18
	123.10	GASKET VITON	158X115X3		5	No.	HW59870	0.3
	123.11	SCREW HEX	A-8.8 M16X60		40	No.	IS:1364PART-2,1367PART-3	4.96
	123.12	NUT HEX	A-8.8 M16		40	No.	IS:1364PART-2,1367	1.36
	123.13	WASHER MCD-ST 13			80	No.	IS:2016-1967, IS:2062 E250 BR	0.496
124		PIPE ASSEMBLY FROM TERM 75(SOUH) TO 71(SOVR)						
	124.4	GASKET VITON	102X60X3		1	No.	HW59870	0.032
	124.5	SCREW HEX	A-8.8 M16X55		4	No.	IS:1364PART-2,1367PART-3	0.46
	124.6	NUT HEX	A-8.8 M16		4	No.	IS:1364PART-3,1367PART-3	0.14
	124.7	WASHER MCD-ST17.0			8	No.	IS:2016-1967, IS:2062 E250 BR	0.09
	124.9	GASKET VITON	102X60X3		6	No.	HW59870	0.768
	124.10	SCREW HEX	A-8.8 M16X55		24	No.	IS:1364PART-2,1367	2.78
	124.11	NUT HEX	A-8.8 M16		24	No.	IS:1364PART-2,1367	0.82
	124.12	WASHER MCD-ST17.0			48	No.	IS:2016-1967, IS:2062 E250 BR	0.53
125		PIPE ASSEMBLY FROM TERM 921(PEM) TO SEAL OIL CLR AIR SIDE SEAL OIL UNIT						
	125.5	GASKET VITON	158X115X3		2	No.	HW59870	0.12
	125.6	SCREW HEX	A-8.8 M16X60		16	No.	IS:1364PART-2,1367PART-3	1.98
	125.7	NUT HEX	A-8.8 M16		16	No.	IS:1364PART-3,1367PART-3	0.54
	125.8	WASHER MCD-ST17.0			32	No.	IS:2016-1967, IS:2062 E250 BR	0.35
	125.10	GASKET VITON	158X115X3		1	No.	HW59870	0.06
	125.11	SCREW HEX	A-8.8 M16X60		8	No.	IS:1364PART-2,1367PART-3	0.99
	125.12	NUT HEX	A-8.8 M16		8	No.	IS:1364PART-3,1367PART-3	0.27
	125.13	WASHER MCD-ST17.0			16	No.	IS:2016-1967, IS:2062 E250 BR	0.18
	125.15	GASKET VITON	158X115X3		4	No.	HW59870	0.24
	125.16	SCREW HEX	A-8.8 M16X60		32	No.	IS:1364PART-2,1367PART-3	3.97
	125.17	NUT HEX	A-8.8 M16		32	No.	IS:1364PART-3,1367PART-3	1.09
	125.18	WASHER MCD-ST17.0			64	No.	IS:2016-1967, IS:2062 E250 BR	0.70

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PIPING FOR SEAL OIL SYSTEM								
ITEM NO.	PART NO.	DESCRIPTION OF SUB-ASSEMBLY	DRG. NO. / SIZE	VAR.	QTY.	UNIT	MAT. SPEC./ DIMENSION STD.	WT.(KG)
126		PIPE ASSEMBLY FROM TERM SEAL OIL CLR AIR SIDE SEAL OIL UNIT TO 922(PEM)						
	126.5	GASKET VITON	158X115X3		2	No.	HW59870	0.12
	126.6	SCREW HEX	A-8.8 M16X60		16	No.	IS:1364PART-2,1367PART-3	1.98
	126.7	NUT HEX	A-8.8 M16		16	No.	IS:1364PART-3,1367PART-3	0.54
	126.8	WASHER MCD-ST17.0			32	No.	IS:2016-1967, IS:2062 E250 BR	0.35
	126.10	GASKET VITON	158X115X3		1	No.	HW59870	0.06
	126.11	SCREW HEX	A-8.8 M16X60		8	No.	IS:1364PART-2,1367PART-3	0.99
	126.12	NUT HEX	A-8.8 M16		8	No.	IS:1364PART-3,1367PART-3	0.27
	126.13	WASHER MCD-ST17.0			16	No.	IS:2016-1967, IS:2062 E250 BR	0.18
	126.15	GASKET VITON	158X115X3		4	No.	HW59870	0.24
	126.16	SCREW HEX	A-8.8 M16X60		32	No.	IS:1364PART-2,1367PART-3	3.97
	126.17	NUT HEX	A-8.8 M16		32	No.	IS:1364PART-3,1367PART-3	1.09
	126.18	WASHER MCD-ST17.0			64	No.	IS:2016-1967, IS:2062 E250 BR	0.70
127		PIPE ASSEMBLY FROM TERM 931(PEM) TO SEAL OIL CLR H2 SIDE SEAL OIL UNIT						
	127.5	GASKET VITON	102X60X3		1	No.	HW59870	0.128
	127.6	SCREW HEX	A-8.8 M16X55		4	No.	IS:1364PART-2,1367PART-3	0.46
	127.7	NUT HEX	A-8.8 M16		4	No.	IS:1364PART-3,1367PART-3	0.14
	127.8	WASHER MCD-ST17.0			8	No.	IS:2016-1967, IS:2062 E250 BR	0.09
	127.10	GASKET VITON	102X60X3		4	No.	HW59870	0.512
	127.11	SCREW HEX	A-8.8 M16X55		16	No.	IS:1364PART-2,1367PART-3	1.86
	127.12	NUT HEX	A-8.8 M16		16	No.	IS:1364PART-3,1367PART-3	0.54
	127.13	WASHER MCD-ST17.0			32	No.	IS:2016-1967, IS:2062 E250 BR	0.35
	127.15	GASKET VITON	102X60X3		2	No.	HW59870	0.256
	127.16	SCREW HEX	A-8.8 M16X55		8	No.	IS:1364PART-2,1367PART-3	0.93
	127.17	NUT HEX	A-8.8 M16		8	No.	IS:1364PART-3,1367PART-3	0.27
	127.18	WASHER MCD-ST17.0			16	No.	IS:2016-1967, IS:2062 E250 BR	0.18
128		PIPE ASSEMBLY FROM TERM SEAL OIL CLR H2 SIDE SEAL OIL UNIT TO TERM 932(PEM)						
	128.5	GASKET VITON	102X60X3		1	No.	HW59870	0.128
	128.6	SCREW HEX	A-8.8 M16X55		4	No.	IS:1364PART-2,1367PART-3	0.46
	128.7	NUT HEX	A-8.8 M16		4	No.	IS:1364PART-3,1367PART-3	0.14
	128.8	WASHER MCD-ST17.0			8	No.	IS:2016-1967, IS:2062 E250 BR	0.09
	128.10	GASKET VITON	102X60X3		4	No.	HW59870	0.512
	128.11	SCREW HEX	A-8.8 M16X55		16	No.	IS:1364PART-2,1367PART-3	1.86
	128.12	NUT HEX	A-8.8 M16		16	No.	IS:1364PART-3,1367PART-3	0.54
	128.13	WASHER MCD-ST17.0			32	No.	IS:2016-1967, IS:2062 E250 BR	0.35
	128.15	GASKET VITON	102X60X3		2	No.	HW59870	0.256
	128.16	SCREW HEX	A-8.8 M16X55		8	No.	IS:1364PART-2,1367PART-3	0.93
	128.17	NUT HEX	A-8.8 M16		8	No.	IS:1364PART-3,1367PART-3	0.27
	128.18	WASHER MCD-ST17.0			16	No.	IS:2016-1967, IS:2062 E250 BR	0.18
129		PIPE ASSEMBLY FROM 70B(SOVR) TO TERM 6B/6D(GEN)						
	129.5	GASKET VITON	68X34X3		1	No.	HW59870	0.03
	129.6	SCREW HEX	A-8.8 M12X50		4	No.	IS:1364PART-2,1367PART-3	0.252
	129.7	NUT HEX	A-8.8 M12		4	No.	IS:1364PART-3,1367PART-3	0.068
	129.8	WASHER MCD-ST 13			8	No.	IS:2016-1967, IS:2062 E250 BR	0.0496
	129.10	GASKET VITON	68X34X3		5	No.	HW59870	0.15
	129.11	SCREW HEX	A-8.8 M12X50		20	No.	IS:1364PART-2,1367PART-3	1.26
	129.12	NUT HEX	A-8.8 M12		20	No.	IS:1364PART-3,1367PART-3	0.34
	129.13	WASHER MCD-ST 13			40	No.	IS:2016-1967, IS:2062 E250 BR	0.248
	129.15	GASKET VITON	88X48X3		1	No.	HW59870	0.03
	129.16	SCREW HEX	A-8.8 M16X40		4	No.	IS:1364PART-2,1367PART-3	0.37
	129.17	NUT HEX	A-8.8 M16		4	No.	IS:1364PART-3,1367PART-3	0.14
	129.18	WASHER MCD-ST17.0			8	No.	IS:2016-1967, IS:2062 E250 BR	0.09
130		BRANCH PIPE ASSEMBLY TO TERM 6D(GEN) (BRANCH OF PIPE AT SI NO. 130)						
	130.4	GASKET VITON	88X48X3		1	No.	HW59870	0.03
	130.5	SCREW HEX	A-8.8 M16X40		4	No.	IS:1364PART-2,1367PART-3	0.37
	130.6	NUT HEX	A-8.8 M16		4	No.	IS:1364PART-3,1367PART-3	0.14
	130.7	WASHER MCD-ST17.0			8	No.	IS:2016-1967, IS:2062 E250 BR	0.09
TOTAL WT.								146.54

TOTAL WEIGHT OF PIPING FOR SEAL OIL SYSTEM = 147

KG



PIPING FOR LIQUID DETECTOR RACK								
ITEM NO.	PART NO.	DESCRIPTION OF SUB-ASSEMBLY	DRG. NO./SIZE	VAR.	QTY.	UNIT	MAT. SPEC./ DIMENSION STD.	WT.(KG)
201		PIPE ASSEMBLY FROM TERM. 21A/B/C(GEN) TO 61A/B/C(LDR)						
	201.1	PIPE	D33.4X2.90		78	Mtr.	ASTM SA106 GR.B	170.04
	201.2	REDUCER CONC.	60.3X33.4X2.90		3	No.	ASTM A234 WPB,ASME B16.9	1.05
	201.3	FLANGE, 25NB	31500001239	04	30	No.	IS:2062 E250 BR	30.60
	201.4	GASKET VITON	68X34X3		15	No.	HW59870	0.45
	201.5	SCREW HEX	A-8.8 M12X50		60	No.	IS:1364PART-2,1367PART-3	3.78
	201.6	NUT HEX	A-8.8 M12		60	No.	IS:1364PART-3,1367PART-3	1.02
	201.7	WASHER MCD-ST 13			120	No.	IS:2016-1967, IS:2062 E250 BR	0.74
		FLANGE, 50NB						
	201.8	(FOR 21B TP GEN END)	31500001239	07	1	No.	IS:2062 E250 BR	2.10
	201.9	GASKET VITON	102X60X3		4	No.	HW59870	0.14
	201.10	SCREW HEX	A-8.8 M16X60		4	No.	IS:1364PART-2,1367PART-3	0.50
	201.11	NUT HEX	A-8.8 M16		4	No.	IS:1364PART-3,1367PART-3	0.14
	201.12	WASHER MCD-ST17.0			4	No.	IS:2016-1967, IS:2062 E250 BR	0.04
		FLANGE, 50NB						
	201.13	(FOR 21A/C TP GEN END)	31500001239	07	2	No.	IS:2062 E250 BR	4.20
	201.14	GASKET VITON	102X60X3		8	No.	HW59870	0.28
	201.15	SCREW HEX	A-8.8 M12X40		8	No.	IS:1364PART-2,1367PART-3	0.50
	201.16	NUT HEX	A-8.8 M12		8	No.	IS:1364PART-3,1367PART-3	0.14
	201.17	WASHER MCD-ST 13			4	No.	IS:2016-1967, IS:2062 E250 BR	0.02
		FLANGE, 25NB						
	201.18	(FOR VLV)	31498201125	00	6	No.	IS:2062 E250 BR	6.78
	201.19	O-RING	41492501071	02	6	No.	HW59870	0.21
	201.20	SCREW HEX	A-8.8 M12X50		24	No.	IS:1364PART-2,1367PART-3	1.512
	201.21	NUT HEX	A-8.8 M12		24	No.	IS:1364PART-3,1367PART-3	0.408
	201.22	WASHER MCD-ST 13			48	No.	IS:2016-1967, IS:2062 E250 BR	0.2976
202		PIPE ASSEMBLY FROM TERM.22(GEN) TO 62(LDR)						
	202.1	PIPE	D33.4X2.90		25	Mtr.	ASTM SA106 GR.B	54.50
	202.2	REDUCER CONC.	60.3X33.4X2.90		1	No.	ASTM A234 WPB,ASME B16.9	0.35
	202.3	FLANGE, 25NB	31500001239	04	6	No.	IS:2062 E250 BR	6.12
	202.4	GASKET VITON	68X34X3		3	No.	HW59870	0.09
	202.5	SCREW HEX	A-8.8 M12X50		12	No.	IS:1364PART-2,1367PART-3	0.76
	202.6	NUT HEX	A-8.8 M12		12	No.	IS:1364PART-3,1367PART-3	0.20
	202.7	WASHER MCD-ST 13			24	No.	IS:2016-1967, IS:2062 E250 BR	0.15
		FLANGE, 50NB						
	202.8	(FOR 22 TP GEN END)	31500001239	07	1	No.	IS:2062 E250 BR	2.10
	202.9	GASKET VITON	102X60X3		1	No.	HW59870	0.04
	202.10	SCREW HEX	A-8.8 M16X60		4	No.	IS:1364PART-2,1367PART-3	0.50
	202.11	NUT HEX	A-8.8 M16		4	No.	IS:1364PART-3,1367PART-3	0.14
	202.12	WASHER MCD-ST17.0			8	No.	IS:2016-1967, IS:2062 E250 BR	0.09
203		PIPE ASSEMBLY FROM TERM. 23/25(GEN) TO 63/64(LDR)						
	203.1	PIPE	D33.4X2.90		50	Mtr.	ASTM SA106 GR.B	109.00
	203.2	REDUCER CONC.	60.3X33.4X2.90		2	No.	ASTM A234 WPB,ASME B16.9	0.70
	203.3	FLANGE, 25NB	31500001239	04	12	No.	IS:2062 E250 BR	12.24
	203.4	GASKET VITON	68X34X3		6	No.	HW59870	0.18
	203.5	SCREW HEX	A-8.8 M12X50		24	No.	IS:1364PART-2,1367PART-3	1.51
	203.6	NUT HEX	A-8.8 M12		24	No.	IS:1364PART-3,1367PART-3	0.41
	203.7	WASHER MCD-ST 13			45	No.	IS:2016-1967, IS:2062 E250 BR	0.28
		FLANGE, 50NB						
	203.8	(FOR 23 TP GEN END)	31500001239	07	1	No.	IS:2062 E250 BR	2.10
	203.9	GASKET VITON	102X60X3		1	No.	HW59870	0.04
	203.10	SCREW HEX	A-8.8 M16X60		4	No.	IS:1364PART-2,1367PART-3	0.50
	203.11	NUT HEX	A-8.8 M16		4	No.	IS:1364PART-3,1367PART-3	0.14
	203.12	WASHER MCD-ST17.0			8	No.	IS:2016-1967, IS:2062 E250 BR	0.09
		FLANGE, 50NB						
	203.13	(FOR 25 TP GEN END)	31500001239	07	1	No.	IS:2062 E250 BR	2.10
	203.14	GASKET VITON	102X60X3		1	No.	HW59870	0.04

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Generator Piping 800 MW for Double Flow Seal Oil system(MATERIAL - CARBON STEEL)

TGE-3629
REV02
DATE-31.03.2019

PIPING FOR LIQUID DETECTOR RACK								
ITEM NO.	PART NO.	DESCRIPTION OF SUB-ASSEMBLY	DRG. NO./SIZE	VAR.	QTY.	UNIT	MAT. SPEC./ DIMENSION STD.	WT.(KG)
	203.15	SCREW HEX	A-8.8 M16X60		4	No.	IS:1364PART-2,1367PART-3	0.50
	203.16	NUT HEX	A-8.8 M16		4	No.	IS:1364PART-3,1367PART-3	0.14
	203.17	WASHER MCD-ST17.0			8	No.	IS:2016-1967, IS:2062 E250 BR	0.09

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PIPING FOR LIQUID DETECTOR RACK								
ITEM NO.	PART NO.	DESCRIPTION OF SUB-ASSEMBLY	DRG. NO./SIZE	VAR.	QTY.	UNIT	MAT. SPEC./ DIMENSION STD.	WT.(KG)
204		PIPE ASSEMBLY FROM TERM. 27(GEN) TO 67(LDR)						
	204.1	PIPE	D33.4X2.90		25	Mtr.	ASTM SA106 GR.B	54.50
	204.2	REDUCER CONC.	60.3X33.4X2.90		1	No.	ASTM A234 WPB,ASME B16.9	0.35
	204.3	FLANGE, 25NB	31500001239	04	6	No.	IS:2062 E250 BR	6.12
	204.4	GASKET VITON	68X34X3		3	No.	HW59870	0.09
	204.5	SCREW HEX	A-8.8 M12X50		12	No.	IS:1364PART-2,1367PART-3	0.76
	204.6	NUT HEX	A-8.8 M12		12	No.	IS:1364PART-3,1367PART-3	0.20
	204.7	WASHER MCD-ST 13			24	No.	IS:2016-1967, IS:2062 E250 BR	0.15
		FLANGE, 50NB						
	204.8	(FOR 27 TP GEN END)	31500001239	07	1	No.	IS:2062 E250 BR	2.10
	204.9	GASKET VITON	102X60X3		1	No.	HW59870	0.04
	204.10	SCREW HEX	A-8.8 M16X60		4	No.	IS:1364PART-2,1367PART-3	0.50
	204.11	NUT HEX	A-8.8 M16		4	No.	IS:1364PART-3,1367PART-3	0.14
	204.12	WASHER MCD-ST17.0			8	No.	IS:2016-1967, IS:2062 E250 BR	0.09
205		PIPE ASSEMBLY FROM TERM.26(GEN) TO 66(LDR)						
	205.1	PIPE	D33.4X2.90		25	Mtr.	ASTM SA106 GR.B	54.50
	205.2	REDUCER CONC.	60.3X33.4X2.90		1	No.	ASTM A234 WPB,ASME B16.9	0.35
	205.3	FLANGE, 25NB	31500001239	04	6	No.	IS:2062 E250 BR	6.12
	205.4	GASKET VITON	68X34X3		3	No.	HW59870	0.09
	205.5	SCREW HEX	A-8.8 M12X50		12	No.	IS:1364PART-2,1367PART-3	0.76
	205.6	NUT HEX	A-8.8 M12		12	No.	IS:1364PART-3,1367PART-3	0.20
	205.7	WASHER MCD-ST 13			24	No.	IS:2016-1967, IS:2062 E250 BR	0.15
		FLANGE, 50NB						
	205.8	(FOR 26 TP GEN END)	31500001239	07	1	No.	IS:2062 E250 BR	2.10
	205.9	GASKET VITON	102X60X3		1	No.	HW59870	0.04
	205.10	SCREW HEX	A-8.8 M16X60		4	No.	IS:1364PART-2,1367PART-3	0.50
	205.11	NUT HEX	A-8.8 M16		4	No.	IS:1364PART-3,1367PART-3	0.14
	205.12	WASHER MCD-ST17.0			8	No.	IS:2016-1967, IS:2062 E250 BR	0.09
							TOTAL WT.	550.05

TOTAL WEIGHT OF PIPING FOR LDR = 550 KG

PIPING FOR PRIMARY WATER SYSTEM			DRG. NO. / SIZE	VAR.	QTY.	UNIT	MAT. SPEC./ DIMENSION STD.	WT.(KG)
ITEM NO.	PART NO.	DESCRIPTION OF SUB-ASSEMBLY						
301		PIPE ASSEMBLY FROM TERM.195 (PW UNIT) TO TERM. 196 (PW PIPELINE)						
	301.3	FLANGE, 150NB (PWU 195 END)	31531401089	01	1	No.	IS:2062 E250 BR	7.59
	301.5	GASKET VITON	218X159X3		1	No.	HW59870	0.06
	301.6	SCREW HEX	A-8.8 M24X130		8	No.	IS:1364PART-2,1367PART-3	5.00
	301.7	NUT HEX	A-8.8 M24		8	No.	IS:1364PART-3,1367PART-3	0.56
	301.8	WASHER MCD-ST 25			16	No.	IS:2016-1967, IS:2062 E250 BR	0.48
	301.10	GASKET VITON	212X169X3		1	No.	HW59870	0.06
	301.11	SCREW HEX	A-8.8 M20X80		8	No.	IS:1364PART-2,1367PART-3	2.06
	301.12	NUT HEX	A-8.8 M20		8	No.	IS:1364PART-3,1367PART-3	0.40
	301.13	WASHER MCD-ST 21			16	No.	IS:2016-1967, IS:2062 E250 BR	0.27
	301.15	GASKET VITON	212X169X3		5	No.	HW59870	0.30
	301.16	SCREW HEX	A-8.8 M20X80		80	No.	IS:1364PART-2,1367PART-3	20.64
	301.17	NUT HEX	A-8.8 M20		80	No.	IS:1364PART-3,1367PART-3	4.00
	301.18	WASHER MCD-ST 21			80	No.	IS:2016-1967, IS:2062 E250 BR	1.36
302		BRANCH PIPE ASSEMBLY FROM TERM.205 (PW TANK PIPE LINE) TO 206 (PW UNIT)						
	302.3	FLANGE, 150NB (PWU 206 END)	31531401089	01	1	No.	IS:2062 E250 BR	7.59
	302.5	GASKET VITON	218X159X3		1	No.	HW59870	0.06
	302.6	SCREW HEX	A-8.8 M24X130		8	No.	IS:1364PART-2,1367PART-3	5.00
	302.7	NUT HEX	A-8.8 M24		8	No.	IS:1364PART-3,1367PART-3	0.56
	302.8	WASHER MCD-ST 25			16	No.	IS:2016-1967, IS:2062 E250 BR	0.48
	302.10	GASKET VITON	212X169X3		1	No.	HW59870	0.06
	302.11	SCREW HEX	A-8.8 M20X80		8	No.	IS:1364PART-2,1367PART-3	2.06
	302.12	NUT HEX	A-8.8 M20		8	No.	IS:1364PART-3,1367PART-3	0.40
	302.13	WASHER MCD-ST 21			16	No.	IS:2016-1967, IS:2062 E250 BR	0.27
	302.15	GASKET VITON	212X169X3		5	No.	HW59870	0.30
	302.16	SCREW HEX	A-8.8 M20X80		80	No.	IS:1364PART-2,1367PART-3	20.64
	302.17	NUT HEX	A-8.8 M20		80	No.	IS:1364PART-3,1367PART-3	4.00
	302.18	WASHER MCD-ST 21			80	No.	IS:2016-1967, IS:2062 E250 BR	1.36
305		PIPE ASSEMBLY FROM TERM.579 (PW UNIT) TO 140 (PW TANK)						
	305.3	GASKET VITON	68X34X3		1	No.	HW59870	0.03
	305.4	SCREW HEX	A-8.8 M16X50		4	No.	IS:1364PART-2,1367PART-3	0.46
	305.5	NUT HEX	A-8.8 M16		4	No.	IS:1364PART-3,1367PART-3	0.14
	305.6	WASHER MCD-ST 17			8	No.	IS:2016-1967, IS:2062 E250 BR	0.09
	305.8	GASKET VITON	68X34X3		4	No.	HW59870	0.12
	305.9	SCREW HEX	A-8.8 M16X50		24	No.	IS:1364PART-2,1367PART-3	2.78
	305.10	NUT HEX	A-8.8 M16		24	No.	IS:1364PART-3,1367PART-3	0.82
	305.11	WASHER MCD-ST 17			48	No.	IS:2016-1967, IS:2062 E250 BR	0.53
	305.13	GASKET VITON	68X34X3		1	No.	HW59870	0.03
	305.14	SCREW HEX	A-8.8 M16X50		4	No.	IS:1364PART-2,1367PART-3	0.46
	305.15	NUT HEX	A-8.8 M16		4	No.	IS:1364PART-3,1367PART-3	0.14
	305.16	WASHER MCD-ST 17			8	No.	IS:2016-1967, IS:2062 E250 BR	0.09
306		PIPE ASSEMBLY FROM TERM.149(PW TANK) TO 567 (PW UNIT)						
	306.3	GASKET VITON	68X34X3		1	No.	HW59870	0.03
	306.4	SCREW HEX	A-8.8 M16X50		4	No.	IS:1364PART-2,1367PART-3	0.46
	306.5	NUT HEX	A-8.8 M16		4	No.	IS:1364PART-3,1367PART-3	0.14
	306.6	WASHER MCD-ST 17			8	No.	IS:2016-1967, IS:2062 E250 BR	0.09
	306.8	GASKET VITON	68X34X3		4	No.	HW59870	0.12
	306.9	SCREW HEX	A-8.8 M16X50		24	No.	IS:1364PART-2,1367PART-3	2.78
	306.10	NUT HEX	A-8.8 M16		24	No.	IS:1364PART-3,1367PART-3	0.82
	306.11	WASHER MCD-ST 17			48	No.	IS:2016-1967, IS:2062 E250 BR	0.53
	306.13	GASKET VITON	68X34X3		1	No.	HW59870	0.03
	306.14	SCREW HEX	A-8.8 M16X50		4	No.	IS:1364PART-2,1367PART-3	0.46
	306.15	NUT HEX	A-8.8 M16		4	No.	IS:1364PART-3,1367PART-3	0.14
	306.16	WASHER MCD-ST 17			8	No.	IS:2016-1967, IS:2062 E250 BR	0.09
307		PIPE ASSEMBLY FROM TERM.585(PW TANK) TO WASTE GAS						
	307.3	GASKET VITON	68X34X3		1	No.	HW59870	0.03
	307.4	SCREW HEX	A-8.8 M16X50		4	No.	IS:1364PART-2,1367PART-3	0.46
	307.5	NUT HEX	A-8.8 M16		4	No.	IS:1364PART-3,1367PART-3	0.14
	307.6	WASHER MCD-ST 17			8	No.	IS:2016-1967, IS:2062 E250 BR	0.09
	307.8	GASKET VITON	68X34X3		4	No.	HW59870	0.12
	307.9	SCREW HEX	A-8.8 M16X50		24	No.	IS:1364PART-2,1367PART-3	2.78
	307.10	NUT HEX	A-8.8 M16		24	No.	IS:1364PART-3,1367PART-3	0.82
	307.11	WASHER MCD-ST 17			48	No.	IS:2016-1967, IS:2062 E250 BR	0.53



Generator Piping 800 MW for Double Flow Seal Oil system(MATERIAL - CARBON STEEL)

TGE-3629
REV02
DATE-31.03.2019

PIPING FOR PRIMARY WATER SYSTEM								
ITEM NO.	PART NO.	DESCRIPTION OF SUB-ASSEMBLY	DRG. NO. / SIZE	VAR.	QTY.	UNIT	MAT. SPEC./ DIMENSION STD.	WT.(KG)
308		PIPE ASSEMBLY FROM PW COOLER INLET/OUTLET TO TERM 208/209						
	308.1	PIPE	D168.3X3.40		30	Mtr.	ASTM SA106 GR.B	414.90
	308.2	REDUCER CONC.	D168.3X141.3X3.4		4	No.	ASTM A234 WPB,ASME B16.9	4.40
	308.3	TEE	D168.3X168.3X3.4		2	No.	ASTM A234 WPB,ASME B16.9	8.00
	308.4	ELBOW LR 90°	D168.3X3.40		10	No.	ASTM A234 WPB,ASME B16.9	72.00
	308.5	CONNECTION FOR TE/TG		41500001118 00	6	No.	IS:2062 E250 BR	3
	308.6	CONNECTION, 15NB FOR PG/PT		31500001190 02	4	No.	IS:2062 E250 BR	0.4
	308.7	CONNECTION, 15NB		31500001190 02	4	No.	IS:2062 E250 BR	0.4
	308.8	FLANGE, 125NB (CLR TP END)		31500001239 18	4	No.	IS:2062 E250 BR	20.00
	308.9	GASKET VITON	188X140X3		4	No.	HW59870	0.24
	308.10	SCREW HEX	A-8.8 M24X80		32	No.	IS:1364PART-2,1367PART-3	11.78
	308.11	NUT HEX	A-8.8 M24		32	No.	IS:1364PART-3,1367PART-3	2.24
	308.12	WASHER MCD-ST 25			64	No.	IS:2016-1967, IS:2062 E250 BR	1.92
	308.13	FLANGE, 150NB (VALVE FLANGES)		31500001239 12	8	No.	IS:2062 E250 BR	48.00
	308.14	GASKET VITON	212X169X3		8	No.	HW59870	0.48
	308.15	SCREW HEX	A-8.8 M20X70		64	No.	IS:1364PART-2,1367PART-3	14.27
	308.16	NUT HEX	A-8.8 M20		64	No.	IS:1364PART-3,1367PART-3	3.20
	308.17	WASHER MCD-ST 21			128	No.	IS:2016-1967, IS:2062 E250 BR	2.18
	308.18	FLANGE, 150NB (PEM TERM)		31500001239 12	4	No.	IS:2062 E250 BR	24.00
	308.19	GASKET VITON	212X169X3		2	No.	HW59870	0.12
	308.20	SCREW HEX	A-8.8 M20X70		16	No.	IS:1364PART-2,1367PART-3	3.57
	308.21	NUT HEX	A-8.8 M20		16	No.	IS:1364PART-3,1367PART-3	0.80
	308.22	WASHER MCD-ST 21			32	No.	IS:2016-1967, IS:2062 E250 BR	0.54
309		PIPE ASSEMBLY FROM ION EXCHANGER TO PW UNIT INLET						
	309.3	GASKET VITON	68X34X3		4	No.	HW59870	0.12
	309.4	SCREW HEX	A-8.8 M16X50		48	No.	IS:1364PART-2,1367PART-3	5.57
	309.5	NUT HEX	A-8.8 M16		48	No.	IS:1364PART-3,1367PART-3	1.63
	309.6	WASHER MCD-ST 17			96	No.	IS:2016-1967, IS:2062 E250 BR	1.06
							TOTAL WT. CS (KG)	747

TOTAL WEIGHT OF PIPING FOR PW SYSTEM = 747 KG



Generator Piping 800 MW for Double Flow Seal Oil system(MATERIAL - CARBON STEEL)

TGE-3629
REV02
DATE-31.03.2019

PIPING FOR WGS								
ITEM NO.	PART NO.	DESCRIPTION	DRG.NO./SIZE	VAR.	QTY.	UNIT	MAT. SPEC./ DIMENSION STD.	WT.(KG)
500		FROM TERM. 105(GU) TO ATM						
	500.1	PIPE	D168.3X3.40		55	Mtr.	ASTM SA106 GR.B	760.65
	500.2	ELBOW LR 90°	D168.3X3.40		5	No.	ASTM A234 WPB,ASME B16.9	36.00
	500.3	H2 VENT STAR	TGE-2774		1	No.	TGE-2774	80.74
501		FROM TERM. (CO2 DIST.) TO WGS						
	501.1	PIPE	D60.3X3.91		20	Mtr.	ASTM SA106 GR.B	108.8
	501.2	ELBOW LR 90°	D60.3X3.91		4	No.	ASTM A234 WPB,ASME B16.9	2.6
	501.3	TEE UNEQUAL	168.3X114.3X3.4		1	No.	ASTM A234 WPB,ASME B16.9	3.50
	501.4	REDUCER CONC.	114.3X60.3X3.05		1	No.	ASTM A234 WPB,ASME B16.9	0.86
	501.5	FLANGE, 50NB (CO2 DIST END)	31500001001	04	1	No.	IS:2062 E250 BR	2.5
	501.6	GASKET VITON	102X60X3		1	No.	HW59870	0.035
	501.7	SCREW HEX	A-8.8 M16X60		4	No.	IS:1364PART-2,1367PART-3	0.50
	501.8	NUT HEX	A-8.8 M16		4	No.	IS:1364PART-3,1367PART-3	0.14
	501.9	WASHER MCD-ST17.0			8	No.	IS:2016-1967, IS:2062 E250 BR	0.09
	501.10	FLANGE, 50NB	31500001001	04	6	No.	IS:2062 E250 BR	15
	501.11	GASKET VITON	102X60X3		2	No.	HW59870	0.035
	501.12	SCREW HEX	A-8.8 M16X60		8	No.	IS:1364PART-2,1367PART-3	0.99
	501.13	NUT HEX	A-8.8 M16		8	No.	IS:1364PART-3,1367PART-3	0.27
	501.14	WASHER MCD-ST17.0			8	No.	IS:2016-1967, IS:2062 E250 BR	0.09
502		FROM TERM. GAC 315 A/B TO WGS						
	502.1	PIPE	D33.4X2.90		50	Mtr.	ASTM SA106 GR.B	109
	502.2	TEE	33.4X33.4X2.77		2	No.	ASTM A234 WPB,ASME B16.9	0.4
	502.3	REDUCER CONC.	60.3X33.4X2.90		1	No.	ASTM A234 WPB,ASME B16.9	0.35
	502.4	REDUCER CONC.	33.4X13.7X2.77X1.65		1	No.	ASTM A234 WPB,ASME B16.9	0.09
	502.5	ELBOW LR 90°	D60.3X3.91		5	No.	ASTM A234 WPB,ASME B16.9	3.25
503		FROM TERM. 296 (SOST VENT) TO VAP. EXHAUSTER						
	503.1	PIPE	D73X3.05		20	Mtr.	ASTM SA106 GR.B	105.2
	503.2	ELBOW LR 90°	D73X3.05		8	No.	ASTM A234 WPB,ASME B16.9	8
	503.3	REDUCER CONC.	D73X60.3X3.05X2.77		1	No.	ASTM A234 WPB,ASME B16.9	0.66
	503.4	REDUCER CONC.	60.3X33.4X2.90		1	No.	ASTM A234 WPB,ASME B16.9	0.35
	503.5	TEE UNEQUAL	88.9X73X3.05		1	No.	ASTM A234 WPB,ASME B16.9	1.69
	503.6	FLANGE, 65NB (FOR 296 SOST)	31500001239	08	1	No.	IS:2062 E250 BR	2.67
	503.7	GASKET VITON	122X76X3		1	No.	HW59870	0.045
	503.8	SCREW HEX	A-8.8 M16X55		4	No.	IS:1364PART-2,1367PART-3	0.46
	503.9	NUT HEX	A-8.8 M16		4	No.	IS:1364PART-3,1367PART-3	0.14
	503.10	WASHER MCD-ST17.0			8	No.	IS:2016-1967, IS:2062 E250 BR	0.09
	503.11	FLANGE, 65NB	31500001239	08	6	No.	IS:2062 E250 BR	16.02
	503.12	GASKET VITON	122X76X3		3	No.	HW59870	0.135
	503.13	SCREW HEX	A-8.8 M16X55		18	No.	IS:1364PART-2,1367PART-3	2.09
	503.14	NUT HEX	A-8.8 M16		18	No.	IS:1364PART-3,1367PART-3	0.61
	503.15	WASHER MCD-ST17.0			36	No.	IS:2016-1967, IS:2062 E250 BR	0.40
504		FROM TERM. H2 DIST. TO WGS						
	504.1	PIPE	D21.3X2.77		25	Mtr.	ASTM SA106 GR.B	31.75
505		FROM TERM. 9A/9B TO VAPOUR EXHAUSTER (COMMON HEADER 80NB) UPTO 100NB COMMON HEADER						
	505.1	PIPE	D88.9X3.05		50	Mtr.	ASTM SA106 GR.B	323
	505.2	ELBOW LR 90°	D88.9X3.05		20	No.	ASTM A234 WPB,ASME B16.9	30
	505.3	TEE	88.9X88.9X3.05		6	No.	ASTM A234 WPB,ASME B16.9	0.14
	505.4	FLANGE, 80NB	31500001239	09	28	No.	IS:2062 E250 BR	91.84
	505.5	GASKET VITON	138X89X3		14	No.	HW59870	0.70
	505.6	SCREW HEX	A-8.8 M16X70		112	No.	IS:1364PART-2,1367PART-3	5.68
	505.7	NUT HEX	A-8.8 M16		112	No.	IS:1364PART-3,1367PART-3	3.81
	505.8	WASHER MCD-ST17.0			112	No.	IS:2016-1967, IS:2062 E250 BR	1.23
	505.9	FLANGE, 80NB (VAP EXHST END)	41500001011	00	4	No.	IS:2062 E250 BR	15.632



Generator Piping 800 MW for Double Flow Seal Oil system(MATERIAL - CARBON STEEL)

TGE-3629
REV02
DATE-31.03.2019

PIPING FOR WGS								
ITEM NO.	PART NO.	DESCRIPTION	DRG.NO./SIZE	VAR.	QTY.	UNIT	MAT. SPEC./ DIMENSION STD.	WT.(KG)
	505.10	GASKET VITON	90X108X3		4	No.	HW59870	0.035
	505.11	SCREW HEX	A-8.8 M8X70		32	No.	IS:1364PART-2,1367PART-3	5.76
	505.12	NUT HEX	A-8.8 M8		32	No.	IS:1364PART-3,1367PART-3	0.16
	505.13	WASHER MCD-ST9.0			64	No.	IS:2016-1967, IS:2062 E250 BR	0.40
	505.14	FLANGE, 80NB (9A/B GEN END)	31500001239	09	2	No.	IS:2062 E250 BR	6.56
	505.15	GASKET VITON	138X89X3		2	No.	HW59870	0.10
	505.16	SCREW HEX	A-8.8 M16X70		16	No.	IS:1364PART-2,1367PART-3	2.24
	505.17	NUT HEX	A-8.8 M16		16	No.	IS:1364PART-3,1367PART-3	0.54
	505.18	WASHER MCD-ST17.0			32	No.	IS:2016-1967, IS:2062 E250 BR	0.35
	505.19	FLANGE, 80NB (DIAPH. VALVE END CONN.)	31500001239	09	4	No.	IS:2062 E250 BR	13.12
	505.20	GASKET VITON	138X89X3		4	No.	HW59870	0.035
	505.21	SCREW HEX	A-8.8 M8X70		32	No.	IS:1364PART-2,1367PART-3	5.76
	505.22	NUT HEX	A-8.8 M8		32	No.	IS:1364PART-3,1367PART-3	0.16
	505.23	WASHER MCD-ST9.0			64	No.	IS:2016-1967, IS:2062 E250 BR	0.40
	505.24	SCREW HEX FOR NRV FLANGE	A-8.8 M16X100		48	No.	IS:1364PART-2,1367PART-3	8.21
	505.25	NUT HEX	A-8.8 M16		48	No.	IS:1364PART-3,1367PART-3	1.63
	505.26	WASHER MCD-ST17.0			96	No.	IS:2016-1967, IS:2062 E250 BR	1.06
	505.27	FLANGE, 80NB (BLIND)	AA7244703		2	No.	IS:2062 E250 BR	9.54
	505.28	CONNECTION, 15NB	31500001190	02	3	No.	IS:2062 E250 BR	0.3
506	FROM COMMON HEADER 100NB TO ATM							
	506.1	PIPE	D114.3X3.05		80	Mtr.	ASTM SA106 GR.B	669.6
	506.2	ELBOW LR 90°	D114.3X3.05		15	No.	ASTM A234 WPB,ASME B16.9	42
	506.3	TEE UNEQUAL	114.3X88.9X3.05		2	No.	ASTM A234 WPB,ASME B16.9	5.00
	506.4	FLANGE, SORF, 100NB	31500001239	10	32	No.	IS:2062 E250 BR	115.84
	506.5	GASKET VITON	158X115X3		16	No.	HW59870	0.96
	506.6	SCREW HEX	A-8.8 M16X60		128	No.	IS:1364PART-2,1367PART-3	15.87
	506.7	NUT HEX	A-8.8 M16		128	No.	IS:1364PART-3,1367PART-3	4.35
	506.8	WASHER MCD-ST17.0			128	No.	IS:2016-1967, IS:2062 E250 BR	1.41
	506.9	FLANGE, 100NB (BLIND)	AA7244703		1	No.	IS:2062 E250 BR	5.65
	506.10	CONNECTION, 20NB	31500001190	03	1	No.	IS:2062 E250 BR	0.115
507	PIPE FITTINGS IN COMMON HEADER 150NB							
	507.1	CONNECTION, 20NB	31500001190	03	1	No.	IS:2062 E250 BR	0.115
	507.2	FLANGE, 20NB (FOR SIGHT GLASS)	31500001239	03	1	No.	IS:2062 E250 BR	0.73
	507.3	GASKET VITON	58X27X3		1	No.	HW59870	0.03
	507.4	SCREW HEX	A-8.8 M12X60		4	No.	IS:1364PART-2,1367PART-3	0.29
	507.5	NUT HEX	A-8.8 M12		4	No.	IS:1364PART-3,1367PART-3	0.07
	507.6	WASHER MCD-ST13.0			8	No.	IS:2016-1967, IS:2062 E250 BR	0.05
	507.7	FLANGE, 20NB (FOR VALVE)	31500001239	03	1	No.	IS:2062 E250 BR	0.73
	507.8	GASKET VITON	58X27X3		1	No.	HW59870	0.03
	507.9	SCREW HEX	A-8.8 M12X60		4	No.	IS:1364PART-2,1367PART-3	0.29
	507.10	NUT HEX	A-8.8 M12		4	No.	IS:1364PART-3,1367PART-3	0.07
	507.11	WASHER MCD-ST13.0			8	No.	IS:2016-1967, IS:2062 E250 BR	0.05
508	PIPE FITTINGS IN COMMON HEADER 25NB							
	508.1	CONNECTION, 20NB	31500001190	03	2	No.	IS:2062 E250 BR	0.23
	508.2	FLANGE, 20NB (FOR SIGHT GLASS)	31500001239	03	1	No.	IS:2062 E250 BR	0.73
	508.3	GASKET VITON	58X27X3		1	No.	HW59870	0.03
	508.4	SCREW HEX	A-8.8 M12X60		4	No.	IS:1364PART-2,1367PART-3	0.29
	508.5	NUT HEX	A-8.8 M12		4	No.	IS:1364PART-3,1367PART-3	0.07
	508.6	WASHER MCD-ST13.0			8	No.	IS:2016-1967, IS:2062 E250 BR	0.05
	508.7	FLANGE, 20NB (FOR VALVE)	31500001239	03	1	No.	IS:2062 E250 BR	0.73
	508.8	GASKET VITON	58X27X3		1	No.	HW59870	0.03
	508.9	SCREW HEX	A-8.8 M12X60		4	No.	IS:1364PART-2,1367PART-3	0.29
	508.10	NUT HEX	A-8.8 M12		4	No.	IS:1364PART-3,1367PART-3	0.07
	508.11	WASHER MCD-ST13.0			8	No.	IS:2016-1967, IS:2062 E250 BR	0.05
TOTAL WT.								2710.38

TOTAL WEIGHT OF PIPING FOR WASTE GAS SYSTEM =

2710 KG

Prepared by KUNAL MISHRA

Checked by MANJU AZAD

Approved by R.L.VYAS

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Generator Piping 800 MW for Double Flow Seal Oil system(MATERIAL - CARBON STEEL)

TGE-3629
REV02
DATE-31.03.2019

PIPING FOR WASTE FLUID SYSTEM								
ITEM NO.	PART NO.	DESCRIPTION	DRG.NO./SIZE	VAR.	QTY.	UNIT	MAT. SPEC./ DIMENSION STD.	WT.(KG)
600		FROM WASTE GAS SYSTEM 40/ 42 TO COMMON HEADER OF 50 NB						
	600.1	PIPE	D26.7X2.87		20	Mtr.	ASTM SA106 GR.B	33.80
	600.2	CONNECTION, 20NB	31500001190	03	2	No.	IS:2062 E250 BR	0.23
601		FROM GIS 74 (LDR) TO COMMON HEADER OF 50 NB						
	601.1	PIPE	D33.4X2.90		20	Mtr.	ASTM SA106 GR.B	43.60
	601.2	CONNECTION, 20NB	31500001190	03	1	No.	IS:2062 E250 BR	0.12
602		FROM U-LOOP SEAL OIL SYS. 297 TO COMMON HEADER OF 50 NB						
	602.1	PIPE	D33.4X2.90		20	Mtr.	ASTM SA106 GR.B	43.60
	602.2	CONNECTION, 20NB	31500001190	03	1	No.	IS:2062 E250 BR	0.12
603		FROM 920 (SOUH) TO COMMON HEADER OF 50 NB						
	603.1	PIPE	D33.4X2.90		25	Mtr.	ASTM SA106 GR.B	54.50
	603.2	CONNECTION, 25NB	31500001190	08	2	No.	IS:2062 E250 BR	0.28
604		FROM 930 (SOUA) TO COMMON HEADER OF 50 NB						
	604.1	PIPE	D33.4X2.90		25	Mtr.	ASTM SA106 GR.B	54.50
	604.2	CONNECTION, 25NB	31500001190	08	2	No.	IS:2062 E250 BR	0.28
605		FROM 950 (SOUA) TO COMMON HEADER OF 50 NB						
	605.1	PIPE	D33.4X2.90		25	Mtr.	ASTM SA106 GR.B	54.50
	605.2	CONNECTION, 25NB	31500001190	08	2	No.	IS:2062 E250 BR	0.28
606		FROM 114 (GS)TO COMMON HEADER OF 50 NB						
	606.1	PIPE	D21.3X2.77		20	Mtr.	ASTM SA106 GR.B	25.40
	606.2	CONNECTION, 15NB	31500001190	02	2	No.	IS:2062 E250 BR	0.20
607		FROM 214 & 390 (PWS) TO COMMON HEADER OF 50 NB						
	607.1	PIPE	D33.4X2.90		25	Mtr.	ASTM SA106 GR.B	54.50
	607.2	CONNECTION, 25NB	31500001190	08	2	No.	IS:2062 E250 BR	0.28
608		FROM 585 (PWT) TO DRAIN OIL COLLECTOR						
	608.1	PIPE	D33.4X2.90		30	Mtr.	ASTM SA106 GR.B	65.40
	608.2	PIPE	D114.3X3.05		1	Mtr.	ASTM SA106 GR.B	8.37
	608.3	REDUCER CONC.	114.3X60.3X3.05		1	No.	ASTM A234 WPB,ASME B16.9	0.86
	608.4	REDUCER CONC.	60.3X33.4X2.90		1	No.	ASTM A234 WPB,ASME B16.9	0.35
	608.5	CONNECTION, 25NB	31500001190	08	2	No.	IS:2062 E250 BR	0.28
609		COMMON HEADER OF 50 NB TO DRAIN OIL COLLECTOR						
	609.1	PIPE	D60.3X3.91		20	Mtr.	ASTM SA106 GR.B	108.80
	609.2	ELBOW LR 90°	D60.3X3.91		5	No.	ASTM A234 WPB,ASME B16.9	3.25
610		FROM DRAIN OIL COLLECTOR TO WASTE DISPOSAL PIT						
	610.1	PIPE	D33.4X2.90		20	Mtr.	ASTM SA106 GR.B	43.60
TOTAL WT.							597.11	

TOTAL WEIGHT OF PIPING FOR WASTE FLUID SYSTEM =

597 KG



SUPPORTS FOR GENERATOR PIPING									
ITEM NO.	PART NO.	DESCRIPTION OF SUB-ASSEMBLY	DRG NO. / SIZE	VAR.	QTY.		MAT. SPEC.	WT.(KG)	
600	600.1	STRIP	3.16X20		60	Mtr.	IS:5985	30.00	
	600.2	FLAT	6X40		100	Mtr.	IS:2062 E250 BR	180.00	
	600.3	FLAT	16X30		70	Mtr.	IS:2062 E250 BR	264.09	
	600.4	ANGLE	50X50X5		100	Mtr.	IS:2062 E250 BR	380.00	
	600.5	ANGLE	75X75X6		100	Mtr.	IS:2062 E250 BR	680.00	
	600.6	CHANNEL ISMC 100			20	Mtr.	IS:2062 E250 BR	185.00	
	600.7	CHANNEL ISMC 75			20	Mtr.	IS:2062 E250 BR	138.00	
	600.8	PIPE CS	D60.3X3.91		10	Mtr.	ASTM SA106 GR.B	54.40	
	600.9	TEE BAR ISNT-50			24	Mtr.	IS:2062 E250 BR	106.00	
	600.10	TEE BAR ISNT-75			24	Mtr.	IS:2062 E250 BR	245.00	
	600.11	PIPE CLAMP NB8	21500001023	01	200	No.	IS:2062 E250 BR	24.00	
	600.12	PIPE CLAMP NB10	21500001023	02	120	No.	IS:2062 E250 BR	14.40	
	600.13	PIPE CLAMP NB15	21500001023	03	80	No.	IS:2062 E250 BR	10.40	
	600.14	PIPE CLAMP NB20	21500001023	04	50	No.	IS:2062 E250 BR	8.00	
	600.15	PIPE CLAMP NB25	21500001023	05	120	No.	IS:2062 E250 BR	27.00	
	600.16	PIPE CLAMP NB40	21500001023	07	40	No.	IS:2062 E250 BR	11.00	
	600.17	PIPE CLAMP NB50	21500001024	08	250	No.	IS:2062 E250 BR	328.00	
	600.18	PIPE CLAMP NB65	21500001026	06	50	No.	IS:2062 E250 BR	40.00	
	600.19	PIPE CLAMP NB80	21500001026	07	40	No.	IS:2062 E250 BR	36.00	
	600.20	PIPE CLAMP NB100	21500001026	08	40	No.	IS:2062 E250 BR	80.00	
	600.21	PIPE CLAMP NB 150	31500001237	01	30	No.	IS:2062 E250 BR	72.00	
	600.22	BEAM ATTACHMENT M12	41500001101	02	40	No.	IS:2062 E250 BR	1.25	
	600.23	TURN BUCKLE M12	41500001103	02	50	No.	IS:2062 E250 BR	52.00	
	600.24	TIE ROD M12	41500001130	00	50	No.	IS:2062 E250 BR	12.00	
	600.25	THREADED ROD M12	41500001131	00	100	No.	IS:2062 E250 BR	72.00	
	600.26	WELDING EYE	41500001132	00	80	No.	IS:2062 E250 BR	90.00	
	600.27	EYE BOLT M12	41500001099	02	50	No.	IS:2062 E250 BR	8.00	
	600.31	SUPPORT FOR PW TANK	11500001097			No.	IS:2062 E250 BR		
	600.31.1	PLATE	11500001097		1	No.	IS:2062 E250 BR	390	
	600.31.2	PIPE CS	48.3X2.77, L=1M		35	Mtr.	ASTM SA106 GR.B	108.85	
	600.31.3	CHANNEL ISMC	175X75		2	Mtr.	IS:2062 E250 BR	39.20	
	600.31.4	CHANNEL ISMC	175X75		2	Mtr.	IS:2062 E250 BR	39.20	
	600.31.5	CHANNEL ISMC	150X75		1.5	Mtr.	IS:2062 E250 BR	25.2	
	600.31.6	CHANNEL ISMC	150X75		1.5	Mtr.	IS:2062 E250 BR	25.2	
	600.31.7	CHANNEL ISMC	150X75		1.85	Mtr.	IS:2062 E250 BR	31.08	
	600.31.8	CHANNEL ISMC	150X75		1.85	Mtr.	IS:2062 E250 BR	31.08	
	600.31.9	CHANNEL ISMC	150X75		1.2	Mtr.	IS:2062 E250 BR	20.16	
	600.31.10	CHANNEL ISMC	150X75		1.2	Mtr.	IS:2062 E250 BR	20.16	
	600.31.11	PIPE CS	48.3X2.77, L=500MM		10	Mtr.	ASTM SA106 GR.B	31.10	
	600.31.12	ANGLE	50X50X6 L=250MM		1	Mtr.	IS:2062 E250 BR	4.5	
	600.31.13	ANGLE	50X50X6 L=350MM		7	Mtr.	IS:2062 E250 BR	31.5	
	600.31.14	FLAT	50X6		6.5	Mtr.	IS:2062 E250 BR	15.3075	
							TOTAL WT. (KG)	3961.08	

TOTAL WEIGHT OF PIPING FOR HANGERS & SUPPORTS = 3961 KG

COMBINED WEIGHT OF CARBON STEEL FOR THE SYSTEM(GS+SOS+LDR+PWS+WGS+WFS+H&S)= 9891 KG

KUNAL MISHRA
Dy. Mg. / BHEL-HWZ (EME)



Generator Piping 800 MW for Double Flow Seal Oil system(MATERIAL - STAINLESS STEEL)

TGE-3630
REV02
DATE-31.03.2019

PIPING FOR SEAL OIL SYSTEM									
ITEM NO.	PART NO.	DESCRIPTION OF SUB-ASSEMBLY	DRG. NO. / SIZE		VAR.	QTY.	UNIT	MAT. SPEC./ DIMENSION STD.	WT.(KG)
101		PIPE ASSEMBLY FROM 76(SOU AIR SIDE) TO TERM. 72(SOVR)							
	101.1	PIPE SS	D73x3.05			30	Mtr.	ASTM A312 TP321	157.8
	101.2	ELBOW LR 90°	D73X3.05			8	No.	ASTM A403 WP321,ASME B16.9	11.2
	101.3	REDUCER CONC	D88.9X73X3.05			1	No.	ASTM A403 WP321,ASME B16.9	1.5
	101.4	FLANGE, 65NB	31500001240	08		10	No.	ASTM A182 F321	26.7
		FLANGE,65NB	31500001240						
	101.9	(FOR 72 SOVR)		08		1	No.	ASTM A182 F321	2.67
102		PIPE ASSEMBLY FROM 80(SOUA) TO U-LOOP SOST							
	102.1	PIPE SS	D73x3.05			30	Mtr.	ASTM A312 TP321	157.8
	102.2	ELBOW LR 90°	D73X3.05			10	No.	ASTM A403 WP321,ASME B16.9	14
	102.3	FLANGE, 65NB	31500001240	08		12	No.	ASTM A182 F321	32.04
103		PIPE ASSEMBLY FROM 283 (SOUA) TO 467 (SOST)							
	103.1	PIPE SS	D73x3.05			30	Mtr.	ASTM A312 TP321	157.8
	103.2	ELBOW LR 90°	D73X3.05			10	No.	ASTM A403 WP321,ASME B16.9	14
	103.3	FLANGE, 65NB	31500001240	08		12	No.	ASTM A182 F321	32.04
		FLANGE,65NB	31500001240						
	103.8	(FOR 467 SOST)		08		1	No.	ASTM A182 F321	2.67
104		PIPE ASSEMBLY FROM 419(SOUA) TO TERM 294(SOST)							
	104.1	PIPE SS	D114.3X3.05			45	Mtr.	ASTM A312 TP321	376.65
	104.2	ELBOW LR 90°	D114.3X3.05			12	No.	ASTM A403 WP321,ASME B16.9	7.8
	104.3	FLANGE, 100NB	31500001240	10		10	No.	ASTM A182 F321	36.2
		FLANGE, 100NB							
	104.8	(VALVE MKW01/AA285)	31500001240	10		2	No.	ASTM A182 F321	7.24
105		PIPE ASSEMBLY FROM 70A(SOVR) TO TERM 6A/6C(GEN)							
	105.1	PIPE SS	D33.4X2.77			20	Mtr.	ASTM A312 TP321	41.8
	105.2	REDUCER CONC	48.3x33.4x2.77			2	No.	ASTM A403 WP321,ASME B16.9	0.46
	105.3	TEE	33.4X33.4X2.77			1	No.	ASTM A403 WP321,ASME B16.9	0.2
		FLANGE,25NB							
	105.4	(FOR 70A SOVR)	31500001240	04		1	No.	ASTM A182 F321	1.02
	105.9	FLANGE, 25NB	31500001240	04		10	No.	ASTM A182 F321	10.2
		FLANGE,40NB							
	105.14	(FOR GEN END 6A)	31500001240	06		1	No.	ASTM A182 F321	1.17
106		BRANCH PIPE ASSEMBLY TO TERM 6C(GEN) (BRANCH OF PIPE AT SI NO. 105)							
	106.1	PIPE SS	D33.4X2.77			10	Mtr.	ASTM A312 TP321	20.9
	106.2	REDUCER CONC	48.3x33.4x2.77			1	No.	ASTM A403 WP321,ASME B16.9	0.35
		FLANGE,40NB							
	106.3	(FOR GEN END 6C)	31500001240	06		1	No.	ASTM A182 F321	1.17
107		PIPE ASSEMBLY FROM 69A(SOVR) TO TERM 5A/5C(GEN)							
	107.1	PIPE SS	D60.3X3.91			20	Mtr.	ASTM A312 TP321	108.8
	107.2	ELBOW LR 90°	D60.3X3.91			10	No.	ASTM A403 WP321,ASME B16.9	30.00
	107.3	REDUCER CONC	60.3X48.3X2.77			1	No.	ASTM A403 WP321,ASME B16.9	1.5
	107.4	TEE	60.3X60.3X2.77			1	No.	ASTM A403 WP321,ASME B16.9	1.49
		FLANGE,50NB	31500001240						
	107.5	(FOR 69A SOVR)		07		1	No.	ASTM A182 F321	2.1
	107.10	FLANGE, 50NB	31500001240	07		10	No.	ASTM A182 F321	21
		FLANGE,40NB							
	107.15	(FOR GEN END 5A)	31500001240	06		1	No.	ASTM A182 F321	1.17
108		BRANCH PIPE ASSEMBLY FROM 5C(GEN) (BRANCH OF PIPE AT SI NO. 107)							
	108.1	PIPE SS	D60.3X3.91			14	Mtr.	ASTM A312 TP321	76.16
	108.2	ELBOW LR 90°	D60.3X3.91			2	No.	ASTM A403 WP321,ASME B16.9	6.00
	108.3	REDUCER CONC	60.3X48.3x2.77			1	No.	ASTM A403 WP321,ASME B16.9	0.5
		FLANGE,40NB							
	108.4	(FOR GEN END 5C)	31500001240	06		1	No.	ASTM A182 F321	1.17
109		PIPE ASSEMBLY FROM TERM.68A (SOVR) TO 4A/4C							
	109.1	PIPE SS	D60.3X3.91			20	Mtr.	ASTM A312 TP321	108.8
	109.2	ELBOW LR 90°	D60.3X3.91			10	No.	ASTM A403 WP321,ASME B16.9	30.00
	109.3	REDUCER CONC	60.3X48.3X2.77			1	No.	ASTM A403 WP321,ASME B16.9	0.5
	109.4	TEE	60.3X60.3X2.77			1	No.	ASTM A403 WP321,ASME B16.9	1.49
		FLANGE,50NB	31500001240						
	109.5	(FOR 68A SOVR)		07		1	No.	ASTM A182 F321	2.1

Kunal Mishra
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By: My-1 BHEL-HR (ENG)

Prepared by KUNAL MISHRA
Checked by MANJU AZAD
Approved by R.L.VYAS



Generator Piping 800 MW for Double Flow Seal Oil system(MATERIAL - STAINLESS STEEL)

TGE-3630
REV02
DATE-31.03.2019

PIPING FOR SEAL OIL SYSTEM								
ITEM NO.	PART NO.	DESCRIPTION OF SUB-ASSEMBLY	DRG. NO. / SIZE	VAR.	QTY.	UNIT	MAT. SPEC./ DIMENSION STD.	WT.(KG)
	109.10	FLANGE, 50NB	31500001240	07	10	No.	ASTM A182 F321	21
	109.15	FLANGE, 40NB (FOR GEN END 4A)	31500001240	06	1	No.	ASTM A182 F321	1.17
110		BRANCH PIPE ASSEMBLY TO TERM.68A(SOVR) (BRANCH OF PIPE AT SI NO. 109)						
	110.1	PIPE SS	D60.3X3.91		14	Mtr.	ASTM A312 TP321	76.16
	110.2	ELBOW LR 90°	D60.3X3.91		2	No.	ASTM A403 WP321, ASME B16.9	6.00
	110.3	REDUCER CONC	60.3X48.3x2.77		1	No.	ASTM A403 WP321, ASME B16.9	0.5
	110.4	FLANGE, 40NB (FOR GEN END 4C)	31500001240	06	1	No.	ASTM A182 F321	1.17
111		PIPE ASSEMBLY FROM TERM.69B (SOVR) TO 5D/5B						
	111.1	PIPE SS	D60.3X3.91		21	Mtr.	ASTM A312 TP321	114.24
	111.2	ELBOW LR 90°	D60.3X3.91		10	No.	ASTM A403 WP321, ASME B16.9	30.00
	111.3	REDUCER CONC	60.3X48.3X2.77		1	No.	ASTM A403 WP321, ASME B16.9	0.5
	111.4	TEE	60.3X60.3X2.77		1	No.	ASTM A403 WP321, ASME B16.9	1.49
	111.5	FLANGE, 50NB (FOR 69B SOVR)	31500001240	07	1	No.	ASTM A182 F321	2.1
	111.10	FLANGE, 50NB	31500001240	07	10	No.	ASTM A182 F321	21
	111.15	FLANGE, 40NB (FOR GEN END 5B)	31500001240	06	1	No.	ASTM A182 F321	1.17
112		BRANCH PIPE ASSEMBLY TO TERM.69B(SOVR) (BRANCH OF PIPE AT SI NO. 111)						
	112.1	PIPE SS	D60.3X3.91		6	Mtr.	ASTM A312 TP321	32.64
	112.2	ELBOW LR 90°	D60.3X3.91		2	No.	ASTM A403 WP321, ASME B16.9	6.00
	112.3	REDUCER CONC	60.3X48.3x2.77		1	No.	ASTM A403 WP321, ASME B16.9	0.5
	112.4	FLANGE, 40NB (FOR GEN END 5D)	31500001240	06	1	No.	ASTM A182 F321	1.17
113		PIPE ASSEMBLY FROM TERM. 68B (SOVR) TO 4B/4D						
	113.1	PIPE SS	D60.3X3.91		21	Mtr.	ASTM A312 TP321	114.24
	113.2	ELBOW LR 90°	D60.3X3.91		10	No.	ASTM A403 WP321, ASME B16.9	30.00
	113.3	REDUCER CONC	60.3X48.3X2.77		1	No.	ASTM A403 WP321, ASME B16.9	0.5
	113.4	TEE	60.3X60.3X2.77		1	No.	ASTM A403 WP321, ASME B16.9	1.49
	113.5	FLANGE, 50NB (FOR 68B SOVR)	31500001240	07	1	No.	ASTM A182 F321	2.1
	113.10	FLANGE, 50NB	31500001240	07	10	No.	ASTM A182 F321	21
	113.15	FLANGE, 40NB (FOR GEN END 4B)	31500001240	06	1	No.	ASTM A182 F321	1.17
114		BRANCH PIPE ASSEMBLY TO TERM.68B(SOVR) (BRANCH OF PIPE AT SI NO. 113)						
	114.1	PIPE SS	D60.3X3.91		6	Mtr.	ASTM A312 TP321	32.64
	114.2	ELBOW LR 90°	D60.3X3.91		2	No.	ASTM A403 WP321, ASME B16.9	6.00
	114.3	REDUCER CONC	60.3X48.3x2.77		1	No.	ASTM A403 WP321, ASME B16.9	0.5
	114.4	FLANGE, 40NB (FOR GEN END 4D)	31500001240	06	1	No.	ASTM A182 F321	1.17
115		PIPE ASSEMBLY FROM TERM 69D(SOVR) TO 12B(GEN)						
	115.1	PIPE SS	D21.3X2.77		21	Mtr.	ASTM A312 TP321	26.67
116		PIPE ASSEMBLY FROM TERM 68D(SOVR) TO 14B(GEN)						
	116.1	PIPE SS	D21.3X2.77		25	Mtr.	ASTM A312 TP321	31.75
117		PIPE ASSEMBLY FROM TERM 69C(SOVR) TO 12A(GEN)						
	117.1	PIPE SS	D21.3X2.77		30	Mtr.	ASTM A312 TP321	38.1
118		PIPE ASSEMBLY FROM TERM 68C(SOVR) TO 14A(GEN)						
	118.1	PIPE SS	D21.3X2.77		30	Mtr.	ASTM A312 TP321	38.1
119		PIPE ASSEMBLY FROM TERM 438(SOVR) TO 439(SOVR)						
	119.1	PIPE SS	D33.4X2.77		30	Mtr.	ASTM A312 TP321	62.7
	119.2	FLANGE, 25NB (FOR 439 SOVR)	31500001240	04	1	No.	ASTM A182 F321	1.02
	119.7	FLANGE, 25NB	31500001240	04	10	No.	ASTM A182 F321	10.2
120		PIPE ASSEMBLY FROM TERM 78 (SOVR) TO 7A/7B (GEN)						
	120.1	PIPE SS	D114.3X3.05		50	Mtr.	ASTM A312 TP321	418.5
	120.2	ELBOW LR 90°	D114.3X3.05		12	No.	ASTM A403 WP321, ASME B16.9	7.8
	120.3	TEE	114.3X114.3X3.05		1	No.	ASTM A403 WP321, ASME B16.9	2.5
	*120.4	FLANGE, 100NB	31500001027	02	8	No.	ASTM A182 F321	36.64
	*120.5	FLANGE, 100NB	31500001000	06	8	No.	ASTM A182 F321	47.04

Prepared by KUNAL MISHRA
Checked by MANJU AZAD
Approved by R.L.VYAS



Generator Piping 800 MW for Double Flow Seal Oil system(MATERIAL - STAINLESS STEEL)

TGE-3630
REV02
DATE-31.03.2019

PIPING FOR SEAL OIL SYSTEM								
ITEM NO.	PART NO.	DESCRIPTION OF SUB-ASSEMBLY	DRG. NO. / SIZE	VAR.	QTY.	UNIT	MAT. SPEC./ DIMENSION STD.	WT.(KG)
	120.10	FLANGE, 100NB (TERM 7B GEN)	31500001240	10	1	No.	ASTM A182 F321	3.62
* REMARKS FOR PROJECT SITE - ITEM NO. 120.4 & 120.5 SHALL BE USED IN COMBINATION i.e. ONE FLAT FLANGE ALONG WITH GROOVED FLANGE WITH O-RING COVERED IN BOM TGE-3629 (ITEM NO. 120.6).								
121	BRANCH PIPE ASSEMBLY TO TERM.78(SOUH) (BRANCH OF PIPE AT SI NO. 120)							
	121.1	PIPE SS	D114.3X3.05		13	Mtr.	ASTM A312 TP321	108.81
	121.2	ELBOW LR 90°	D114.3X3.05		8	No.	ASTM A403 WP321, ASME B16.9	5.2
	*121.3	FLANGE, 100NB	31500001027	02	2	No.	IS-2062 GR.B	9.16
	*121.4	FLANGE, 100NB	31500001000	06	2	No.	ASTM A182 F321	11.76
		FLANGE, 100NB						
	121.9	(TERM 7A GEN)	31500001240	10	1	No.	ASTM A182 F321	3.62
* REMARKS FOR PROJECT SITE - ITEM NO. 121.3 & 121.4 SHALL BE USED IN COMBINATION i.e. ONE FLAT FLANGE ALONG WITH GROOVED FLANGE WITH O-RING COVERED IN BOM TGE-3629 (ITEM NO. 121.5).								
122	PIPE ASSEMBLY FROM U LOOP TO TERM 450 (DPR LINE SOVR)							
	122.1	PIPE SS	D21.3X2.77		25	Mtr.	ASTM A312 TP321	31.75
123	PIPE ASSEMBLY FROM TERM 79 (SOUH) TO 295 (SOST)							
	123.1	PIPE SS	D114.3X3.05		30	Mtr.	ASTM A312 TP321	251.1
	123.2	REDUCER CONC	114.3X60.3X3.05X2.77		1	No.	ASTM A403 WP321, ASME B16.9	1
	123.3	REDUCER CONC	60.3X33.4X2.77		1	No.	ASTM A403 WP321, ASME B16.9	0.23
		FLANGE, 100NB						
	123.4	(FOR 295 SOST)	31500001240	10	1	No.	ASTM A182 F321	3.62
	123.9	FLANGE, 100NB	31500001240	10	10	No.	ASTM A182 F321	36.2
124	PIPE ASSEMBLY FROM TERM 75(SOUH) TO 71(SOVR)							
	124.1	PIPE SS	D60.3X3.91		30	Mtr.	ASTM A312 TP321	163.2
	124.2	ELBOW LR 90°	D60.3X3.91		10	No.	ASTM A403 WP321, ASME B16.9	30.00
		FLANGE, 50NB	31500001240					
	124.3	(FOR 71 SOVR)		07	1	No.	ASTM A182 F321	2.1
	124.8	FLANGE, 50NB	31500001240	07	12	No.	ASTM A182 F321	25.2
125	PIPE ASSEMBLY FROM TERM 921(PEM) TO SEAL OIL CLR AIR SIDE SEAL OIL UNIT							
	125.1	PIPE SS	D114.3X3.05		5	Mtr.	ASTM A312 TP321	41.85
	125.2	ELBOW LR 90°	D114.3X3.05		3	No.	ASTM A403 WP321, ASME B16.9	1.95
	125.3	TEE	114.3X114.3X3.05		1	No.	ASTM A403 WP321, ASME B16.9	2.5
		FLANGE, 100NB						
	125.4	(CLR. END TERM)	31500001240	10	2	No.	ASTM A182 F321	7.24
		FLANGE, 100NB						
	125.9	(PEM TERM)	31500001240	10	2	No.	ASTM A182 F321	7.24
	125.14	FLANGE, 100NB (FOR VLV)	31500001240	10	4	No.	ASTM A182 F321	14.48
126	PIPE ASSEMBLY FROM TERM SEAL OIL CLR AIR SIDE SEAL OIL UNIT TO 922(PEM)							
	126.1	PIPE SS	D114.3X3.05		5	Mtr.	ASTM A312 TP321	41.85
	126.2	ELBOW LR 90°	D114.3X3.05		3	No.	ASTM A403 WP321, ASME B16.9	1.95
	126.3	TEE	114.3X114.3X3.05		1	No.	ASTM A403 WP321, ASME B16.9	2.5
		FLANGE, 100NB						
	126.4	(CLR. END TERM)	31500001240	10	2	No.	ASTM A182 F321	7.24
		FLANGE, 100NB						
	126.9	(PEM TERM)	31500001240	10	2	No.	ASTM A182 F321	7.24
	126.14	FLANGE, 100NB (FOR VLV)	31500001240	10	4	No.	ASTM A182 F321	14.48
127	PIPE ASSEMBLY FROM TERM 931(PEM) TO SEAL OIL CLR H2 SIDE SEAL OIL UNIT							
	127.1	PIPE SS	D60.3X3.91		5	Mtr.	ASTM A312 TP321	27.2
	127.2	ELBOW LR 90°	D60.3X3.91		3	No.	ASTM A403 WP321, ASME B16.9	9.00
	127.3	TEE	60.3X60.3X2.77		1	No.	ASTM A403 WP321, ASME B16.9	1.49
		FLANGE, 50NB	31500001240					
	127.4	(PEM TERM)		07	2	No.	ASTM A182 F321	4.2
	127.9	FLANGE, 50NB (FOR VLV)	31500001240	07	4	No.	ASTM A182 F321	8.4
		FLANGE, 50NB	31500001240					
	127.14	(CLR. END TERM)		07	2	No.	ASTM A182 F321	4.2
128	PIPE ASSEMBLY FROM TERM SEAL OIL CLR H2 SIDE SEAL OIL UNIT TO TERM 932(PEM)							
	128.1	PIPE SS	D60.3X3.91		5	Mtr.	ASTM A312 TP321	27.2
	128.2	ELBOW LR 90°	D60.3X3.91		3	No.	ASTM A403 WP321, ASME B16.9	9.00
	128.3	TEE	60.3X60.3X2.77		1	No.	ASTM A403 WP321, ASME B16.9	1.49

Prepared by KUNAL MISHRA
Checked by MANJU AZAD
Approved by R.L.VYAS

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Generator Piping 800 MW for Double Flow Seal Oil system(MATERIAL - STAINLESS STEEL)

TGE-3630
REV02
DATE-31.03.2019

PIPING FOR SEAL OIL SYSTEM								
ITEM NO.	PART NO.	DESCRIPTION OF SUB-ASSEMBLY	DRG. NO. / SIZE	VAR.	QTY.	UNIT	MAT. SPEC./ DIMENSION STD.	WT.(KG)
	128.4	FLANGE, 50NB (PEM TERM)	31500001240	07	2	No.	ASTM A182 F321	4.2
	128.9	FLANGE, 50NB (FOR VLV)	31500001240	07	4	No.	ASTM A182 F321	8.4
	128.14	FLANGE, 50NB (CLR. END TERM)	31500001240	07	2	No.	ASTM A182 F321	4.2
129		PIPE ASSEMBLY FROM 70B(SOVR) TO TERM 6B/6D(GEN)						
	129.1	PIPE SS	D33.4X2.77		20	Mtr.	ASTM A312 TP321	41.8
	129.2	REDUCER CONC	48.3x33.4x2.77		1	No.	ASTM A403 WP321, ASME B16.9	0.35
	129.3	TEE	33.4X33.4X2.77		1	No.	ASTM A403 WP321, ASME B16.9	0.2
	129.4	FLANGE, 25NB (FOR 70B SOVR)	31500001240	04	1	No.	ASTM A182 F321	1.02
	129.9	FLANGE, 25NB	31500001240	04	10	No.	ASTM A182 F321	10.2
	129.14	FLANGE, 40NB (FOR GEN END 6B)	31500001240	06	1	No.	ASTM A182 F321	1.17
130		BRANCH PIPE ASSEMBLY TO TERM 6D(GEN) (BRANCH OF PIPE AT SI NO. 130)						
	130.1	PIPE SS	D33.4X2.77		10	Mtr.	ASTM A312 TP321	20.9
	130.2	REDUCER CONC	48.3x33.4x2.77		1	No.	ASTM A403 WP321, ASME B16.9	0.35
	130.3	FLANGE, 40NB (FOR GEN END 6D)	31500001240	06	1	No.	ASTM A182 F321	1.17
TOTAL WT.								3780.03

TOTAL WEIGHT OF PIPING FOR SEAL OIL SYSTEM = 3780 KG

Manish Mishra

Prepared by KUNAL MISHRA
Checked by MANJU AZAD
Approved by R.L.VYAS

C/757

Generator Piping 800 MW for Double Flow Seal Oil system(MATERIAL -STAINLESS STEEL)

TGE-3630
REV02
DATE-31.03.2019

PIPING FOR PRIMARY WATER SYSTEM								
ITEM NO.	PART NO.	DESCRIPTION OF SUB-ASSEMBLY	DRG. NO. / SIZE	VAR.	QTY.	UNIT	MAT. SPEC./ DIMENSION STD.	WT.(KG)
301		PIPE ASSEMBLY FROM TERM.195(PW UNIT) TO TERM. 196 (GEN.)						
	301.1	PIPE SS	D168.3X3.40		41	Mtr.	ASTM A312 TP321	567.03
	301.2	ELBOW LR 90°	D168.3X3.40		6	No.	ASTM A403 WP321,ASME B16.9	23.10
		NECK						
	301.4	(TERM.195 PW UNIT)	31531401088	01	1	No.	ASTM A182 F321	5.20
		FLANGE, 150NB						
	301.9	(TERM.196 PW PIPELINE)	31500001240	12	1	No.	ASTM A182 F321	6.00
	301.14	FLANGE, 150NB	31500001240	12	10	No.	ASTM A182 F321	60.00
302		BRANCH PIPE ASSEMBLY FROM TERM.205 (PW TANK PIPE LINE) TO 206 (PW UNIT)						
	302.1	PIPE SS	D168.3X3.40		60	Mtr.	ASTM A312 TP321	829.80
	302.2	ELBOW LR 90°	D168.3X3.40		10	No.	ASTM A403 WP321,ASME B16.9	38.50
		NECK, 150NB						
	302.4	(TERM.206 PW UNIT)	31531401088	01	1	No.	ASTM A182 F321	5.20
		FLANGE, 150NB						
	302.9	(TERM.205 PW PIPELINE)	31500001240	12	1	No.	ASTM A182 F321	6.00
	302.14	FLANGE, 150NB	31500001240	12	10	No.	ASTM A182 F321	60.00
303		PIPE ASSEMBLY FROM TERM.732 (GEN PPG) TO 731 (PW UNIT)						
	303.1	PIPE SS	D21.3X2.77		100	Mtr.	ASTM A312 TP321	127.00
304		PIPE ASSEMBLY FROM TERM.581A,582A TO 582B,582B						
	304.1	PIPE SS	D21.3X2.77		50	Mtr.	ASTM A312 TP321	63.50
305		PIPE ASSEMBLY FROM TERM.579 (PW UNIT) TO 140 (PW TANK)						
	305.1	PIPE SS	D33.4X2.77		50	Mtr.	ASTM A312 TP321	104.50
		FLANGE, 25NB						
	305.2	(TERM.597 PW UNIT)	31500001240	04	1	No.	ASTM A182 F321	1.02
	305.7	FLANGE, 25NB	31500001240	04	8	No.	ASTM A182 F321	8.16
		FLANGE, 25NB						
	305.12	(TERM.140 PW TANK)	31500001240	04	1	No.	ASTM A182 F321	1.02
306		PIPE ASSEMBLY FROM TERM.149(PW TANK) TO 567 (PW UNIT)						
	306.1	PIPE SS	D33.4X2.77		50	Mtr.	ASTM A312 TP321	104.50
		FLANGE, 25NB						
	306.2	(TERM.576 PW UNIT)	31500001240	04	1	No.	ASTM A182 F321	1.02
	306.7	FLANGE, 25NB	31500001240	04	8	No.	ASTM A182 F321	8.16
		FLANGE, 25NB						
	306.12	(TERM.149 PW TANK)	31500001240	04	1	No.	ASTM A182 F321	1.02
307		PIPE ASSEMBLY FROM TERM.585(PW TANK) TO WASTE GAS						
	307.1	PIPE SS	D33.4X2.77		50	Mtr.	ASTM A312 TP321	104.50
		FLANGE, 25NB						
	307.2	(TERM.585PW UNIT)	31500001240	04	1	No.	ASTM A182 F321	1.02
	307.7	FLANGE, 25NB	31500001240	04	8	No.	ASTM A182 F321	8.16
308		PIPE ASSEMBLY FROM PW COOLER INLET TO TERM 208/209						
	308.5	THERMOWELL FOR TG	41531401027	00	6	No.	ASTM A182 F321	2.4
309		PIPE ASSEMBLY FROM ION EXCHANGER TO PW UNIT INLET						
	309.1	PIPE SS	D33.4X2.77		10	Mtr.	ASTM A312 TP321	20.90
		FLANGE, 25NB						
	309.2	(VALVE FLANGE)	31500001240	04	6	No.	ASTM A182 F321	6.12
TOTAL WT. SS (KG)								2164

TOTAL WEIGHT OF PIPING FOR PW SYSTEM (STAINLES STEEL) = 2164 KG
COMBINED WEIGHT OF THE SYSTEM (SOS+PWS) = 5944 KG
TOTAL WEIGHT OF STAINLES STEEL MATERIAL = 5944 KG

Kunal Mishra
KUNAL MISHRA
Dy. Mg. BHUL-HWR(ENR)

Prepared by PRATIBHA GUPTA
Checked by R.L.VYAS
Approved by RAKESH KUMAR

C/756

Piping for Hydrogen Cooler-800MW (Carbon Steel)

TGE-3043
REV05
DATE-31.03.2019

H2 COOLER PIPING								
ITEM NO.	PART NO.	DESCRIPTION OF SUB-ASSEMBLY	DRAWING NO. / SIZE	VAR.	QTY.	UNIT	MAT. SPEC.	WT.(KG)
1	1.1	INLET HEADER	21500001127	00	1	No.	ASTM SA106 GR.B	536
2	2.1	OUTLET HEADER	21500001129	00	1	No.	ASTM SA106 GR.B	536
3	3.1	PIPE	D168.3X3.4		200	Mtr.	ASTM SA106 GR.B	2766
	3.2	PIPE	D33.4X2.90		85	Mtr.	ASTM SA106 GR.B	185.3
	3.3	PIPE	D21.3X2.77		100	Mtr.	ASTM SA106 GR.B	127
	3.4	PIPE	D17.1X2.31		50	Mtr.	ASTM SA106 GR.B	42
	3.5	PIPE	D13.7X1.85		20	Mtr.	ASTM SA106 GR.B	10.8
	3.6	ELBOW LR 45°	D168.3X3.4		16	No.	ASTM A234 WPB B16.9	57.6
	3.7	ELBOW LR 90°	D168.3X3.4		80	No.	ASTM A234 WPB B16.9	576
	3.8	CONNECTION	41500001118	00	16	No.	IS:2062 E250 BR	8
	3.9	THERMOWELL	41531401027	00	16	No.	ASTM A182 F321	6.4
	3.10	CONNECTION, 15NB FOR PG/PT	31500001190	02	8	No.	IS:2062 E250 BR	0.8
	3.11	CONNECTION 10 NB	41500001182	00	6	No.	IS:2062 E250 BR	3
	3.12	CONNECTION 8 NB	31500001190	06	8	No.	IS:2062 E250 BR	0.92
	3.13	FLANGE NB150	31500001239	12	80	No.	IS:2062 E250 BR	480
	3.14	GASKET VITON	212X169X3TK		40	No.	HW59870	2.4
	3.15	SCREW HEX A-8.8	M20X80		320	No.	IS:1364PART-2,1367PART-3	82.56
	3.16	NUT HEX A-8.8	M20		320	No.	IS:1364PART-3,1367PART-3	16
	3.17	WASHER MCD-ST 21			640	No.	IS:2016-1967, IS:2062 E250 BR	10.88
	3.18	FLANGE NB150 (C.F. OF VALVES)	31500001239	12	16	No.	IS:2062 E250 BR	96
	3.19	GASKET VITON	212X170X3TK		16	No.	HW59870	0.96
	3.20	SCREW HEX A-8.8	M20X80		128	No.	IS:1364PART-2,1367PART-3	33.024
	3.21	NUT HEX A-8.8	M20		128	No.	IS:1364PART-3,1367PART-3	6.4
	3.22	WASHER MCD-ST 21			256	No.	IS:2016-1967, IS:2062 E250 BR	4.352
4	4.1	SUPPORT	21500001041		1	SET	IS:2062 E250 BR	322
	4.2	SUPPORT U3,U4	21500001042		1	No.	IS:2062 E250 BR	330
	4.3	HANGER ASSEMBLY F1,F2,F3,F4	11500001019		1	SET		192
	4.3.1	PARALLEL BEAM IPB 100	L=3000		1	No.	IS:2062 E250 BR	
	4.3.2	CHANNEL ISMC 150X75	L=1200		2	No.	IS:2062 E250 BR	
	4.3.3	PIPE CLAMP	21500001026	10	8	No.	IS:2062 E250 BR	
	4.3.4	BEAM ATTACHEMENT M20	41500001101	04	8	No.	IS:2062 E250 BR	
	4.3.5	EYE BOLT M20	41500001099	04	8	No.	IS:2062 E250 BR	
	4.3.6	THREADED ROD M20X1.5	41500001131	02	8	No.	IS:2062 E250 BR	
	4.3.7	TURN BUCKLE M20	41500001103	04	8	No.	IS:2062 E250 BR	
	4.3.8	TIE ROD M20X2000	41500001176	00	2	No.	IS:2062 E250 BR	
	4.3.9	SPRING HANGER	41500001198	00	2	No.	IS:2062 E250 BR	
	4.3.10	SPRING HANGER	41500001199	00	2	No.	IS:2062 E250 BR	
	4.4	HANGER ASSEMBLY F5	21500001043		1	SET		65
	4.4.1	PARALLEL BEAM IPB 100	L=1800		2	No.	IS:2062 E250 BR	
	4.4.2	BEAM ATTACHEMENT M20	41500001101	04	1	No.	IS:2062 E250 BR	
	4.4.3	EYE BOLT M20	41500001099	04	2	No.	IS:2062 E250 BR	
	4.4.4	PIPE CLAMP	21500001026	10	1	No.	IS:2062 E250 BR	
	4.4.5	THREADED ROD M20X1.5	41500001131	02	1	No.	IS:2062 E250 BR	
	4.4.6	TIE ROD M20X2000	41500001176	00	1	No.	IS:2062 E250 BR	
	4.4.7	SPRING HANGER	41500001199	00	1	No.	IS:2062 E250 BR	
	4.4.8	TURN BUCKLE M20	41500001103	04	2	No.	IS:2062 E250 BR	
	4.5	HANGER ASSEMBLY F6	21500001044		1	SET		63
	4.5.1	PARALLEL BEAM IPB 100	L=1800		1	No.	IS:2062 E250 BR	
	4.5.2	PLATE	41500001177	00	1	No.	IS:2062 E250 BR	
	4.5.3	BEAM ATTACHEMENT M20	41500001101	04	2	No.	IS:2062 E250 BR	
	4.5.4	EYE BOLT M20	41500001099	04	1	No.	IS:2062 E250 BR	
	4.5.5	THREADED ROD M20X1.5	41500001131	02	1	No.	IS:2062 E250 BR	
	4.5.6	TIE ROD M20X2000	41500001176	00	1	No.	IS:2062 E250 BR	
	4.5.7	SPRING HANGER	41500001199	00	1	No.	IS:2062 E250 BR	

Kunal Mishra
KUNAL MISHRA
By Mr. BHUL-HWZ (CHE)

Prepared by KUNAL
Checked by MANJU
Approved by R.L. VYAS

Piping for Hydrogen Cooler-800MW (Carbon Steel)

TGE-3043
REV05
DATE-31.03.2019

4.6	HANGER ASSEMBLY F7	21500001045		1	SET		60
4.6.1	PARALLEL BEAM IPB 100	L=1800		1	No.	IS:2062 E250 BR	
4.6.2	BEAM ATTACHEMENT M20	41500001101	04	1	No.	IS:2062 E250 BR	
4.6.3	EYE BOLT M20	41500001099	04	2	No.	IS:2062 E250 BR	
4.6.4	PIPE CLAMP	21500001026	10	1	No.	IS:2062 E250 BR	
4.6.5	THREADED ROD M20X2000	41500001178	00	1	No.	IS:2062 E250 BR	
4.6.6	SPRING HANGER	41500001199	00	1	No.	IS:2062 E250 BR	
4.7	HANGER ASSEMBLY F8	21500001046		1	SET		60
4.7.1	PARALLEL BEAM IPB 100	L=1800		1	No.	IS:2062 E250 BR	
4.7.2	PLATE	41500001177	00	1	No.	IS:2062 E250 BR	
4.7.3	BEAM ATTACHEMENT M20	41500001101	04	2	No.	IS:2062 E250 BR	
4.7.4	EYE BOLT M20	41500001099	04	1	No.	IS:2062 E250 BR	
4.7.5	THREADED ROD M20X2000	41500001178	00	1	No.	IS:2062 E250 BR	
4.7.6	SPRING HANGER	41500001199	00	1	No.	IS:2062 E250 BR	
4.8	PIPE CLAMP NB150	21500001026	10	30	No.	IS:2062 E250 BR	72
4.9	FLAT	5X40		6	Mtr.	IS:2062 E250 BR	9.42
4.10	ANGLE	75X75X6		10	Mtr.	IS:2062 E250 BR	68
4.11	CHANNEL ISMC 75			6	Mtr.	IS:2062 E250 BR	42.84
TOTAL WT. (KG)							6873

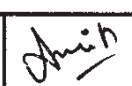
TOTAL WEIGHT OF PIPING FOR H2 COOLER SYSTEM =

6873

KG

Kunal Mishra
KUNAL MISHRA
Dy. Mg. BH-EL-HWR (EME)

दिनांक एवं हस्ताक्षर SIGN & DATE		संस्थान क्रय विनिर्देश (हीप - हार्डवेयर) PLANT PURCHASE SPECIFICATION (HEEP - HARDWAR)		HW-59870 पृष्ठ 11 का 1 Page 1 of 11																																			
		<u>FLOUROCARBON /VITON RUBBER SHEETS, GASKETS</u> <u>CORDS, PROFILES, MOULDINGS ETC</u>		Supersedes old standard no. TG-60101, TG-60108, TG60154, TG60158, TG-60413 partially, TG-60414, TG-60415																																			
सामग्री सूची संख्या को अधिकृतित करता है SUPERSEDES INVENTORY NO	1. GENERAL : This specification governs the quality of fluorocarbon/viton rubber sheets, gaskets, cords, profiles & mouldings of different grades..																																						
COPYRIGHT AND CONFIDENTIAL The information on this documents is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company	2. APPLICATION : Used as gaskets, mouldings & seals in DC & AC machines, water turbines, shunt reactors and generators.																																						
	3. COMPLIANCE WITH NATIONAL STANDARD : There is no Indian standard covering this specification.																																						
	4. DIMENSIONS AND TOLERANCES																																						
स्वत्वाधिकार एवं गोपनीय इस प्रलेख में दी गई सूचना भारत हेवी इलेक्ट्रिकल्स की सम्पत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी भी तरह प्रयोग, जो कि कंपनी के हित में हानिकारक हो न किया जाए	4.1 SIZES - Length x Width x Thickness of sheet shall be stated on the order. - Gaskets, mouldings, cords, profiles shall be supplied as per our drawings. - Preferred thickness of sheets & gaskets shall be 2,3,4,5,6,8,10,12 & 16 mm.																																						
	4.2 TOLERANCES Variation in individual piece not to increase more than 50% of given tolerance. Unless otherwise stated on the order/drawing tolerance on length, width and thickness shall be as follows:-																																						
हस्ताक्षर एवं दिनांक SIGN & DATE 11/11/10	<table border="1"> <tr> <td></td> <td></td> <td></td> <td></td> <td>नाम NAME</td> <td>दिनांक एवं हस्ताक्षर SIGNATURE & DATE</td> </tr> <tr> <td></td> <td></td> <td></td> <td>अनुवादक TRANSLATED BY</td> <td></td> <td></td> </tr> <tr> <td>TSX</td> <td>V.K. Singh</td> <td></td> <td>निर्माणकर्ता WORKED BY</td> <td>Amit</td> <td>27/11/10</td> </tr> <tr> <td>QAX</td> <td>S.K. Chandra</td> <td></td> <td>जांचकर्ता CHECKED BY</td> <td>Rakesh Kumar</td> <td>27/11/10</td> </tr> <tr> <td>सहमत विभाग AGREED DEPT.</td> <td>नाम NAME</td> <td>दिनांक एवं हस्ताक्षर DATE & SIGNATURE</td> <td>पर्यवेक्षणकर्ता SUPERVISED BY</td> <td>R.C. Bajpai</td> <td>27.11.10</td> </tr> </table>									नाम NAME	दिनांक एवं हस्ताक्षर SIGNATURE & DATE				अनुवादक TRANSLATED BY			TSX	V.K. Singh		निर्माणकर्ता WORKED BY	Amit	27/11/10	QAX	S.K. Chandra		जांचकर्ता CHECKED BY	Rakesh Kumar	27/11/10	सहमत विभाग AGREED DEPT.	नाम NAME	दिनांक एवं हस्ताक्षर DATE & SIGNATURE	पर्यवेक्षणकर्ता SUPERVISED BY	R.C. Bajpai	27.11.10				
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सामग्री सूची संख्या INVENTORY NO P-3721	<table border="1"> <tr> <td colspan="3">(Supersedes)</td> <td>स्वीकृति APPROVED : AGM (EME)</td> <td>PS</td> </tr> <tr> <td colspan="3"></td> <td>संस्थान मानक समिति PLANT STANDARDS COMMITTEE</td> <td>2.76</td> </tr> <tr> <td>Rev. No.01</td> <td></td> <td></td> <td>निर्माण PREPARED : EME</td> <td>जारी : मानक विभाग ISSUED : STANDARDS DIVISION</td> <td>दिनांक : DATE : 10.11.80</td> </tr> <tr> <td>27/11/2010</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>					(Supersedes)			स्वीकृति APPROVED : AGM (EME)	PS				संस्थान मानक समिति PLANT STANDARDS COMMITTEE	2.76	Rev. No.01			निर्माण PREPARED : EME	जारी : मानक विभाग ISSUED : STANDARDS DIVISION	दिनांक : DATE : 10.11.80	27/11/2010																	
(Supersedes)			स्वीकृति APPROVED : AGM (EME)	PS																																			
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27/11/2010																																							

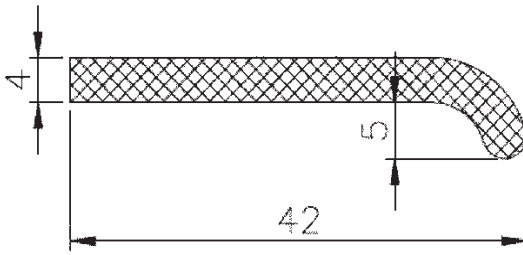
दिनांक एवं हस्ताक्षर SIGN & DATE		संस्थान क्रय विनिर्देश (हीप - हरिद्वार) PLANT PURCHASE SPECIFICATION (HEEP - HARDWAR)		HW-59870 पृष्ठ 11 का 2 Page 2 of 11	
SUPERSEDES INVENTORY NO सामग्री सूची संख्या को अतिरिक्तित करता है	4.2.1 On Length & width: $\pm 3 \%$ (Max.3mm) 4.2.2 On Thickness: +10% upto 4mm thickness +0.40 from 05 to 08 mm +0.60 from 09 to 12 mm. +0.80 from 13 to 16 mm. 4.2.3 On Cord dia: +0.20mm upto dia. 06 mm. +0.25mm from dia. 07 to 12mm. +0.30mm from dia. 13 to 20mm. +0.35mm from dia. 21 to 30mm. +0.40mm from dia. 31 to 40mm.				
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5. FINISH & FREEDOM FROM DEFECTS : Material shall have a smooth finish when seen with a magnifying glass (1X10). All ingredients of the mix shall be free from grit and extraneous matter. The selection and processing of the ingredients shall be such that the vulcanizate is free from surface imperfections, blisters, porosity, voids, inclusions, flow marks, inadequate joint of moulding blank, cracks, twists and other defects which could impair the satisfactory performance.					
6. CHEMICAL COMPOSITION : Sheets, gaskets, mouldings shall be made out of fluorocarbon rubber.					
7. IDENTIFICATION : The material when identified by infrared spectrometer or by infrared spectrometer or by other convenient method shall be of fluoro-elastomer rubber. It is inert to 80% H ₂ SO ₄ or concentrated HNO ₃ . Burns brightly in flame but extinguishes immediately on removal from flame.					
8. TEST SAMPLES : The test certificates in respect of tests at sl. No. 9 & 10 shall be supplied alongwith test samples. The samples shall have the same composition and shall be made by the same process as the original product. Supplier shall not change the composition/ process after type approval. In case of any change, the same shall be revalidated from BHEL.					
8.1 SAMPLE FOR ROUTINE TESTING Solid cylinder dia. $29 \pm 0.5 \times 12.5 \pm 0.5$ ----- 3 nos.					
दिनांक एवं हस्ताक्षर SIGN & DATE 27/11/10	REV.NO. 01	निर्माणकर्ता WORKED BY Amit	जांचकर्ता CHECKED BY Rakesh Kr.		27/11/10
सामग्री सूची संख्या INVENTORY NO P-3721					

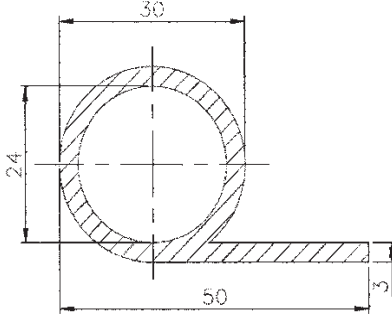
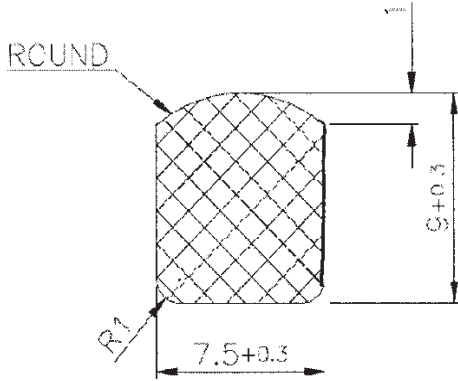
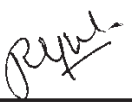
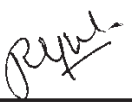
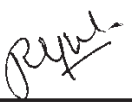
	संस्थान क्रय विनिर्देश (हीप - हार्डवार) PLANT PURCHASE SPECIFICATION (HEEP - HARDWAR)		HW-59870 पृष्ठ 11 का 3 Page 3 of 11													
दिनांक एवं हस्ताक्षर SIGN & DATE	SUPERSEDES INVENTORY NO.	Extra component in case 'O' ring Or if otherwise mentioned in P.O. ----- 1 No.														
सामग्री सूची संख्या को अधिकृतित करना है	The samples for routine testing shall be supplied alongwith the consignment. The compression test & any other test to the extent possible shall be carried out on the original supplies to ascertain the reliability of the supplies material. In case of gaskets & moulded articles the testing may be done on 5% pieces selected at random. In case of cords the required length for testing may be taken from each roll supplied.															
COPYRIGHT AND CONFIDENTIAL The information on this documents is the property of Bharat Heavy Electrical Limited It must not be used directly or indirectly in any way detrimental to the interest of the company		8.2 SAMPLES FOR TYPE TESTING : Sheet 150x150x3mm ----- 3 nos. Solid cylinder dia . 29±0.5 x 12.5±0.5 ----- 9 nos. A complete set of test samples for type testing shall be supplied for testing/evaluation at BHEL for vendor approval as well as once in a year for revalidation of vendor approval. A complete set of test of test samples for type test shall also be supplied alongwith consignment in case it is specially asked for in P.O./enquiry.														
स्वत्वाधिकार एवं गोपनीय इस प्रलेख में दी गई सूचना भारत हेतु इलेक्ट्रिकल्स की सम्पत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी भी तरह प्रयोग, जो कि कंपनी के हित में होनिवारक हो न किया जाए ।		9 ROUTINE TESTS : 9.1. DIMENSIONS AND TOLERANCES: To be checked as per clause no. 4.														
दिनांक SIGN & DATE		9.2 FINISH & FREEDOM FROM DEFECTS : To be checked as per clause no. 5.														
सामग्री सूची संख्या INVENTORY NO.		9.3 HARDNESS (B.S. 903: PART A 26: METHOD N) : Unless otherwise stated on drawing/purchase order, hardness shall be 80±5 IRHD.														
REV.NO. 01		9.4. COMPRESSION SET AT 200°C FOR 22 HRS. (IS:3400, PART X) : 14% max.														
सामग्री सूची संख्या INVENTORY NO.		9.5. IDENTIFICATION : As per clause no.7.														
P-3721		<table border="1"> <tr> <td>निर्माणकर्ता WORKED BY</td> <td>Amit</td> <td><i>Amit</i></td> <td>27/11/10</td> </tr> <tr> <td>जांचकर्ता CHECKED BY</td> <td>Rakesh Kr.</td> <td><i>Rakesh</i></td> <td>27/11/10</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> </tr> </table>			निर्माणकर्ता WORKED BY	Amit	<i>Amit</i>	27/11/10	जांचकर्ता CHECKED BY	Rakesh Kr.	<i>Rakesh</i>	27/11/10				
निर्माणकर्ता WORKED BY	Amit	<i>Amit</i>	27/11/10													
जांचकर्ता CHECKED BY	Rakesh Kr.	<i>Rakesh</i>	27/11/10													

दिनांक एवं हस्ताक्षर SIGN & DATE		संस्थान क्रय विनिर्देश (हीप - हार्डवार) PLANT PURCHASE SPECIFICATION (HEEP - HARDWAR)	HW-59870													
			पृष्ठ 11 का 4	Page 4 of 11												
सामग्री सूची संख्या को अधिकृतित करता है	SUPERSEDES INVENTORY NO.	10. TYPE TESTs : 10.1 TENSILE STRENGTH (IS:3400. PART I. DUMB BELL) : 10 N/mm ² Min. 10.2 ELONGATION AT BREAK (IS:3400. PART I. DUMB BELL) : 150%Min. 10.3 COMPRESSION SET AT 200° C FOR 22 HRS. (IS : 3400. PART X) : 14% Max. 10.4 COMPRESSION SET AT 200° C FOR 70 HRS. (IS : 3400. PART X) : 25% Max. 10.5 ADHESION TO & CORROSION OF METALS (BS: 2751. APPENDIX-A) : There shall be no corrosion or pitting of the metals and the material shall not adhere to the metal surface or show any sign of liquid exudation. 10.6 ACCELERATED AGING. (IS : 3400. PART IV) : 10.6.1 AGEING IN AIR : The specimen shall be aged in air for 168 hours at 200±5° C. Following shall be the changes over the values obtained at clause 09.3, 10.1, 10.2. <table border="0"> <tr> <td>Change in Hardness</td> <td>Not more than +5 IRHD</td> </tr> <tr> <td>Change in T.S.</td> <td>±2.5 N/mm²</td> </tr> <tr> <td>Elongation</td> <td>125 % Min.</td> </tr> </table> 10.6.2 AGEING IN OIL : The specimen shall be aged in insulating oil, confirming to IS : 335, for 168 hrs. at 100 °C. After oil is wiped by blotting paper, the specimen shall show the following properties. 10.6.2.1 OIL ABSORPTION : The original weight of the specimen shall not increase by more than 1.5%			Change in Hardness	Not more than +5 IRHD	Change in T.S.	±2.5 N/mm ²	Elongation	125 % Min.						
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स्वत्वाधिकार एवं गोपनीय इस प्रलेख में दी गई सूचना भारत हेवी इलेक्ट्रिकल्स की सम्पत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी भी तरह प्रयोग, जो कि कंपनी के हित में हानिकारक हो न किया जाए ।		कॉपीराइट एंड कॉन्फिडेंशियल The information on this documents is the property of Bharat Heavy Electrical Limited It must not be used directly or indirectly in any way detrimental to the interest of the company														
हस्ताक्षर एवं दिनांक SIGN & DATE	REV.NO. 01	<table border="1"> <tr> <td>निर्माणकर्ता WORKED BY</td> <td>Amit</td> <td><i>Amit</i></td> <td>27/11/10</td> </tr> <tr> <td>जांचकर्ता CHECKED BY</td> <td>Rakesh Kr.</td> <td><i>Rakesh</i></td> <td>27/11/10</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> </tr> </table>			निर्माणकर्ता WORKED BY	Amit	<i>Amit</i>	27/11/10	जांचकर्ता CHECKED BY	Rakesh Kr.	<i>Rakesh</i>	27/11/10				
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सामग्री सूची संख्या INVENTORY NO.	REV. 3721															

दिनांक एवं हस्ताक्षर SIGN & DATE		संस्थान क्रय विनिर्देश (हीप – हर्द्वार) PLANT PURCHASE SPECIFICATION (HEEP - HARDWAR)	HW-59870	
			पृष्ठ 11 का 5	Page 5 of 11
सामग्री सूची संख्या को अधिकारित करता है	SUPERSEDES INVENTORY NO.	10.6.2.2 CHANGE IN VOLUME : $\pm 5\%$ Max. 10.7 RESISTANCE TO SOLVENTS, LUBRICANTS ETC : The material shall have long wearing characteristics, resistance to oil, fuels, grease, lubricants, solvents etc., coupled with excellent resistance to atmospheric oxidation.		
COPYRIGHT AND CONFIDENTIAL The information on this documents is the property of Bharat Heavy Electrical Limited it must not be used directly or indirectly in any way detrimental to the interest of the company	11 STORAGE : The finished rubber items shall be stored at ambient temp. not exceeding 30 °C & not below 15 °C. Condensation, moist conditions should be avoided and humidity generally should not exceed 80%. Exposure to direct sunlight, strong artificial light, ultraviolet light should be avoided. Contact with liquid or semi-solid materials should be avoided. Under the recommended storage conditions, shelf life is considered to be 2 yrs.			
	12 TRACABILITY OF MATERIAL : The supplier shall print the name of his organization, monogram, month & year of manufacture on each and every item. In case of cord the same shall be done on every meter length. The printing so done should not damage the surface of rubber component and no way affect its quality			
स्वत्वधिकार एवं गोपनीय इस प्रलेख में दी गई सूचना भारत हेवी इलेक्ट्रिकल्स की सम्पत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी भी तरह प्रयोग जो कि कंपनी के हित में हानिकारक हो न किया जाए ।	13 TEST CERTIFICATES : Unless otherwise stated, three copies of the certificates shall be supplied alongwith each consignment giving the following information:- -Fluorocarbon/Viton Rubber to BHEL Purchase specification No. : -BHEL purchase order No. : -Drawing no. & item no. if any : -Supplier's Name : -Batch No. and Month & Year of manufacture : -Size & Quantity supplied :			
दिनांक एवं हस्ताक्षर SIGN & DATE 21/11/10	सामग्री सूची संख्या INVENTORY NO. P-3721	REV.NO. 01	निर्माणकर्ता WORKED BY Amit	27/11/10
			जांचकर्ता CHECKED BY Rakesh Kr.	27/11/10

दिनांक एवं हस्ताक्षर SIGN & DATE		संस्थान क्रय विनिर्देश (हीप - हार्डवार) PLANT PURCHASE SPECIFICATION (HEEP - HARDWAR)		HW-59870													
				पृष्ठ 11 का 6 Page 6 of 11													
सामग्री सूची संख्या INVENTORY NO. सामग्री सूची संख्या को अधिकृतित करता है	-Test results of routine tests as per clause No. 09 : -Reference & copy of test Report as per clause no. 10																
14 INSPECTION AT SUPPLIERS WORK : All the facilities shall be provided by the supplier for carrying out the inspection at supplier's works. The BHEL shall have the right to check at manufacturing stage of the product ordered.																	
15 PACKING & MARKING : The material shall be preserved with french chalk powder, packed to prevent damage from contamination and handling during transit & storage. The moulded articles should be packed individually in a sealed transparent plastic cover packing which should be further kept in a carton having max. gross wt. of 10Kg The "O" rings may be packed in a similar way as above. The cords should be rolled over wooden/plastic drums of dia. 250mm with max. gross wt. of 10Kg and the drum should be sealed air tight. The drum flange size should be such that the cord when rolled does not project over the flange. The minimum length of the cord required in a single piece shall be mentioned in the P.O. Each package shall be legibly marked with the following information:- -Fluorocarbon/Viton Rubber to BHEL Purchase specification No. : -BHEL purchase order No. : -Drawing no. & item no. if any : -Supplier's Name : -Batch No. and Month & Year of manufacture : -Size & Quantity supplied :																	
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	संस्थान क्रय विनिर्देश (हीप - हार्डवार) PLANT PURCHASE SPECIFICATION (HEEP - HARDWAR)		HW-59870	
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दिनांक एवं हस्ताक्षर SIGN & DATE	SUPERSEDES INVENTORY NO.	16 ACCEPTANCE CRITERIA : The items shall be accepted by BHEL on the basis of the following:- -Compliance certificate furnished by the supplier. -Test certificate furnished by the supplier as per cl. No. 13 -Testing carried out by BHEL on furnished products or otherwise.		
सामग्री सूची संख्या को अधिकृतित करना है		17 REJECTION : BHEL reserves the right to reject the entire lot of material, if found not confirming to stipulations of this specification. Parts of the lot not subjected to testing but found to be defective and those with hidden defects can also be rejected later on.		
PROFILE VITON TYPE 107.001				
				
स्वत्वाधिकार एवं गोपनीय इस प्रलेख में दी गई सूचना भारत देशी इलेक्ट्रिकल्स की सम्पत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी भी तरह प्रयोग, जो कि कंपनी के हित में हानिकारक हो न किया जाए ।				
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P-3721		जांचकर्ता CHECKED BY	Rakesh Kr.	27/11/10

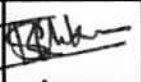
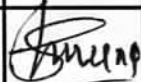
दिनांक एवं हस्ताक्षर SIGN & DATE		संस्थान क्रय विनिर्देश (हीप - हार्डवार) PLANT PURCHASE SPECIFICATION (HEEP - HARDWAR)		HW-59870													
				पृष्ठ 11 का 8 Page 8 of 11													
सामग्री सूची संख्या को अधिकतम करता है SUPERSEDES INVENTORY NO.	TYPE 502.003 FLUOR-KAUKSCHOK  SKETCH PROFILE RUBBER VITON HW5984588013 																
COPYRIGHT AND CONFIDENTIAL The information on this documents is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company																	
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2

Rakesh Kr.

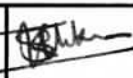
27/4/18

दिनांक एवं हस्ताक्षर SIGN & DATE		संस्थान मानक (हीप : हरिद्वार)		HW0850199																			
		PLANT STANDARD (HEEP: HARIDWAR)		पृष्ठ Page	का 1 of 58																		
SUPERSEDES INVENTORY NO.	Based on PV0026-0-00000 (date 2014-06)																						
सामग्री सूची संख्या को अधिकृतित करना है	Non-destructive testing of welded joints																						
Introduction: This Standard deals with the testing of weld joints in assemblies within the boundary of the "turbo-set" (turbine, generator, condenser) and their related piping assemblies. For simplicity and convenience of use, the standard has been divided into following parts:																							
<table border="1"> <thead> <tr> <th>Part</th> <th>Description</th> <th>Page No.</th> </tr> </thead> <tbody> <tr> <td>Part 1</td> <td>General Principles</td> <td>Pages (2-8)</td> </tr> <tr> <td>Part 2</td> <td>Requirements on test procedures</td> <td>Pages (9-33)</td> </tr> <tr> <td>Part 2.4</td> <td>Hardness Testing</td> <td>Pages (34-45)</td> </tr> <tr> <td>Part 10</td> <td>Part Specific information on Heat Exchangers</td> <td>Pages (46-48)</td> </tr> <tr> <td>Part 11</td> <td>Component-specific data for piping</td> <td>Pages (49-58)</td> </tr> </tbody> </table>						Part	Description	Page No.	Part 1	General Principles	Pages (2-8)	Part 2	Requirements on test procedures	Pages (9-33)	Part 2.4	Hardness Testing	Pages (34-45)	Part 10	Part Specific information on Heat Exchangers	Pages (46-48)	Part 11	Component-specific data for piping	Pages (49-58)
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स्वत्वधिकार एवं गोपनीय इस दस्तावेज में दी गई सूचना भारत भारती गैरविध्वंसक निरिक्षण की समिति है जिनके प्रमुख एवं अध्यक्ष रूप में भारती की तरह प्रयोग को कि, भारती के जिन में हस्ताक्षर हो न किया जाए।																							
दिनांक एवं हस्ताक्षर SIGN & DATE	दिनांक एवं हस्ताक्षर SIGNATURE & DATE	नाम NAME																					
सामग्री सूची संख्या INVENTORY NO.	STE EME HXE	DINESH GOND ANIL MITAL TARUN BANSAL	15.12.18 17/12/18 17/12/18	अनुवाद TRANSLATED BY निर्माणकर्ता WORKED BY जांचकर्ता CHECKED BY पर्यवेक्षणकर्ता SUPERVISED BY	--- SUSHANT KR. THAKUR BL MEENA BS ARORA																		
मंजूर विभाग AGREED DEPT.	नाम NAME	A K Sharma	दिनांक एवं हस्ताक्षर DATE & SIGNATURE	SUPERSEDES स्वीकृति संस्थान मानकीकरण समिति APPROVED : PLANT STANDARDIZATION COMMITTEE																			
REV. NO.	05	निर्माण PREPARED : WTX																					
Dt.	24/12/2018	जारी ISSUED : TSX																					
CHANGE ADVICE NO.	TSX(WT)-18-181	दिनांक DATE : 11.11.93																					

दिनांक एवं प्रमाण SIGN & DATE नमूने की सूची नम्बर INVENTORY NO.	स्वत्वाधिकार एवं गोपनीय इस प्रवेश से की गई प्रकृत भारत की प्रसिद्धि के विरुद्ध है इसका प्रकृत एवं प्रकृत रूप से किसी भी रूप में प्रयोग नहीं किया जा सकता है।	COPYRIGHT AND CONFIDENTIAL The information on this documents is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company.	नमूने की सूची नम्बर अधिकृतिकरण नम्बर है	SUPERSEDES INVENTORY	दिनांक एवं प्रमाण SIGN & DATE		संस्थान मानक (हीप : हरिद्वार) PLANT STANDARD (HEEP : HARIDWAR)	HW0850199
					पृष्ठ का Page 2 of 58			
Non-destructive testing of welded joints – General Principles (Part 1)								
Content								
0. Introduction 0.1. General 0.2. Requirements of the standards to be considered 0.3. Requirements of the weld seam quality 0.4. Requirements of the extent of testing 1. Scope 2. Structure and layout 3. Applicability of ISO 17635 3.1. General 3.2. ISO 17635 Exclusions and additional requirements 3.2.1. ISO 17635, Subclause 3.6 'Inspection lot' 3.2.2. ISO 17635, Subclause 5.2 'Extent of testing' 3.2.3. ISO 17635, Subclause 6 'Personnel qualification' 3.2.4. ISO 17635, Clause 7 'Testing organization' 3.2.5. ISO 17635, Subclause 8.1.1 'Written procedures' 3.2.6. ISO 17635, Subclause 8.2.2 'Final report' 3.2.7. ISO 17635, Subclause 10.3 'Time of testing' 3.2.8. ISO 17635, Subclause 10.4 'Non-acceptable indications' 4. Separate requirements 4.1. Testing method 4.1.1. Visual testing (VT) 4.1.2. Hardness testing (HT) 4.1.3. Testing for surface discontinuities (PT and MT) 4.1.4. Testing for internal discontinuities (RT and UT) 4.2. Identification marking 4.3. Testing and evaluation of weld areas and weld groove faces								
नमूने की सूची नम्बर INVENTORY NO.	REV. NO.			निर्माणकर्ता WORKED BY	SUSHANT KR. THAKUR		13.09.2018	
नमूने की सूची नम्बर INVENTORY NO.	REV. NO.			जांचकर्ता CHECKED BY	BL MEENA		13.09.2018	

दिनांक एवं हस्ताक्षर SIGN & DATE			संस्थान मानक (हीप : हरिद्वार) PLANT STANDARD (HEEP : HARIDWAR)		HW0850199 पृष्ठ का Page 3 of 58	
SUPERSEDES INVENTORY		Introduction 0.1 General This test specification shall ensure the testing of weld seams to necessary quality and required parameters, which fundamentally shall be stated in a design drawing. 0.2 Requirements of the standards to be considered This specification refers to the testing of weld seams, within system boundaries of the "turboset" (turbine, generator, condenser). The requirement of piping are described in HW0850199-11 "Piping". Note: In case, any assembly is governed by pressure vessel requirements, the same shall be clearly mentioned in the drawing. Applicable NDT specifications (techniques and acceptance norms) shall be written in the drawing. Hereby, the drawing specifications shall be read as follows: - Testing according to HW0850199 0.3 Requirements of the weld seam quality The drawing shall indicate the weld seam quality of every weld seam (quality level according to HW0620099). Hereby, the drawing specification could be read as follows: - Quality level according to HW0620099- BS/BK - Quality level according to HW0620099- CS/CK - Quality level according to HW0620099- DS/DK 0.4 Requirements of the extent of testing The drawing shall indicate the extent of testing of weld seam in the form of an inspection stage as a percentage value according to Table 1 or a serial number of HW0850199-Part11.				
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स्वत्वाधिकार एवं गोपनीयता इस दस्तावेज में दी गई सूचना भारत भारती लिमिटेड का स्वतंत्र संपत्ति है। इसका प्रयोग बिना भारत भारती लिमिटेड की अनुमति के बिना नहीं किया जा सकता है। इस दस्तावेज का उपयोग केवल भारत भारती लिमिटेड के लिए ही किया जाना है।						
दिनांक एवं हस्ताक्षर SIGN & DATE		REV. NO. 05		निर्माणकर्ता WORKED BY	SUSHANT KR. THAKUR	 13.09.2018
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सुपरसेडिज INVENTORY	1. Scope This test specification is applicable to inside plant and manufacturing at sub-contractor works and Service /Erection at site whenever mentioned in the relevant drawing. It applies to newly manufactured components or repaired jobs. This also applies to purchase parts, when required by applicable purchase specifications. This specification does not apply to the testing of deposited surfaces (cladding, sprayed coatings etc.) but may be cross-referenced as a requirement in other test specifications and welding instructions for such processes.				
COPYRIGHT AND CONFIDENTIAL The information on this document is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company.	2. Structure and layout HW0850199 consists of: – Part 1: General principles; – Part 2: Requirements on test procedures; – Part 2.4: Hardness testing; – Part 10: Part Specific Information on Heat Exchangers – Part 11: Component-specific data for piping.				
स्वतन्त्राधिकार एवं गोपनीय इस प्रवेश में की गई सूचना भारत हेवी एलेक्ट्रिकल्स लिमिटेड की सम्पत्ति है इसका प्रयोग एवं प्रकाशन अन्य में किसी भी तरह प्रयोग, जो कि कंपनी के हित में अधिकारक हो, न किया जाए।	3. Applicability of ISO 17635 3.1. General Further additional requests and requirements to ISO 17635 are described in Subclause 3.2. 3.2. ISO 17635 Exclusions and additional requirements 3.2.1. ISO 17635, Subclause 3.6 'Inspection lot' Where the extent of testing is < 100 % each inspection lot shall be determined according to the requirements of ISO 17635, Subclause 3.6. The following applies over and above the requirements of ISO 17635: (1) Only those parts and components of a work order may belong to one inspection lot, for which the extent of testing is indicated on the component drawing. The inspection lot is defined by the testing department. (2) Where the extent of testing is < 100 % and longitudinal welds are joined to circumferential welds, the weld intersection shall be included in the testing. (3) Where the extent of testing is < 100 % and the inspection lot comprises several welds, it is not necessary that portion of each weld to be included in the testing, provided that all of the above mentioned requirements have been fulfilled. (4) Where the extent of testing is < 100 % and the inspection lot comprises several identical component parts, it is not necessary that portion of each component part to be included in the testing, provided that all of the above mentioned requirements have been fulfilled.				
दिनांक एवं हस्ताक्षर SIGN & DATE	REV. NO. 05	निर्माणकर्ता WORKED BY SUSHANT KR. THAKUR	जांचकर्ता CHECKED BY BL MEENA	13.09.2018 13.09.2018	

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			पृष्ठ का Page 5 of 58																			
3.2.2. ISO 17635, Subclause 5.2 'Extent of testing' The required testing grade or category of service requirement defines the extent of testing which is mentioned in the component drawing. A testing grade is generally indicated. There are 7 different testing grades from 1 to SM. The relationship between testing grade and extent of testing is shown in table 1.																						
Table 1 – Relationship between testing grade and extent of testing																						
<table border="1"> <tr> <th>Testing grade</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> <th>5</th> <th>St</th> <th>SM</th> </tr> <tr> <td>Extent of testing in %</td> <td>100</td> <td>50</td> <td>25</td> <td>10</td> <td>5</td> <td>< 5</td> <td>^a</td> </tr> </table>							Testing grade	1	2	3	4	5	St	SM	Extent of testing in %	100	50	25	10	5	< 5	^a
Testing grade	1	2	3	4	5	St	SM															
Extent of testing in %	100	50	25	10	5	< 5	^a															
^a 100 % visual inspection (VT) and UT/RT testing at weld intersection.																						
The extent of testing can also be given directly as a percentage value or as a serial number of the tables of Parts 1 and 11. Parts 2, 10 and 11 provide an overview of the requirements regarding the testing of welded heat exchanger and piping components. The requirements of the drawing are to be followed.																						
3.2.3. ISO 17635, Subclause 6 'Personnel qualification' Testing personnel are required to be certified in relevant NDT methods from ASNT/ ISNT/ BARC or other similar institutions. For ultrasonic testing, a certified Level 2 personnel is required. For RT, PT and MT level 1 is sufficient if the tests are performed under supervision of level 2 or level 3 personnel. If the direct supervising level 2 or level 3 personnel sign the testing report and HW0850199 Part 1, Subclause 3.2.5 is fulfilled, no written instruction is required.																						
3.2.4. ISO 17635, Clause 7 'Testing organization' If testing is not performed by the manufacturer's own testing organization but by external testing organization, its testing personnel shall be qualified as mentioned in Subclause 3.2.3 above. The organization will also be capable of carrying out testing as per requirements of this specification.																						
3.2.5. ISO 17635, Subclause 8.1.1 'Written procedures' Written procedure is not required, if tests and evaluations are performed according to the standards listed in Table A.1 to A.9 of ISO 17635. When minimum test requirements cannot be fulfilled and therefore additional tests become necessary, written procedure will be required.																						
मशीन नं. संख्या INVENTORY NO.	दिनांक एवं प्रमाणित SIGN & DATE	REV. NO.	निर्माणकर्ता WORKED BY	SUSHANT KR. THAKUR		13.09.2018																
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इस दस्तावेज में दी गई सूचना भारत भारती लिमिटेड की संपत्ति है। इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी भी तरह का उपयोग जो कि इसकी हानि के कारण नुकसान पहुंचाए बिना न किया जाय।

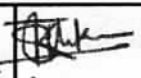
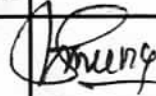
प्रमाणित करने वाला SIGN & DATE SUPERSEDES INVENTORY मासिक मूली मूला के अतिरिक्त करना है		संस्थान मानक (हीप : हरिद्वार) PLANT STANDARD (HEEP : HARIDWAR)		HW0850199	
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3.2.6. ISO 17635, Subclause 8.2.2 'Final report' No final report is required if testing records are available for all the required tests on a component. These testing records are to be countersigned by the testing supervisor.					
3.2.7. ISO 17635, Subclause 10.3 'Time of testing' Contrary to the requirements of ISO 17635, the execution of volumetric testing prior to surface testing is permitted. In line with this test specification the following applies in addition to the requirement of ISO 17635, that tests should be performed subsequent to completion of the requisite heat treatments:					
(1) For welds, which shall be tested using both ultrasonic and radiographic methods, the radiographic testing can be performed before final heat treatment. (2) In the course of manufacture it can become necessary to perform testing before final heat treatment as the examinability of test pieces or individual areas to be tested, may be impaired to such an extent that the requirements of this test specification cannot be fulfilled. For example, the inside areas of the turbine casings, which are not accessible at the time of heat treatment. (3) For pressurized cast steel parts which are heat treated, after construction welding, it is necessary to repeat the surface crack testing on the heat affected zone in accordance with the applicable cast steel testing specifications.					
3.2.8. ISO 17635, Subclause 10.4 'Non- acceptable indications' ISO 17635 requires that the procedure for processing of non-acceptable indications has to be described in application standards. The following requirements apply for this test specification:					
(1) Non-acceptable indications are generally repaired. The repaired areas will be tested at least in the same way as required for the original weld. (2) Only in exceptional cases, non-acceptable indications can be tolerated if appropriate measures are taken such as calculations or other suitable measures (repeat testing after a set number of operating hours etc.). Acceptance in such cases will be provided by Engineering Department. (3) If non-acceptable indications can be removed by grinding. The cavities can remain without any further activity provided that the limits according to ISO 5817, number 1.14 are complied with.					
The procedure for increasing the extent of testing will be as follows:					
(4) For all inspections where the extent of testing < 100 %, the next higher testing grade or extent of testing shown in Table 1 shall be applied, if non-acceptable indications are found. If non-acceptable indications are found after extending the testing, an extent of testing from the next higher testing grade will be implemented again. By further occurrences of non-acceptable indications, this procedure has to be repeated until the extent of testing reaches 100 %. (5) For all inspections where the extent of testing is < 100 %, where non-acceptable indications are found and where a common cause has been reliably detected (e.g. limited access for welding in localized areas), all welds and areas which could exhibit the same discontinuities shall be tested.					
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 इस दस्तावेज में दी गई सूचना भारत भारती लिमिटेड का सम्पत्ति है। इसका प्रयोग एवं प्रकाशन बिना भारत भारती लिमिटेड की अनुमति के बिना न होना चाहिए।

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4. Separate requirements 4.1. Testing method As per the quality level and the extent of testing in the drawing, the following testing methods are generally applicable: 4.1.1. Visual testing (VT) Irrespective of the testing grade mentioned in the drawing, 100 % visual inspection has to be performed as described in HW0850199-Part 2, Clause "Visual testing". 4.1.2. Hardness testing (HT) Hardness testing is to be performed as per standard HW0850199 part 2.4 4.1.3. Testing for surface discontinuities (PT and MT) The penetrant testing (PT) and the magnetic particle testing (MT) are considered equivalent within the scope of this test specification. MT is the preferred method on welds which have been ground smooth in ferro-magnetic materials (e.g. structural welds in cast steel, gas turbine casings etc). PT is the preferred method on weld surfaces, which have not been ground, eg. fabricated turbine casings. Even if it is not mentioned in the component drawing, the weld areas of welded on technological supports will be ground smooth suitable for testing following removal of the technological supports. Components manufactured from materials in HW0850199 part 2.4, Table 1 are subjected to a surface crack testing. PT or MT is not to be performed in the area of backing strips. 4.1.4. Testing for internal discontinuities (RT and UT) Via the testing grade, one of the two volumetric testing methods - radiographic testing (RT) or ultrasonic testing (UT) is to be performed. The following are the conditions: - Welds on nipples and nozzles with inside diameters ≤ 100 mm or a connecting weld thickness ≤ 15 mm will be subjected exclusively to a surface crack testing (outside and where possible inside, also). - Unless otherwise defined in the drawing, all welds without full penetration will be subjected to surface crack testing only. - Irrespective of the testing grade, welds with the quality level 'D' will not be subjected to radiographic or ultrasonic testing, but only to surface crack testing. - Radiographic testing and ultrasonic testing may be omitted, if the testing grade is 5 or St (extent of testing ≤ 5 %) and penetrant or magnetic particle testing can be performed on both weld surfaces. - The following applies for weld joints for which a test scope of ≤ 10 % is required and which, based on the radiographic testing and ultrasonic testing, are subject to test restrictions because of backing strip remnants and/or permanent connections: - Volumetric testing is omitted. Instead, the surface crack test has to be carried out with a doubled extent of testing.			
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नामकी नवी गणना INVENTORY NO.	REV. NO.	जांचकर्ता CHECKED BY	BL MEENA
नामकी नवी गणना INVENTORY NO.	REV. NO.	जांचकर्ता CHECKED BY	13.09.2018

दिनांक एवं प्रमाणित SIGN & DATE			संस्थान मानक (हीप : हरिद्वार) PLANT STANDARD (HEEP : HARIDWAR)		HW0850199 पृष्ठ का Page 8 of 58	
सुपरसेड्स INVENTORY		- The following applies for weld joints for which a test scope > 10 % is required and which, based on the radiographic testing and ultrasonic testing, are subject to test restrictions because of backing strip remnants and/or permanent connections: - The bottom 5 mm of the weld joint cannot be assessed by ultrasonic testing. - Generally root imperfections cannot be ruled out by ultrasonic testing and radiographic testing. - On Generator Stator Frames with a testing scope ≤ 10 % on which no volumetric testing (RT/UT) is performed, a 100 % surface testing is required. This requires a prior approval of the engineering. On austenitic welds with a required test range of ≤ 10 % (test scope 4 and higher) according to drawings, the volume testing can be dropped, if a 100 % surface crack testing is carried out on both sides of the seams.				
COPYRIGHT AND CONFIDENTIAL The information on this document is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company.		4.2. Identification marking Where the extent of testing is < 100 %, the test sections may be marked on the component. For example by zero stamping next to the weld with an arrow pointing towards the test section. If not every weld has been tested on a component, the testing report should indicate on which welds which extent of testing has been implemented. Welds where location of test section is clear through the testing report in conjunction with drawings, isometrics etc. and which have been completely examined don't have to be marked. Welds, with indications above the recording level or with non-acceptable indications, are always to be marked in such a way, that the position of the indications can be found at any time (e.g. through a zero stamp). Alternatively, the same should be clearly mentioned in the testing report. Ferritic materials with a wall thickness of ≤ 4 mm have to be marked with an electric engraver. Austenitic materials shall not be marked mechanically. 4.3. Testing and evaluation of weld areas and weld groove faces In the cast steel parts, surface crack testing on the weld edges will be performed before welding. Welding ends on cast steel parts subjected to operational loads shall be subjected to a surface crack testing and a volumetric testing. The same shall be mentioned in the drawing.				
स्वत्वाधिकार एवं गोपनीय इस दस्तावेज में दी गई सूचना भारत भारती लिमिटेड की संपत्ति है। इसका प्रयोग अन्य प्रयोजनों के बिना और बिना अनुमति के नहीं किया जा सकता।						
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SUPERSEDES INVENTORY	Non-destructive testing of welded joints – Requirements on test procedures (Part 2)				
सामग्री सूची संख्या को अतिरिक्त करना है	Content				
COPYRIGHT AND CONFIDENTIAL The information on this documents is the property of Bharat Heavy Electrical. Limited It must not be used directly or indirectly in any way detrimental to the interest of the company	1. Scope 2. General requirements 3. Abbreviated terms 4. Standards to be applied 4.1. ISO 17635 5. Surface preparation for NDT of welds 6. Test Reports 7. Visual testing 7.1. Extent of testing 7.2. ISO 17637, Exclusions and additional requirements 8. Penetrant testing 8.1. ISO 3452-1, Exclusions and additional requirements 8.2. ISO 23277, Exclusions and additional requirements 9. Magnetic particle testing 9.1. ISO 17638, Exclusions and additional requirements 9.2. ISO 23278, Exclusions and additional requirements 10. Radiographic testing 10.1. General 10.2. ISO 17636-1, Exclusions and additional requirements 10.3. ISO 17636-2, Exclusions and additional requirements 10.4. ISO 10675 requirements for evaluation 11. Ultrasonic testing 11.1. General 11.2. ISO 17640 (UT-PE test technique) Exclusions and additional requirements 11.3. ISO 11666 (UT-PT acceptance levels) Exclusions and additional requirements 11.4. ISO 10863 (TOFD-method) Exclusions and additional requirements 11.5. EN 15617 (TOFD-estimation) Exclusions and additional requirements				
स्वत्वाधिकार एवं गोपनीय इस दस्तावेज में दी गई सूचना भारत भारती एलेक्ट्रिकल्स लिमिटेड की संपत्ति है। इसका प्रयोग एक अनपेक्षित रूप से किसी भी प्रकार के हित में हानिकारक हो न किता आए।					
निम्न एवं प्रसार SIGN & DATE 15/9					
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SUPERSEDES INVENTORY सामग्री सूची संख्या की अतिरिक्ति संख्या है	1. Scope This test specification is applicable to inside plant and manufacturing at sub-contractor works and Service /Erection at site whenever mentioned in the relevant drawing. It applies to newly manufactured components or repaired jobs. This also applies to purchase parts, when required by applicable purchase specifications. This test specification HW0850199-Part 2 specifies non-destructive examinations to be performed on the following fusion welded joints: - welded joints out of steel; - structural welds in cast steel; - associated weld edge areas; - welding points after the removal of technological supports. This test specification does not apply to the testing of deposited surfaces (cladding, sprayed coatings, etc.), but may be cross-referenced as a requirement in other test specifications for such processes.				
COPYRIGHT AND CONFIDENTIAL The information on this documents is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company	2. General requirements In general (if nothing is specifically mentioned in drawing), ISO 17635 standard will be applied for execution and evaluation of non-destructive testing. Whenever, pressure vessel requirements are applicable, it will be clearly mentioned in the drawing. In such cases, applicable NDT specifications (for testing technique and acceptance norms) will also be mentioned in the drawing.				
स्वत्वाधिकार एवं गोपनीय इस प्रवेश में की गई प्रतियां भारत हीवी इलेक्ट्रिकल्स लिमिटेड की संपत्ति हैं, इनका प्रयोग एवं प्रसारण अन्य से किसी भी तरह प्रयोग को कि कंपनी के हित में हानिकारक हो न किता जाए।	3. Abbreviated terms 3.1. IQI Image Quality Indicators 3.2. RT-CS Radiographic testing – computed radiography 3.3. RT-F Radiographic testing with film 3.4. RT-S Radiographic testing – radioscopy 3.5. TOFD Time-of-flight diffraction technique 3.6. UT-PE Ultrasonic testing – pulse echo 3.7. HAZ Heat-affected zone				
दिनांक एवं प्रमाण SIGN & DATE	4. Standards to be applied 4.1. ISO 17635 ISO 17635 combines the requirements on weld quality, as set forth in HW0620099 and hence, in the quality levels of EN ISO 5817, 'B, C and D' with those arising from the viewpoint of non-destructive examination. This standard serves as a guideline for selecting the testing method and defines the general codes and standards for the various testing techniques and for the acceptance levels (see Table 1). It forms the basis for the testing of welds in steel in line with this test specification				
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Table 1 – Standards to be applied according to ISO 17635

Test method	Quality level EN ISO 5817	Test technique	Test levels	Criteria of acceptance	Acceptance levels
VT	B	ISO 17637	a	EN ISO 5817	B ^b
	C				C ^b
	D				D ^b
PT	B	ISO 3452-1	a	ISO 23277	2 x
	C				2 x
	D				3 x
MT	B	ISO 17638	a	ISO 23278	2 x
	C				2 x
	D				3 x
RT-F	B	ISO 17636-1	B	ISO 10675-1	1
	C		B ^c		2
	D		min. A		3
RT-S	B	ISO 17636-2	Sb ^{d,e}	ISO 10675-1	1
	C		Sb ^{c,d,e}		2
	D		Sb ^{c,d,e}		3
RT-CS	B	EN 14784-2	B ^f	ISO 10675-1	1
	C		B ^{c,f}		2
	D		min. A ^f		3
UT-PE	B	ISO 17640	min. B	ISO 11666	2
	C		min. A		3
	D		a		g
TOFD	B	ISO 10863	C	EN 15617	1
	C		min. B		2
	D		min. A		3

a Not specified.

^b The acceptance levels for visual testing comply with the quality levels according to EN ISO 5817.

c. The minimum no. of radiographic exposures for testing of circumferential welds may comply with the requirements according to ISO 17636-1 and ISO 17636-2, class A.

d The weld-specific requirements, such as the minimum number of radiographic exposures, shall comply with ISO 17636-2 Class A for quality level D and Class B for quality levels B and C.

e In addition to complying with the requirements of EN 13068-3, the visibility of the image quality indicator (IQI) for digital images shall be demonstrated and documented according to ISO 17636-2 Class A for quality level D and Class B for quality levels B and C.

f The weld-specific requirements, such as the minimum number and geometries of radiographic exposures as well as the requirements of the image quality indicator (IQI), shall comply with ISO 17636-2, Class A for quality level D and Class B for quality levels B and C. The visibility of the IQI for digital images shall be demonstrated and documented. X-ray tube voltage shall comply with EN 13068-3. Blurring shall be verified according to ISO 19232-5 and EN 14784-2.

g UT is not recommended, but can be determined in a specification (with equal requirements as quality level C).

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WORKED BY

**SUSHANT
KR. THAKUR**

13.09.2018

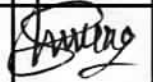
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सुपरसेड INVENTORY	5. Surface preparation for NDT of welds Higher is the weld quality, better surface condition will be required to get satisfactory results of NDT. In general: Welds analyzed by NDT are required to be free of: - surface coatings, layers and coats of paint; - oil, grease; - slag; - weld spatter; - and other material, which can affect the testing.				
आपकी सूची में इसका प्रविष्टि कर रहे हैं	According to the weld method, as well as the test technique, the specified requirements in Table 2 are to consider				
Table 2 - Surface preparation for NDT of welds					
Welding method		GTAW	SAW	GMAW	SMAW
Test technique	Surface	fine rippled, smooth	fine rippled, smooth, slightly rough	rippled, irregular weld surface, notches	rippled to rough rippled, irregular weld surface, notches
	UT	beside the weld, depending on wall thickness according to ISO 17640 clean respectively grind according to the condition of component part, Ra < 12,5			
	MT	Weld surface and HAZ, at least 10 mm: clean, if necessary slight grind Ra ≤ 12,5.	Weld surface and HAZ: wire brush/ shot blasting/ grinding/machining. The test area should meet the requirements of visual testing with Ra ≤ 12,5		
	PT	Weld surface and HAZ, at least 10 mm: clean, if necessary slight grind Ra ≤ 12,5.	Weld surface and HAZ: wire brush/ shot blasting/ grinding/machining. The test area should meet the requirements of visual testing with Ra ≤ 12,5		
	RT	Weld surface and HAZ: clean, if necessary slight grind			
Note: Austenitic welds shall not be cleaned with a blasting method. There is a risk of closing cracks on the surface.					
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सुपरसेडस INVENTORY	6. Test Reports The Annex A contains sample formats for test reports. Formats other than the same may be used, provided that, they contain the required information.				
सामग्री सूची संख्या को प्रतिबिंबित करना है COPYRIGHT AND CONFIDENTIAL The information on this document is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company.	7. Visual testing 7.1. Extent of testing The extent of testing for visual inspections shall be considered as being separate to the extent of testing for other non-destructive testing methods and is therefore not stated in the drawing. For visual testing the extent of testing is always 100%. 7.2. ISO 17637, Exclusions and additional requirements 7.2.1. ISO 17637, Clause 6 "Visual testing" (1) Visual testing of weld joint preparation (ISO 17637, Subclause 6.2), visual testing during welding (ISO 17637, Sub-clause 6.3) and visual testing of repaired weld edges (ISO 17637, Subclause 6.5) within the scope of this test specification shall be allocated to the welding process itself and shall therefore be the responsibility of the welder. Visual testing of the finished weld (ISO 17637, Subclause 6.4) and visual testing of repaired welds – general (ISO 17637, Subclause 6.5.1) shall be performed by the following personnel: 1. Welding Supervisor; or 2. Other personnel from quality department. 7.2.2. ISO 17637, Clause 7 "Test records" Test reports for visual inspection of welds and visual inspection of repaired welds will be maintained.				
स्वत्वाधिकार एवं गोपनीयता इस दस्तावेज में की गई प्रकृता भारत भारती एलेक्ट्रिकल्स लिमिटेड की संपत्ति है। इसका प्रयोग एवं प्रकाशन अन्य के बिना की जा सकता है। इस दस्तावेज के प्रसारण से निम्न में हानिकारक हो न सके।	8. Penetrant testing 8.1. ISO 3452-1, Exclusions and additional requirements 8.1.1. ISO 3452-1, Subclause 6.3 "Sensitivity" Penetrants (penetrant systems) with sensitivity class of 1 (normal) or better for colour contrast testing, and accordingly sensitivity class 2 (medium) or better for fluorescent testing according to ISO 3452-2 are to be used. Penetrant material conforming to other equivalent national/ international standards may be used. 8.1.2. ISO 3452-1, Subclause 7.3 "Compatibility of penetrant testing materials with parts under examination" When examining austenitic welds a penetrant with low halogen content, and when examining nickel base welds a penetrant with low sulfur content according to ISO 3452-2 or ASME Section V, Article 6 are to be used.				
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8.1.3. ISO 3452-1, Subclause 8.4.2 "Penetration time" and Subclause 8.6.7 "Development time" The 'penetration times', 'development times' and 'evaluation intervals' given in Table 3 shall be complied with.					
Table 3 – Minimum penetration time					
Material		Penetration time min	Developing and evaluation time min		
ferritic		> 5	directly	≥ 10	–
austenitic		> 30	directly	> 30	≥ 60
austenitic cladding on ferritic base material		> 60	directly	> 30	≥ 60
Nickel-based welds		> 120	directly	> 30	> 60
8.2. ISO 23277, Exclusions and additional requirements 8.2.1. ISO 23277, Subclause 5.3 "Allowable level for groups of indications" Groups of acceptable individual indications shall be considered unallowable when they exceed the following limits: $\sum l \geq s$ for $l = \min. (12 s; 150 \text{ mm})$ (1) In words this means: Depending on which value is smaller, over a weld length of 150 mm or the length corresponding to twelve times the wall thickness, the cumulative length of several adjacent indications may not exceed the wall thickness. This however only applies to indications which are otherwise acceptable on the basis of their distance from each other and their individual lengths.					
9. Magnetic particle testing 9.1. ISO 17638, Exclusions and additional requirements The usage of prods is a special application, which is only allowed for materials as mentioned in Annex B. The application of prods for other material groups requires permission from Engineering. In this case, the following procedures described are to be adhered to. The arc strikes shall be machined or ground to a sufficient depth and examined by the MT or PT method. If testing is performed by the current flow method, melting electrodes (e.g. lead-tin alloys) should be used where possible. It shall be ensured that overheating of the materials to be tested is prevented in the contact areas. If overheated areas occur, the areas are to be identified, and after conclusion of the testing, they are to be ground and subjected to magnetic particle testing using yoke magnetization.					
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सामग्री सूची संख्या INVENTORY NO.		9.2. ISO 23278, Exclusions and additional requirements									
COPYRIGHT AND CONFIDENTIAL The information on this document is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company.		9.2.1. ISO 23278, Clause 4 'Testing parameters'									
		Magnetic particle examinations according to HW0850199-Part 2 require surfaces which do not give rise to spurious indications which lie above the acceptance levels. Eventually this shall be achieved by grinding. Notch-free ground welds with a surface roughness $R_a \leq 12.5$, $R_z < 50 \mu m$ are generally sufficient to satisfy this requirement. If spurious indications greater than acceptance level are detected by the test performance, the surface roughness has to be decreased further on.									
		Magnetic particle testing shall be performed by using wet testing medium according to ISO 17638. If linear indications more than the acceptance norms appear on surface, the surface is to be ground and the test is to be repeated.									
		9.2.2. ISO 23278, Subclause 5.2 'Grouped indications'									
		Groups of acceptable individual indications shall be considered unallowable when they exceed the following limits:									
		$\sum l \geq s$ for $l = \min. (12 s; 150 \text{ mm})$ (2)									
		In words this means:									
		Depending on which value is smaller, over a weld length of 150 mm or the length corresponding to twelve times the wall thickness, the cumulative length of several adjacent indications may not exceed the wall thickness. This however only applies to indications which are otherwise acceptable owing to their distance from each other and their individual lengths.									
स्वत्व अधिकार एवं गोपनीय दस्तावेज में दी गई सूचना भारत भारती लिमिटेड की संपत्ति है, इसका प्रसार एवं उपयोग केवल उसी उद्देश्य के लिए ही किया जा सकता है जो कि दस्तावेज के तहत से निर्धारित है।		10. Radiographic testing									
		10.1. General									
		ISO 17636-1 can be used for radiography using film (RT-F)									
		ISO 17636-2 can be used for radiography technique (RT-S).									
		EN 14784-2 can be used for Computed radiography (RT-CS)									
		10.2. ISO 17636-1, Exclusions and additional requirements									
		10.2.1. ISO 17636-1, Subclause 6.9 'Minimum image quality values'									
		It is additionally defined that the following in Table 4 applies for the exposure techniques referenced in ISO 17636-1:									
		Table 4 – Exposure techniques									
		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 60%;">Exposure technique</th> <th style="width: 40%;">Quality class</th> </tr> <tr> <td>radiographic exposures class A</td> <td style="text-align: center;">A</td> </tr> <tr> <td>radiographic exposures class B</td> <td style="text-align: center;">B</td> </tr> </table>				Exposure technique	Quality class	radiographic exposures class A	A	radiographic exposures class B	B
Exposure technique	Quality class										
radiographic exposures class A	A										
radiographic exposures class B	B										
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10.2.2. ISO 17636-1, Subclause 7.2 'Choice of tube voltage and radiation source'

Table 2 of ISO 17636-1 makes recommendations for the selection of the radiation source. For thin-walled components, x-ray tubes are preferred. Should this not be technically feasible (e.g. inaccessibility of the test object), an isotope (e.g. Se75 or Ir192) can be used as the source if the requirements according to HW0850199-Part 2, 10.2.3 are met.

10.2.3. ISO 17636-1, Subclause 7.2.2 'Other radiation sources'

The provision of the standard that radiographic testing may be carried out with Se 75 up to 5 mm and for Ir 192 up to 10 mm transmission thickness, is only allowed for geometrical inaccessibility, if the following conditions according to Table 5 of HW0850199-Part 2 are met.

Table 5 – Other radiation-sources

Location	Radiation, source	Penetrated wall thickness	Additional requirements
Single-wall figure 5 to 10	Ir 192	≥ 10 mm	– radiation source has to be placed on the concave side;
	Se 75	≥ 5 mm	– where possible both weld surfaces should be ground free of notches;
Double-wall figure 11 to 16	Ir 192	≥ 10 mm	– additional surface crack test.
	Se 75	≥ 5 mm	– where possible both weld surfaces should be ground free of notches;
			– additional surface crack test.

10.2.4. ISO 17636-1, Subclause 7.8 'Density of radiograph'

It is recommended that a minimum image density of > 2.5 to 3.0 is targeted. The lower allowable optical film density should meet the requirements of Table 5 of ISO 17636-1.

Footnote b in testing level A does not apply. The minimum image density shall not be less than 1.8.

10.3. ISO 17636-2, Exclusions and additional requirements

10.3.1. General

Radiographic testing of welds by means of radioscopy or imaging plates represents a new development as an addition to film radiography and may be used in future more and more with increasing resolution of the storage media.

According to the current state of the art, the imaging systems or test systems found in the service sector are unable or are only able in certain areas to meet the high-quality requirements of weld radiography. Testing organizations, using this technique, have to verify the qualification concerning their test personnel and their test system. In addition to EN 13068-3, Subclause 4.1, herewith it is required to Clause 3 of ISO 17636-2 that the suitability of such test systems has to be audited (reviewed) by BHEL prior to their first application

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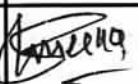
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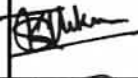
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10.3.6. ISO 17636-2, Subclause 7.3 'Detector systems and metal screens' If the minimum SNR _N value according to ISO 17636-2, Subclause 7.3 for the required test class is not achieved, the quality of the weld shall be tested by film radiography or another volume testing procedure (e.g. UT-TOFD, manual UT).														
10.3.7. ISO 17636-2, Subclause 7.7 'Magnification technique' The possibility is indicated here that an acceptable spatial resolution (minimum SNR _N value) can be achieved by special magnification methods due to the pixel size for CR and DDA systems. Paragraphs 2 and 3 of ISO 17636-2 are to be noted in particular, which suggest that the testing system is not suitable in such cases. High-resolution standard film radiography shall therefore be used in this case.														
10.3.8. ISO 17636-2, Subclauses 7.9 'Processing' and 7.10 'Monitor viewing conditions and storage of digital radiographs' The quality characteristics for processing described in Subclauses 7.9.1, 7.9.2, 7.9.3 and 7.9.4 of ISO 17636-2 shall be verified by the performing test center (e.g. internal or external test laboratory). This verification shall be performed prior to or in conjunction with production of the radiographic images. The performance of the viewing monitor (type, serial number) shall be checked and documented. An existing monitor inspection should not be older than 12 months.														
10.3.9. ISO 17636-2, Clause 8 'Examination report' The test report shall meet the minimum requirements according to Clause 8 of ISO 17636-2. In addition, it shall be ensured that the images are stored in the raw data format and in the evaluated form, see ISO 17636-2, Subclause 7.10. It shall also be ensured prior to start of the test, that the image data is available on suitable data storage media, as well as with an appropriate evaluation tool, so that they can be incorporated in the required documentation. An image printout is merely of informal nature and does not meet the requirements.														
10.4. ISO 10675 requirements for evaluation 10.4.1. General ISO 10675 is divided into 2 parts: Part 1 – Evaluation of welds in steel, nickel, titanium and their alloys with radiography acceptance levels Part 2 – Evaluation of welds in aluminum and its alloys with radiography acceptance levels Note: Only Part-1 is applicable for the jobs covered in the scope of present specification.														
10.4.2. Testing technique Details of the test methods are given in Table 8														
Table 8 – Test methods														
<table border="1" style="width: 100%;"> <thead> <tr> <th>Quality levels in accordance with EN ISO 5817</th> <th>Test techniques and test levels in accordance with ISO 17636-1, -2</th> <th>Acceptance levels in accordance with ISO 10675-1</th> </tr> </thead> <tbody> <tr> <td>B</td> <td>B</td> <td>1</td> </tr> <tr> <td>C</td> <td>B^a</td> <td>2</td> </tr> </tbody> </table> ^a For testing of circumferential welds, however, the minimum number of radiographic films according to Figures A3 and A4 of ISO 17636-1 and ISO 17636-2 may meet the requirements of class A of these standards.						Quality levels in accordance with EN ISO 5817	Test techniques and test levels in accordance with ISO 17636-1, -2	Acceptance levels in accordance with ISO 10675-1	B	B	1	C	B ^a	2
Quality levels in accordance with EN ISO 5817	Test techniques and test levels in accordance with ISO 17636-1, -2	Acceptance levels in accordance with ISO 10675-1												
B	B	1												
C	B ^a	2												
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10.4.3. ISO 10675-1, Table 2 – Acceptance levels for internal indications in butt welds The acceptance criteria according to ISO 10675-1 apply for the evaluation of radiographic images. According to Table 2 of ISO 10675-1, wormholes in single pass welds are not allowed. For the scope of HW0850199-2, wormholes in single-pass welds are not permissible. 10.4.4. Explanations for evaluation Maximum indication sizes are given for varying acceptance levels (AL) in Table 2 of ISO 10675-1. The following examples are given as explanations. Linear indication: an indication whose length is three times its width. Explanation: for multiple-pass welds: – Wormhole AL 1 $\sum l \leq s$, max. 25mm, ($L = 100\text{ mm}$) (3) The additive (cumulative) length of multiple wormholes shall not exceed the wall thickness, but 25 mm maximum, relating to a weld section of 100 mm length. 11. Ultrasonic testing 11.1. General ISO 17635, which represents the basis for this test specification, specifies two methods for ultrasonic testing of welds. These are the UT-PE (pulse echo) method and the UT-TOFD (time of flight diffraction) method. One of these two methods may be selected for UT weld testing in accordance with HW0850199-2, for wall thickness ranges < 60 mm. This also applies for quality levels C and D for wall thicknesses ≥ 60 mm. Additional requirements result for wall thicknesses ≥ 60 mm and quality level B which are regulated by Subclause 11.2.1, (3) and Table 9. 11.2. ISO 17640 (UT-PE test technique) Exclusions and additional requirements 11.2.1. ISO 17640, Clause 5 “Information required prior to testing” (1) The method for setting the reference height is established by the manufacturer of the part or component. This should be consistent for the entire part, particularly for a weld, and is not allowed to be changed after the start of testing. (2) The test for indications in the transverse direction can be omitted if all of the following conditions are met: – required inspection scope ≤ 25 % (inspection stages 3, 4, 5, St, SM); – weld thickness < 40 mm; – BHEL grade materials (refer Annex B) of construction; and – a surface crack test by dye penetrant or magnetic particle testing has been performing on both weld surfaces in addition to UT for longitudinal defect test. If the transverse defect test cannot be omitted in accordance with these conditions, it shall be performed in the same weld section as for the longitudinal defect test.							
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	(3) For welds in quality level B according to EN ISO 5817 with thickness ≥ 60 mm, a longitudinal defect test for inhomogeneities perpendicular to the surface shall also be performed in addition to a UT-PE test, if the weld bevel angles are $\leq 10^\circ$. For welds with wall thicknesses ≥ 100 mm, this test shall always be performed regardless of bevel angle. This test can be performed by applying one of the following test methods: - TOFD test according to ISO 10863 (see also HW0850199-Part 2, Subclauses 11.4 and 11.5); - Tandem test according to EN 583-4; - LLT method according to EN 583-4, if this can be validated with using test objects with circular reference reflectors perpendicular to the test surface, such that a sensitivity calibration and evaluation of indications can be performed according to ISO 11666; If none of the mentioned UT methods can be applied for wall thicknesses $60 \text{ mm} \leq t < 100 \text{ mm}$, the following substitute tests may be used: - for bevel angles $5^\circ < \alpha \leq 10^\circ$, additional radiographic testing with two beam directions parallel to the weld bevels; - for bevel angles $\leq 5^\circ$, additional perpendicular radiographic testing of the weld. In both cases, depending on accessibility, both weld surfaces shall be as free of notches as possible and to ground flush.																																							
Table 9 – Selection matrix of UT methods <table border="1"> <thead> <tr> <th>Evaluation group</th> <th>Thickness mm</th> <th>Bevel angle</th> <th>PE</th> <th>TOFD ^a</th> <th>Testing for defects vertical to the surface ^a</th> </tr> </thead> <tbody> <tr> <td>B</td> <td>< 60</td> <td>Any bevel angle</td> <td>X</td> <td>–</td> <td>–</td> </tr> <tr> <td>B</td> <td>$\geq 60 < 100$</td> <td>$> 10^\circ$</td> <td>X</td> <td>–</td> <td>–</td> </tr> <tr> <td>B</td> <td>$\geq 60 < 100$</td> <td>$\leq 10^\circ$</td> <td>X ^a</td> <td>(X)</td> <td>(X)</td> </tr> <tr> <td>B</td> <td>≥ 100</td> <td>irrespective</td> <td>X ^a</td> <td>(X)</td> <td>(X)</td> </tr> <tr> <td>C/D</td> <td>irrespective</td> <td>irrespective</td> <td>X</td> <td>–</td> <td>–</td> </tr> </tbody> </table> X Test method shall be used. (X) One of the test methods can be chosen as an alternative. ^a The required test lengths beside the weld depend on TOFD-testing, if it is selected as second test method.					Evaluation group	Thickness mm	Bevel angle	PE	TOFD ^a	Testing for defects vertical to the surface ^a	B	< 60	Any bevel angle	X	–	–	B	$\geq 60 < 100$	$> 10^\circ$	X	–	–	B	$\geq 60 < 100$	$\leq 10^\circ$	X ^a	(X)	(X)	B	≥ 100	irrespective	X ^a	(X)	(X)	C/D	irrespective	irrespective	X	–	–
Evaluation group	Thickness mm	Bevel angle	PE	TOFD ^a	Testing for defects vertical to the surface ^a																																			
B	< 60	Any bevel angle	X	–	–																																			
B	$\geq 60 < 100$	$> 10^\circ$	X	–	–																																			
B	$\geq 60 < 100$	$\leq 10^\circ$	X ^a	(X)	(X)																																			
B	≥ 100	irrespective	X ^a	(X)	(X)																																			
C/D	irrespective	irrespective	X	–	–																																			
(4) If possible, testing of the base material should be performed prior to welding of weld joints, where testing grade is 1 (extent of testing 100%)																																								
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SUPERSEDES INVENTORY मासिक सूची संख्या को अतिरिक्त अर्थ है	11.2.2. ISO 17640, Subclause 6.3.4 'Adaptation of probes to curved scanning surfaces' Subclause 6.3.4 of ISO 17640 is herewith replaced by the following requirement: The gap between the test surface and the base of the probe shoe is not allowed to be more than 0.5 mm. For cylindrical and spherical surfaces, this requirement is typically met when the following equation is satisfied: $D \geq \frac{a^2}{2} \text{ mm} \quad (4)$ Where: D diameter of the test object in mm a length of the probe shoe in the direction of curvature in mm If this requirement cannot be met, the probe shoe will fit to the curvature of the surface and a corresponding sensitivity and range adjustment has to be performed. 11.2.3. ISO 17640, Clause 11 'Testing levels' It is hereby specified that testing level 'B' for wall thicknesses > 100 mm, are automatically raised to testing level 'C' for quality level 'B'. Testing level 'A' is also automatically raised to testing level 'B' for wall thicknesses > 40 mm. The acceptance levels according to ISO 11666 are not affected by this. 11.3. ISO 11666 (UT-PT acceptance levels) Exclusions and additional requirements 11.3.1. ISO 11666, Clause 3 'Measurement of indication length' When measuring the length of indications, the sound bundle diameter may be accounted for or a probe with a smaller sound bundle diameter may be used in order to achieve a more accurate result. 11.3.2. ISO 11666, Clause 4 'Sensitivity setting and levels' Text correction for definition of recording threshold in ISO 11666, Clause 4, bullet point 3: "Recording threshold (for two acceptance levels, recording threshold is equal to acceptance level – 4dB);" 11.3.3. ISO 11666, Subclause 5.2 'Longitudinal indications' Addendum: In addition to the requirements of the ISO 11666 that indications of a certain length above the monitoring threshold are subject to additional testing, this is expanded here to also apply for indications which lie above the monitoring threshold and for which it is determined that depth > sound bundle diameter at the location of the indication. Probes with more narrow sound bundles can be used to achieve a more accurate result in measuring length as well as depth, preferably probes with larger crystals or dual-element angle beam probes.				
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	स्वतंत्रताधिकार एवं गोपनीय इस दस्तावेज में की गई प्रतिलिपि बनाए बिना इसकी प्रतिलिपि की प्रतिलिपि है इसका प्रयोग बिना अनुमति के अन्य किसी भी तरह से किया जाना न कि इसकी प्रतिलिपि के बिना से प्रतिलिपि के बिना				
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If probes with higher frequencies are used, the increasing effect of the directional pattern shall be accounted for.

The width of the sound bundle and the half amplitude depth of indications for angle beam probes can be calculated from the following formulae (5) and (6):

$$D_{\text{Bündel}-6\text{dB}} = \frac{(\lambda s)}{D_{\text{Schwinger}}} \quad (5)$$

Dabei ist/ where

$D_{\text{Bündel}-6\text{dB}}$ Schallbündeldurchmesser zum 6 dB Abfall [mm]/Sound bundle diameter at 6 dB attenuation [mm]
 $D_{\text{Schwinger}}$ Schwingerdurchmesser [mm]/Crystal diameter [mm]
 λ Wellenlänge [mm]/Wave length [mm]
 s Schallweg [mm]/Sound path [mm]

$$HWT = \cos \alpha \Delta s \quad (6)$$

Dabei ist/where

HWT Halbwertstiefenausdehnung [mm]/Half amplitude depth [mm]
 α Einschallwinkel [°]/Beam angle [°]
 Δs Schallwegdifferenz zum 6 dB Abfall/Sound path difference at 6 dB attenuation

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स्वाधिकार एवं गोपनीय

यह प्रयोग के बिना मूल प्रमाण प्रदान करने के बिना प्रमाणित नहीं किया जा सकता है। इसका प्रयोग के बिना मूल प्रमाण प्रदान करने के बिना प्रमाणित नहीं किया जा सकता है।

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INVENTORY NO.

REV.
NO.

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WORKED BY

SUSHANT
KR. THAKUR

13.09.2018

जांचकर्ता
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13.09.2018

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सुपरसेड्स INVENTORY	11.3.4. ISO 11666, Subclause 5.5 'Cumulative length of acceptable indications' Correction: The maximum total length of allowable isolated indications above the recording level shall not exceed 20% of this length for acceptance level 2 and 30% of this length for quality level 3 for any weld section with a length of 6 t. 11.4. ISO 10863 (TOFD-method) Exclusions and additional requirements 11.4.1. ISO 10863, Clause 5 'Testing levels' Linear indications (cracks and fusion defects) which are already unallowable at slight lengths can occur on weld surfaces for all testing levels. Because it is not certain whether such small defects can be detected by TOFD testing, the following has been defined: TOFD test is always done in combination with a surface crack test (either PT or MT, see Clauses 8 and 9 of HW0850199-2) on the surface of scanning ("lateral wave surface"). Where possible, this also applies for the surface on the rear wall. If it is not possible to crack test this surface (inner surface) due to inaccessibility, a (possible additional) TOFD scan shall fulfill the following requirements by the improvement of the defect discernability of the rear wall: - An interception of the sound beams shall be set in a depth which matches the wall thickness. Here, the rear handed "dead zone" shall be minimized by application of a preferably large PCS and a high frequency (beam angle ≥ 50 frequency > 5 MHz). 11.4.2. ISO 10863, Subclause 6.3 'Written test instruction or procedure' The requirements of the ISO 10863 are hereby extended to also include testing level 'B' with a written test procedure. A written test procedure shall therefore be prepared for all TOFD testing which can be done according to HW0850199. The written test procedure shall cover all points addressed in ISO 10863, Clause 6 "Information required prior to testing". In addition, the information required for the test report (ISO 10863, Clause 13) shall be set forth in the test procedure in advance. 11.4.3. ISO 10863, Subclause 7.1 'Personnel qualifications' The TOFD test is only allowed to be performed by qualified personnel who meet level 2 in UT. In addition, a special TOFD qualification is also to be required by the testing personnel. 11.4.4. ISO 10863, Subclause 7.2.2 'Ultrasonic probes' The ISO 10863 references concerning the adaptation of the test probe to the conditions of ISO 17640. These conditions are newly regulated in Subclause 11.2 of HW0850199-Part 2 also apply for TOFD testing. 11.4.5. ISO 10863, Subclause 8.1 'Volume to be inspected' In general, when the TOFD testing is used as volume testing in the context of HW0850199, the volume of the weld plus 10 mm of the adjacent base material within the testing lot is tested 100 %. In addition to the surface crack testing to be performed on the same weld section (PT or MT), testing shall document and ensure the required weld quality. If other requirements apply for the purpose or for the testing volume, these shall appear in the testing procedure.				
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स्वतंत्रता, एवं गोपनीयता इस दस्तावेज़ में दी गई जानकारी भारत भारती लिमिटेड की संपत्ति है। इसका प्रयोग एवं प्रसारण के बिना भारत भारती लिमिटेड की अनुमति के बिना नहीं किया जा सकता है।					
दिनांक एवं संख्या SIGN & DATE	REV. NO. 05				
सामग्री सूची संख्या INVENTORY NO. R-2227	REV. NO. 05		निर्माणकर्ता WORKED BY	SUSHANT KR. THAKUR	13.09.2018
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सुपरसेड्स INVENTORY	11.4.6. ISO 10863, Subclause 8.2 'Setup of probes' In addition to the requirement of ISO 10863, that the configuration of the probe in testing levels 'C' and 'D' shall be checked with a calibration block, it is hereby established that this also applies for testing level 'B'. 11.4.7. ISO 10863, Subclause 10.2 'Checking of the settings', Table 3 – 'Sensitivity and range corrections' The check of the test area refers to the accuracy with which the depth of a known reflector is indicated either in the calibration block or in the test object. This can be either the back wall of the calibration block or of the test object as well as reflectors of known depth (holes, slots) in the calibration block. A reflector is selected which comes closest to the maximum depth of the respective test setup. The requirements of Table 3 of ISO 10863, described with "deviations ≤ 0.5 mm (or >0.5 mm) or 2 % of the depth range, depending on whichever is greater" is hereby corrected to <u>depending on which value is less</u>. 11.4.8. ISO 10863, Subclause 10.3.4 'Reference reflectors' The requirements of ISO 10863 for the number and size of reference reflectors cannot always be implemented. This applies in particular to thin-walled test objects < 20 mm thickness. All specifications given in ISO 10863, Subclause 10.3 "Calibration blocks" apply as recommendations which should be implemented if possible but which may also be extended or varied as expedient. 11.4.9. ISO 10863, Clause 11 'Weld testing' The instruction in ISO 10863 on this matter that the evaluation of the first test of TOFD indications can necessitate additional testing is clarified and expanded on here. Under certain circumstances in a non-parallel scan, the occurrence of multiple point indications at varying depths can be misinterpreted as a defect with depth. Especially welds in cast steel parts manifesting casting defects in the weld ends often exhibit such patterns. Additional tests shall be done in case of doubt. These could be parallel scans or PE or RT testing, which permit the realization that there are no defects with length/depth dimensions and that the TOFD indications are due to harmless defects (point defects). Note: According to HW0850199-Part 2 a PE-testing is always done in addition to the TOFD test, for testing on welds with wall thicknesses ≥ 60 mm and bevel angles $\leq 10^\circ$ in quality level "B", as well as wall thicknesses of ≥ 100 mm. This test can be used to verify the result of the TOFD test. This applies in particular to the verification that there are no unallowable transverse defects, as a test for transverse defects in accordance with the standard is in most cases part of the PE-testing for such welds (see Note to ISO 17640, Clause 5). 11.4.10. ISO 10863:2011, Subclause 12.5.1 'Location' Correction: The position of a point inhomogeneity is described with sufficient accuracy by its x and z coordinates. The position of inhomogeneities with length/depth dimensions shall have their endpoints described by x and z coordinates. 11.5. EN 15617 (TOFD-estimation) Exclusions and additional requirements 11.5.1. EN 15617 references the specification ISO 10863 11.5.2. EN 15617, Subclause 3.1 'Symbols' Correction: The annotations for symbols 'h, l and t' reference Figures 1, 2 and 3. This should be corrected to: Figures 4, 5 and 6.				
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Annex A (informative) Examples of test reports

Examples of test reports of the following testings:

- PT (Figure A.1)
- MT (Figure A.2)
- RT (Figure A.3)
- UT (Figure A.4 and Figure A.5)
- TOFD (Figure A.6 and Figure A.7)

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इस दस्तावेज में दी गई सूचना भारत हेवी इलेक्ट्रिकल लिमिटेड की सम्पत्ति है। इसका प्रयोग एवं प्रसारण अन्य से किसी भी तरह उपयोग, जो कि कंपनी के हित में हानिकारक हो न किता जाय।

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 KR. THAKUR

13.09.2018

 जांचकर्ता
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पृष्ठ का
Page 26 of 58Gas- und Dampfturbinenanlage
Gas- and Steam Turbine PlantFarbeindringprüfung
Schweißverbindungen
Dye Penetrant Inspection
of welds

Bericht/Report

FS26/12/

Anlage/End.

Seite/Page 1 von/of

Kennwort, T.-IG.-Nr.:

Job Name, T.-IG.-No.:

Komponente, Kenn-Nr.:

Component, Id.-No.:

Zeichnungs-Nr.:

Drawing no.:

Prüfspezifikation:

Test specification:

Oberflächenzustand:

Surface conditions:

Prüfobjekt:

Test object:

☐ unbehandelt

unfinished

☐ beschliffen

ground

☐ gesäubert

cleaned

☐ mech. bearbeitet

machined

Gruppen-Nr.:

Group no.:

Prüftemperatur:

Test temperature:

☐ gestrahlt

blasted

Prüfumfang:

Test scope:

Positionsnummer:

Item:

Schweißtechnische Daten/ Welding data

Schweißvorschrift:

Welding procedure:

Schweißverfahren gem. DIN EN ISO 4063:

Welding process acc. to EN ISO 4063:

Wärmebehandlung:

Heat treatment:

☐ ohne / without

vor / before

☐ nach / after

Schweißnahtform:

Weld type:

Werkstoff A:

Material A:

Teil-Nr. Pos. A:

Part No. Item A:

Werkstoff B:

Material B:

Teil-Nr. Pos. B:

Part No. Item B:

Abmessungen A:

Dimension A:

Schweißnaht-Nr.:

Weld No.:

Abmessungen B:

Dimension B:

Schweißer-Nr.:

Welder No.:

Prüftechnische Daten / Inspection data

PT – Prüfung gem. ISO 3452-1 / DIN EN ISO 23277

Dye penetrant test acc. to ISO 3452-1 / EN ISO 23277

Empfindlichkeitsklasse:

Sensitivity level:

Bewertungsgruppe DIN EN ISO 5817:

Quality level to EN ISO 5817:

Eindringmittel/Hersteller:

Penetration/Manufacturer:

Bezeichnung:

Designation:

Chargen-Nr.:

Batch No.:

Eindringmittel-Typ:

Penetrant type:

☐ I☐ II☐ III

Eindringdauer:

Penetration time:

min

Zwischenreiniger/Herst.:

Cleaner / Manufact.:

Bezeichnung:

Designation:

Chargen-Nr.:

Batch No.:

Zwischenreiniger-Verf.:

Cleaning Method:

☐ A☐ B☐ C☐ D☐ E

Entwickler/Hersteller:

Developer / Manufacturer:

Bezeichnung:

Designation:

Chargen-Nr.:

Batch No.:

Entwickler-Art:

Developer type:

☐ a☐ b☐ c☐ d☐ e

Entwicklungsdauer:

Developer time:

min

Beurteilung nach:

Estimation after:

☐ sofort

at once

☐ 5 min☐ 10 min☐ 15 min☐ 30 min☐ 60 min☐

Beleuchtungsstärke:

Illuminance:

Lux

Messgerät für Beleuchtungsstärke:

Test device for Illuminance:

Bestrahlungsstärke *)

Irradiance *)

W/m²

Messgerät für Bestrahlungsstärke *)

Test device for Irradiance *)

Kontrolle der Systemleistung unter Verwendung des Kontrollkörpers 2 gemäß EN ISO 3452-3, erkennbare Anzeigen

Control of system performance using reference test block type 2 in acc. to EN ISO 3452-3, visible indications

Kontrollkörpers 2 gemäß EN ISO 3452-3, Serien-Nr.:

Reference test block type 2 in acc. to EN ISO 3452-3, serial no.:

*) bei fluoreszierender Prüfung I für fluorescent testing

Bemerkung:

Remark:

Prüfergebnis:

Test result

☐ keine registrierpflichtigen Anzeigen

No recordable indications

☐ registrierpflichtige Anzeigen

Recordable indications

☐ unzulässige Anzeigen

Unacceptable indications

☐ erfüllt

Completed

☐ nicht erfüllt

Not completed

Ort, Datum:

Place, Date:

Abteilung, Prüfer:

Department, Insp.:

Unterschrift:

Signature:

Freigabe:

Release:

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Schweißnaht PT.doc

Figure A.1 – Test report of a penetrant testing

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PLANT STANDARD (HEEP : HARIDWAR)

Gas- und Dampfturbinenanlage
Gas- and Steam Turbine PlantDurchstrahlungsprüfung
Schweißverbindungen
Radiographic Inspection
of weldsBericht/Report
FS26/13/
Anlage/End.
Seite/Page 1 von/of 2Kennwort, T.-IG.-Nr.:
Job Name, T.-IG.-No.:Komponente, Kenn-Nr.:
Component, Id.-No.:Zeichnungs-Nr.:
Drawing no.:Prüfspezifikation:
Test specification:Oberflächenzustand:
Surface conditions:Prüfobjekt:
Test object:
☐ unbehandelt
unfinished

☐ gesäubert
cleaned

☐ gestrahlt
blasted

☐ beschliffen
ground

☐ mech. bearbeitet
machined
Gruppen-Nr.:
Group no.:Prüftemperatur:
Test temperature:Prüfumfang:
Test scope:Positionsnummer:
Item:

Schweißtechnische Daten / Welding data

Schweißvorschrift: Welding procedure:	☐ ohne / without ☐ vor / before ☐ nach / after	Schweißverfahren gem. DIN EN ISO 4063: Welding process acc. to EN ISO 4063
Wärmebehandlung: Heat treatment:		Schweißnahtform: Weld type:
Werkstoff A: Material A:		Teil-Nr. Pos. A: Part No. Item A:
Werkstoff B: Material B:		Teil-Nr. Pos. B: Part No. Item B:
Abmessungen A: Dimension A:		Schweißnaht-Nr.: Weld No.:
Abmessungen B: Dimension B:		Schweißer-Nr.: Welder No.:

Prüftechnische Daten / Inspection data

Prüfklasse gem. ISO 17636-1: Test class acc. to ISO 17636-1:	☐ A ☐ B	Bewertungsgruppe ISO 5817: Quality level to ISO 5817:	☐ B ☐ C ☐ D
Zulässigkeitsgrenze gem. ISO 10675-1: Acceptance level acc. to ISO 10675-1:	☐ 1 ☐ 2 ☐ 3	Aufnahmeanordnung nach ISO 17636-1: Test arrangement acc. to ISO 17636-1:	
Strahlenquelle: Source of radiation:		Brennfleck: Focal spot:	d: (mm)
Abstand Oberfläche - Film: Distance surface - film:	b: (mm)	Abstand Strahlenquelle - Oberfläche: Distance source - surface:	f: (mm)
Filmsorte: Film type:		Filmsystemklasse: Film system class:	☐ C3 ☐ C4 ☐ C5
Folienart: Screen type:	☐ Pb ☐ Fe ☐	Folienstärke: Screen thickness:	(mm)
Röhreneinstellung: Tube voltage/current:	(KV) (mA)	Aktivität: Activity:	
Belichtungszeit: Exposure time:		Ausnahmeregel gem. ISO 5817: Exceptions as per ISO 17636-1:	
Bildgüteprüfkörper: Image Quality Indicator (IQI)		Lage: Position:	☐ Filmmat Film side ☐ Filmfern Away from film

Bemerkung:
Remark:Handhabung: Vertraulich
Handling Instructions: ConfidentialOrt, Datum:
Place, Date:Abteilung, Prüfer:
Department, Insp.:Unterschrift:
Signature:Freigabe:
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Report_SN_RT_PV0026_2_Aug2013.doc

Figure A.3 – Test report of a radiographic testing

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13.09.2018

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INVENTORY NO.
A-2227निर्माणकर्ता
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स्वायत्तिका एवं गोपनीय

इस प्रयोग से की गई प्रतियां भारत देश की परमाणु सुरक्षा विधियों के अंतर्गत हैं, जिनमें इसका उपयोग केवल हीन और शांतिपूर्ण उद्देश्यों के लिए ही किया जा सकता है।
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PLANT STANDARD (HEEP : HARIDWAR)

Bericht/Report
FS26/12/xxxx
Anlage/End.
Seite/Page von/of

Component Id-No :

Prüfergebnis / Test data

Befund gemäß DIN EN ISO 11666
Result acc. to EN ISO 11666

Anzeigenposition ®
indication position

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इस प्रश्न में वी. गंदू सूचना भारत है। एलेक्ट्रिकल विनिर्देश की संपत्ति है इसका प्रयोग पूर्व अप्रत्यक्ष रूप से किसी की तरह प्रयोग को कि कम्पनी के हित में हानिकारक हो न किया जाय ।

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Remark:

Ort, Datum:
Place, Date:

Abteilung, Prüfer:
Department, Insp.

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Schweißnaht UT - Seite 2.doc

Figure A.5 – Page 2 of a test report of an ultrasonic testing

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**SUSHANT
KR. THAKUR**

13.09.2018

जांचकर्ता
CHECKED BY

BL MEENA

13.09.2018

निम्न एवं प्रमाणित SIGN & DATE		संस्थान मानक (हीप : हरिद्वार) PLANT STANDARD (HEEP : HARIDWAR)	HW0850199 पृष्ठ का Page 31 of 58																																																																																													
SUPERSEDES INVENTORY	Gas- und Dampfturbinenanlage Gas and Steam Turbine Plant TOFD-Ultraschallprüfung Schweißverbindungen TOFD-Ultrasonic inspection of welds Bericht/Report Anlage/End Seite/Page 1 von/of																																																																																															
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Figure A.6 – Page 1 of a test report of a TOFD-testing

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जांचकर्ता CHECKED BY	BL MEENA		13.09.2018



संस्थान मानक (हीप : हरिद्वार)

HW0850199

PLANT STANDARD (HEEP : HARIDWAR)

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Annex B

Material details referred in Clause 9.1 & Clause 11.2.1 – point 2 of HW0850199 Part 2

Group	Sub group	Type of steel	Equivalent BHEL Standard
1		Steels with a specified minimum yield strength $R_{eH} \leq 460 \text{ N/mm}^2$ and with analysis in per cent (%):	All specifications of AA101XX and HW101XX series All specification of AA104XX series
		$C \leq 0,25$	HW10298 HW19591
		$Si \leq 0,60$	HW10564 HW19592
		$Mn \leq 1,8$	HW10567 HW19595
		$Mo \leq 0,70^b$	HW10568 HW19473
			HW10569 HW19484
			HW10570 HW19381
		$S \leq 0,045$	AA19331
		$P \leq 0,045$	AA19337
			AA19341
		$Cu \leq 0,40^b$	AA19501
			AA19502
		$Ni \leq 0,5^b$	AA19510
			AA19511
		$Cr \leq 0,3$ (0,4 for castings) ^b	AA19513
			AA19516
		$Nb \leq 0,06$	AA19521
		$V \leq 0,1^b$	HW19379
			HW19380
		$Ti \leq 0,05$	HW19381
			HW19562
			HW19572
			HW19573
			HW19577
			HW19578
			HW19579
	1.1	Steels with a specified minimum yield strength $R_{eH} \leq 275 \text{ N/mm}^2$	
	1.2	Steels with a specified minimum yield strength $275 \text{ N/mm}^2 < R_{eH} \leq 360 \text{ N/mm}^2$	
	1.3	Normalized fine-grain steels with a specified minimum yield strength $R_{eH} > 360 \text{ N/mm}^2$	
	1.4	Steels with improved atmospheric corrosion resistance whose analysis may exceed the requirements for the single elements as indicated in group 1	
	a	In accordance with the specification of the steel product standards, R_{eH} may be replaced by $R_{p0,2}$ or $R_{t0,5}$.	d
	b	A higher value is accepted, provided $Cr + Mo + Ni + Cu + V \leq 0,75 \%$.	
	c	A higher value is accepted, provided $Cr + Mo + Ni + Cu + V \leq 1 \%$.	

सिगनेचर
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KR. THAKUR

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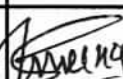
दिनांक एवं हस्ताक्षर SIGN & DATE		संस्थान मानक (हीप : हरिद्वार) PLANT STANDARD (HEEP : HARIDWAR)		HW0850199 पृष्ठ का Page 34 of 58	
सापेक्ष सूची संख्या को अधिकृतित करना है	SUPERSEDES INVENTORY	Non-destructive testing of welded joints – Hardness Testing (Part 2.4)			
COPYRIGHT AND CONFIDENTIAL The information on this documents is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company.	Content	1. Scope 2. Purpose of test 3. Abbreviations 4. Applicable methods 5. Allowable hardness values 6. Description 6.1. Personnel qualification 6.2. Test methods 6.3. Test object, preparation, requirements 6.4. Execution of hardness measurements 6.5. Documentation of hardness values 6.6. Converting measurements 7. Test Report			
		स्वतंत्र/विकास एवं गोपनीय इस प्रलेख में दी गई सूचना भारत हेवी एलेक्ट्रिकल्स लिमिटेड की संपत्ति है, इसका प्रयोग एवं प्रकाशन केवल उसी उद्देश्य के लिए ही किया जा सकता है जो कि संपत्ति के मूल में प्रविष्टि के लिए है। अन्यथा इसका प्रयोग कानूनन दंडनीय होगा।			
दिनांक एवं हस्ताक्षर SIGN & DATE	REV. NO. 05		निर्माणकर्ता WORKED BY SUSHANT KR. THAKUR		13.09.2018
सापेक्ष सूची संख्या INVENTORY NO. A-2227			जांचकर्ता CHECKED BY BL MEENA		13.09.2018

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		PLANT STANDARD (HEEP : HARIDWAR)		पृष्ठ का Page 35 of 58																					
SUPERSEDES INVENTORY	सामग्री की सूची अतिरिक्त करना है	1. Scope This test specification is applicable to inside plant, manufacturing at sub-contractor works and Service/Erection at site whenever mentioned in the relevant drawings. This also applies to purchase parts, when required by applicable purchase specifications. This test specification governs the procedure for performing portable hardness tests and applies to metals of BHEL specifications, subjected to post-weld heat treatment (PWHT). Dissimilar metal welds of these metals with materials (see Table 1) not listed here are also subject to this test specification. The scope of applicability is restricted to steel and cast steel. Other casting materials and nickel-based alloys are not included. Hardness testing is performed on the base material (BM), in the heat-affected zone (HAZ) and in the weld metal (WM). Where induction or resistance annealing has been performed on pipe circumferential welds of DN ≥ 500 mm, hardness must be measured at two locations spaced 180° apart. No hardness tests are performed on pipes and nozzles with outside diameters ≤ 76.1 mm or a wall thickness of ≤ 5 mm or on fillet welds and seal welds. Representative welds are to be specifically tested in each annealing lot. At least one weld is to be tested in every case. An annealing lot is understood to be individual welds or several welds subjected to common post-weld heat treatment under the same conditions. The specific test scope as well as the locations of the hardness tests shall be taken from the applicable material specification or part drawing. Note: Where hardness testing in line with this specification is required on components in service, this shall be performed in the base material both before welding as well as after the post-weld heat treatment.																							
		2. Purpose of test The purpose of portable hardness testing is to determine the hardness of the welded part (new fabrication or parts in service), especially at the critical area of the weld and the HAZ. The results of the hardness test provides information regarding correct execution of the scheduled working processes.																							
निम्न एवं प्रमाण SIGN & DATE	स्वत्वाधिकार एवं गोपनीय इस प्रमाण में की गई सूचना भारत की प्रौद्योगिकी विविधता की संपत्ति है, इसका प्रयोग केवल भारत सरकार के अधिकारियों द्वारा ही किया जा सकता है।	3. Abbreviations <table border="0"> <tr> <td>BM</td> <td>Base material</td> </tr> <tr> <td>HB</td> <td>Brinell hardness</td> </tr> <tr> <td>HV</td> <td>Vickers hardness</td> </tr> <tr> <td>WM</td> <td>Weld metal</td> </tr> <tr> <td>t</td> <td>Loading time, in h</td> </tr> <tr> <td>TIV</td> <td>Through-Indenter-Viewing (Vickers hardness test under load) based on ISO 6507</td> </tr> <tr> <td>TT</td> <td>transition temperature for characterizing thermally affected long-term material behavior, in $^\circ\text{C}$</td> </tr> <tr> <td>UCI</td> <td>Ultrasonic contact impedance method HAZ (Heat-affected zone)</td> </tr> <tr> <td>GTAW</td> <td>Gas Tungsten Arc Welding</td> </tr> <tr> <td>RBI</td> <td>Rebound type hardness method</td> </tr> </table>				BM	Base material	HB	Brinell hardness	HV	Vickers hardness	WM	Weld metal	t	Loading time, in h	TIV	Through-Indenter-Viewing (Vickers hardness test under load) based on ISO 6507	TT	transition temperature for characterizing thermally affected long-term material behavior, in $^\circ\text{C}$	UCI	Ultrasonic contact impedance method HAZ (Heat-affected zone)	GTAW	Gas Tungsten Arc Welding	RBI	Rebound type hardness method
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मासिक सूची संख्या INVENTORY NO.	SUPERSEDES INVENTORY	4. Applicable methods The HAZ can only be tested using hardness testing methods which reliably measure this area without leaving excessively large indentations. Portable hardness testers based on UCI principle or rebound principle may be used.		
COPYRIGHT AND CONFIDENTIAL The information on this documents is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company	स्वत्वाधिकार एवं गोपनीय इस दस्तावेज में दी गई सूचना भारत भारती भारतीभारत लिमिटेड की संपत्ति है इसका प्रयोग एवं प्रकाशन अन्य में किसी भी तरह उपयोग जो कि कंपनी के हित में हानिकारक हो न किया जाए।			
दिनांक एवं हस्ताक्षर SIGN & DATE	REV. NO.		निर्माणकर्ता WORKED BY	SUSHANT KR. THAKUR
मासिक सूची संख्या INVENTORY NO.	05		जांचकर्ता CHECKED BY	BL MEENA

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निम्न एवं हस्ताक्षर SIGN & DATE SUPERSEDES INVENTORY माधुरी श्री मंगल को अतिरिक्त बनाई		संस्थान मानक (हीप : हरिद्वार) PLANT STANDARD (HEEP : HARIDWAR)		HW0850199		
				पृष्ठ का Page 37 of 58		
5. Allowable hardness values The hardness limits for heat-treated welded joints are listed in the following tables.						
Table 1 – Vickers hardness values						
Material No.	Material	BHEL standard	TLV standard	HV10 max. ^a HAZ, WM	HV10 min. ^c BM- new fabrication	HV10 min. ^e BM – parts in service
Cast steel						
1.0619	GP240GH	HW19592	9059 01; 02	320	110	100
1.7357	G17CrMo5-5	HW19574, HW19691	9161 01; 02	320	135	110
1.7706	G17CrMoV5-10	HW19581	9182 01; 08	320	165	140
1.7379	G17CrMo9-10	HW19576, HW19685	9166 01	320	165	140
1.5419	G20Mo5	HW19595	9173 01; 02	320	120	100
1.6220	G20Mn5+QT	–	9073 01	320	135	115
1.4317	GX4CrNi13-4	HW19690	9254 04; 12	350	220	200
^b	GX12CrMoVWNBn10-1-1	HW19688	9257 01	350	195	170
1.4931	GX23CrMoV12-1	HW19565	9249 01	350	215	195
1.4107	GX8CrNi12	HW19564	9256 01	320	155	135
^b	GX12CrMoVNBn9-1	HW19683	9263 01	350	180	160
Small forgings / steel bar + sheet^d						
1.5415	16Mo3 ^f	HW19379	9170 09; 01 + 04; 20	320	120	100
1.7383	11CrMo9-10	HW19387	9163 01	320	140	120
1.7380	10CrMo9-10	HW10685, HW10675	9165 01 + 05; 12	320	130	120
1.7335	13CrMo4-5	HW19497	9160 04; 08 +	320	120	110
1.4313	X3CrNiMo13-4	–	9350 05; 02 + 01	350	225	205
1.4903	X10CrMoVNB9-1	HW19462	9242 01; 02	350	180	160
K90901	A336 (A182) Gr F91	HW19470	9244 02; (04); 01	350	165	145
1.4021	X20Cr13+QT700	AA19321	9238 06	350	200	180
1.4922	X20CrMoV11-1	–	9246 03;	350	200	180
1.4923	X22CrMoV12-1+QT1	HW19390	9248 02; 07	350	230	210
1.7709	21CrMoV5-7+QT	HW10673	9186 01; 02	320	200	180
1.6981	21CrMoNiV4-7+QT	HW19386	9187 01; 02	320	200	180
1.4906	X12CrMoVWNBn10-1-1	HW19469	9258 01	350	235	215
^b	X13CrMoCoVNBnB9-2-1	HW10684	9265 02	350	230	210
^a Maximum in heat-affected zone = 350 HV10. ^b Material and material No. not in accordance with current EN standard. ^c Higher values by 20 HV10 apply for laboratory hardness testing with stationary equipment. ^d The smallest dimension (highest strength) is taken as the basis. ^e t ≥ 100 000 h and T ≥ TT ^f Heat treatment only for dissimilar materials of Group 2 and higher (see 1. Scope).						
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स्वतंत्रता एवं गोपनीय इस दस्तावेज में दी गई सूचना भारत की स्वतंत्रता एवं गोपनीयता के लिए है। इसका प्रयोग एवं प्रसारण केवल केवल केवल के लिए ही किया जाना चाहिए। अन्य किसी भी उद्देश्य के लिए इसका उपयोग नहीं किया जाना चाहिए।						
निम्न एवं हस्ताक्षर SIGN & DATE 						
माधुरी श्री मंगल को INVENTORY NO. P-2227	REV. NO. 05	निर्माणकर्ता WORKED BY SUSHANT KR. THAKUR			13.09.2018	
		जांचकर्ता CHECKED BY BL MEENA			13.09.2018	



संस्थान मानक (हीप : हरिद्वार)

HW0850199

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Table 1(continued)

Material No.	Material	BHEL standard	TLV standard	HV10 max. ^a HAZ, WM	HV10 min. c BM- new fabrication	HV10 min. e BM - parts in service
Pipes						
1.5415	16Mo3 ^f	HW10567	9170 02; 16; 19; 20	320	120	100
1.7745	15CrMoV5-10	--	VdTUV 506	320	135	115
1.4922	X20CrMoV11-1	--	(9246 04; 05)	350	200	180
1.7380	10CrMo9-10	AA10630, AA10628	9165 02; 16	320	130	120
1.7335	13CrMo4-5	AA10627, AA10632	9160 01; 02	320	120	110
1.7715	14MoV6-3	9177 02	9177 02	320	125	115
1.6368	15NiCuMoNb5	VdTUV 377	VdTUV 377	320	170	140
1.6210	15MnNi6-3	VdTUV 427	VdTUV 427	320 ^a	135	120
1.6310	20MnMoNi5-5	VdTUV 401	VdTUV 401	320 ^a	155	135
1.4903	X10CrMoVNb9-1	AA10633, AA10634	9242 03	350	180	160
K91560	A335 Gr P91	AA10633, AA10634	9244 03	350	165	145
1.4901	X10CrWMoVNb9-2	--	ASTM A335 (P92)	350	175	155
^a Maximum in heat-affected zone = 350 HV10. ^b Material and material No. not in accordance with current EN standard. ^c Higher values by 20 HV10 apply for laboratory hardness testing with stationary equipment. ^d The smallest dimension (highest strength) is taken as the basis. ^e $t \geq 100\ 000\ h$ and $T \geq TT$ ^f Heat treatment only for dissimilar materials of Group 2 and higher (see 1. Scope).						

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स्वातंत्र्यार एवं गोपनीय

इस दस्तावेज में दी गई सूचना भारत भारती लिमिटेड की सम्पत्ति है, इसका प्रयोग एवं प्रकाशक रूप में किसी भी तरह प्रयोग, जो कि भारती के हित में प्रतिस्पर्धा हो न किया जाए।

 दिनांक एवं हस्ताक्षर
 SIGN & DATE

 सामग्री सूची संख्या
 INVENTORY NO.

REV. NO.

05

निर्माणकर्ता
WORKED BYSUSHANT
KR. THAKUR

13.09.2018

जांचकर्ता
CHECKED BY

BL MEENA

13.09.2018

निम्न एवं उपर SIGN & DATE		संस्थान मानक (हीप : हरिद्वार)				HW0850199	
		PLANT STANDARD (HEEP : HARIDWAR)				पृष्ठ का Page 39 of 58	
SUPERSEDES INVENTORY	Allowable hardness values for dissimilar and similar, heat-treated welded joints in shafts are given in Table 2:						
Table 2 – Vickers hardness values							
Material A (Material No.)		Material B (Material No.)		qual. test No.	HV10 max. HAZ A, WM	HAZ B, WM	HV10 min. WM BM A BM B
30CrMoNiV5-11 (1.6946)		26NiCrMoV14-5 (1.6957)		VP387	370	370	200 200 200
23CrMoNiWV8-8 (1.6945)		26NiCrMoV14-5 (1.6957)		VP424 VP385	370	370	200 200 200
26NiCrMoV14-5 (1.6957)		26NiCrMoV14-5 (1.6957)		VP476	370	370	200 200 200
23CrMoNiWV8-8 (1.6945)		X12CrMoWVNbN10-1-1 (1.4906)		VP405	370	370	200 200 220
Deviations from the hardness values indicated in Table 2 may be allowable if non-GTAW welding procedures are used for which corresponding procedure qualification tests are available and the function of the part in operation is not affected by this deviation.							
6. Description							
6.1. Personnel qualification							
Personnel from the quality departments are responsible for the performance of manual hardness testing in accordance with this Test Specification.							
If personnel from other disciplines perform manual hardness testing for quality certification, they shall be instructed in working with the equipment							
6.2. Test methods							
Equipment based on the following methods will be used:							
- Hardness testing with the UCI method; - Hardness testing by the TIV method; - The Leeb rebound method.							
निम्न एवं उपर SIGN & DATE	REV. NO. 05						
निम्न एवं उपर SIGN & DATE	निर्माणकर्ता WORKED BY		SUSHANT KR. THAKUR		13.09.2018		
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स्वत्वाधिकार एवं गोपनीय
 इस दस्तावेज में दी गई सूचना भारत हीवी एलेक्ट्रिकल लिमिटेड की सम्पत्ति है। इसका प्रयोग अन्य किसी भी उद्देश्य के लिए बिना कम्पनी के लिखित अनुमति के नहीं किया जा सकता।

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The following points regarding the test object, surface preparation and performance of the measurement shall be observed in order to obtain reliable measurement results:

- Portable hardness testing is possible on specimens of different geometry as long as the probe can be positioned vertical to the test surface and the test area is smooth.
- The test area must be prepared such that changes to the surface such as due to heating or cold deformation remain restricted to a minimum. Scale, foreign objects or other surface imperfections must be completely removed. In particular, the surface should be free from lubricants.

Surface roughness has a significant effect on repeat accuracy of the measurement, hence, surfaces must be prepared accordingly.

Tools such as flap disk sanders with 120, 240 and 320 or finer grits may be used. Work is started with 120 grit and is completed with the finest grit. Each grinding step is done perpendicular to the previous one. Each grinding step is not finished until all of the marks from the previous step have been ground away. The individual grinding steps shall be performed with light pressure on the machine.

There is no defined relationship between the grit of the grinding medium and the achievable surface roughness Ra. However, the following approximate relationship can be observed:

Table 3 – Approximate relationship between grit and surface roughness

Grit	Surface roughness Ra in μm
120	1,2
180	1,0
240	0,6

The maximum allowable surface roughness depends on the test method used as well as the test load. Detailed information on this is given in sources such as Table 3 in standard DIN 50159-1 (see table 4).

Table 4 – Maximum allowable surface roughness subject to test load

Test load in N	Maximum allowable surface roughness Ra in μm
98	1
50	0,8
10	0,5

SIGN & DATE

**SUPERSEDES
INVENTORY**

सामग्री गुंजी गण्ड्या को
अधिष्ठानित करता है

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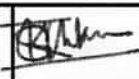
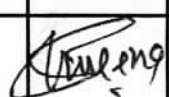
**SUSHANT
KR. THAKUR**

13 09 2018

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13.09.2018

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SUPERSEDES INVENTORY	- The wall thickness and mass of the test object can affect UCI hardness testing, with the result that a minimum wall thickness and mass in accordance with manufacturer's specifications or standards must be accounted for in the absence of additional measures such as coupling or supporting of the specimen. Specimens with masses less than the minimum mass specified in DIN 50159-1 or specimens with sufficient mass but with areas thinner than the indicated minimum thickness require a heavy support and/or coupling to a solid object. - This test should be performed at temperatures between 10 °C and 35 °C. The test supervisor shall be consulted if these temperatures are not met (ambient or part temperature). - It shall be ensured that the specimen does not shift during testing. A suitable clamping device shall be used to ensure this if necessary. It shall also noted that falsified results occur in the event of any decarburization of the surface after annealing in oxidizing atmospheres or due to hardening effects on blast-cleaned surfaces. It is therefore recommended that some surface material is removed by rough preliminary grinding of the measuring points, followed by corresponding fine polishing.				
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निष्कर्ष एवं प्रमाण SIGN & DATE	INVENTORY NO. R2727	REV. NO. 05		निर्माणकर्ता WORKED BY	SUSHANT KR. THAKUR  13.09.2018
				जांचकर्ता CHECKED BY	BL MEENA  13.09.2018

दिनांक एवं हस्ताक्षर SIGN & DATE		संस्थान मानक (हीप : हरिद्वार) PLANT STANDARD (HEEP : HARIDWAR)	HW0850199 पृष्ठ का Page 42 of 58
SUPERSEDES INVENTORY	सामग्री सूची संख्या को अधिकृतित करना है	6.4. Execution of hardness measurements The test equipment shall be handled in accordance with the manufacturer's procedures. This test shall be performed normal to the test surface. The arithmetic mean of at least three measurements per measuring point shall be determined to determine hardness. The distance of the center of each test indentation from the edge of the specimen shall be at least 5 mm. The distance between the centers of two adjacent test indentations shall be at least 1 mm for materials such as steel. The hardness measurement in the base material should be performed at least 30 mm from the HAZ. Macroetching is required when testing welds (such as with a 10% solution of HNO₃ for low-alloyed steels or Adler's reagent for low and high-alloyed steels). If macroetching cannot be performed, a hardness curve shall be determined in which hardness is measured in all areas of the weld (BM, HAZ, WM) by having an adequate number of hardness readings between the base material and the weld material.	
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स्वत्वधिकार एवं गोपनीय इस दस्तावेज में दी गई सूचना भारत हेवी इलेक्ट्रिकल्स लिमिटेड की संपत्ति है। इसका प्रयोग एवं प्रसारण अन्य से किसी भी तरह करण जो कि कंपनी के हित में हानिकारक हो न किया जाए।			
सामग्री सूची संख्या INVENTORY NO. P-2227	REV. NO. 05	निर्माणकर्ता WORKED BY SUSHANT KR. THAKUR	जांचकर्ता CHECKED BY BL MEENA
		13.09.2018	13.09.2018



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6.5. Documentation of hardness values

The hardness to be recorded shall be calculated as the average of at least three individual measurements. The results will be documented in the test report

6.6. Converting measurements

Working with different hardness test methods often requires that the hardness measured by one method be converted to that for a different method or to strength (tensile strength in N/mm²).

However, there are no mathematical relationships between the individual scales. Empirical values have therefore been determined based on a large number of comparison measurements, conversion tables prepared and the values standardized in the corresponding ISO 18265 standard (formerly DIN 50150).

The requirements in accordance with ISO 18265 are always to be observed for occasionally necessary further conversion from one hardness scale to another or to strength (tensile strength in N/mm²).

7. Test Report

An example of a test report is given in Annex A. report formats other than the same may be used, provided that, they contain the required information.

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KR. THAKUR

13.09.2018

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SUPERSEDES INVENTORY	Annex A (informative)					
मापदंड पूर्ण संख्या को अतिरिक्त करना है	PV 0026.0-00000-2.4: 2012					
Prüfung von Schweißverbindungen – Härteprüfung Testing of weld joints – Hardness testing		Bericht/Report Anlage/Encl Seite/Page 1 von/of				
Kennwort, T.-/G.-Nr.: Job Name, T.-/G.-No.:		Komponente, Kenn-Nr.: Component, Id.-No.:				
Zeichnungs-Nr.: Drawing no.:		Prüfspezifikation: Test specification:				
Oberflächenzustand: Surface conditions:		Prüfobjekt: Test object:				
☐ unbehandelt unfinished		☐ beschliffen ground				
☐ gesäubert cleaned		☐ mech. bearbeitet machined				
☐ gestrahlt blasted		Gruppen-Nr.: Group no.:				
		Prüftemperatur: Test temperature:				
		Prüfumfang: Test scope:				
Positionsnummer: Item:						
Schweißtechnische Daten/ Welding data						
Schweißvorschrift: Welding procedure:		Schweißverfahren gem. DIN EN ISO 4063: Welding process acc. to EN ISO 4063:				
Wärmebehandlung: Heat treatment:		Schweißnahtform: Weld type:				
☐ ohne / without ☐ vor / before ☐ nach / after						
Werkstoff A: Material A:		Teil-Nr. Pos. A: Part No. Item A:				
Werkstoff B: Material B:		Teil-Nr. Pos. B: Part No. Item B:				
Abmessungen A: Dimension A:		Schweißnaht-Nr.: Weld No.:				
Abmessungen B: Dimension B:		Schweißer-Nr.: Welder No.:				
Prüftechnische Daten/ Inspection data						
Härteprüfgerät: Hardness test equipment:		Serien-Nr.: Serial No.:				
Härteprüfung nach: Hardness test acc.:		Sonden Typ: Detector type:				
☐ DIN 50158 (Leeb) ☐ DIN 50150 (UCI) ☐ TIV		Härteskala: Hardness scale:				
Referenzmat. / Kalibrierzahl: Reference mat. / Cal-Number:		Sonden Nr.: Detector No.:				
Härtevergleichsplatte Nr.: Hardness reference block No.:		☐ HV ☐ HB ☐ HL				
		geschliffen mit Körnung: Grinded with grain size:				
		Sollwert: Nominal value:				
Indirekte Kontrolle des Prüfgerätes (Härtevergleichsplatte) / Indirect verification of the test equipment						
Sollwert Nominal Value	Messwert 1 Reading 1	Messwert 2 Reading 2	Messwert 3 Reading 3	Mittelwert Average	Abweichung (%) Deviation (%)	Ergebnis Result
Example of a Hardness Test Report						
मापदंड पूर्ण संख्या INVENTORY NO.	REV. NO.	निर्माणकर्ता WORKED BY		SUSHANT KR. THAKUR	13.09.2018	
P-2227	05	जांचकर्ता CHECKED BY		BL MEENA	13.09.2018	



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PV 0026.0-00000-2.4: 2012

Prüfung von Schweißverbindungen –
Härteprüfung

Bericht/Report
Anlage/Encl.

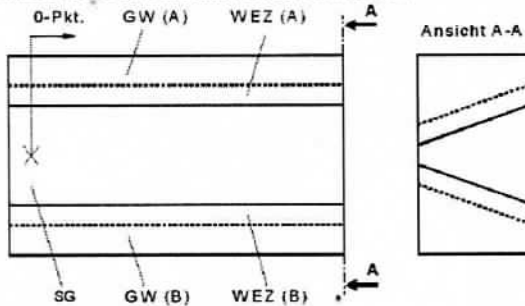
Testing of weld joints – Hardness testing

Seite/Page 2 von/of

Kennwort, T.-/G.-Nr.:
Job Name, T.-/G.-No.:

Komponente, Kenn-Nr.:
Component, Id.-No.:

Skizze der Schweißnaht / Sketch of the weld



Schweißnaht: SG / welded seam; WS
Grundwerkstoff: GW / base material; BM
Wärmeeinflußzone WEZ / heat affected zone: HAZ

Test results

Meßpunkt / test point		Härte-Messwerte					Mittelw.	Standardabw.	Standardmessunsicherh.		Bewertung	
Umfang [%] / Circumf. [%]		Hardness Readings					Average	Standard dev.	Standard meas. uncert.		classification	
									absolut	%	erfüllt / completed	nicht erfüllt / not completed
	GW (A)	235	230	260	200	185	222	29,7	15,1	6,8		
	WEZ (A)											
	SG											
	WEZ (B)											
	GW (B)											
	GW (A)											
	WEZ (A)											
	SG											
	WEZ (B)											
	GW (B)											
	GW (A)											
	WEZ (A)											
	SG											
	WEZ (B)											
	GW (B)											
	GW (A)											
	WEZ (A)											
	SG											
	WEZ (B)											
	GW (B)											

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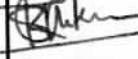
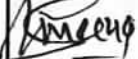
स्वत्वधिकार एवं गोपनीय

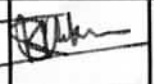
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निर्माणकर्ता
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INVENTORY NO.

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निम्न एवं हस्ताक्षर SIGN & DATE		संस्थान मानक (हीप : हरिद्वार) PLANT STANDARD (HEEP : HARIDWAR)		HW0850199 पृष्ठ का Page 46 of 58	
SUPERSEDES INVENTORY मापरी नुमाई नमूना को अधिस्थिति करता है	Non-destructive testing of welded joints – Part Specific Information on Heat Exchangers (Part 10) Content 1. Scope 2. Part Specific Information				
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स्वाधिकार एवं गोपनीय इस दस्तावेज में की गई सूचना भारत हेवी एलेक्ट्रिकल्स लिमिटेड की सम्पत्ति है, इसका प्रयोग या प्रकाशना के बिना भारत हेवी एलेक्ट्रिकल्स लिमिटेड की लिखित अनुमति के बिना न किया जाए।					
निम्न एवं हस्ताक्षर SIGN & DATE	REV. NO. 05		निर्माणकर्ता WORKED BY SUSHANT KR. THAKUR		13.09.2018
मापरी नुमाई INVENTORY NO. R 2227			जांचकर्ता CHECKED BY BL MEENA		13.09.2018

चिह्नक एवं दिनांक SIGN & DATE			संस्थान मानक (हीप : हरिद्वार) PLANT STANDARD (HEEP : HARIDWAR)		HW0850199 पृष्ठ का Page 47 of 58	
सामग्री सूची संख्या को अतिरिक्त करता है	SUPERSEDES INVENTORY	1. Scope This test specification shall apply to design groups of Heat Exchangers. It contains part specific information data. 2. Part Specific Information The following table contains the data to the scopes of testing and quality grades, examination methods and requirements. Part specific information for pipelines are laid down in HW0850199 Part 11.				
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सामग्री सूची संख्या INVENTORY NO.	P-2227	REV. NO. 05		निर्माणकर्ता WORKED BY	SUSHANT KR. THAKUR	 13.09.2018
				जांचकर्ता CHECKED BY	BL MEENA	 13.09.2018

दिनांक एवं हस्ताक्षर SIGN & DATE		संस्थान मानक (हीप : हरिद्वार) PLANT STANDARD (HEEP : HARIDWAR)						HW0850199		
								पृष्ठ का Page 48 of 58		
SUPERSEDES INVENTORY	NDT Of Weld Joints: Plant Standard No. HW0850199									
	Table: Examination scope of Heat Exchangers									
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	1		Condenser			len %	len %			
	1.1	4	Butt welded joints (except those covered at S.No. 1.3 & 1.5	CS	RT OR UT & SCE	10%	10%	10%	All intersection are to be covered & 10% of the rest of weld joints (each weld joint length)	
	1.2	4	Main Tube plate welded to water chamber weld joints	CS	UT & SCE	10%	10%	10%	10% SCE of root run & 10% UT of K-joint And 10 % SCE of Final run of weld joint	
	1.3	1	Water Box & water chamber main flange weld joint	BS	RT OR UT & SCE	100%	100%	100%		
	1.4	1	Plate/pipe to flange weld joint of water box/ water chamber/ which would be subsequently machined	CS	SCE		---	100%	100% SCE after final machining.	
	1.5	4	Other weld joints (including butt weld joints of Air Extraction Piping)	CS/BK	SCE		--	10%		
	2		Ejectors, LP Heaters, Gland Steam Cooler, Gland Cooler, Gland steam condenser , Turbine oil Cooler, Seal Oil cooler, Stator/ primary water cooler, Hydrogen cooler, Air Cooler, Drain cooler, Air cooler, drain cooler, Flash boxes, Stand pipes & panels, except for items at Sl.No.3	CS	---		--	---		
	2.1	4	Butt welded joints (except those covered at Sl. No.2.2)	CS/BK	RT OR UT & SCE	10%	10%	10%	All intersection are to be covered & 10% of the rest of weld joints (each weld joint length)	
	2.2	4	Other welded joints (including butt joints of inner casing of Oil and Water coolers)	BS/BK	SCE		--	10%		
	3	1	Welded joints of lifting lugs including pads/eyes/lifting boxes on condenser & heat exchangers assemblies at Sl. No. 1&2	BS/BK	SCE		---	100%	100% SCE of root run & final run.	
	Notes: 1. Unless otherwise specified in the drawing above requirements hold good for condenser & heat exchangers 2 Exam Grade 1: 100%; Exam Grade 2: 50%, Exam Grade 3: 25%, Exam Grade 4: 10%. The examination grades were named as category of service requirements (CSR) in older drawings. 3. In the case of CS/BK, BS/BK quality restrictive stipulations will be according to HW 0620099 4. Radiographic examination; UT: Ultrasonic examination; SCE: Surface Crack Examination									
	दिनांक एवं हस्ताक्षर SIGN & DATE	REV. NO. 05	SUPERSEDES		निर्माणकर्ता WORKED BY	SUSHANT KR. THAKUR	15.12.2018			
			जांचकर्ता CHECKED BY	BL MEENA	15.12.2018					

दिनांक एवं हस्ताक्षर SIGN & DATE		संस्थान मानक (हीप : हरिद्वार) PLANT STANDARD (HEEP : HARIDWAR)		HW0850199 पृष्ठ का Page 49 of 58	
SUPERSEDES INVENTORY	Non-destructive testing of welded joints – Component-specific data for piping (Part 11) Content 1. Scope 2. Structure and layout 3. ISO 17635 3.1. General 3.2. Quality Levels 3.3. Minimum extents of testing 4. Tests 5. Extents of testing				
सामग्री सूची संख्या को अधिकतम बनाएं है	COPYRIGHT AND CONFIDENTIAL The information on this documents is the property of Bharat Heavy Electrical, Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company				
स्वत्वाधिकार एवं गोपनीय इस प्रवेश में की गई मुद्रा भारत हेवी एलेक्ट्रिकल्स लिमिटेड की संपत्ति है। इसका प्रयोग बिना अनुमति के अन्य से किसी भी तरह प्रयोग जो कि कंपनी के हित में हो सकेगा उसे न किया जाए।					
दिनांक एवं हस्ताक्षर SIGN & DATE					
सामग्री सूची संख्या INVENTORY NO.	REV. NO. 05		निर्माणकर्ता WORKED BY	SUSHANT KR. THAKUR	 13.09.2018
सामग्री सूची संख्या INVENTORY NO.			जांचकर्ता CHECKED BY	BL MEENA	 13.09.2018

दिनांक एवं हस्ताक्षर SIGN & DATE		संस्थान मानक (हीप : हरिद्वार) PLANT STANDARD (HEEP : HARIDWAR)		HW0850199 पृष्ठ का Page 50 of 58	
SUPERSEDES INVENTORY	1. Scope This test specification is applicable to inside plant and manufacturing at sub-contractor works and Service/Erection at site whenever mentioned in the relevant drawings. It applies to newly manufactured components or repaired jobs. This also applies to purchase parts, when required by applicable purchase specifications. It sets forth the minimum extent of testing for the non- destructive testing of welds in piping. The extent of testing for semi-finished products is set forth in the Technical Purchasing Specifications and is not governed by this test specification. It is not applicable to control devices, pumps, valves, tanks and vessels, bearing housings, coolers, filters, strainers, oil flow restrictors, I&C cabinets. Though, it is applicable to welds connecting these parts to the piping.				
COPYRIGHT AND CONFIDENTIAL The information on this document is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company.	2. Structure and layout 2.1. General The minimum extents of testing for the non-destructive testing methods to be employed are defined in the tables 2 to 4. These are divided into an informative part "a" for the design engineer for selection of the serial number (serial no.) and a binding part "b" for the extents of testing. The informative parts are classified according to piping features such as type of weld, part, mechanical load, category, nominal thickness and joint coefficient. Assignment of an extent of testing to a part is performed in the drawing through stipulation of a serial number (line number) from part "b" of the applicable table and is binding. Minimum extents of testing: - Table 2: flammable and fire-resistant media; - Table 3: steam and condensate; - Table 4: water and air.				
स्वतंत्रतापूर्वक एवं गोपनीय इस दस्तावेज में दी गई सूचना भारत भारती उपकरणों के निर्यात के लिए है। इस दस्तावेज में दी गई सूचना को किसी भी प्रकार के निर्यात के लिए उपयोग नहीं किया जाना चाहिए।	Materials are not quoted directly in Table 3, but are compiled into the material groups G1 to G3 (see Table 1). This considerably simplifies stipulation of the extents of testing in tabular form. In addition to the material number, Table 1 informs about the different BHEL material grades. The same also gives corresponding old & new material grade designation as per CEN ISO/TR 15608 for information. In Table 3, different extents of testing are required for circumferential welds depending on the material. The applicable material is to be found in the material group of Table 1. Note: In case, any assembly is governed by pressure vessel requirements, the same shall be clearly mentioned in the drawing. Applicable NDT specifications (techniques and accepted norms) shall be written in the drawing. Hereby, the drawing specifications shall be read as follows: - Testing according to HW0850199, Part 11 SI No -				
दिनांक एवं हस्ताक्षर SIGN & DATE	13/09/2018				
सामग्री सूची संख्या INVENTORY NO.	REV. NO. 05		निर्माणकर्ता WORKED BY	SUSHANT KR. THAKUR	13.09.2018
			जांचकर्ता CHECKED BY	BL MEENA	13.09.2018

निम्न एवं प्रमाणित SIGN & DATE		संस्थान मानक (हीप : हरिद्वार) PLANT STANDARD (HEEP : HARIDWAR)		HW0850199 पृष्ठ का Page 51 of 58		
सामग्री सूची संख्या INVENTORY NO.	SUPERSEDES INVENTORY	2.2. Quality levels Notes for design and analysis engineers regarding the selection of quality levels according to HW0620099: - For piping containing flammable and fire-resistant media, as well as containing steam and condensate (Tables 2 and 3), quality level - B – according to HW0620099 shall apply for an operating pressure > 2,5 bar. For operating pressures ≤ 2,5 bar and piping containing water and air, quality level 'C' can be adopted. - For pressure-test flanges/pressure-test cover plates, quality level 'B' shall apply with a visual testing according to HW0850199 Part 2. Where visual testing indicates imperfections, a surface crack testing is required. - For safe ends (transition pieces) the quality level and extent of testing shall be the same as for the dedicated part.				
COPYRIGHT AND CONFIDENTIAL The information on this documents is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company.		Seams for water and air with only low loading: Table 4 determines quality level 'C' for seams for water and air with only low loading.				
स्वतंत्रता एवं गोपनीय इस दस्तावेज में दी गई सूचना भारत हेवी इलेक्ट्रिकल्स लिमिटेड की संपत्ति है, इसका प्रयोग एवं प्रसारण केवल उसी उद्देश्य के लिए ही किया जा सकता है जो कि दस्तावेज के तैयार होने के उद्देश्य के अनुरूप है।						
निम्न एवं प्रमाणित SIGN & DATE	15/9					
सामग्री सूची संख्या INVENTORY NO.	27227	REV. NO. 05		निर्माणकर्ता WORKED BY	SUSHANT KR. THAKUR	13.09.2018
				जांचकर्ता CHECKED BY	BL MEENA	13.09.2018

दिनांक एवं हस्ताक्षर SIGN & DATE		संस्थान मानक (हीप : हरिद्वार) PLANT STANDARD (HEEP : HARIDWAR)		HW0850199 पृष्ठ का Page 52 of 58	
SUPERSEDES INVENTORY	2.3. Minimum extents of testing The Non-destructive testing methods to be used and its minimum extent of testing are also stipulated in the drawing through the selection of a serial number. <i>Serial no. 4</i> Where different extents of testing are given in a single drawing the information regarding the serial number can be given in tabular form. If a discrepancy exists between the serial number stated and the corresponding description of the part, the serial number in the drawing (stipulation of the minimum extent of testing in the drawing) is binding.				
COPYRIGHT AND CONFIDENTIAL The information on this documents is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company	3. Tests The test performance is described in HW0850199 Part-2 and the hardness testing in HW0850199 Part-2.4. HW0850199 Part-2 also defines the testing categories and the acceptance standards for the individual test methods. A volumetric testing UT/RT (ultrasonic testing or radiographic testing) and a surface crack testing PT/MT (magnetic particle or penetrant method) are generally required. The selection of the test method for the volumetric testing and the surface crack testing has to be performed according to HW0850199 Part-1. The testing category and acceptance standard for the individual test method as per ISO 17635 are automatically selected through stipulation of the quality level (please also refer to Part 1, Table 1). Some materials are required to be subjected to a hardness test (HT) according to HW0850199 Part-2.4. The materials affected and the extents of the hardness testing are defined in Table 2 to 4, too. Other materials have to be assigned to the stated steel and steel groups according to its chemical composition.				
स्वत्वधिकार एवं गोपनीय इस दस्तावेज में की गई सूचना भारत भारती लिमिटेड का संपत्ति है। इसका प्रयोग एवं प्रकाशन अन्य से किसी भी तरह करना, जो कि कंपनी के हित में हानिकारक हो न किया जाए।	4. Extents of testing The extents of testing given in Table 2 to 4 represent minimum requirements. In the event of unacceptable indications, the extent of testing shall be increased according to the procedure described in HW0850199 Part-1. The requirement regarding the test batch (random testing) is described in HW0850199 Part-1.				
दिनांक एवं हस्ताक्षर SIGN & DATE	REV. NO. 05 निर्माणकर्ता WORKED BY SUSHANT KR. THAKUR जांचकर्ता CHECKED BY BI. MEENA				
सामग्री सूची संख्या INVENTORY NO. R-2227	13.09.2018 13.09.2018				



संस्थान मानक (हीप : हरिद्वार)

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Table 1 – Material groups for piping materials

Mat. no. EN 10027-2: 1992	BHEL Material Specification	New material designation EN 10027-1:2005	Old material designation	Material groups			
				CEN ISO/TR 15608:2013	G1	G2	G3
1.0427		C22G1	C22.3	1.1	X	-	-
1.0460		C22G2, P250GH	C22.8	1.1	X	-	-
1.0619	HW19592	GP240GH	GS-C25	1.1	X	-	-
1.0352		P245GH	-	1.1	X	-	-
1.0345		P235GH-TC1, P235GH-TC2	-	1.1	X	-	-
1.7706	HW19581	G17CrMoV5-10	GS-17CrMoV511	6.2	-	-	X
1.7357	HW19574, HW19691	G17CrMo5-5	GS-17CrMo55	5.1	-	-	X
1.7379	HW19576, HW19685	G17CrMo9-10	GS-18CrMo910	5.2	-	-	X
1.5419	HW19595	G20Mo5	GS-22Mo4	3.1	-	X	-
1.0446		GE240	GS-45.3	1.1	X	-	-
1.4931	HW19565	GX23CrMoV12-1	G-X22CrMoV121	6.4	-	-	X
a	HW19688	GX12CrMoVWVnBn10-1-1	-	-	-	-	X
1.0425	AA10401	P265GH	H11	1.1	X	-	-
1.0038		S235JR	RS137-2	1.1	X	-	-
1.0308		E235	St35	1.1 ^b	X	-	-
1.0308		St35GZF	-	1.1	X	-	-
1.0309		St35.4	-	(1.1)	X	-	-
1.0305		P235G1TH	St35.8	1.1	X	-	-
1.0254		P235TR1	St37.0	1.1	X	-	-
1.0255		P235TR2	St37.4	1.1	X	-	-
1.0405		P255G1TH	St45.8	(1.1)	X	-	-
1.0570	AA10122/HW10181	S355J2+N	St52-3	1.2	X	-	-
1.4313	HW19699	X3CrNiMo13-4	X4CrNi13-4	7.2 ^b	-	-	X
1.4961	HW10781/HW10782	X8CrNiNb16-13	X8CrNiNb1613	8.1	-	-	X
1.4539		X1NiCrMoCu25-20-5	-	8.2	-	-	X
1.4550		X6CrNiNb18-10	X10CrNiNb189	8.1	-	-	X
1.6905		GX5CrNiNb18-10	-	(8.1)	-	-	X
1.4903	HW19462	X10CrMoVnB9-1	-	6.4	-	-	X
1.4571	AA10730	X6CrNiMoTi17-12-2	X10CrNiMoTi1810	8.1	-	-	X
1.4541	AA10725/AA10740	X6CrNiTi18-10	X10CrNiTi189	8.1	-	-	X
1.4922		X20CrMoV12-1	X20CrMoV121	6.4	-	-	X
1.4923	HW19390	X22CrMoV12-1	X22CrMoV121	7.2 ^b	-	-	X
1.7380	HW10685, HW10675	10CrMo9-10	10CrMo910	5.2	-	X	-
1.7335	HW19497	13CrMo4-5	13CrMo44	5.1	-	X	-
1.7715		14MoV6-3	14MoV63	6.1	-	-	X
1.5415	HW10567	16Mo3	15Mo3	1.1/1.2	X	-	-
1.6368		15NiCuMoNb5-6-4	15NiCuMoNb5	4.2	-	-	X
1.7337		16CrMo4-4	-	(5.1)	-	X	-
1.7709	HW10673	21CrMoV5-7	21CrMoV57	(6.2)	-	-	X

NOTE There is no explicit assignment for the data in parentheses ().

^a Material and material number not as per EN 10027-2:1992, it is a Siemens material.^b Assignment according to CEN ISO/TR 20172:2009

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NO.

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WORKED BY

SUSHANT
KR. THAKUR

13.09.2018

CHECKED BY

BL MEENA

13.09.2018



संस्थान मानक (हीप : हरिद्वार)

HW0850199

PLANT STANDARD (HEEP : HARIDWAR)

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(Informative part for design engineer for selection of serial number)

Serial no.	Testin g grade ^a	Type of weld or part	Operating pressure in bar (gauge)	Load transmission	Nominal diameter	Quality level ISO 5817:2003	Serial no.
1	St.	Circular welds and longitudinal welds	$p \leq 2,5$	-	-	C	1
2	3		$2,5 < p \leq 16$	-	$DN \leq 20$	B	2
3	4			-	$DN > 20$	B	3
4	1		$150 \quad p > 16$	-	$DN \leq 20$	B	4
5	1		$p > 150$	-		B	5
			$p > 16$	-	$DN > 20$	B	
6	St.	Nipples and nozzles	$p \leq 2,5$	-	-	C	6
7	4		$2,5 < p \leq 16$	-	-	B	7
8	1		$p > 16$	-	-	B	8
9	St.	Weld-on parts (fillet and double-bevel groove welds)	$p \leq 2,5$	without	-	C	9
10	4			with	-	C	10
11	St.		$2,5 < p \leq 16$	without	-	B	11
12	2			with	-	B	12
13	4		$p > 16$	without	-	B	13
14	1			with	-	B	14
60	1	Combustion chamber branch lines fillet welds	-	-	-	B	60
61	1	Combustion chamber branch lines circ. welds	-	-	-	B	61

^a 1 = 100%; 2 = 50%, 3 = 25%, 4 = 10%, 5 = 5%, St. = Stichprobe < 5%.^a 1 = 100%; 2 = 50%, 3 = 25%, 4 = 10%, 5 = 5%, St. = random test < 5%.

स्वाधिकार एवं गोपनीय

इस दस्तावेज़ में दी गई सूचना भारत की पूर्णस्वतंत्रता विधि के तहत है, जहाँ इसका प्रयोग केवल भारत के अंदर ही किया जा सकता है। इस दस्तावेज़ को किसी भी तरह से प्रसारित करने से कानून के अंतर्गत दंडित किया जा सकता है।

 निर्माणक
SIGN & DATE
13/9

 सामग्री की संख्या
INVENTORY NO.
P-2227

REV. NO.

05

निर्माणकर्ता
WORKED BYSUSHANT
KR. THAKUR

13.09.2018

जांचकर्ता
CHECKED BY

BL MEENA

13.09.2018

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Table 2b – Piping for flammable and fire-resistant media
(binding part for minimum extents of testing)

Serial no.	Minimum extents of testing				lfd. Nr. Serial no.
	RT in % ^a	UT in % ^a	MT/PT in % ^{a, g}	HT ^a	
1	St. ^e		St.	-	1
2	-	-	25	-	2
3	10	-	10	^b	3
4	-	-	100	-	4
5	100	-	100	^c	5
6	-	^d	St.	-	6
7	-	^d	10	^b	7
8	-	^d	100	^c	8
9	-	^d	St.	-	9
10	-	^d	10	-	10
11	-	^d	St.	^b	11
12	-	^d	50	^b	12
13	-	^d	10	^c	13
14	-	^d	100	^c	14
60	-	-	100 ^f	-	60
61	100	-	100 ^f	-	61

NOTE Data in percentages (to footnotes ^{b,c}) refer to the number of the welds to be tested according to HW0850199 Part 2.4 following heat treatment.

^a PT, MT, RT and UT acc. to HW0850199 Part-2, HT acc. to HW0850199 Part-2.4.

^b 10% HT for 13CrMo4-5 and 10CrMo9-10.

^c 25% HT for 13CrMo4-5; 50% HT for 10CrMo9-10.

d For nipples, nozzles and weld-on parts with wall thicknesses < 15 mm, in addition to the surface crack testing, an UT is to be performed with the same extent of testing.

^e Alternatively RT or UT.

^f Additional visual examination of the root using borescope.

⁹ Selection of PT or MT according to HW0850199 Part-1.

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SIGN & DATE

**SUPERSEDES
INVENTORY**

सामग्री सूर्य संख्या को
अधिगमित बनाता है।

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स्वत्वाधिकार एवं गोपनीय

इस प्रलेख में दी गई सूचना भारत देवी एन्विकुलम लिमिटेड की संपत्ति है इसका प्रयोग एवं प्रकाशक रूप से किसी भी तरह प्रयोग को किसी के हित में इसकाकारक हो न किया जाय।

DESIGN & DATE

माधरी मूची संख्या
INVENTORY NO

REV.
NO.

05

निर्माणकर्ता
WORKED BY

SUSHANT
KR. THAKUR

जांचकर्ता
CHECKED BY

BL MEENA

13.09.2018

13.09.2018

संस्थान मानक (हीप : हरिद्वार)

HW0850199

PLANT STANDARD (HEEP : HARIDWAR)

पृष्ठ का
Page 56 of 58Table 3a – Piping for steam and condensate –
(Informative part for Design Engineer for Selection of Serial number)

Serial No.	Exam. grade ^a	Type of weld or part	Operating pressure in bar (gauge)	Load transmission	Nominal diameter	Material ^b wall thickness	Quality level ISO 5817:2003	Serial No.
15	St.	Long. welds	$p \leq 2,5$	welds not fully-loaded			C	15
16	4			fully-loaded welds or in piping with creep analysis			B	16
17	1		$p > 2,5$	-	-	-	B	17
18	St.	Circ. welds	$p \leq 2,5$	-	-	-	C	18
19	5		$2,5 < p \leq 16$	-	DN ≤ 120	G1	B	19
20	4/5					G2	B	20
21	4				DN > 120	G1	B	21
22	1/3					G2	B	22
23	3		$p > 16$	-	DN ≤ 120	G1	B	23
24	2					G2	B	24
25	1					G3	B	25
26	2/4				DN > 120	G1	B	26
27	1					G2 + G3	B	27
28a	St.	Nipples and nozzles	$p \leq 2,5$	-	-	-	C	28a
28	1		$p > 2,5$	-	DN ≤ 120	-	B	28
29	1				DN > 120	$t \leq 15$	B	29
30	1					$t > 15$	B	30
31a	St.	Weld-on parts (Fillet and double-bevel groove welds)	$p \leq 2,5$	-	-	-	C	31a
31	3		$p > 2,5$	without	-	-	B	31
32	1			with	DN ≤ 120	-	B	32
33	1				DN > 120	$t \leq 15$	B	33
34	1					$t > 15$	B	34

^a 1 = 100%; 2 = 50%, 3 = 25%, 4 = 10%, 5 = 5%, St. = random test < 5%.^b Material groups for piping see Table 1.सिग्नल एवं डेटा
SIGN & DATESUPERSEDES
INVENTORYसमय की सीमा को
अवधि का समय हैCOPYRIGHT AND CONFIDENTIAL
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इस दस्तावेज में दी गई सूचना भारत भारी उपकरण लिमिटेड की संपत्ति है, इसका प्रयोग इस दस्तावेज के बिना की जा नहीं सकता। जो कि कंपनी के हित में अधिकारक हो न बिना।सिग्नल एवं डेटा
SIGN & DATEसमय की सीमा
INVENTORY NO.REV.
NO.

05

निर्माणकर्ता
WORKED BYSUSHANT
KR. THAKUR

13.09.2018

जांचकर्ता
CHECKED BY

BL MEENA

13.09.2018

संस्थान मानक (हीप : हरिद्वार)

HW0850199

PLANT STANDARD (HEEP : HARIDWAR)

पृष्ठ का
Page 57 of 58

Table 3b – Piping for steam and condensate – (binding part for minimum extents of testing)

Serial no.	Minimum extents of testing			Serial no.
	RT / UT in % ^a	PT / MT in % ^a	HT ^a	
15	St ^g	St ^g	-	15
16	10 ^g	10 ^g	-	16
17	100	-	-	17
18	St ^g	St ^g	-	18
19	5	-	-	19
20	10	5	d, e	20
21	10	-	-	21
22	25	100	d, e, f	22
23	25	-	-	23
24	50	60	d, e	24
25	100	100	f	25
26	50	10	-	26
27	100	100	f	27
28a	-	St	-	28a
28	-	100	-	28
29	-	100	-	29
30	100 ^b	100	-	30
31a	-	St	-	31a
31	-	25 ^c	-	31
32	-	100	-	32
33	-	100	-	33
34	100 ^b	100	-	34

NOTE Data in percentages (to footnotes ^{d, e, f}) refer to the number of the welds to be tested according to HW0850199 Part 2.4 following heat treatment.

^a PT, MT, RT and UT acc. to HW0850199 Part-2, HT acc. to HW0850199 Part -2.4.

^b Examine using ultrasound, insofar as geometry allows.

^c Weld-on parts which are hard to access, particularly those welded onto alloyed components, should be given priority.

^d 20% HT for 13CrMo4-5, 16CrMo44 and $t \geq 15$ mm.

^e 30% HT for 10CrMo9-10 and $t \geq 15$ mm.

^f 100% HT for $t \geq 5$ mm, except for austenitic materials.

^g Alternatively RT/UT and PT/MT.

For all extents of testing < 100%, where circumferential welds are joined to longitudinal welds the weld line shall all be subjected to PT/MT.

हस्ताक्षर एवं तारीख
SIGN & DATE



सुपरसेड्स
INVENTORY

सामग्री सूची संख्या को
अभिज्ञित करना है

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स्वायत्तधिकार एवं गोपनीय

इस दस्तावेज में दी गई सूचना भारत भारती लिमिटेड की संपत्ति है। इसका प्रयोग अन्य किसी भी उद्देश्य के लिए बिना भारत भारती लिमिटेड की अनुमति के नहीं किया जा सकता।

हस्ताक्षर एवं तारीख
SIGN & DATE

सामग्री सूची संख्या
INVENTORY NO.

REV.
NO.

05

निर्माणकर्ता
WORKED BY

SUSHANT
KR. THAKUR

13.09.2018

जांचकर्ता
CHECKED BY

BL MEENA

13.09.2018

निम्न एवं प्रमाणित SIGN & DATE		संस्थान मानक (हीप : हरिद्वार) PLANT STANDARD (HEEP : HARIDWAR)		HW0850199																																																																		
				पृष्ठ का Page 58 of 58																																																																		
SUPERSEDES INVENTORY		Table 4 – Piping for water and air with only low loading																																																																				
मासुकी मुरी संख्या को अभिलेखित करना है		<table border="1"> <thead> <tr> <th colspan="3">a) <u>Informative part</u> for design engineer for selection of serial number</th> <th colspan="3">b) <u>Binding part</u> for minimum extents of testing</th> </tr> <tr> <th rowspan="2">Serial no.</th> <th rowspan="2">Exam. grade ^a</th> <th rowspan="2">Quality level ISO 5817:2003</th> <th colspan="3">Minimum extents of testing</th> <th rowspan="2">Serial no.</th> </tr> <tr> <th>RT / UT ^b in %</th> <th>PT / MT ^b in %</th> <th>HT ^b</th> </tr> </thead> <tbody> <tr> <td>50</td> <td>1</td> <td>C</td> <td>100</td> <td>100</td> <td>-</td> <td>50</td> </tr> <tr> <td>51</td> <td>1</td> <td>C</td> <td>-</td> <td>100</td> <td>-</td> <td>51</td> </tr> <tr> <td>52</td> <td>2</td> <td>C</td> <td>-</td> <td>50</td> <td>-</td> <td>52</td> </tr> <tr> <td>53</td> <td>3</td> <td>C</td> <td>-</td> <td>25</td> <td>-</td> <td>53</td> </tr> <tr> <td>54</td> <td>4</td> <td>C</td> <td>-</td> <td>10</td> <td>-</td> <td>54</td> </tr> <tr> <td>55</td> <td>5</td> <td>C</td> <td>-</td> <td>5</td> <td>-</td> <td>55</td> </tr> <tr> <td>56</td> <td>St.</td> <td>C</td> <td>-</td> <td>St.</td> <td>-</td> <td>56</td> </tr> </tbody> </table>				a) <u>Informative part</u> for design engineer for selection of serial number			b) <u>Binding part</u> for minimum extents of testing			Serial no.	Exam. grade ^a	Quality level ISO 5817:2003	Minimum extents of testing			Serial no.	RT / UT ^b in %	PT / MT ^b in %	HT ^b	50	1	C	100	100	-	50	51	1	C	-	100	-	51	52	2	C	-	50	-	52	53	3	C	-	25	-	53	54	4	C	-	10	-	54	55	5	C	-	5	-	55	56	St.	C	-	St.	-	56
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PPX-BOI DEPARTMENT
BHARAT HEAVY ELECTRICALS LIMITED
HEEP: HARDWAR-249 403 (Uttarakhand)
FAX: +91 1334 226084/226462
TEL: +91 1334 28 1660/1753
PRE-QUALIFICATION REQUIREMENT

Enquiry No.:
B/4133/2015/3117V/2

Annexure-A

Sl. No.	Pre-Qualification Requirements (Annexure-A)								Vendor's Response
1.	TG integral piping is used for connection of various equipment to Generator and its auxiliaries.								
2.	The material of construction of pipe & fittings (CS & SS) and dimensions shall be as per ASME B36.19/B16.9 or equivalent. Water header (fabricated), Neck. Hangers & Supports shall be in line with IS-2062.								
3.	Vendor should have experience of supply pipe and fitting in thermal power-plant/process industries.								
4.	Vendors to confirm that all the items specified at Sl. No.1 shall be quoted and offer with part supply shall be not be considered.								
5.	Requirement of testing facilities: - a) Vendor should have capability for Pickling & passivation (Only for CS items). Dye penetrant Testing and Hydraulic testing in-house. b) Ultrasonic testing. Radiography testing (NABL accredited Laboratory). Chemical analysis facility shall be either in house or outsourced. c) Particulars for testing facilities (at point a and b) along with details to be furnished. Photographs of pickling & passivation facility (tanks) will be provided. d) Vendor to submit third party approved WPS/PQR for welding requirement								
6.	The vendor should be a regular of such items mentioned at clause 1.0. Vendor should have executed Purchase order (having date of delivery not earlier than 8 year at the time of bid submission) for CS & SS items. Total supply of each PO should be min. 5 tons and 1.5 tons for CS items & SS items respectively. In support of above. vendor shall furnish details in following format along with their credential lists for the past 8 years.								
	Sl no	Application	Name & address of customer	Contract details of customer (email and phone number)	Purchase order Reference no.	Purchase order issue date	Total weight of quantity of piping item (K.G.)	Brief technical details of Material of Construction	Details of test carried out
		Thermal power-plant/process industries Only							
7.	In support of year of supply. Vendor shall furnish copy of Purchase Order along with Bill of Material executed in past along with test certificates (for one of the submitted POs.)								
8.	Vendor to furnish the acceptance certificates from customer for complete supplies of at least 01 No. of PO.								
9.	BHEL reserves the right to verify information submitted by vendor. In case the information is found to be false/ incorrect. The offer shall be rejected.								
10.	Vendors to confirm specific compliance of the above mentioned points else offers will not be considered.								

(Sign & Stamp of Bidder)

MANUFACTURER'S NAME AND ADDRESS				STANDARD QUALITY PLAN				TO BE FILLED BY BHEL		TO BE FILLED BY BHEL		
BHEL		VENDOR'S NAME		ITEM	GENERATOR INTERNAL PIPING & HYDROGEN COOLER PIPING		QIP NO.	QA/B/1QP/021				
				DRG. NO.	AS PER PO		REV.	02				
				SPEC.-	TG60682							
				REV.-	02							
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE CRITERIA	FORMAT OF RECORDS	AGENCY		REMARKS	
1	2	3	4	5	6	7	8	9	M	B	N	11

Page 1 of 7

1.0	MATERIAL	Co-relation & verification of Mill TCs for	Major	Verify	100%	Standard as per BOM	Standard as per BOM	Mill TCs	✓	P	V	-	
1.1	Seamless C.S. pipes as per A106 Gr. B & SS	a) Chem. Composition	Major	Chem. Analysis	1/Heat	-DO-	-DO-	-DO-		P	V	-	
	Seamless pipe	b) Mech. Properties	Major	Mech. Test	1/Lot	-DO-	-DO-	-DO-		P	V	-	
		c) Flattening or bending test (as applicable as per ASTM)	Major	Mech. Test	1/Lot	-DO-	-DO-	-DO-		P	V	-	
		d) Hydraulic test	Major	Pressure Test	100%	-DO-	-DO-	-DO-		P	V	-	
		e) Heat Treatment (As applicable)	Major	Time/Temp	100%	-DO-	-DO-	-DO-		P	V	-	
		f) Surface finish	Major	Visual	100%	-DO-	-DO-	-DO-		P	V	-	
		g) Dimensions (OD, ID & wall Thickness)	Major	Measurement	10%	-DO-	-DO-	-DO-		P	V	-	
		h) NDT (UT/ECT)	Major	UT/ECT	100%	SA 106	-DO-	-DO-		P	V	-	
1.2	Pipe fitting	Co-relation & verification of MTCs For	Major	Verify	100%	Standard as per BOM	Standard as per BOM	MILL TCs	✓	P	V	-	
		a) Chem. Composition	Major	Chem. Analysis	1/Heat	-DO-	-DO-	TCs		P	V	-	
		b) Mech. Properties	Major	Mech. Test	1/Heat batch	-DO-	-DO-	-DO-		P	V	-	

MANUFACTURER/SUBCONTRACTOR		LEGEND:		FOR CUSTOMER USE	
NTRACTOR		RECORDS IDENTIFIED WITH 'TICK' SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION.		APPROVED BY Santeev Kumar Bhardwaj Senior Engineer Bharat Assurance	
		M: MANUFACTURER / SUBCONTRACTOR B: BHEL / NOM. INSPECTION AGENCY N: CUSTOMER			
		INDICATE 'P' PERFORM 'W' WITNESS AND 'V' VERIFICATION			
		ALL 'W' INDICATED IN COLUMN 'N' SHALL BE 'CHP' OF CUSTOMER			

490

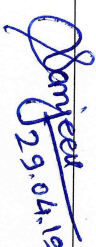
MANUFACTURER'S NAME AND ADDRESS			STANDARD QUALITY PLAN				TO BE FILLED BY BHEL		TO BE FILLED BY BHEL				
BHEL	VENDOR'S NAME	ITEM	GENERATOR INTEGRAL PIPING & HYDROGEN COOLER PIPING			QP NO.	QA/BI/QP/021						
		DRG. NO.	AS PER PO			REV.	02						
		SPEC.-	TG60682										
		REV.-	02			Page 2 of 7							
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE CRITERIA	FORMAT OF RECORDS	AGENCY		REMARKS		
1	2	3	4	5	6	7	8	9	D	M	B	N	11

		c)Dimensions , Finish	Major	Measurment	100%	ANSI B16.9	ANSI B16.9	-DO-	P	V	-	
		d)Wall thickness of bend by UT Gauge	Major	-DO-	100%	ASTM A234	ASTM A234	TC	P	V	-	
		e)Heat Treatment (as applicable)	Major	Time / Temp	10%	Standard as per BOM	Standard as per BOM	-DO-	P	V	-	
		g)Hardness of fitting	Major	Measurment	10% (random)	Standard as per BOM	Standard as per BOM	TC	P	V	-	
		h)Surface defects	Major	DPT/MPI	100%	ASME SEC-V art-6	ASME Sec-VIII-div-1 APPENDIX-8	-DO-	P	V	-	
1.3	FLANGES	Co-relation & verification of Mill TCS For	Major	verify	100%	Standard as per BOM	Standard as per BOM	TC	V	P	V	-
		a) Chemical Composition	Major	Chem. test	1/Heat	-DO-	-DO-	-DO-	P	V	-	
		b)mechanical properties	Major	Mech. Test	1/HT Batch	-DO-	-DO-	-DO-	P	V	-	
		c)Heat Treatment	Major		100%	-DO-	-DO-	-DO-	P	V	-	
		d)Dimension	Major	Time/Temperature	10%	As per Drawing in BOM	As per Drawing in BOM	TCs	P	V	-	
		e)surface defects	Major	DPT	10%	E165/A275	ASME Sec-VIII Div-1 Appendix 8	TC/IR				

MANUFACTURER/SUBCONTRACTOR		LEGEND:		FOR CUSTOMER USE	
		! RECORDS IDENTIFIED WITH 'TICK' SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION. M: MANUFACTURER / SUBCONTRACTOR B: BHEL / NOM. INSPECTION AGENCY N: CUSTOMER INDICATE 'P' PERFORM 'W' WITNESS AND 'V' VERIFICATION ALL 'W' INDICATED IN COLUMN 'N' SHALL BE 'CIP' OF CUSTOMER		APPROVED BY  29.04.19	

MANUFACTURER'S NAME AND ADDRESS				STANDARD QUALITY PLAN					TO BE FILLED BY BHEL			TO BE FILLED BY BHEL			
BHEL	VENDOR'S NAME	ITEM	GENERATOR INTEGRAL PIPING & HYDROGEN COOLER PIPING			QP NO.	QA/B/QP/021								
						REV.	02								
		DRG. NO.	AS PER PO												
		SPEC.-	TG60682												
		REV.-	02			Page 3 of 7									
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANC E NORMS	FORMAT OF RECORDS	AGENCY		REMARKS				
1	2	3	4	5	6	7	8	9	D	10	11				

1.4	Fasteners	a) Verification of trade mark & prop. Class	Major	Verify	10%	Standard as per BOM	Standard as per BOM	TC	✓	P	V	-	
		b) Dimension	-DO-	Measurement	10%	Standard as per BOM	Standard as per BOM	IR	✓	P	V	-	
		c) Marking & Packing	-DO-	Visual	100%	TG60682	TG60682	IR	✓	P	W		
		a) Review of Test certificates	Major	Review	100%	Standard as per BOM	Standard as per BOM	TC	✓	P	V		Gaskets procured by the vendor shall be from BHEL approved sources only.
1.5	Gaskets	b) Dimension	Major	Measurement	100%	As per BOM	As per BOM	TC	✓	P	W		
		c) Marking & Packing	Major	Visual	100%	TG60682	TG60682	TC	✓	P	W		
		a) Review of Test certificates	Major	Review	100%	Standard as per BOM	Standard as per BOM	TC	✓	P	V		
		b) Dimension	Major	Measurement	100%	As per BOM	As per BOM	TC	✓	P	W		
1.6	Rods, Round, Flanges	c) Marking & Packing	Major	Visual	100%	TG60682	TG60682	TC	✓	P	W		
		a) Verification of Mill TC	-DO-	Chem. & Mech. Measurement	1/ Heat	Drawing & Standard as per BOM	Drawing & Standard as per BOM	TC	✓	P	V		
		a) Chemical composition, Mechanical		Measurement	10%								
		b) Dimension, finish		Time/Temp.	100%								
1.7	Angle, Beam, Channel, Tee Bar, Beam attachment, AS plate/Flat	c) H.T. if applicable			100%								
		d) DPT/UT			100%								
		a) Visual	-DO-	Measurement & Visual	100%	Drawing & Standard as per BOM	Drawing & Standard as per BOM	TC	✓	P	V	-	
		b) Dimensional											
1.8	Forging, Turn buckle, Pipe clamp	c) Chemical		Chem & Mech.	1/Heat/ heat treatment batch								
		d) Mechanical											
		a) Chemical & Mech. properties	-DO-	Analysis/ Mechanical	1/Heat	Drawing & Standard as per BOM	Drawing & Standard as per BOM	TC	✓	P	V	-	Inform vendor name
		b) Heat treatment	-DO-	Verify	100%								
		c) Hardness	-DO-	Hardness	20%								
		d) Surface defect	-DO-	DPT	20% of each item								

MANUFACTURER/SUBCONTRACTOR		LEGEND:		FOR CUSTOMER USE		APPROVED BY	
NTRACTOR		! RECORDS IDENTIFIED WITH 'TICK' SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION. M: MANUFACTURER / SUBCONTRACTOR B: BHEL / NOM. INSPECTION AGENCY N: CUSTOMER INDICATE 'P' PERFORM 'W' WITNESS AND 'V' VERIFICATION ALL 'W' INDICATED IN COLUMN 'N' SHALL BE 'CIP' OF CUSTOMER				 29.04.19	

MANUFACTURER'S NAME AND ADDRESS				STANDARD QUALITY PLAN					TO BE FILLED BY BHEL			TO BE FILLED BY BHEL			
BHEL	VENDOR'S NAME	ITEM	GENERATOR INTEGRAL PIPING & HYDROGEN COOLER PIPING			QP NO.	QA/BI/QP/021								
		DRG. NO.	AS PER PO			REV.	02								
		SPEC.-	TG60682												
		REV.-	02			Page 4 of 7									
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANC E NORMS	FORMAT OF RECORDS	AGENCY			REMARKS			
1	2	3	4	5	6	7	8	9	D	M	B	N	10	11	

1.9	Thermo well	Co-relation & verification of Mill TC Or Visual & Dimensional Chemical Mechanical	-DO-	Load test	20% or Min. 2pc.	100%	Drawing & Standard as per BOM	Drawing & Standard as per BOM	TC	✓	P	V	-	
1.10	Connection, Inlet Header, Outlet header	Dimension & Visual Weld Quality H.T (if applicable)	-DO-	Measurment/Verify RT/DPT	100%	Random	Drawing & Standard as per BOM	Drawing & Standard as per BOM	TC	✓	P	V	-	
1.11	Clamp, Support, Pipe Clamp assembly	Material TC's Heat Treatment Visual & Dimensional	-DO-	Verify	100%	100%	Drawing & Standard as per BOM	Drawing & Standard as per BOM	IR	✓	P	V	-	
1.12	Base plate	Material TC's Visual & Dimensional	-DO-	Verify	100%	100%	Drawing & Standard as per BOM	Drawing & Standard as per BOM	TC	✓	P	V	-	
1.13	The rod, Threaded rod	a)Material TC b)Visual c)Dimensional d)Galvanizing	-DO-	Verify	100%	100%	Drawing & Standard as per BOM	Drawing & Standard as per BOM	TC	✓	P	V	-	
1.14	Eye bolt, Welding eye	Supplier TC's	-DO-	Verify	100%	100%	Drawing & Standard as per BOM	Drawing & Standard as per BOM	TC	✓	P	V	-	Inform vendor name
1.15	Spring hanger, hanger assembly	Supplier TC's	-DO-	Verify	100%		Drawing & Standard as per BOM	Drawing & Standard as per BOM	TC	✓	P	V	-	Inform vendor name

MANUFACTURER/SUBCONTRACTOR		LEGEND:		FOR CUSTOMER USE	
		I RECORDS IDENTIFIED WITH 'TICK' SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION.			
		M: MANUFACTURER / SUBCONTRACTOR B: BHEL / NOM. INSPECTION AGENCY N: CUSTOMER			
		INDICATE 'P' PERFORM 'W' WITNESS AND 'V' VERIFICATION			
		ALL 'W' INDICATED IN COLUMN 'N' SHALL BE 'CHP' OF CUSTOMER			
				APPROVED BY	

787

MANUFACTURER'S NAME AND ADDRESS				STANDARD QUALITY PLAN				TO BE FILLED BY BHEL		TO BE FILLED BY BHEL	
BHEL		VENDOR'S NAME		ITEM	GENERATOR INTEGRAL PIPING & HYDROGEN COOLER PIPING		QP NO.	QA/B/1QP/021			
				DRG. NO.	AS PER PO		REV.	02			
				SPEC. -	TG60682						
				REV. -	02						
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE CRITERIA	FORMAT OF RECORDS	AGENCY	REMARKS	
1	2	3	4	5	6	7	8	9	10	11	

Page 5 of 7

1.16	H2 vent Star	Material TC's Visual Dimensional	-DO-	Measurement & Visual	100%	Drawing & Standard as per BOM	Drawing & Standard as per BOM	TC	✓	P	V	-	
2.00	INSPECTION PROCESS												
2.1	Preparation	a) Marking & Identification Check	Major	Visual	100%	As per Drawing	As per Drawing	IR		P	V	-	
		b) Cutting & Edge preparation	-DO-	-DO	100%	As per Drawing	As per Drawing	-		P	V	-	
		c) Dimensions	-DO-	-DO	10%	As per Drawing	As per Drawing	IR		P	V	-	
		d) Surface defects on edge preparation on Alloy steel pipes	-DO-	DPT	10%	ASME Sec. V Art-6	ASME Sec.-VIII Div-I Appendix 8	-	✓	P	V	-	
2.2	Bending	a) Dimensions	Major	Measurement	100%	As per Drawing	As per Drawing	IR	✓	P	V	-	
		b) Ovality	-DO-	Measurement	100%	As per Drawing	Max. 10%	-		P	V	-	
		c) Wrinkles	-DO-	Measurement	100%	As per Drawing	As per Drawing	-		P	V	-	
		d) Thinning	-DO-	Measurement	100%	By UT thickness meter	Max. 12.5%	-	✓	P	W*	-	
		e) Surface defects (On bend portion only)	-DO-	DPT	10%	ASME Sec. V Art-6	ASME Sec. VIII Div-I Appendix 8	-	✓	P	V	-	

MANUFACTURER/SUBCO		LEGEND:		FOR CUSTOMER USE	
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[illegible]

Samuel
29.04.19

88 L.

MANUFACTURER'S NAME AND ADDRESS			STANDARD QUALITY PLAN					TO BE FILLED BY BHEL		TO BE FILLED BY BHEL				
VENDOR'S NAME		ITEM	GENERATOR INTEGRAL PIPING & HYDROGEN COOLER PIPING		Q.P. NO.	QA/B/OP/021								
BHEL		DRG. NO.	AS PER PO		REV.	02								
SL. NO.		COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE CRITERIA	FORMAT OF RECORDS	AGENCY		REMARKS		
1		2	3	4	5	6	7	8	9	D	M	B	N	11
			c) Marking	-DO-	Visual	100%	-DO-	-DO-	-	✓	P	V	-	
			d) Cleaning (small bore pipes up to 3" NB by acid pickling)	-DO-	-DO-	100%	TG60682	ST34001 clause-8	-	✓	P	W	-	
			e) Preservation & Painting	-DO-	-DO-	100%	TG60682	TG60682	-	✓	P	V	-	
			f) End protection & packing	-DO-	-DO-	100%	TG60682	TG60682	-	✓	P	W	-	
			g) D.P. site wedge edges	-DO-	DPT	Random	HW0850199	HW0850199		✓	P	W		

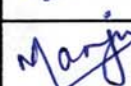
NOTES:-

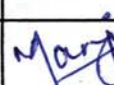
- 1 All edge preparation shall be done by machining only.
- 2 For small bore piping, where the individual stamping & stencilling may not be possible metal tags or plastic tags may be used for identification.
- 3 i) Small items like small reducers, elbows, tees, stubs, flanges etc. and other machines components duly preserved shall be packed in wooden boxes.
- ii) Each item either individually or jointly will be segregated system wise for dispatch.
- 4 Inside protection by VPI tablets/powder shall be ensured before end capping.
- 5 The raw material used shall be procured from BHEL agreed vendors.
- 6 The pipe with requirement for UT shall be UT/Hydro tested at mill and shall indicate in certificates only.
- 7 All material of construction shall be as per approved Drawing / pipe schedule / BHEL plant Std.
- 8 Electrodes used shall be procured from BHEL agreed vendors.
- 9 Gaskets procured by the vendor shall be from BHEL approved sources only.

MANUFACTURER/SUBCO		LEGEND:		FOR CUSTOMER USE	
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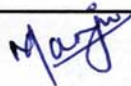
दिनांक एवं हस्ताक्षर SIGN & DATE		उत्पाद क्रय विनिर्देश (हीप : हरिद्वार) PRODUCT PURCHASE SPECIFICATION (HEEP: HARIDWAR)	TG 60682 मुख्य पृष्ठ PREFACE SHEET
सामग्री सूची संख्या INVENTORY NO.	सुपरसेड्स INVENTORY NO.	<u>SPECIFICATION FOR FABRICATION AND SUPPLY OF</u> <u>GENERATOR INTEGRAL PIPING</u> केवल आंतरिक प्रयोग हेतु प्रदायक को देने से पूर्व इस मुख्य पृष्ठ को निकाल दें। FOR INTERNAL USE ONLY REMOVE THIS PREFACE BEFORE ISSUE TO SUPPLIERS. समतुल्य मानक / सूची आदि COMPARABLE STANDARDS / CATALOGUES ETC. सुझाए / सम्भावित प्रदायक एवं श्रेणी SUGGESTED / PROBABLE SUPPLIERS AND GRADES. AS PER PMD – BI-153 - DEE DEVELOPMENT ENGINEERS LTD. - PAL ENGG CORPORATION - S&G ENGINEERS PVT. LTD. - UNITECH MACHINES LTD - BEND JOINTS - GUJARAT INFRAPIPES PVT. LTD. - PVT. LTD. - FLASH FORGE PVT. LTD. कोई अन्य जानकारी ANY OTHER INFORMATION	
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स्वतंत्रताधिकार एवं गोपनीय इस दस्तावेज में दी गई सूचना भारत की एलईएलसीएस लिमिटेड की सम्पत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी भी तरह प्रयोग जो कि कम्पनी के हित में होना आवश्यक हो न			
दिनांक एवं हस्ताक्षर SIGN & DATE			
सामग्री सूची संख्या INVENTORY NO.	P-6395	REV.NO. 02 DATE 23.08.2017	स्वीकृति APPROVED : RAKSH KUMAR (AGM - EME) निर्माण PREPARED : EME जारी ISSUED : TSX दिनांक DATE : 29.03.2010 Gr. No. 2.11

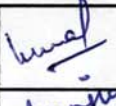
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समूची स्वी संख्या को अधिकृतित करने हे	1.0 PROJECT INFORMATION The piping covered under this specification are to be used in association with mechanical auxiliaries for generator piping at power station for carrying oil, water and gas.																																																											
COPYRIGHT AND CONFIDENTIAL The information on this documents is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company	2.0 SCOPE OF WORK The scope of work for piping vendor shall be to completely supply the total Piping to site, which includes materials, fabrication, testing, cleaning, painting, packing and dispatch, as mentioned in the order. All pipes shall be seamless and supplied in approximately 6.0 meter length. Tees, Bends, Reducers and flanges etc as per Bill of Material (BOM) shall be supplied loose.																																																											
	3.0 MATERIAL SPECIFICATION 3.1 The material to be used for fabrication of piping is specified in the BOM. 3.2 The vendor shall furnish the correlated mill test certificate for the material used. 3.3 Plates to be used for flanges > 25mm shall be checked for laminations by UT as per ASME-435. 3.4 Gaskets procured by the vendor shall be from BHEL Approved sources only.																																																											
स्वत्वाधिकार एवं गोपनीय इस प्रलेख में दी गई सूचना भारत हेवी एलेक्ट्रिकल लिमिटेड की सम्पत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी भी तरह प्रयोग जो कि कंपनी के हित में हानिकारक हो न किया जाय।	4.0 FABRICATION 4.1 All Pipes, Bend/Elbows, Tee, Reducer, Flange, Gasket, Fasteners etc shall be in accordance with the respective Bill of material. 4.2 All fitting shall be clean finished and reasonably free from scales. They shall be totally free from cracks, porosity, surface flaws, laminations, informal surface and other harmful defects.																																																											
दिनांक एवं हस्ताक्षर SIGN & DATE	<table border="1"> <tr> <td>TSX</td> <td>Lalit Kumar</td> <td>Lalit Kumar</td> <td>नाम NAME</td> <td>दिनांक एवं हस्ताक्षर SIGNATURE & DATE</td> </tr> <tr> <td>PSC MEMBER</td> <td>R.K. Sharma</td> <td>R.K. Sharma</td> <td>अनुवादक TRANSLATED BY</td> <td></td> </tr> <tr> <td>QAX</td> <td>S.K. BHARDWAJ</td> <td>S.K. BHARDWAJ</td> <td>निर्माणकर्ता WORKED BY</td> <td>KUNAL MISHRA</td> </tr> <tr> <td></td> <td></td> <td></td> <td>जांचकर्ता CHECKED BY</td> <td>MANJU AZAD</td> </tr> <tr> <td></td> <td></td> <td></td> <td>पर्यवेक्षणकर्ता SUPERVISED BY</td> <td>R. L. VYAS</td> </tr> <tr> <td>सहमत विभाग AGREED DEPTT.</td> <td>नाम NAME</td> <td>दिनांक एवं हस्ताक्षर DATE & SIGNATURE</td> <td colspan="2"></td> </tr> <tr> <td>EME</td> <td>Jagdish</td> <td>Jagdish</td> <td>स्वीकृति APPROVED :</td> <td>Gr. NO.</td> </tr> <tr> <td>EME</td> <td>R. L. VYAS</td> <td>R. L. VYAS</td> <td>RAKSH KUMAR (AGM - EME)</td> <td>2.11</td> </tr> <tr> <td>REV. NO.</td> <td>02</td> <td></td> <td>निर्माण PREPARED :</td> <td>जारी ISSUED :</td> </tr> <tr> <td>DATE</td> <td>23.08.2017</td> <td></td> <td>EME</td> <td>TSX</td> </tr> <tr> <td>Change Advice No.</td> <td>TGE-17-39</td> <td>21-08-17</td> <td colspan="2">दिनांक DATE : 29.03.2010</td> </tr> </table>					TSX	Lalit Kumar	Lalit Kumar	नाम NAME	दिनांक एवं हस्ताक्षर SIGNATURE & DATE	PSC MEMBER	R.K. Sharma	R.K. Sharma	अनुवादक TRANSLATED BY		QAX	S.K. BHARDWAJ	S.K. BHARDWAJ	निर्माणकर्ता WORKED BY	KUNAL MISHRA				जांचकर्ता CHECKED BY	MANJU AZAD				पर्यवेक्षणकर्ता SUPERVISED BY	R. L. VYAS	सहमत विभाग AGREED DEPTT.	नाम NAME	दिनांक एवं हस्ताक्षर DATE & SIGNATURE			EME	Jagdish	Jagdish	स्वीकृति APPROVED :	Gr. NO.	EME	R. L. VYAS	R. L. VYAS	RAKSH KUMAR (AGM - EME)	2.11	REV. NO.	02		निर्माण PREPARED :	जारी ISSUED :	DATE	23.08.2017		EME	TSX	Change Advice No.	TGE-17-39	21-08-17	दिनांक DATE : 29.03.2010	
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				पृष्ठ 6 का 2 Page 2 Of 6	
SUPERSEDES INVENTORY सामग्री सूची संख्या को अधिष्ठापित करता है	COPYRIGHT AND CONFIDENTIAL The information on this documents is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company	4.3 All elbows shall be of long radius type with R= 1.5 NB or as specified in the Bill of Material. 4.4 The final drg of H2 Cooler header shall be issued after placement of order. However tentative drg shall be furnished for the same along with enquiry BOM. 5.0 TESTING AND CERTIFICATION 5.1 HYDRAULIC TESTING Hydraulic test certificate of mother pipe shall be supplied by the fabricator. In the event of mill test certificate not being available, the pipelines shall be hydraulically tested by the vendor in his shop as per ANSI B31.1 before induction. 5.2 In case of standard fitting like elbows, tees, reducers etc hydraulic test certificate of mother pipe shall be furnished. 5.3 Material test certificates of individual item as per BOM shall be furnished. 5.4 DPT/MPI shall be carried out on all fittings for surface crack as per applicable ASME/ASTM. 6.0 CLEANING & PAINTING 6.1 STAINLESS STEEL PIPING All hot bent, forged, fabricated and straight section of piping shall be thoroughly cleaned, wire brushed and purged with an air blast to remove water, sand and scale from inner surface. The out side surface of all pipes shall also be free of cleaning slag. Vendor shall not leave any material on the inner or outer surface that will affect the serviceability of the pipe. 6.2 CARBON STEEL PIPING All CS pipes shall be treated by pickling with acid neutralised before dispatch. All pipes which are cleaned by acid pickling shall be conserved in accordance with the procedure detailed below. Any alternative method used by the supplier shall have to be got approved from BHEL for which the supplier shall furnish all the details along with the acceptance norms etc. with his offer.			
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SIGN & DATE 	REV. NO. 02	निर्माणकर्ता WORKED BY	KUNAL MISHRA		11/07/17
INVENTORY NO. 20395		जांचकर्ता CHECKED BY	MANJU AZAD		11/7/17

नमक एवं हस्तक्षेप नमकी सूची संख्या को अधिकृतित करता है		उत्पाद क्रय विनिर्देश (हीप : हरिद्वार) PRODUCT PURCHASE SPECIFICATION (HEEP: HARIDWAR)		TG 60682																																					
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** Vapour phase inhibitor shall be used for protecting the inner surface of the pipes after cleaning by pickling or otherwise as the case may be. The recommended quantity is 60gm/m² (min.) The vapour phase inhibitor used by the supplier shall be such that it is effective for the purpose for which it is used and does not leave any residue after vaporization. After cleaning, the pipes shall be coated with one coat of anti-corrosive chromated primer paint and two additional coats of light colored semi matt paint. The inner surface of the pipe shall be protected with the help of vapour phase inhibitors put inside the pipe with ends sealed with plastic caps with suitable adhesives. Tentative painting schedule - After cleaning, pipe shall be painted as per details given below- <table border="1"> <thead> <tr> <th>Paint (Coat)</th> <th>Paint Type</th> <th>No. of Coat</th> <th>DFT (in microns)</th> </tr> </thead> <tbody> <tr> <td>Primer Paint</td> <td>Epoxy Based Zinc Rich paint</td> <td>2 Coat (each of 35 microns)</td> <td>70</td> </tr> <tr> <td>Intermediate Paint</td> <td>Epoxy Tio2 pigmented coat paint</td> <td>1 Coat</td> <td>70</td> </tr> <tr> <td>Finish (Final) Paint</td> <td>Epoxy Based Finish paint Shade GREY" as per RAL 9002.</td> <td>2 Coat (each of 30 microns)</td> <td>60</td> </tr> <tr> <td>Total DFT(Minimum)</td> <td></td> <td></td> <td>200</td> </tr> </tbody> </table> Final painting schedule will be furnished after issuance of PO.				Paint (Coat)	Paint Type	No. of Coat	DFT (in microns)	Primer Paint	Epoxy Based Zinc Rich paint	2 Coat (each of 35 microns)	70	Intermediate Paint	Epoxy Tio2 pigmented coat paint	1 Coat	70	Finish (Final) Paint	Epoxy Based Finish paint Shade GREY" as per RAL 9002.	2 Coat (each of 30 microns)	60	Total DFT(Minimum)			200																		
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नमकी सूची संख्या INVENTORY NO. P-6395		REV. NO. 02	निर्माणकर्ता WORKED BY KUNAL MISHRA		11/07/17																																				
		जांचकर्ता CHECKED BY MANJU AZAD		11/7/17																																					

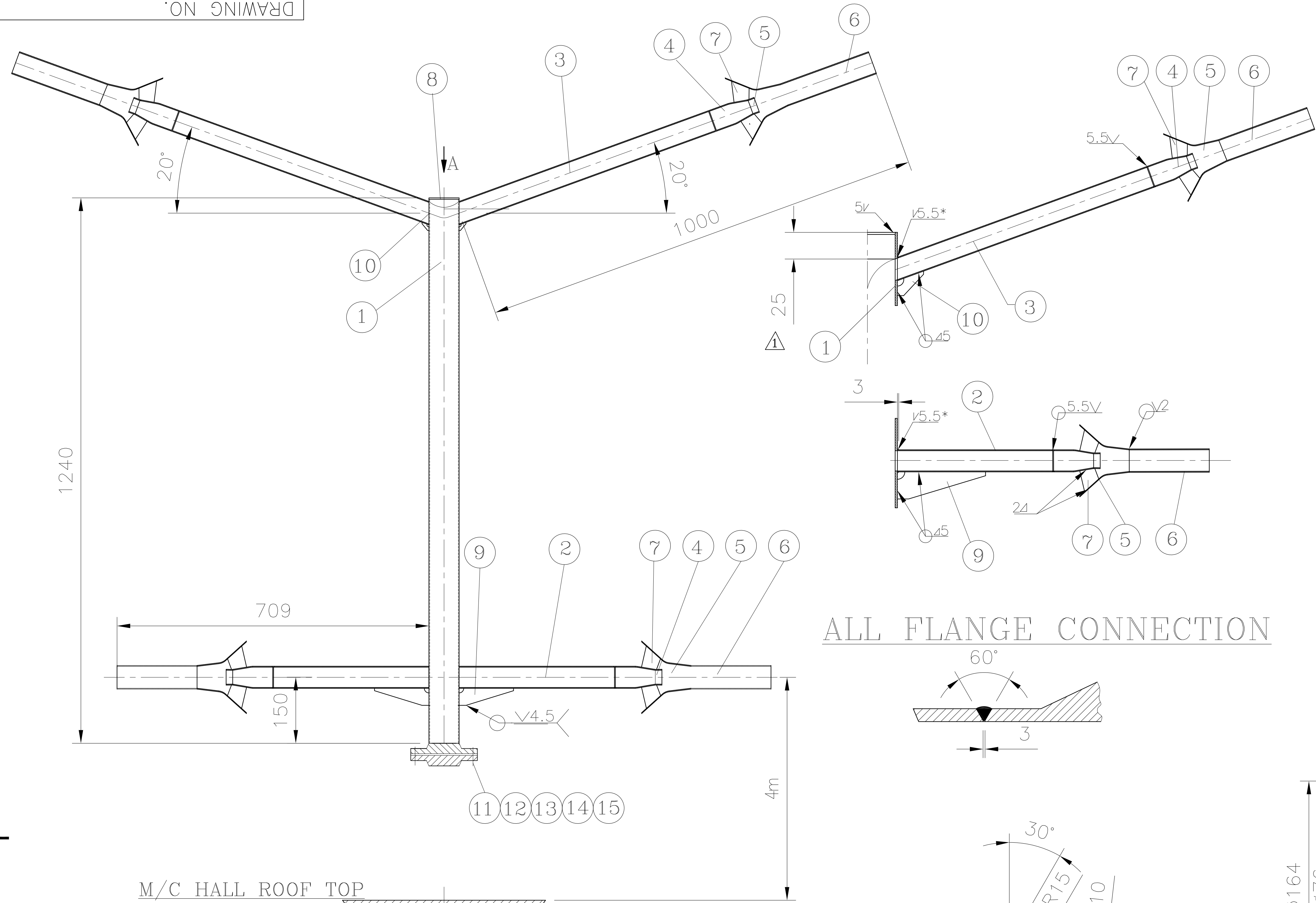
दिनांक एवं हस्ताक्षर SIGN & DATE		उत्पाद क्रय विनिर्देश (हीप : हरिद्वार) PRODUCT PURCHASE SPECIFICATION (HEEP: HARIDWAR)		TG 60682	
				पृष्ठ 6 का 4 Page 4 Of 6	
SUPERSEDES INVENTORY	7.0 PACKING & MARKING				
सामग्री सूची संख्या को अधिकृतित करता है	7.1 Item no. of BOM shall be clearly marked on each item with punch and paint. 7.2 All straight pipes of a particular system shall be packed in separate Box/Boxes. System name, BOM no. and item name shall be clearly mentioned on the Box. 7.3 All flanges, Tees, Reducers etc. of a particular system shall packed in separate box. System name, BOM no. and item name shall be clearly mentioned on the Box. 7.4 All fasteners of a particular system shall packed in separate box. System name, BOM no. and item name shall be clearly mentioned on the Box. 7.5 All Gaskets of a particular system shall be packed in separate box. System name shall be clearly mentioned on the Box. On each Gasket, Gasket size (as indicated in BOM), BOM sl. no. make & grade shall be clearly marked with suitable paint or marker for easy identification. 7.6 Vendor to ensure that the procurement of gaskets (or gasket material used for manufacturing) shall be done just before dispatch of the entire material so as to maintain the shelf life of the gasket for a min period of 2 years (from the date of dispatch). 7.7 All the parts shall be carefully packed for transport in such a manner that these are protected against all damage and the climatic conditions including saline atmosphere to which it may be subjected in transit and one year of storage. 7.8 Pipe ends, flange and other similar open ends shall be protected from both external damage (by provision of plastic caps) and ingress of dirt or moisture during transit and storage. All machined surface shall be protected by means of wooden protecting pieces bolted to such surfaces. 7.9 Small bore items are to be bundled or bagged and fitted with wired metal tags stamped with item number & BOM number, make & grade. 7.10 Water Proof paper & felt lining of the packages shall overlap seams at least up to 15mm and seams shall also be sealed.				
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स्वतंत्रताधिकार एवं गोपनीय इन प्रलेख में दी गई सूचना भारत हेवी एलेक्ट्रिकल्स लिमिटेड की सम्पत्ति है इसका प्रयोग एवं प्रसारण के बिना भारत हेवी एलेक्ट्रिकल्स लिमिटेड की लिखित अनुमति के बिना नहीं किया जा सकता है					
दिनांक एवं हस्ताक्षर SIGN & DATE	REV. NO. 02 (SUPERSEDES)				
सामग्री सूची संख्या INVENTORY NO. P-6595	निर्माणकर्ता WORKED BY Jagdeesh Chauhan		जांचकर्ता CHECKED BY R. L. Vyas		23.08.17 23/8/17

माक एवं हस्ताक्षर (Signature)		उत्पाद क्रय विनिर्देश (हीप : हरिद्वार) PRODUCT PURCHASE SPECIFICATION (HEEP: HARIDWAR)		TG 60682 पृष्ठ 6 का 5 Page 5 Of 6																			
सामग्री सूची संख्या को अधिकृतित करता है	SUPERSEDES INVENTORY	7.11 Vendor to ensure to take receipt from site for boxes for every dispatch against GR verification of items sent inside box. GR Verification should be done in presence of supplier's representative at site. Supplier is required to depute their representative to site (one visit per set) on demand from site for verification of items sent inside the box and ensure receipt of all items. Any shortage found during verification is to be replenished free of cost by supplier. However, payment will be released against dispatch documents as per present practice.																					
COPYRIGHT AND CONFIDENTIAL The information on this documents is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company		7.12 Each straight pipe and pipe fitting belonging to the different systems shall be color coded by making one color band on each free end of the component for identification of material at site as mentioned below: - <table border="1"> <thead> <tr> <th>S. No.</th> <th>DESCRIPTION</th> <th>COLOUR CODE</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Seal oil system and Liquid Detector Rack System</td> <td>Light brown (ISC 410)</td> </tr> <tr> <td>2</td> <td>Primary water system</td> <td>Sea Green (ISC 217)</td> </tr> <tr> <td>3</td> <td>Gas system</td> <td>Canary yellow (ISC 309)</td> </tr> <tr> <td>4</td> <td>Waste gas and waste Fluid system</td> <td>Black (ISC 632)</td> </tr> <tr> <td>5</td> <td>H2 Cooler Piping system</td> <td>Sea Green (ISC 217)</td> </tr> </tbody> </table>				S. No.	DESCRIPTION	COLOUR CODE	1	Seal oil system and Liquid Detector Rack System	Light brown (ISC 410)	2	Primary water system	Sea Green (ISC 217)	3	Gas system	Canary yellow (ISC 309)	4	Waste gas and waste Fluid system	Black (ISC 632)	5	H2 Cooler Piping system	Sea Green (ISC 217)
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दिनांक एवं SIGN & DATE		9.0 GUARANTEE Vendor shall guarantee all material fabrication and workman ship of all piping furnished by vendor for a period of 24 months from the actual delivery or 18 months from the date of commissioning of the piping system whichever is earlier.																					
सामग्री सूची संख्या INVENTORY NO.	REV. NO. 02		निर्माणकर्ता WORKED BY	KUNAL MISHRA		11/07/17																	
2-6395			जांचकर्ता CHECKED BY	MANJU AZAD		11/21/17																	

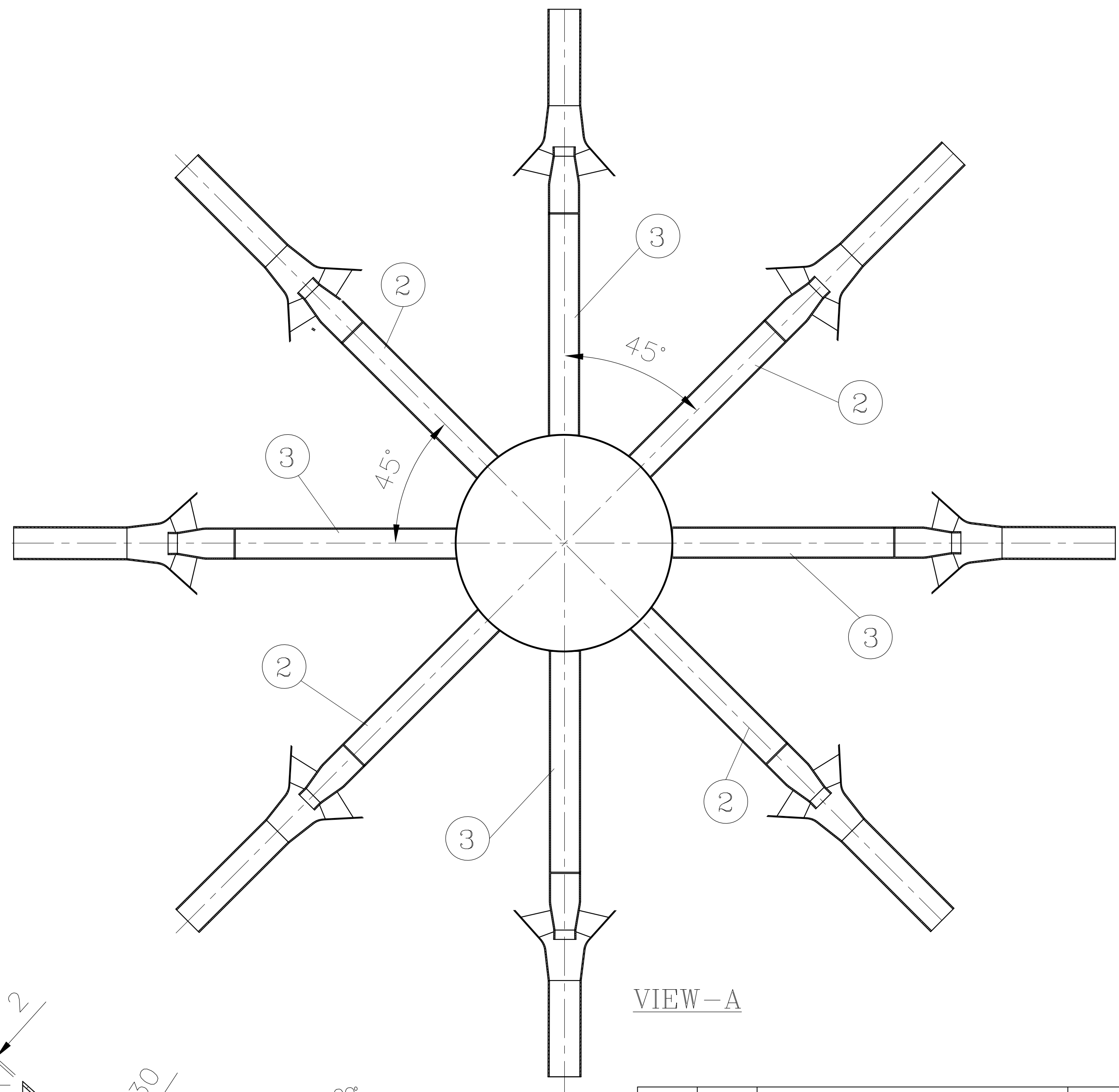
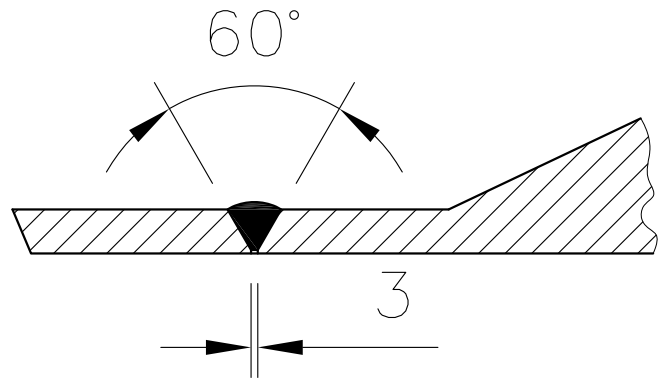
नाम एवं हस्ताक्षर		उत्पाद क्रय विनिर्देश (हीप : हरिद्वार) PRODUCT PURCHASE SPECIFICATION (HEEP: HARIDWAR)		TG 60682 पृष्ठ 6 का 6 Page 6 Of 6	
समयी सूची संख्या को अपडेट कर रहा है	SUPERSEDES INVENTORY	10.0 INSTRUCTION FOR BID PREPERATION 10.1 The supplier shall furnish a quality plan on BHEL's format detailing all the tests/ checks conducted by supplier at various stages including receipt of raw material, fabrication, packing and dispatch etc. BHEL shall identify hold points in this quality plan beyond which work shall not proceed without the approval of BHEL. The quality plan will form a pre-approval document. 10.2 The supplier shall furnish a list of deviations with respect to this purchase specification, if any, otherwise mention No DEVIATIONS. 10.3 The pipes and fittings shall be as per detailed B.O.M. 10.4 The material of the pipes and fittings shall be as per list of referred standards & drawings.			
COPYRIGHT AND CONFIDENTIAL The information on this documents is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company		11.0 CROSS REFERRED STANDARDS ASME SA 106, ASME A182, ASME A 435, ASTM A234, ASTM A403, ASME B16.9, IS 2062, ANSI B31.1, HW 59870, HW0620599, HW0850199.			
स्वत्वधिकार एवं गोपनीय इस प्रलेख में दी गई सूचना भारत की भारती लिमिटेड की सम्पत्ति है। इसका प्रयोग एवं प्रकाशक रूप से किसी भी तरह प्रयोग जो कि कंपनी के हित में हानिकारक					
दिनांक एवं हस्ताक्षर	SIGN & DATE				
समयी सूची संख्या	INVENTORY NO.	REV. NO. 02	निर्माणकर्ता WORKED BY	KUNAL MISHRA	 11/07/17
			जांचकर्ता CHECKED BY	MANJU AZAD	 11/07/17

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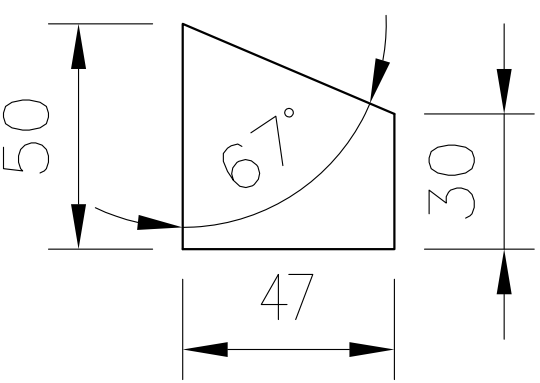
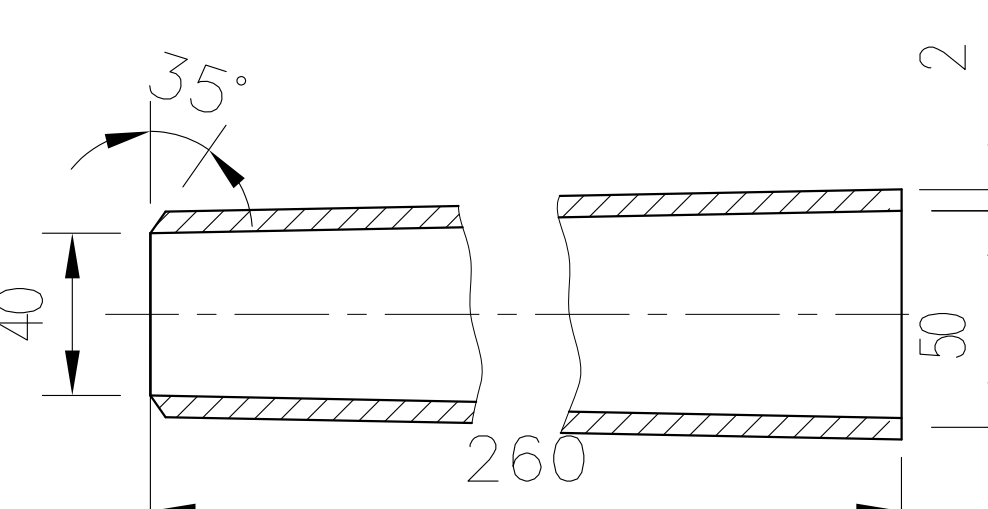
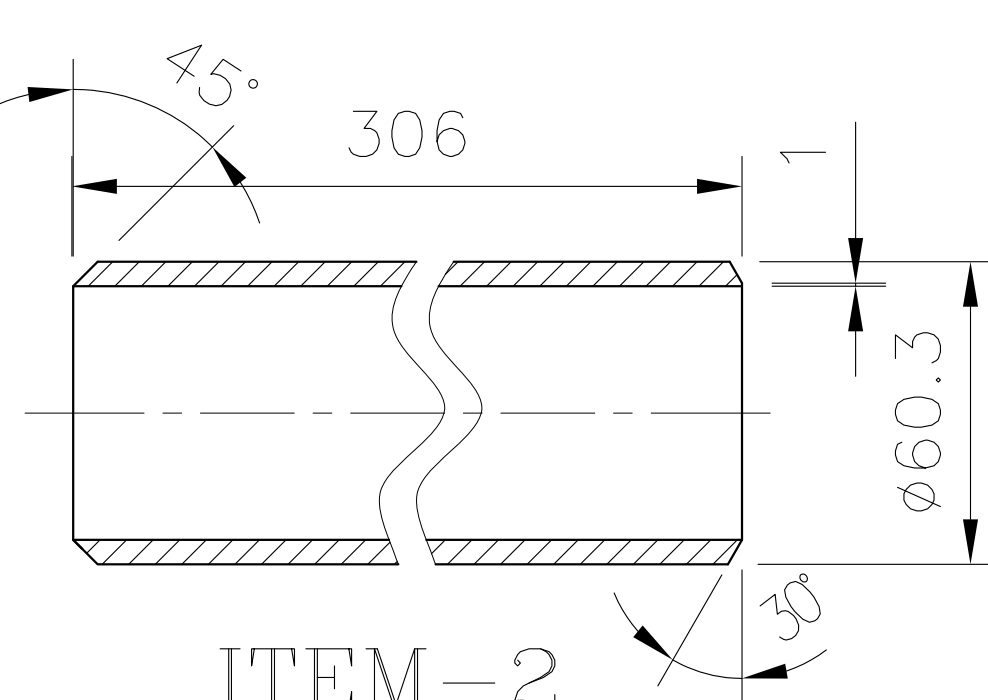
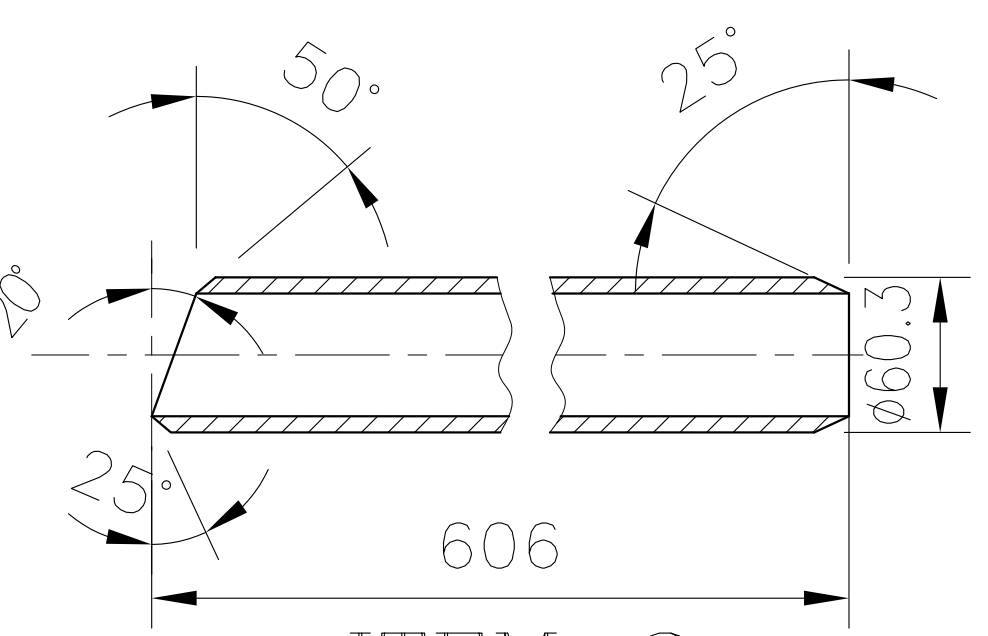
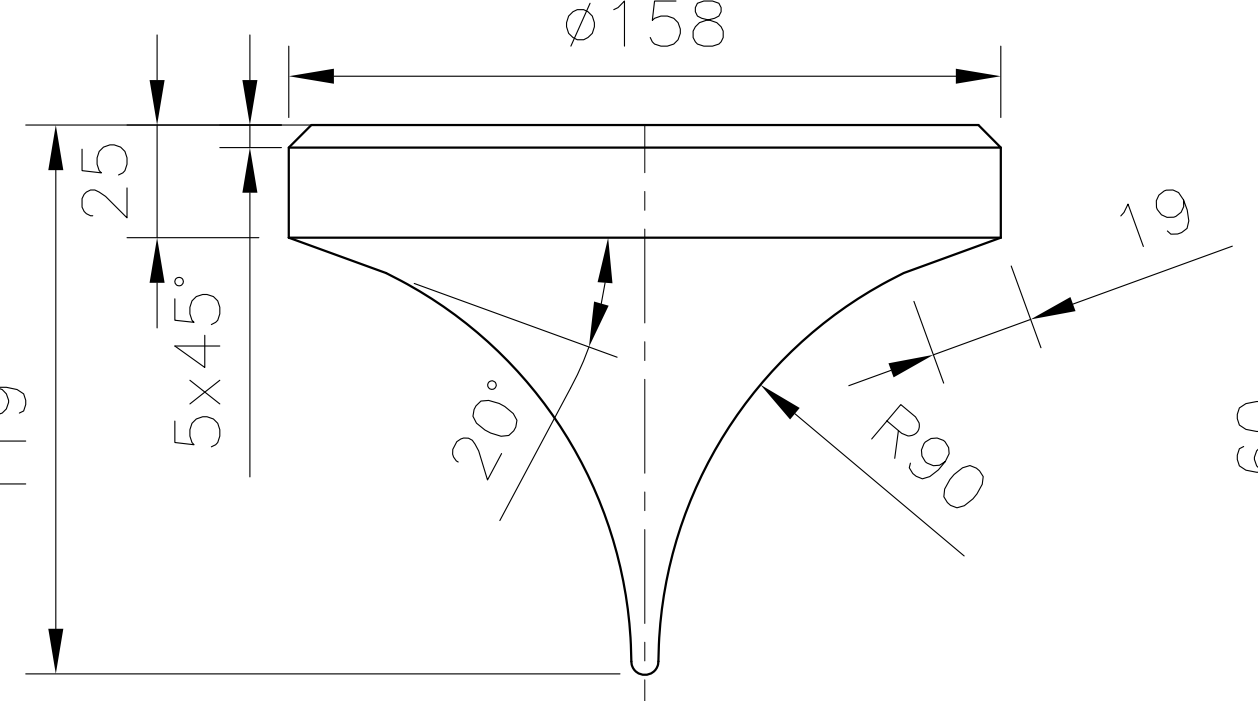
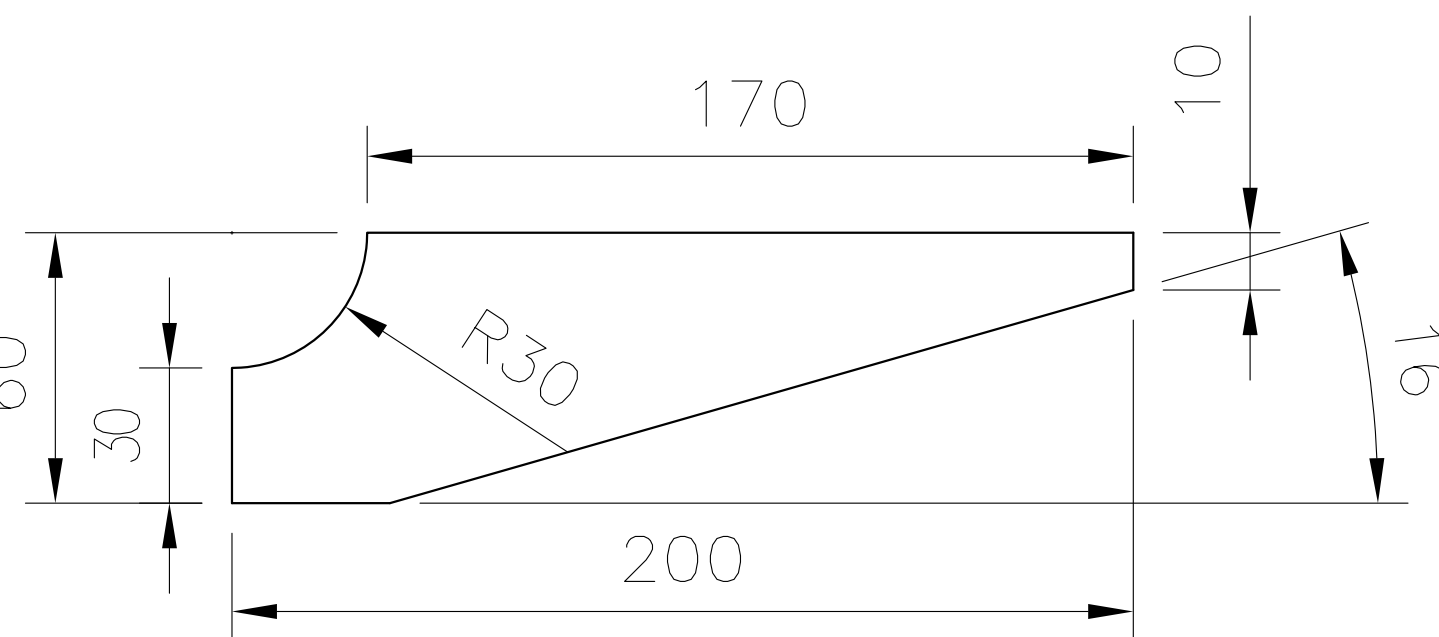
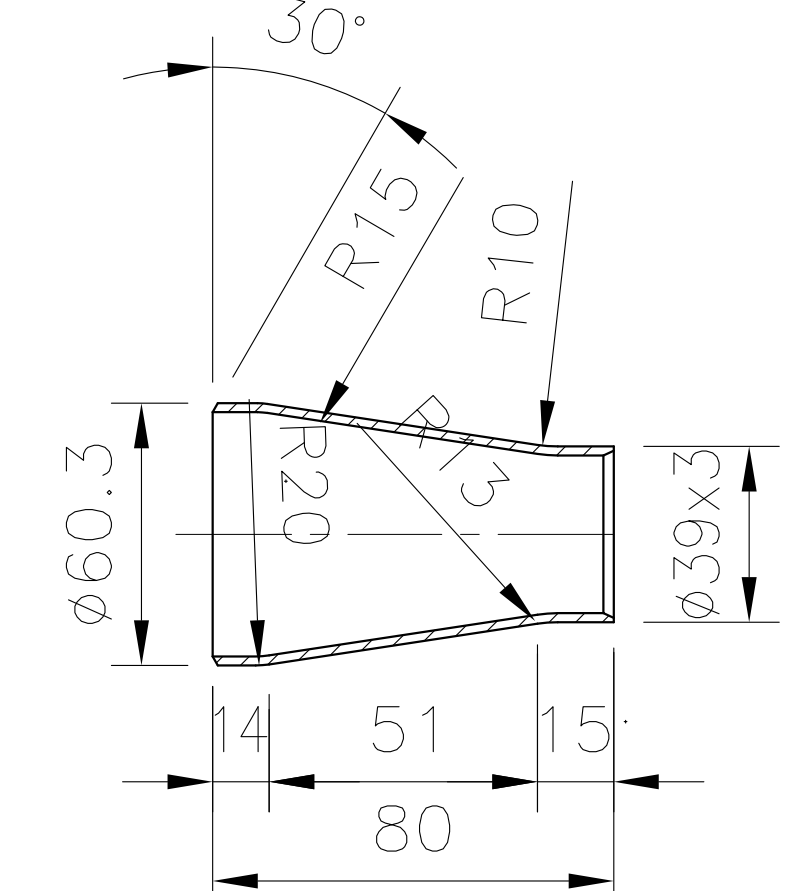
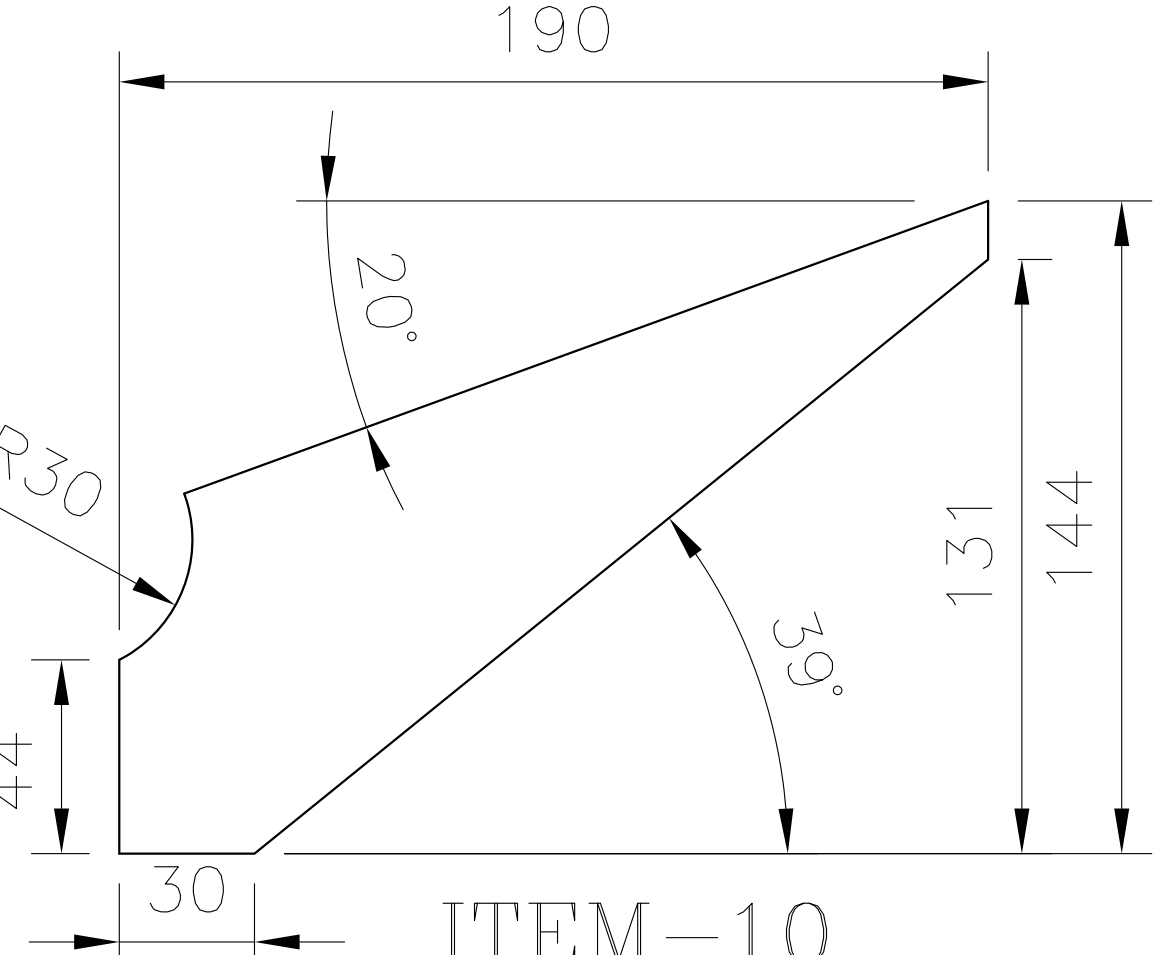
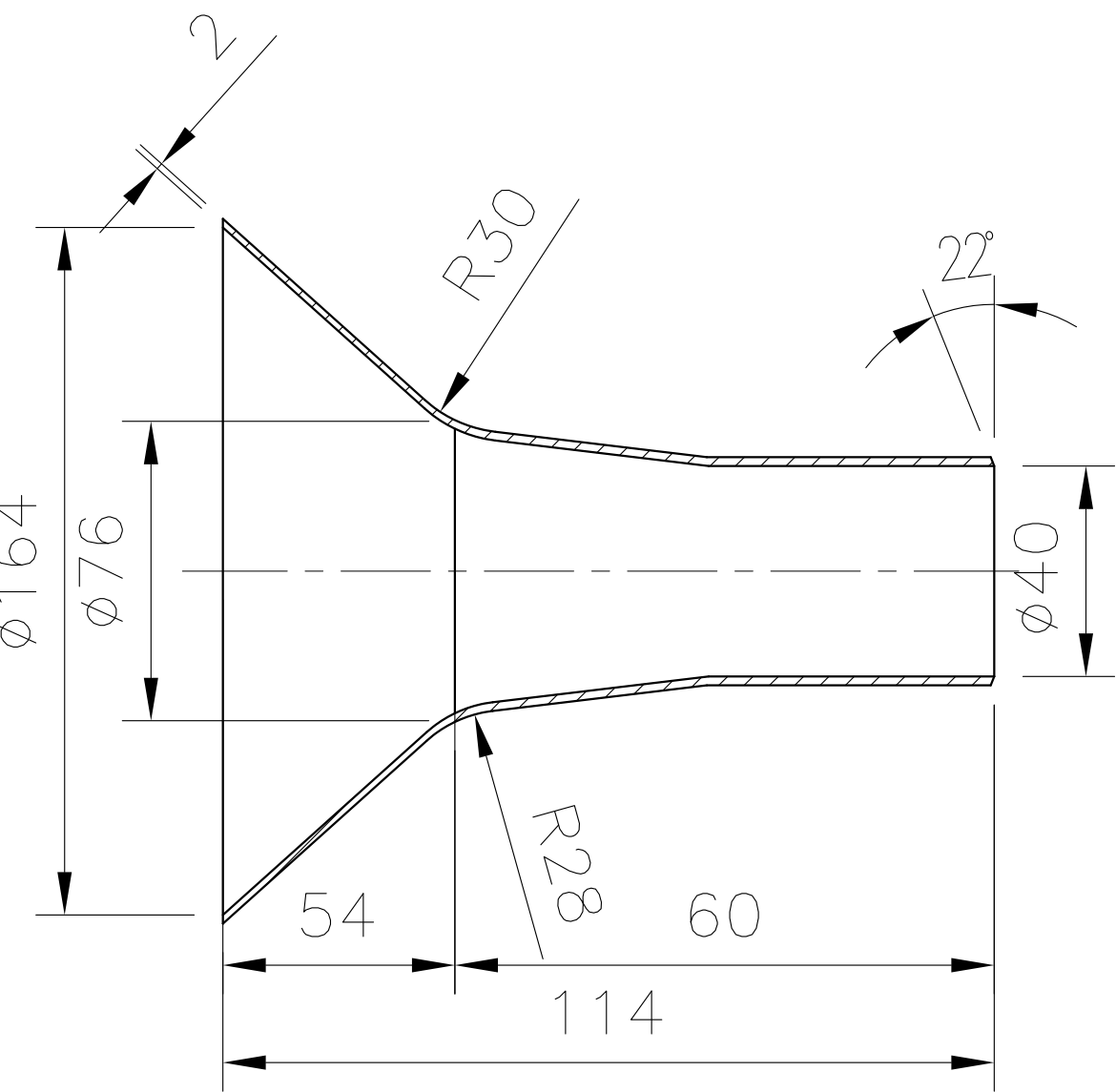
DRAWING NO. TGE-2774



ALL FLANGE CONNECTION



015	16	WASHER D21	AA7161001	NO	0	01	
014	08	NUT M20	AA7151115	NO	0	02	
013	08	BOLT M20X80	AA7111122	NO	0	02	
012	01	GASKET 210X168X3TK	HW59870	NO	0	01	
011	02	FLANGE NB150	AA7244303	NO	6	00	
010	04	SUPPORT (THK=8MM)	IS:2062 E250BR	NO	0	5	
009	04	SUPPORT (THK=8MM)	IS:2062 E250BR	NO	0	5	
008	01	FLOW GUIDE	IS:2062 E250BR	NO	1	00	
007	024	SUPPORT (THK=4MM)	IS:2062 E250BR	NO	0	05	
006	08	PIPE ASSY	ASME SA106GR.B	NO	1	5	
005	08	VENT CAWL	ASTM216	NO	1	2	
004	08	REDUCER $\phi 60.3 \times 30 \times 3$	ASME SA106GR.B	NO	0	4	
003	04	C.S PIPE ASSY. $\phi 60.3 \times 3.91$	ASME SA106GR.B	NO	3	29	
002	04	C.S PIPE ASSY. $\phi 60.3 \times 3.91$	ASME SA106GR.B	NO	1	66	
001	01	C.S PIPE $\phi 168.3 \times 3.4$ L=1240	ASME SA106GR.B	NO	17	15	
ITEM NO.	QTY.	DESCRIPTION	MATERIAL CODE A	UNIT WEIGHT	NO. OF		
			MATERIAL SPECN C		ITEM		



TOLERANCES ON DIMENSIONS SHALL BE AS PER COARSE "C" GRADE OF STANDARDD AA0230208

REV.	DATE	ALTERED	CHECKED	REV.	DATE	ALTERED	KM
01	29.05.18			01	29.05.18		MA
				REVISION MARKED AS Δ			

THDF 115/67

BHARAT HEAVY ELECTRICALS LTD.
HARDWAR

DEPT. EME	SCALE 1:10	WEIGHT(Kg.) 80.44	REF. TO ASSY. DRG.
CODE 4133			

NAME RAVINDRA	SIGN SD/-	DATE 16.01.10	NO.OF VAR.
CHD RLV	SIGN SD/-	DATE 16.01.10	
APD AKM	SIGN SD/-	DATE 16.01.10	73, 74

DRAWING NO. TGE-2774	ITEM NO. 75, 77
SHEET NO.	NO.OF SHEETS