Bharat Heavy Electricals Limited

Heavy Equipment Repair Plant

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

Enquiry Number : **E-RC-304-24-0636-61-1** Date : **03/Feb/2025**

Enquiry For Material :-

Sl No	Material Description	Material Code	Quantity	Unit
1	CENTRE FEED PIPE UPPER (HY-922.31) AS PER DRG. 36138802095/05 WITH MATERIAL AS PER DRG.	RV1079838015	25.0	NOS
2	PIPE OD 406.4 x 12 x 1828 MM AS PER DRG. HY-187.01 REV-01 WITH MATL. AS PER SPEC. AA10738 REV-07	RV1079838023	30.0	NOS
3	CENTRE FEED PIPE UPPER 24" AS PER DRG. 26130000549/07 WITH MATERIAL AS PER DRAWING.	RV1079838074	10.0	NOS
4	CENTER FEED PIPE - LOWER (HY-346.01) AS PER DRG. 26130002501/04 WITH MATL. AS PER DRG.	RV1079839216	25.0	NOS
5	CENTRE FEED PIPE ASSLY (UPPER) (HY-346.02) AS PER DRG. 2-61-300-02500/06 WITH MATL. AS PER DRG.	RV1079839224	35.0	NOS
6	CENTRE PIPE UPPER AS PER DRG 36136200661/05 MATERIAL AS PER DRG.	RV9313806614	5.0	NOS
7	CENTRE FEED PIPE LOWER 24" AS PER DRG. 26130000548/04 WITH MATERIAL AS PER DRAWING.	RV9513805484	5.0	NOS
8	PIPE (HY-925.A.04) OD-508 X 12THK. X 2500 LENGTH AS PER DRG. HY-925.A.04/00 WITH MATERIAL AS PER DRG AA10738 REV 07	RV9513892042	15.0	NOS

Remarks

(A) SCOPE OF SUPPLY:-
1. THIS ENQUIRY HAS BEEN RAISED FOR ENTERING INTO FRAMEWORK AGREEMENT WITH VENDORS QUANITYWISE FOR SS PIPE. SEPARATE INDENTS WILL BE GIVEN TIME TO TIME AS PER REQUIREMENT FOR PLACING THE PO UNDER THIS RC. ITEM QUANTITY MENTIONED IN THE INDENT IS TENTATIVE & IT MAY INCREASE OR DECREASE AS PER OUR FINAL REQUIREMENT.
2. RATES OF ITEMS AGAINST FA WILL BE FIRM & VALID FOR ORDERING FOR A PERIOD OF ONE YEAR FROM THE DATE OF AGREEMENT. PRICE VARIATION CLAUSE (PVC) IS NOT ACCEPTABLE.
AFTER FINALIIZATION OF RATE CONTRACT, PO QUANTITY WILL BE PLACED AS PER REQUIREMENT.

(B) SUPPLY CONDITION :
1. ITEM TO BE SUPPLIED AT HERP STORES.
2. PRE-DESPATCH INSPECTION SHALL BE CARRIED OUT AT PARTY'S WORKS BY BHEL REPRESENTATIVE AS PER QUALITY PLAN NO. RV/FAB/31.

(C) TECHNICAL DELIVERY CONDITION :
1. MATERIAL SHOULD BE AS PER SPECIFICATION MENTIONED IN THE DRAWINGS. STAINLESS STEEL PLATES AS PER SPECN. AA10738/07.
2. DIMENSIONS AND TOLERANCES TO BE MAINTAINED AS PER DRAWING.
3. WELDING SHOULD BE CARRIED OUT BY QUALIFIED WELDERS AS PER APPLICABLE WPS MENTIONED IN THE DRAWINGS. SUITABLE WELDING ELECTRODES AS MENTIONED IN WPS WE-079, AND WE-148 (CASE TO CASE BASIS) SHOULD BE USED FOR WELDED JOINTS CARRIED OUT BY SMAW PROCESS. IF SUPPLIER IS USING MIG/MAG WELDING, PRIOR APPROVAL OF APPLICABLE WPS SHOULD BE TAKEN FROM BHEL.
4. PREHEAT OF JOB AND POST WELD HEAT TREATMENT MUST BE ENSURED IN LINE WITH WPS WE-055 TO AVOID DEFECTS IN WELD AND DISTORTION OF JOB AFTER WELDING. HEAT TREATMENT CYCLE MENTIONED IN QAP SHOULD BE FOLLOWED FOR POST WELD HEAT TREATMENT.
5. WELDING SHOULD BE FREE FROM ALL DEFECTS AND WELDING SEAM SHOULD BE CHECKED WITH 100% D.P. TEST.
6. TWO NOS OF PIPE STIFFNERS TO BE WELDED (IN CROSS MANNER) IN FREE END OF PIPE TO AVOID OVALITY DURING TRANSPORTATION.

(D) TEST CERTIFICATE : REQUIRED FOR CHEMICAL AND MEHCANICAL PROPERTIES OF RAW MATERIAL.

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

(F) PACKING INSTRUCTION : ITEM TO BE SUPPLIED IN PROPERLY STACKED CONDITION ON TRUCKS/TRAILORS. MACHINED PORTION OF MILD STEEL PLATES TO BE PROTECT BY APPLYING TRP BLACK PAINT AND HOLES SHOULD BE PROPERLY GREASED. MACHINED SURFACES SHOULD BE PROTECTED BY PROPER MEANS TO AVOID TRANSIT DAMAGE.

(G) SPECIAL REMARKS:
1. ITEM WISE MAXIMUM QTY IN EACH LOT (WHICH MAY BE REQUIRED IN A PARTICULAR ORDER) WILL BE 10NOS. THERE WILL BE A GAP OF 01 MONTH BETWEEN TWO CONSECUTIVE LOTS.
2 .DELIVERY IS WITHIN 120 DAYS FROM DATE OF PO FOR FIRST LOT.HOWEVER EARLY DELIVERY IS ALSO ACCEPCTABLE.

(H) REVERSE AUCTION:-

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

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

(I) BEING AN OPEN TENDER VENDORS HAVE TO SUBMIT THE DULY FILLLED AND SIGNED & STAMP COPY OF PQR ALONG WITH ALL RELATED DOCUMENTS.

(J) ALL OTHER TERMS AND CONDITIONS SHALL BE AS PER ATTACHED GTC.

PQR for Crirical Regular Direct Mil items

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

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

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

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

FIRST ANGLE PROJECTION

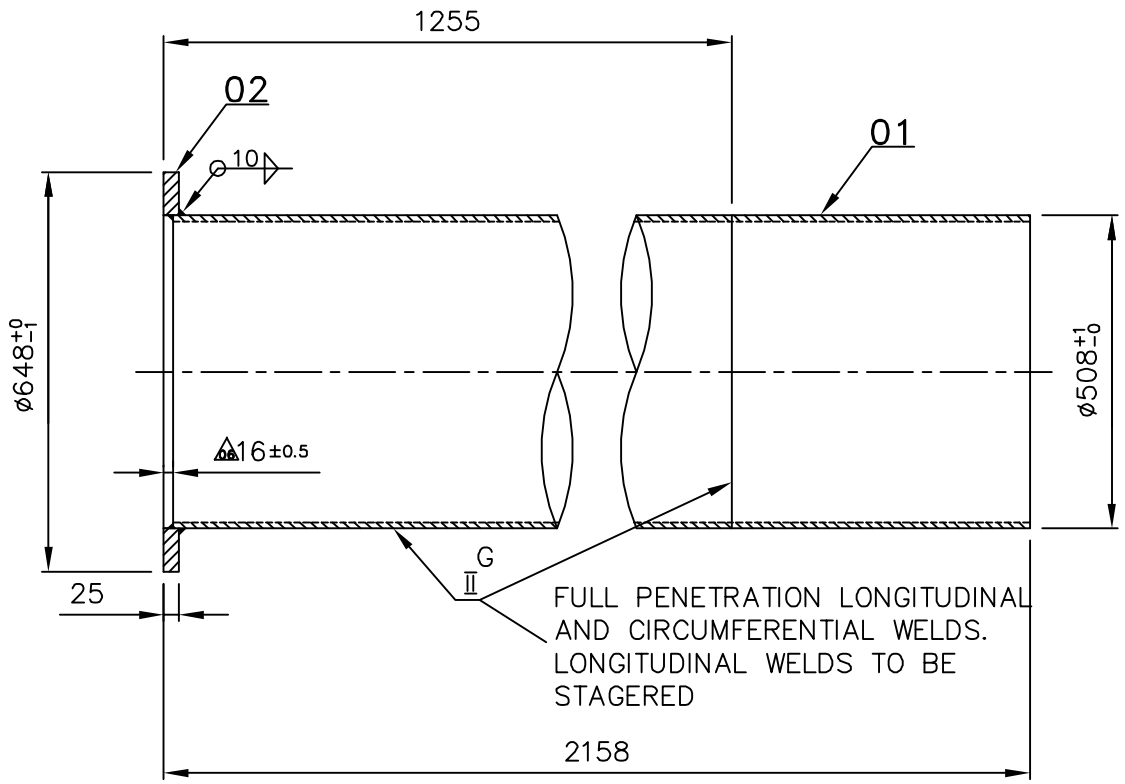
(ALL DIMENSIONS ARE IN mm)

DRG.NO. 3-61-388-02095

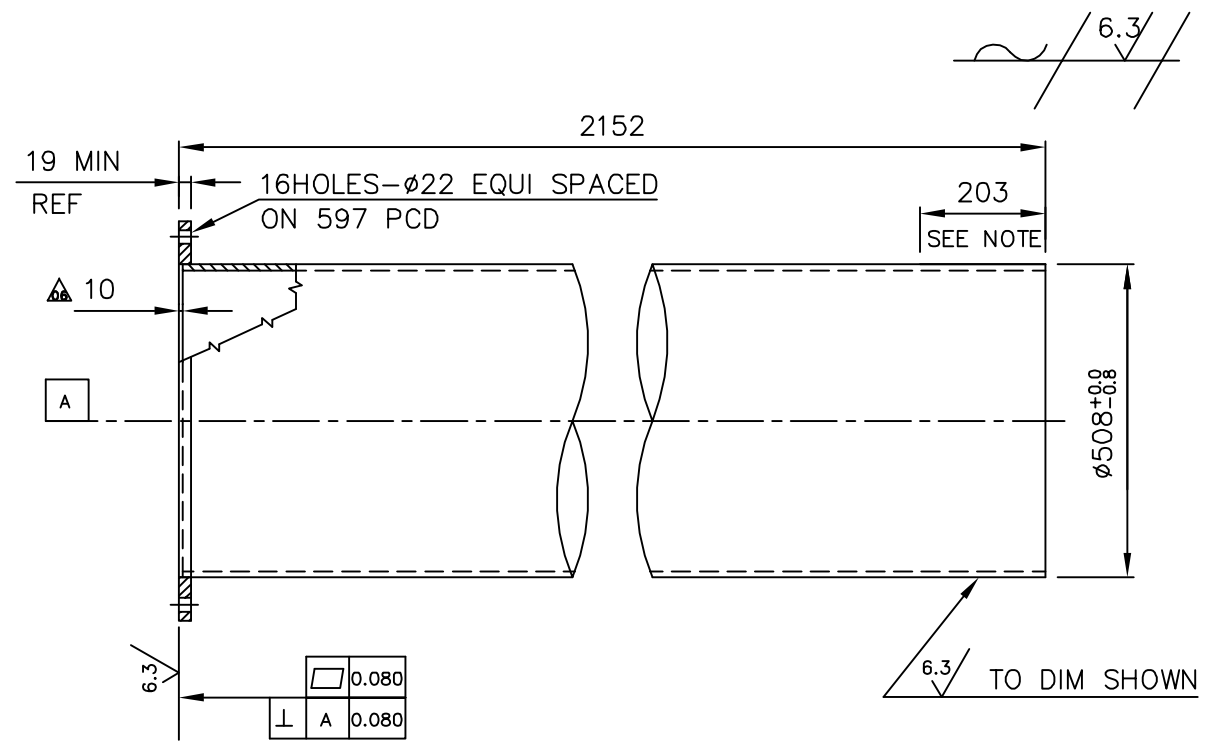
COMP. FILE NAME 36102046.DWG

REF.DRG.NO. (B-94-368-1)

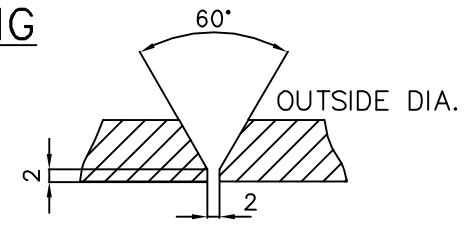
INVENTORY NO.



FABRICATION



MACHINING



BUTT WELD–EDGE PREPARATION

NOTE:

1. THIS PORTION OF PIPE TO BE ROUND SMOOTH AND FREE FROM BURRS.
2. PIPE OD WITHIN ø508 +0.0 −0.8 FOR A LENGTH OF 203mm.
3. EXTRA 300MM ALLOWANCE ADDED FOR BENDING FOR ITEM 0:1
4. WPS: WE155 (FOR SA240TP410S)
   WPS: WE079 (AA10738 TO AA10738)
   WPS: WE148 (AA10738 TO AA10119)

GROSS WT.=398.95

ITEM NO	DESCRIPTION	DRAWING NO.	VAR. NO.	RAW MATERIAL SIZE OR CASTING DRG.NO. OR FORGING DRG.NO.	MATERIAL CODE	NET WT.	GROSS WT.
					MATERIAL SPECN.	QUANTITY	
02	FLANGE	3-61-388-02122			AA1011819155	19.0	24.95
					AA10119	1	
01	PLATE			PL 12 x 1858 x 2147	AA1071838091	320.0	374
					AA10738	1	

REV.	DATE	ALTERED / CHECKED/APPD.	REV.	DATE	ALTERED / CHECKED/APPD.
08	06.02.13	ALTERED SHARIFF / CHECKED/APPD. S.GHATGE	07	17.02.12	ALTERED SHARIFF / CHECKED/APPD. AMAN S.GHATGE
	DIMS 2158, 2152, & 2147 WERE 2108, 2102 & 2097 RESPLY. WT WAS 331.94 EDGE PREPARATION ADDED.			GROSS WT OF ITEM–02 WAS 2.4 KG	
06	02.12.11	ALTERED BGK / CHECKED/APPD. SHARIFF AMAN	05	23.09.06	ALTERED EMA / CHECKED/APPD. GK
	NOTE 3 ADDED, DIM 10 CHANGED TO 16. DIM 1.5 CHANGED TO 10.			NOTE–4 MODIFIED BY ADDING WPS: WE155.	
04	24.12.04	ALTERED UNIC / CHECKED GSNMR / APPD.	03	30.09.03	ALTERED UNIC / CHECKED GSNMR / APPD.
	DIM 2102, 2108 WERE 2134 & 2140. R/W FOR ITEM CORRECTED.			DRG. REDRAWN ON AUTOCAD INCORPARING ALL PREVIOUS REVISIONS. FABRICATION DETAIL ADDED.ITEM NO.1. MATERIAL SPEC. WAS AA10731. NOTE 3 MODIFIED.	

THE FOLLOWING CONDITIONS APPLY EXCEPT OTHERWISE STATED...

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

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

BHEL भारत हेवी इलेक्ट्रिकल्स लिमिटेड हैदराबाद
BHARAT HEAVY ELECTRICALS LTD. HYDERABAD

	NAME	SIGN.	DATE	NO.OF VAR.
DRN.	UNIC		30.09.03	
CHD.	R.RANJAN		1.12.04	
APPD.	S.GHATGE		1.12.04	

DEPT.	CODE	SCALE	WEIGHT (KG)	REF. TO ASSY DRG.	ITEM NO.	NO.OF ITEMS
BMD	446	NTS	339.0	0-61-388-00577	31	67

TITLE: CENTER FEED PIPE–UPPER

DRAWING NO. 3-61-388-02095 REV. 08

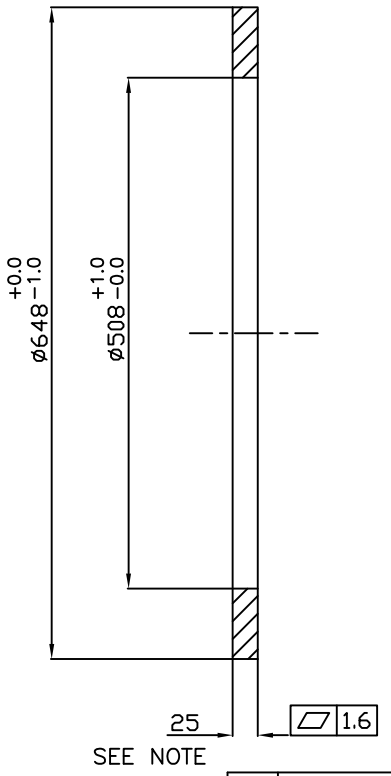
SHEET NO. 01 NO OF SHEETS 01

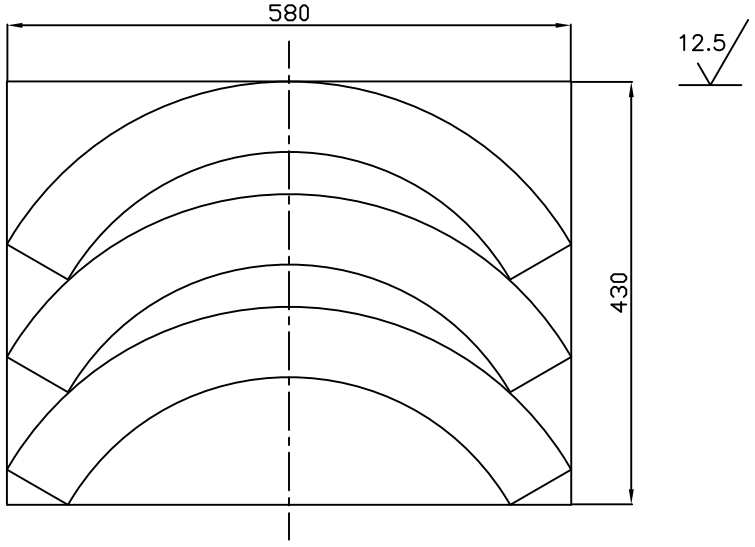
TD–151/REV. 03 SIZE A3

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRG.NO. 3-61-388-02122





CUTTING PLAN

FILE NAME 36102122

REF.DRG.NO.

INVENTORY NO.

NOTE:-

MACHINING IS NOT REQUIRED TO ACHIEVE FLATNESS.

ITEM NO	DESCRIPTION	DRAWING NO.	VAR. NO.	RAW MATERIAL SIZE OR CASTING DRG.NO. OR FORGING DRG.NO.	MATERIAL CODE	NET WT.	GROSS WT.
					MATERIAL SPECN.	QUANTITY	
01	PLATE			PL.25 X 430 X 580	AA1011819155	25.4	
					AA10119	1	

THE FOLLOWING CONDITIONS APPLY EXCEPT OTHERWISE STATED...

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

REV.	DATE	ALTERED	CHD.	APPD.
ZONE				

REV.	DATE	ALTERED RAZVI	CHD. G.S.N.M.RAO	APPD.
01	1.10.03	DRAWING REDRAWN ON AUTOCAD.		
ZONE				

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

BHARAT HEAVY ELECTRICALS LTD. HYDERABAD

	NAME	SIGN.	DATE	NO.OF VAR.
DRN.	RAZVI	-sd-	1.10.03	
CHD.	G.S.N.M.RAO	-sd-	1.10.03	
APPD.	S.GHATGE	-sd-	1.10.03	

DEPT.	SCALE	WEIGHT (KG)	REF. TO ASSY DRG.	ITEM NO.	NO.OF ITEMS
PULVE.ENGG	1:5	25.4	3.61.388.02345	1	2
CODE 446					

TITLE: PIPE FLANGE

DRAWING NO. 3-61-388-02122 REV. 01

SHEET NO. 01 NO OF SHEETS 01

TD-151/REV. 03 SIZE A3

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

0.0 GENERAL:

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

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

1.0 SCOPE:

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

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

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

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

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

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

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

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

It does not apply for the following dimensions:

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

b) Auxiliary dimensions indicated in brackets.

c) Theoretically exact dimensions indicated in rectangular frames.

2.0 COMPLIANCE WITH STANDARDS:

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

3.0 GENERAL TOLERANCES:

3.1 Linear dimensions are given in Table 1 and 2.

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

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

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

Revision: This standard was based on 1969 version of IS:2102			Approved: INTERPLANT STANDARDIZATION COMMITTEE-WG (DOP + BES)		
Rev.No. 01	Amd.No.	Reaffirmed	Prepared BHOPAL	Issued CORP. R&D	Dt. of 1st issue 22-06-1978
Dt. 1-12-1995	Dt.	Year: 2008			

CORPORATE STANDARD

BHEL

4.0 INDICATIONS ON DRAWINGS:

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

Example: AA 023 02 08 m

5.0 REJECTION:

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

6.0 NOTE:

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

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

Values in millimetres

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

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

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

Values in millimetres

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

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

Table 3 — Permissible deviations of angular dimensions

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

Annex A
(informative)

Concepts behind general tolerancing of linear and angular dimensions

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

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

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

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

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

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

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

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

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

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

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

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

The workshop should therefore

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

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

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

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

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

ACCEPTANCE STANDARDS FOR LIQUID PENETRANT EXAMINATION OF WELDS

1.0 SCOPE:

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

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

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

2. DEFINITION OF IHDICATIONS:

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

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

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

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

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

3. ACCEPTANCE STANDARDS:

All surfaces to be examined shall be free from:

a) relevent linear indications.

b) relevent rounded indications greater than 4.8 mm.

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

PROCEDURE FOR LIQUID PENETRANT EXAMINATION

1.0 SCOPE:

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

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

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

2.0 PERSONNEL REQUIREMENT:

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

3.0 DESCRIPTION:

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

4.0 APPROVED METHODS & MATERIALS:

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

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

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

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

5.0 PROCEDURE:

5.1 Surface Preparation:

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

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

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

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

5.2 **Drying:**

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

5.3 **Application Of Penetrants:**

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

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

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

5.4 **Removal Of Excess Penetrant:**

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

5.4.1 **Postemulsifying Penetrants:**

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

5.4.2 **Solvent Removable Penetrants:**

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

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

5.4.3 **Water Washable Penetrants:**

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

5.5 **Drying:**

Surface shall be dried before the application of developer.

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

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

5.6 **Application Of Developer:**

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

5.6.1 **Application Of Dry Developer:**

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

5.6.2 **Application Of Wet Developer**

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

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(a) **Aqueous Developer Application:**

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

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

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

6.0 **EXAMINATION:**

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

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

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

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

6.2 **Fluorescent Penetrants:**

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

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

7.0 **EVALUATION OF INDICATIONS & INTERPRETATION:**

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

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

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

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

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

8.0 **ACCEPTANCE STANDARDS:**

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

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

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

9.0 **POST EXAMINATION CLEANING:**

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

TABLE - 1 (Clause 5.3.2)

Suggested Penetration Time For Post-emulsified And Solvent Removable Penetrants

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

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TABLE - 1 (Clause 5.3.2) Contd.

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

* For lower temperatures, penetration time should be increased.

ANNEXURE - 1 (Clause 5.3.3)

PROCEDURE FOR NON-STANDARD TEMPERATURES

A.1 **General:**

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

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

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

A.3 **Comparator Application:**

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

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

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

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

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

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

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

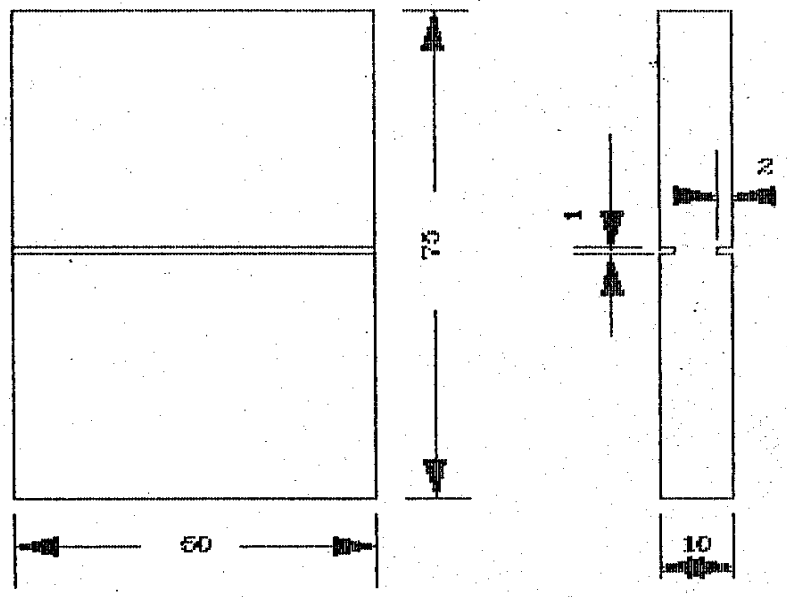

FIGURE: 1-LIQUID PENETRANT COMPARATOR BLOCK

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

ORDERING DESCRIPTION

1.0 GENERAL:

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

2.0 APPLICATION:

For general engineering purposes, suitable for welding.

3.0 CONDITION OF DELIVERY:

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

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

3.3 Any other additional requirement as per BHEL Purchase order.

4.0 DIMENSIONS AND TOLERANCES:

4.1 Sizes:

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

4.2 Tolerances:

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

4.3 Straightness for hot rolled bars:

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

5.0 TEST SAMPLES:

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

Revisions:	APPROVED:
Clause No. 1, 3, 5 & 8 revised (as per MOM of 38th MRC meeting), Clause 10 added	INTERPLANT MATERIAL RATIONALISATION COMMITTEE – MRC(S&GPS)

Rev No.15	Amd No.	Reaffirmed	Prepared	Issued	Dt. of 1st Issue
Dt:11-03-2014	Dt:	Year:	HPEP, Hyderabad	Corp.R&D	June, 1976

CORPORATE PURCHASING SPECIFICATION

6.0 ULTRASONIC EXAMINATION:

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

6.1 For plates above 40 mm thick:

Shall be ultrasonically examined unless when otherwise specified in order.

7.0 TEST CERTIFICATES:

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

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

The test certificate shall bear the following information:

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

BHEL order No.

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

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

8.0 PACKING AND MARKING:

Plates shall be transported suitably to avoid damage during transit.

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

9.0 REJECTION AND REPLACEMENT

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

10.0 REFERRED STANDARDS (Latest publications including amendments):

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

26/6/14

CS-721

STAINLESS STEEL SHEETS AND PLATES - ANNEALED ASTM A 240M, TYPE 410 Î

ORDERING DESCRIPTION

1.0 GENERAL :

The sheets and plates shall conform to the latest version of ASTM A 240M, Î Type: 410 and comply with the following additional requirements.

2.0 APPLICATION:

For general engineering purposes, where corrosion resistance is essential.

3.0 CONDITION OF DELIVERY:

Hot Rolled, annealed and descaled (Finish No.1).

Cold rolled, annealed (2B / 2 D).

4.0 DIMENSIONS AND TOLERANCES:

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

5.0 CHEMICAL COMPOSITION:

As per ASTM A 240M, Type 410. Î

6.0 TEST CERTIFICATES :

Three copies of test certificates shall be supplied along with the following information:

BHEL References :

AA 107 38 -Rev. No.07 / ASTM A 240M, Type:410 Î
BHEL order No,

Supplier's References :
Name
Identification No.
Melt No.
Process of manufacture
Details of heat treatment.

Result of Tests:
Dimensional inspection.
Results of chemical analysis, mechanical tests

7.0 PACKING AND MARKING :

Sheets shall be supplied in bundles or in packages each weighing upto a maximum of 3000kg. Plates shall be suitably packed to prevent damage during transit.

For plates below 25 mm thick, each pile (preferably of 16 plates) shall be marked with suppliers identification mark, 'AA 107 38 / ASTM A 240M, Type:410, melt No., BHEL Î order No., on the top plate.

Each plate of 25mm thickness and above shall be stamped/painted with the suppliers identification mark, 'AA 107 38 / ASTM A 240M, Type:410 , melt No., BHEL order Î No., on the top plate.

FOR INFORMATION ONLY

CHEMICAL COMPOSITION

C	Si	Mn	Ni	Cr	S	P	Al
0.08-0.15	≤ 1.0	≤ 1.0	≤ 0.75	11.5-13.5	≤ 0.030	≤ 0.040	-

MECHANICAL PROPERTIES

Hardness, max		0.2% PS min	UTS, min	% El min	Cold Bend. Î
BHN	HRB	N/mm²	N/mm²		
217	96	205	450	20	180^0

RUST PREVENTIVE HARD FILM, BLACK (TRP)

1.0 GENERAL:

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

2.0 APPLICATION:

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

3.0 REMOVAL:

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

4.0 COLOUR : Steel Black.

5.0 COMPLIANCE WITH NATIONAL STANDARDS:

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

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

6.0 COMPOSITION:

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

7.0 TEST SAMPLES:

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

8.0 PROPERTIES:

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

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

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

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

8.4 Weight : 11 ± 0.5 kg per 10 litres.

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

8.6 Test for Adhesion : To pass the test

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

8.8 Protection against corrosion at high temperature and humidity:

To pass the test for 360 hours, minimum..

9.0 TYPE TESTS:

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

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

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

10.0 TEST CERTIFICATES:

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

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

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

11.0 KEEPING PROPERTY:

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

12.0 PACKING & MARKING:

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

Each container shall marked with the following information:

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

8.0 ENVIRONMENTAL REQUIREMENTS:

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

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

13.0 REFERRED STANDARDS (Latest Publications Including Amendments):

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

BHEL HERP VARANASI
QUALITY PLAN

Centre Feed Pipes (Pipe Material AA10738)

SL.NO.	COMPONENT	CHARACTERISTIC CHECKED	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENTS & ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
							P	W	V	
1.0	Raw Material : Plates	i.Chemical & Mechanical properties	Chemical analysis and Mechanical test	1 sample per heat batch	AA10119	TC	3	-	2	Manufacturer's TC is also acceptable for chemical and mechanical properties
		ii.Chemical & Mechanical properties	Chemical analysis and Mechanical test	1 sample per heat batch	AA 10738	TC	3	-	2	Plates AA10738 should be procured from BHEL approved sources only (Specified in Purchase Order)
2.0	Fabrication	ii. Fit up exam and welding	Measurement	100%	Drawing	Dim.report	3	-	2	Tolerance to be maintained as per drg. All welding shall be done by qualified welders only. BHEL WPS nos. WE-079, and WE-148 should be followed for SMAW as per requirement of drawings. Compatible welding electrodes (as mentioned in above WPS) should be used. Job should be preheated to temperature mentioned in WPS no. WE-079. If MIG/MAG welding process is used, prior WPS approval is to be taken from BHEL.
		iii.Post Weld Heat Treatment	Review of HT Chart	100%	As per applicable WPS WE-079		3	-	2	As per WPS WE-079 Following Heat treatment cycle should be followed : 1) Free Heating upto 400°C 2) Rate of Heating 100°C/Hr upto 680°C to 710°C 3) Soaking time 1 hour. 4) Rate of cooling 100°C/Hr upto 400°C 5) Free Cooling in ambient air below 400°C
		iv. D.P.Testing of welded joints	D.P.test	100%	AA0850131 & AA0850129	TC	3	2	-	100% D.P.test shall be witnessed by BHEL AIA
3.0	Final Inspection after Fabrication, Stress relieving and NDT.	i.Dimensions	Measurement	100%	Drawing.	Dimension Report	3	2	-	Unspecified tolerances shall be maintained as follows : a) As per medium tolerance class of Specn. AA0230208 for machined dimensions. b) As per Tolerance class B of specn. AA0621104 for fabricated dimensions.
		ii. Painting & preservation		100%		Insp.Report	3	2	-	All Machined surfaces of material other than SS (AA 10738) shall be protected by applying TRP black paint (specn. AA55154). All threaded holes to be protected by applying grease
		iii.Identification & Marking	Punching of Drg. No., P.O.No., Vendor code no., year, Inspector Seal	100%	Drawing	Inspection Report	3/2	2	-	
			APPROVED BY		MANAGER P&D					
			SIGNATURE & DATE							

QP. NO.	RV/FAB /31
DATE	09/08/2011
PG. NO.	1 OF 1

P = PERFORM.C. = TEST CERTIFICATE
W = WITNESS H.T. = HEAT TREATMENT
V = VERIFY
3 = VENDOR
2 = BHEL AUTHORISED INSPECTION AGENCY (AIA)

विरेन्द्र कुमार/VIRENDRA KU...
प्रबंधक (यो०वि०) / Manager (P...)
भारत हेवी इलेक्ट्रिकल्स लिमिटेड
Bharat Heavy Electricals Ltd.
हर्प, वाराणसी
HERP, Varanasi

635

POSITIONS (QW-405)

Position [s] Groove 1G

Welding Progression : Up ... Down ... ...

Position [s] Fillet ...

[POSTWELD HEAT TREATMENT QW-407

Temperature Range 600-620°C

Time Range One hour

GAS [QW-408]

Percent Composition

Gas [es] [Mixture] Flow Rate

Shielding -

Trailing -

Backing -

PREHEAT [QW-406]

Preheat Temp Min 150°C (For 1st layer only)

Interpass Temp. Max 200°C

Preheat Maintenance -

ELECTRICAL CHARACTERISTICS [QW-409]

Current AC or DC DC Polarity +Ve

Amps [Range] 140-180 Volts Range 22-26

Tungsten Electrode size and type -

Mode of Metal Transfer for GMAW -

Electrode wire feed speed range -

TECHNIQUE [QW-410]

String or Weave Bead String only Orifice or Gas Cup Size -

Initial and Interpass Cleaning By Chipping, Brushing, Grinding

Method of Back Gouging - oscillation -

Contact Tube to Work Distance - Multiple or Single Pass Multi

Multiple or single Electrodes Single Travel Speed [Range] -

Peening No Electrode Spacing -

Other Clean the weld area prior to welding to remove Oil, Rust, Grease etc.

Weld Layer [s]	Process	Filler Metal Class	Filler Metal Dia. mm	Current Type Polar	Current Amp. Range	Volt Range	Travel Speed Range mm/min	Other
1st layer	SMAW	E309Mo-15	5.0	DC+	160-180	22-26	-	String only
subsequent layers	"	E308-L-15	"	"	"	"	-	--do--

CONTROLLED COPY

Prepared by [signature] 14/12/87

MANAGER
WELDING ENGG.

BHARAT HEAVY ELECTRICALS LIMITED

RAMACHANDRAPURAM, HYDERABAD-500 032.

PD - 268

QW-482 WELDING PROCEDURE SPECIFICATION (WPS)

Welding Procedure Specification No. WE055 Date 8.10.82 Supporting PQR No 193

Revision No. 1 Date 01.03.1989

Welding Process (es) SMAW Type (s) Manual

Details

JOINTS (QW 402)

Joint Design S.S.Overlay on P1,

Backing (Yes) - (No) -

Backing Material (Type) -

Metal - non fusing metal -

BASE METALS (QW-403) A8 overlay

P. No. 1 Group No. 1 & 2 to P. No. - Group No. -

OR

Specification type and grade

to Specification type and grade

OR

Chem. Analysis and Mech Prop

to Chem Analysis and Mech Prop

Thickness Range : 25mm & above

Base Metal Groove Fillet -

Pipe Dial Range : Groove - Fillet -

Other -

FILLER METAL (QW-404) 1st layer by E 309 Mo-15

F. No. 5 Other Subsequent layers by E 308L-15

A. No 8 Other (1)

Spec. No. (SFA) 5.4

DEPOSITED WELD METAL

AWS No. (Class) E309Mo-15&E308L-15 Thickness Range : 6mm and above (Overlay)
3mm Max by E 309Mo-15

Size of filler metals ∅ 5.0mm Groove Rest by E308L-15

Electrode-Flux. (Class) Basic Fillet

Flux Trade Name - Max. bead thickness : 5mm

Consumable insert No; Retainer: No.

(1) Rev., Format details added

AUTHORISED SIGN

BHARAT HEAVY ELECTRICALS LIMITED

RAMACHANDRAPURAM, HYDERABAD-500 032.

PD - 268

QW-482 WELDING PROCEDURE SPECIFICATION (WPS)

Welding Procedure Specification No WE.079. Date 31.10.90 Supporting PQR No. 322

Revision No 1 Date 10.03.95

Welding Process (es) SMAW Type (s) Manual

JOINTS (QW 402) Details

Joint Design As per Drawing

Backing (Yes) For double side welds (No) For single side welds

Backing Material (Type) Base metal/Weld metal

Metal Yes Non fusing metal --

Retainer : No

BASE METALS (QW-403)

P. No. - Group No. - to P. No. - Group No. -

OR

Specification type and grade X 12 Cr 13

to Specification type and grade X 12 Cr 13

OR

Chem. Analysis and Mech. Prop. --

to Chem. Analysis and Mech. Prop. --

Thickness Range :

Base Metal : ——— Groove 4.75 to 200mm Fillet All

Pipe Dia. Range : Groove All dia Fillet All

Other Root spacing for backing strip jts : 8-10mm
For others : 2 ± 1mm

FILLER METALS (QW-404)

Spec. No. (SFA)	5.4
AWS No. (Class)	E 410 - 16/15
F. No.	4
A. No	6
Size of Filler Metals	Ø 2.5 to 5.0mm
Deposited Weld Metal	Max head thickness : 5mm
Thickness Range : Groove	200mm Max
Fillet	All
Electrode Flux (Class)	Rutile
Flux Trade Name	--NA-
Consumable Insert	No

POSITIONS (QW-405)

Position [s] Groove All

Welding Progression : Up For V Down —

Position [s] Fillet All

[POSTWELD HEAT TREATMENT QW-407]

Temperature Range 680 - 710

Time Range 1 Hr/25mm upto 50mm. For every Additional 25mm : 15 Minutes

PREHEAT [QW 406]

Preheat Temp Min 280°C

Interpass Temp. Max 350°C

Preheat Maintenance By Oxy Accetalyne or Producer Gas

GAS [QW-408] NA

Percent Composition

Gas [es] [Mixture] Flow Rate

Shielding

Trailing

Backing

ELECTRICAL CHARACTERISTICS [QW-409]

Current AC or DC DC Polarity +Ve (DCEP)

Amps [Range] 60-180 Volts Range 22-26

Tungsten Electrode size and type NA

Mode of Metal Transfer for GMAW NA

Electrode wire feed speed range NA

TECHNIQUE [QW-410]

String or Weave Bead String Orifice or Gas Cup Size NA

Initial and Interpass Cleaning Chipping, Brushing, Grinding

Method of Back Gouging By Grinding oscillation No

Contact Tube to Work Distance NA Multiple or Single Pass Multi

Multiple or sinlge Electrodes Single Travel Speed [Range] --NA-

Peening Not allowe Electrode Spacing NA

Other Clean edges to be welded to remove, Grease, Rust etc. Prior to welding.

Weld Layer [s]	Process	Filler Metal Class	Filler Metal Dia. mm	Current Type Polar	Current Amp. Range	Volt Range	Travel Speed Range mm/min	Other
	SMAW	E410-16	2.5	DC+	60-80	--	--	String
	SMAW	E410-16	3.15	DC+	90-110	--	--	"
	SMAW	E410-16	4.0	DC+	110-140	--	--	"
	SMAW	E410-16	5.0	DC+	140-180	--	--	"

PREPARED BY

SR MANAGER
WELDING ENGG.

BHARAT HEAVY ELECTRICALS LIMITED

Ramachandrapuram, Hyderabad – 500 032.

QW – 482 WELDING PROCEDURE SPECIFICATION (WPS)

Welding Procedure Specification No.: *WE 148* **Date:** *05/01/2004* **Supporting PQR No.: 466**

Revision No.: 0 **Date: --**

Welding Process (es) : SMAW **Type (s) :** *Manual*

JOINTS (QW 402) **Details**

Joint Design : As per manufacturing drawing

Backing (Yes) : BASE MATERIAL

Backing Material (Type) : *Base Metal/weld metal*
Metal : *Yes*
Retainer : *No*

Non-Fusing Metal : *No*

BASE METALS (QW – 403)

P. No. : 6 **Group No. :** *1* **TO** **P. No.: 1** **Group No.1&2**

OR

Specification type & grade : ---
to Specification type & grade : ---

OR

Chemical Analysis & Mechanical Properties : ----
to Chemical Analysis & Mechanical Properties : -----

Thickness Range :
Base Metal : **Groove: 4.75 to 24 mm** **Fillet :** *All sizes*

Pipe Dia. Range : Groove: all dia **Fillet :** *All sizes*

Other : --

Filler Metals (QW – 404)	
Spec. No. (SFA)	*5.4*
AWS No. (Class)	*E309-15*
F. No.	*5*
A. No.	-
Size of Filler Metals	*2.5 – 5.0 mm*
Deposited Weld Metal	-
Thickness Range: Groove	*24 mm*
Fillet	*All*
Electrode Flux (Class)	*Basic*
Flux Trade Name	*NA*
Consumable Insert	*No*
Max. Bead Thickness	5.0 mm max

BHARAT HEAVY ELECTRICALS LIMITED

Ramachandrapuram, Hyderabad – 502 032.

QW – 482 WELDING PROCEDURE SPECIFICATION (WPS)

Welding Procedure Specification No.: ***WE 155*** **Date:** **08-09-06** **Supporting PQR No.:** **488**

Revision No.: ***0*** **Date: ----**

Welding Process (es) : ***SMAW*** **Type (s) :** ***MANUAL***

JOINTS (QW 402)

Joint Design : **As per manufacturing drawing (groove / fillet)**

Backing (Yes) : ***for double side and backing strip joints***
(No) : ***for single side joints***
Backing Material (Type) : ***Base metal / Weld metal***

Metal : ***Yes*** **Non-Fusing Metal :** ***No***
Retainer : ***No***

BASE METALS (QW – 403)

P. No. : 7 **Group No. :** 1 **TO** **P. No.: 7** **Group No.:** 1

OR
Specification type & grade : **SA240 TP410S** **to** Specification type & grade **SA240 TP410S**

Thickness Range :
Base Metal : **Groove:** ***4.75 mm to 20 mm*** **Fillet :** ***all sizes***

Pipe Dia. Range : Groove: ***all dia*** **Fillet : :** ***all sizes***

Other : ---

403.13 : not applicable

Filler Metals (QW – 404)	
Spec. No. (SFA)	***5.4***
AWS NO (CLASS)	***E 309-15***
F. No.	**5**
A. No.	**--**
Size of Filler Metals	***Dia 2.5 to5.0 mm***
Deposited Weld Metal	
Thickness Range:Groove: **Fillet :**	***32 mm Max.*** **ALL**
Electrode Flux (Class)	***Basic***
Consumable Insert	***No***
Max. Bead Thickness	---

WPS:WE 155

POSITIONS (QW-405)	POSTWELD HEAT TREATMENT (QW-407)
Position(s) : ALL POSITIONS **Welding Progression : UP for Vertical Down ---** **Position (s) Fillet : ALL**	**Temperature and TimeRange : NIL**
PREHEAT (QW-406)	**GAS (QW-408)**
Preheat Temp Min : 100° C upto 10mm **200° C above 10mm** **Interpass Temp Max : 350 ° C** **Preheat Maintenance : Throughout welding**	**NOT APPLICABLE**

ELECTRICAL CHARACTERISTICS (QW-409)

Current AC or DC : ***DIRECT CURRENT*** **Polarity :** ***ELECTRODE POSITIVE***

Amps [Range] : 60 to 180 A **Volts Range : 22-26 V**

TECHNIQUE (QW-410)

String or Weave Bead : string only
Initial and Interpass Cleaning : chipping ; brushing ; grinding
Method of Back Gouging: by grinding
Multiple or Single Pass : multiple pass
Multiple or Single Electrodes : single electrode
Peening : no

Clean weld area to remove oil, rust, grease, etc. prior to welding.

Weld Layer (s)	Process	Filler Metal		Current		Volt Range	Other
		Class	Dia mm	Type Polar	Amp Range		
1	*SMAW*	*E309_15*	*2.5*	*DC +*	*60-80*	--	*String only*
2	*SMAW*	*E309_15*	*3.15*	*DC +*	*80-110*	--	,,
3	*SMAW*	*E309_15*	*4.0*	*DC +*	*110-140*	--	,,
4	*SMAW*	*E309_15*	*5.0*	*DC +*	*140-180*	--	,,

HEAD / WELDING ENGG

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

0.0 GENERAL:

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

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

1.0 SCOPE:

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

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

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

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

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

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

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

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

It does not apply for the following dimensions:

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

b) Auxiliary dimensions indicated in brackets.

c) Theoretically exact dimensions indicated in rectangular frames.

2.0 COMPLIANCE WITH STANDARDS:

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

3.0 GENERAL TOLERANCES:

3.1 Linear dimensions are given in Table 1 and 2.

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

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

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

Revision: This standard was based on 1969 version of IS:2102			Approved: INTERPLANT STANDARDIZATION COMMITTEE-WG (DOP + BES)		
Rev.No. 01	Amd.No.	Reaffirmed	Prepared BHOPAL	Issued CORP. R&D	Dt. of 1st issue 22-06-1978
Dt. 1-12-1995	Dt.	Year: 2008			

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4.0 INDICATIONS ON DRAWINGS:

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

Example: AA 023 02 08 m

5.0 REJECTION:

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

6.0 NOTE:

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

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

Values in millimetres

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

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

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

Values in millimetres

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

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

Table 3 — Permissible deviations of angular dimensions

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

Annex A
(informative)

Concepts behind general tolerancing of linear and angular dimensions

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

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

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

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

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

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

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

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

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

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

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

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

The workshop should therefore

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

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

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

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

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

GENERAL TOLERANCES FOR WELDING CONSTRUCTIONS FOR LENGTHS AND ANGLES

1.0 GENERAL

1.1 General tolerances are permissible variations corresponding to the degrees of accuracy normally observed in workshops where details of tolerances are not provided in the drawings.

1.2 The general tolerances specified in this standard apply to dimensions for which the tolerances are indicated on the nominal dimensions for welded components, welded assemblies and welded structures.

1.3 The variations apply to linear dimensions such as outside dimensions, inside dimensions, stepped dimensions, widths, Centre-to-Centre distances and also angles.

1.4 Special rulings may be stated for linear dimensions of welded structures consisting of several assemblies.

1.5 This standard is based on BS EN ISO 13920-1997

1.6 General tolerances for machined components are covered in Corporate Standard AA0230208.

1.7 Refer Corporate Standard AA0621105 for general tolerances for welded structures - Form and Position.

2.0 SCOPE

2.1 This standard prescribes four degrees of accuracy based on differences arising out of function and manufacture of welded components, assemblies and structures.

2.2 For technical and economic reasons other degrees of accuracy may be appropriate which have to be specifically stated.

3.0 GENERAL TOLERANCES

3.1 Tolerances for linear dimensions are given in Table 1.

3.2 Table 2, for the tolerances on angular dimensions.

4.0 REPRESENTATION ON DRAWINGS

4.1 The required degree of accuracy shall be specified in all fabrication drawings.

For example class 'B' of AA0621104 (BS EN ISO 13920)

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4.2 Figures 1 to 5 give examples of how dimensions (linear & angular) are to be indicated on the drawings. (Refer page 6 of 6 of this standard)

5.0 TESTING

5.1 The actual size of an angular structural component is determined by placing suitable measuring instruments tangentially on the welded part so that the zone affected by the weld is eliminated. The variation is obtained from the difference between the dimension in the drawing and the actual size.

TABLE-1 **TOLERANCE FOR LINEAR DIMENSIONS**

Range of nominal sizes l in mm											
Tolerance Class	2 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	Over 4000 up to 8000	Over 8000 up to 12000	Over 12000 up to 16000	Over 16000 up to 20000	Over 20000
	Tolerances t in mm										
A	± 1	± 1	± 1	± 2	± 3	± 4	± 5	± 6	± 7	± 8	± 9
B		± 2	± 2	± 3	± 4	± 6	± 8	± 10	± 12	± 14	± 16
C		± 3	± 4	± 6	± 8	± 11	± 14	± 18	± 21	± 24	± 27
D		± 4	± 7	± 9	± 12	± 16	± 21	± 27	± 32	± 36	± 40

TABLE-2 **TOLERANCES FOR ANGULAR DIMENSIONS**

Tolerance Class	Range of Nominal sizes l in mm (Length of shorter leg)		
	Up to 400	Over 400 upto 1000	Over 1000
	Tolerance Δα (In degrees and minutes)		
A	± 20’	± 15’	± 10’
B	± 45’	± 30’	± 20’
C	± 1°	± 45’	± 30’
D	± 1°30’	± 1°15’	± 1º
Calculated and rounded tolerances t, in mm/m[a]			
A	± 6	± 4.5	± 3
B	± 13	± 9	± 6
C	± 18	± 13	± 9
D	± 26	± 22	± 18
[a] The value indicated in mm/m correspond to the tangent value of the general tolerance. It is to be multiplied by the length, in m, of the shorter leg.			

NOTE:

1) The permissible variations also apply to unmarked angles of 90º and 180º.
2) The shorter side of the angle is specified as the reference side.
3) Its length can also be taken from a specially indicated reference point to be shown in the drawings.
4) If the drawing contains no angle data, but only linear dimensions, then the permissible variations are to be taken in mm/m.

6.0 Tolerances on dimensions of welded assemblies, the part of which are machined preliminarily and the assembly after welding as per given size not subjected to machining are set 50% lower than the tolerances on dimensions requiring a given accuracy.

7.0 In case of necessity, it is allowed to set as symmetrical tolerances in relation to nominal, but in this case the sum total of the value of the tolerance is to be preserved as per table 1.

8.0 Deformation of welded constructions (not in contact with floor plate) is allowed up to limits given in table 3.

Remarks:

1) The local convexities and concavities of the sheathing surface having smooth transition are allowed up to 4 mm.
2) General bend along the whole length of the sheathing should not exceed W mm per running metre.
3) Bends in the thin walled construction of the type of branch pipes, baffles of air draft hydro-generators are considered separately in every particular case.

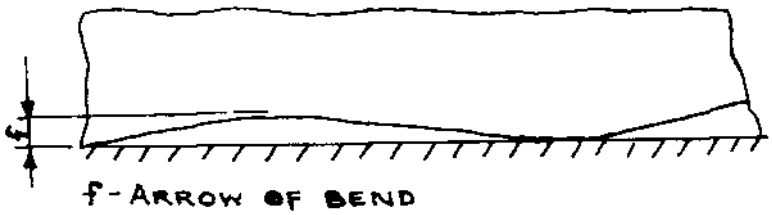

TABLE-3

Type of Construction	Length in mm						
Beams, spokes, stands, guards and similar parts	10000 to 15000	5000 to 10000	3000 to 5000	1500 to 3000	1000 to 1500	500 to 1000	Upto 500
	Allowable bend in mm						
	10.0	8.0	6.0	4.5	3.0	2.5	2.0
Frames, Floor plates dished parts, boxes External covers, bearings and Similar parts.	12.0	10.0	8.0	6.0	4.0	3.0	2.0

9.0 Allowance for machining of welded construction is determined as per table 5.

Remarks:

1) In case of machining of diameters and constructions from two sides the allowance is doubled.

2) For "Dimension as per drawing" is taken the dimension for which the allowance is meant.

10.0 Tolerances on bend "C" shall be as per table 4.

TABLE – 4

Width of flange ''b'' in mm	Thickness of flange ''s'' in mm	Tolerance ''c'' in mm
400-201	60-41	3.0
	40-31	3.5
	30-21	4.0
	20-11	4.5
	10 and lower	5.0
200-150	40-31	3.0
	30-21	3.5
	20-11	4.0
	10 and lower	5.0
149-100	40-31	2.5
	30-21	3.0
	20-11	3.5
	10	4.5
99-50	30-21	2.0
	20-11	2.5
	10	3.0
50 and lower	30-21	1.5
	20-11	2.0
	10	2.5

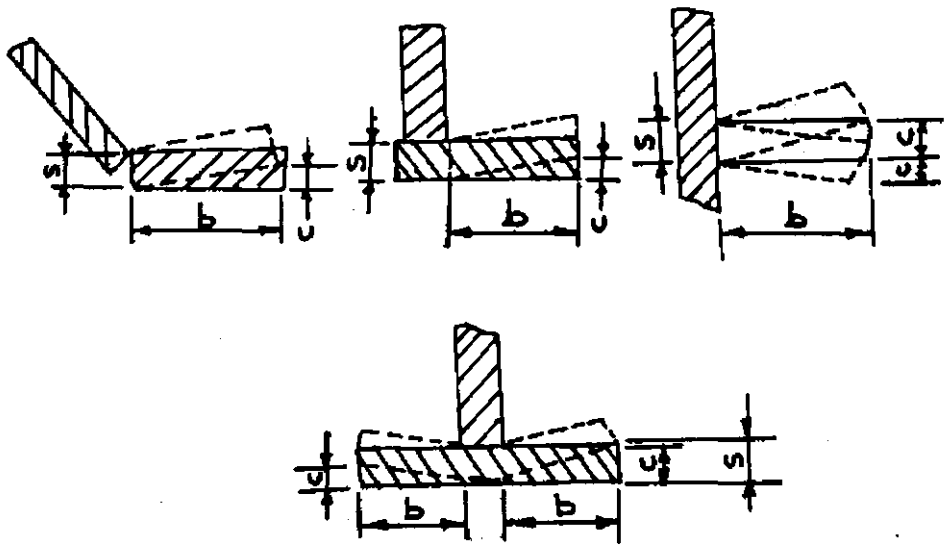

TABLE-5

Dimension as per Drawing (mm)	Machining Allowance per side (mm)
Upto 500	6
More than 500 & upto 1000	8
More than 1000 & upto 2000	10
More than 2000 & upto 4000	12
More than 4000 & upto 6000	14
More than 6000 & upto 10000	18
More than 10000 & upto 15000	22
More than 15000	24

11.0 REFERRED STANDARDS (Latest publications including amendment)

1) AA0230208
2) AA0621105

CORPORATE STANDARD

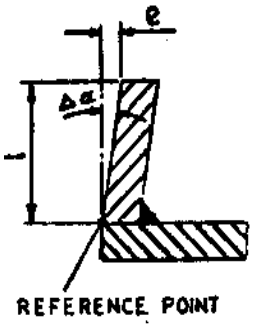

FIG. 1

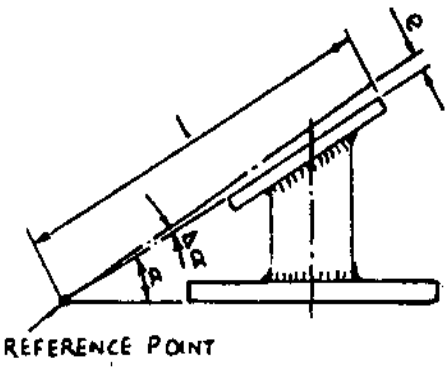

FIG. 2

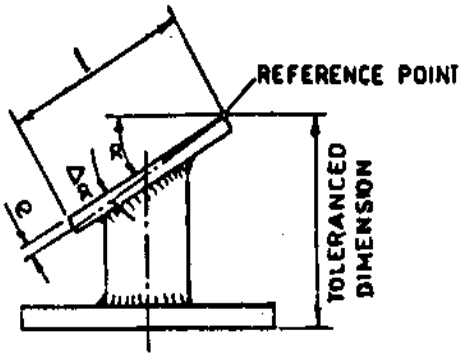

FIG. 3

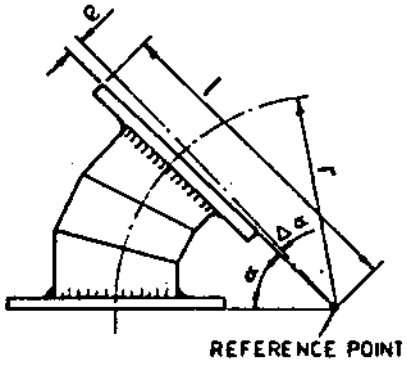

FIG. 4

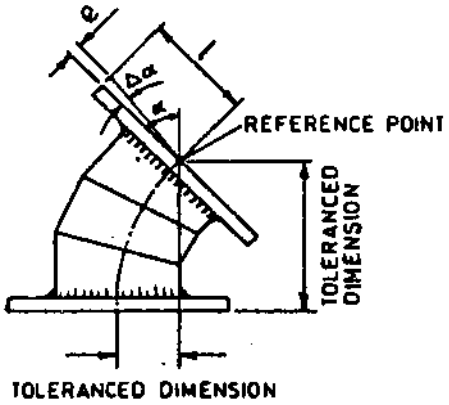

FIG. 5

ACCEPTANCE STANDARDS FOR LIQUID PENETRANT EXAMINATION OF WELDS

1.0 SCOPE:

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

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

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

2. DEFINITION OF IHDICATIONS:

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

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

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

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

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

3. ACCEPTANCE STANDARDS:

All surfaces to be examined shall be free from:

a) relevent linear indications.

b) relevent rounded indications greater than 4.8 mm.

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

PROCEDURE FOR LIQUID PENETRANT EXAMINATION

1.0 SCOPE:

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

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

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

2.0 PERSONNEL REQUIREMENT:

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

3.0 DESCRIPTION:

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

4.0 APPROVED METHODS & MATERIALS:

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

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

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

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

5.0 PROCEDURE:

5.1 Surface Preparation:

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

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

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

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

5.2 **Drying:**

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

5.3 **Application Of Penetrants:**

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

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

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

5.4 **Removal Of Excess Penetrant:**

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

5.4.1 **Postemulsifying Penetrants:**

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

5.4.2 **Solvent Removable Penetrants:**

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

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

5.4.3 **Water Washable Penetrants:**

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

5.5 **Drying:**

Surface shall be dried before the application of developer.

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

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

5.6 **Application Of Developer:**

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

5.6.1 **Application Of Dry Developer:**

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

5.6.2 **Application Of Wet Developer**

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

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(a) **Aqueous Developer Application:**

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

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

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

6.0 **EXAMINATION:**

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

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

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

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

6.2 **Fluorescent Penetrants:**

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

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

7.0 **EVALUATION OF INDICATIONS & INTERPRETATION:**

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

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

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

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

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

8.0 **ACCEPTANCE STANDARDS:**

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

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

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

9.0 **POST EXAMINATION CLEANING:**

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

TABLE - 1 (Clause 5.3.2)

Suggested Penetration Time For Post-emulsified And Solvent Removable Penetrants

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

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TABLE - 1 (Clause 5.3.2) Contd.

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

* For lower temperatures, penetration time should be increased.

ANNEXURE - 1 (Clause 5.3.3)

PROCEDURE FOR NON-STANDARD TEMPERATURES

A.1 **General:**

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

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

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

A.3 **Comparator Application:**

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

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

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

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

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

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

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

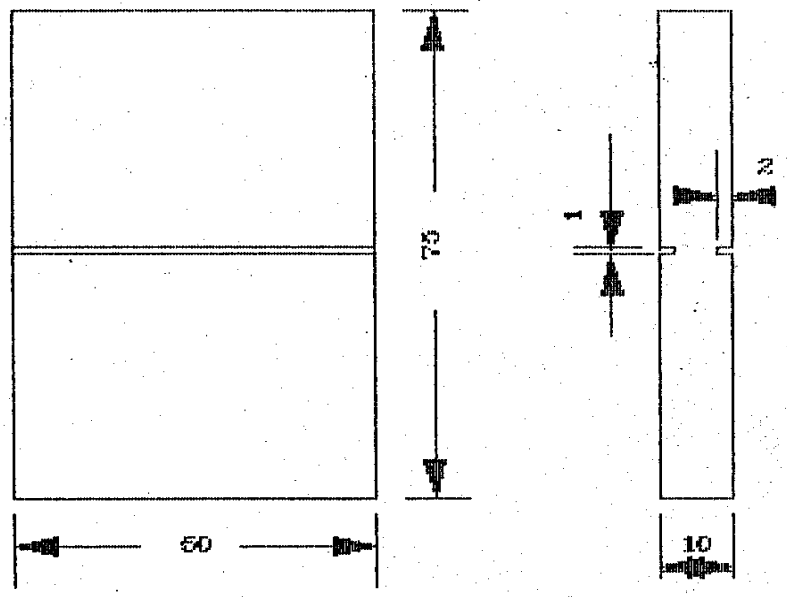

FIGURE: 1-LIQUID PENETRANT COMPARATOR BLOCK

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

ORDERING DESCRIPTION

1.0 GENERAL:

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

2.0 APPLICATION:

For general engineering purposes, suitable for welding.

3.0 CONDITION OF DELIVERY:

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

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

3.3 Any other additional requirement as per BHEL Purchase order.

4.0 DIMENSIONS AND TOLERANCES:

4.1 Sizes:

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

4.2 Tolerances:

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

4.3 Straightness for hot rolled bars:

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

5.0 TEST SAMPLES:

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

Revisions:	APPROVED:
Clause No. 1, 3, 5 & 8 revised (as per MOM of 38th MRC meeting), Clause 10 added	INTERPLANT MATERIAL RATIONALISATION COMMITTEE – MRC(S&GPS)

Rev No.15	Amd No.	Reaffirmed	Prepared	Issued	Dt. of 1st Issue
Dt:11-03-2014	Dt:	Year:	HPEP, Hyderabad	Corp.R&D	June, 1976

CORPORATE PURCHASING SPECIFICATION

6.0 ULTRASONIC EXAMINATION:

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

6.1 For plates above 40 mm thick:

Shall be ultrasonically examined unless when otherwise specified in order.

7.0 TEST CERTIFICATES:

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

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

The test certificate shall bear the following information:

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

BHEL order No.

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

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

8.0 PACKING AND MARKING:

Plates shall be transported suitably to avoid damage during transit.

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

9.0 REJECTION AND REPLACEMENT

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

10.0 REFERRED STANDARDS (Latest publications including amendments):

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

26/6/14

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STAINLESS STEEL SHEETS AND PLATES - ANNEALED ASTM A 240M, TYPE 410 Î

ORDERING DESCRIPTION

1.0 GENERAL :

The sheets and plates shall conform to the latest version of ASTM A 240M, Î Type: 410 and comply with the following additional requirements.

2.0 APPLICATION:

For general engineering purposes, where corrosion resistance is essential.

3.0 CONDITION OF DELIVERY:

Hot Rolled, annealed and descaled (Finish No.1).

Cold rolled, annealed (2B / 2 D).

4.0 DIMENSIONS AND TOLERANCES:

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

5.0 CHEMICAL COMPOSITION:

As per ASTM A 240M, Type 410. Î

6.0 TEST CERTIFICATES :

Three copies of test certificates shall be supplied along with the following information:

BHEL References :

AA 107 38 -Rev. No.07 / ASTM A 240M, Type:410 Î
BHEL order No,

Supplier's References :
Name
Identification No.
Melt No.
Process of manufacture
Details of heat treatment.

Result of Tests:
Dimensional inspection.
Results of chemical analysis, mechanical tests

7.0 PACKING AND MARKING :

Sheets shall be supplied in bundles or in packages each weighing upto a maximum of 3000kg. Plates shall be suitably packed to prevent damage during transit.

For plates below 25 mm thick, each pile (preferably of 16 plates) shall be marked with suppliers identification mark, 'AA 107 38 / ASTM A 240M, Type:410, melt No., BHEL Î order No., on the top plate.

Each plate of 25mm thickness and above shall be stamped/painted with the suppliers identification mark, 'AA 107 38 / ASTM A 240M, Type:410 , melt No., BHEL order Î No., on the top plate.

FOR INFORMATION ONLY

CHEMICAL COMPOSITION

C	Si	Mn	Ni	Cr	S	P	Al
0.08-0.15	≤ 1.0	≤ 1.0	≤ 0.75	11.5-13.5	≤ 0.030	≤ 0.040	-

MECHANICAL PROPERTIES

Hardness, max		0.2% PS min	UTS, min	% El min	Cold Bend. Î
BHN	HRB	N/mm²	N/mm²		
217	96	205	450	20	180^0

RUST PREVENTIVE HARD FILM, BLACK (TRP)

1.0 GENERAL:

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

2.0 APPLICATION:

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

3.0 REMOVAL:

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

4.0 COLOUR : Steel Black.

5.0 COMPLIANCE WITH NATIONAL STANDARDS:

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

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

6.0 COMPOSITION:

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

7.0 TEST SAMPLES:

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

8.0 PROPERTIES:

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

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

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

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

8.4 Weight : 11 ± 0.5 kg per 10 litres.

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

8.6 Test for Adhesion : To pass the test

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

8.8 Protection against corrosion at high temperature and humidity:

To pass the test for 360 hours, minimum..

9.0 TYPE TESTS:

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

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

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

10.0 TEST CERTIFICATES:

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

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

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

11.0 KEEPING PROPERTY:

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

12.0 PACKING & MARKING:

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

Each container shall marked with the following information:

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

8.0 ENVIRONMENTAL REQUIREMENTS:

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

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

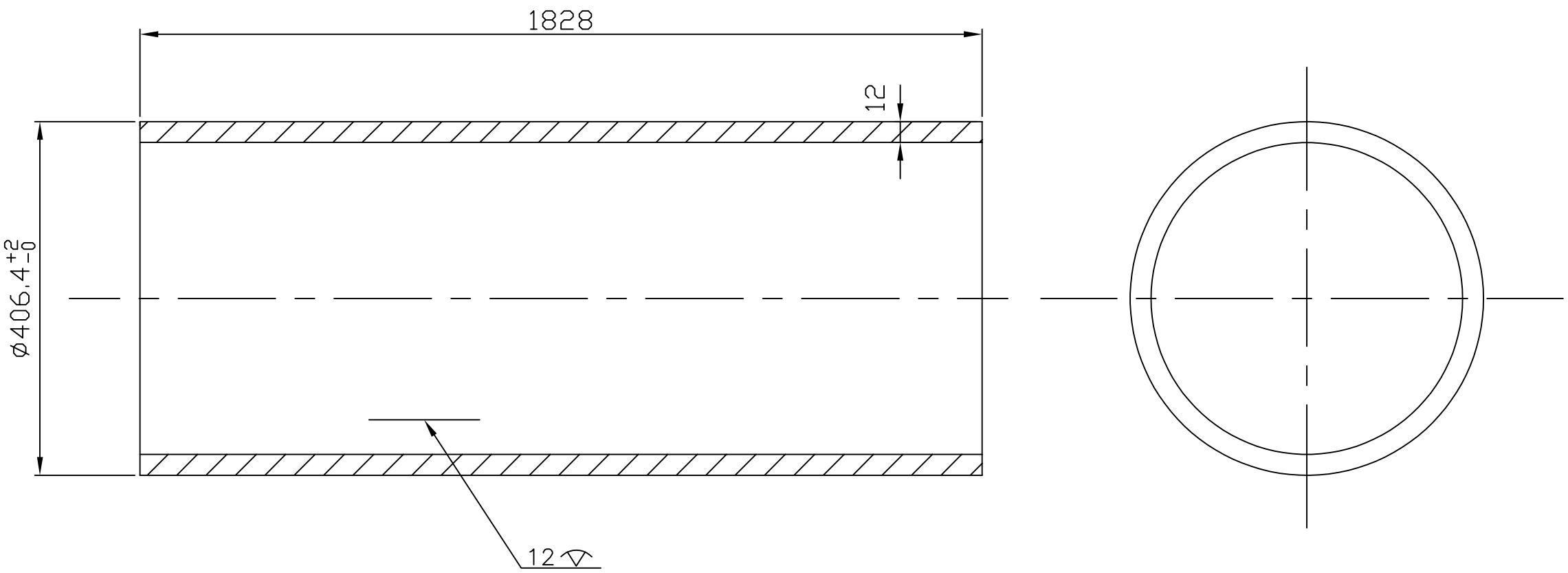
13.0 REFERRED STANDARDS (Latest Publications Including Amendments):

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

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN mm)

DRG. NO. HY-187.01 SHEET NO. 1 OF 1

COMPUTER FILE NAME | 36100049.DWG/1328 | REF. DRG. NO. | SIGN. AND DATE | INVENTORY NO



NOTE:

BREAK ALL SHARP CORNERS

ITEM NO.	DESCRIPTION	DRAWING NO.	VAR. NO.	RAW MATERIAL SIZE OR CASTING DRG. NO. OR FORGING DRG. NO.	MATERIAL CODE	NET WT.	GROSS WT.
01	PL. 12X1239X1828				AA10738	219	1
					MATERIAL SPECN.	QUANTITY	

REV.	DATE	ALTERED	APPD.
		CHD.	
ZONE			

REV.	DATE	ALTERED	APPD.
01	29.09.10	CHD.	V.KUMAR
ZONE	DRG. REDRAWN ON ACAD MATL. SPECN. WAS AISI-304 TOL. ON OD ADDED RAW MATL. SIZE CORRECTED		

THE FOLLOWING CONDITIONS APPLY EXCEPT OTHERWISE STATED.

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

TYPE OF PRODUCT

NAME OF CUSTOMER/PROJECT

BHARAT HEAVY ELECTRICALS LIMITED
VARANASI

	NAME	SIGN.	DATE	NO.OF VAR.
DRN.	CKP		29.09.10	0
CHD.	PKP		29.09.10	
APPD.	V.KUMAR		29.09.10	

DEPT. PULV.ENGG.	UNTOL. DIMS. GR.		SCALE	WEIGHT (KG)	REF. TO ASSY DRG.	ITEM NO.	NO.OF ITEMS
CODE 446	¢/M/¢		NTS	219	16138000207		

TITLE: PIPE ø406.4X12-1828 LONG

CARD CODE

DRAWING NO. HY-187.01 REV. 01

SHEET NO. 1 NO OF SHEETS 1

BHEL HERP VARANASI
QUALITY PLAN

Centre Feed Pipes (Pipe Material AA10738)

SL.NO.	COMPONENT	CHARACTERISTIC CHECKED	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENTS & ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
							P	W	V	
1.0	Raw Material : Plates	i.Chemical & Mechanical properties	Chemical analysis and Mechanical test	1 sample per heat batch	AA10119	TC	3	-	2	Manufacturer's TC is also acceptable for chemical and mechanical properties
		ii.Chemical & Mechanical properties	Chemical analysis and Mechanical test	1 sample per heat batch	AA 10738	TC	3	-	2	Plates AA10738 should be procured from BHEL approved sources only (Specified in Purchase Order)
2.0	Fabrication	ii. Fit up exam and welding	Measurement	100%	Drawing	Dim.report	3	-	2	Tolerance to be maintained as per drg. All welding shall be done by qualified welders only. BHEL WPS nos. WE-079, and WE-148 should be followed for SMAW as per requirement of drawings. Compatible welding electrodes (as mentioned in above WPS) should be used. Job should be preheated to temperature mentioned in WPS no. WE-079. If MIG/MAG welding process is used, prior WPS approval is to be taken from BHEL.
		iii.Post Weld Heat Treatment	Review of HT Chart	100%	As per applicable WPS WE-079		3	-	2	As per WPS WE-079 Following Heat treatment cycle should be followed : 1) Free Heating upto 400°C 2) Rate of Heating 100°C/Hr upto 680°C to 710°C 3) Soaking time 1 hour. 4) Rate of cooling 100°C/Hr upto 400°C 5) Free Cooling in ambient air below 400°C
		iv. D.P.Testing of welded joints	D.P.test	100%	AA0850131 & AA0850129	TC	3	2	-	100% D.P.test shall be witnessed by BHEL AIA
3.0	Final Inspection after Fabrication, Stress relieving and NDT.	i.Dimensions	Measurement	100%	Drawing.	Dimension Report	3	2	-	Unspecified tolerances shall be maintained as follows : a) As per medium tolerance class of Specn. AA0230208 for machined dimensions. b) As per Tolerance class B of specn. AA0621104 for fabricated dimensions.
		ii. Painting & preservation		100%		Insp.Report	3	2	-	All Machined surfaces of material other than SS (AA 10738) shall be protected by applying TRP black paint (specn. AA55154). All threaded holes to be protected by applying grease
		iii.Identification & Marking	Punching of Drg. No., P.O.No., Vendor code no., year, Inspector Seal	100%	Drawing	Inspection Report	3/2	2	-	
			APPROVED BY		MANAGER P&D					
			SIGNATURE & DATE							

QP. NO.	RV/FAB /31
DATE	09/08/2011
PG. NO.	1 OF 1

P = PERFORM.C. = TEST CERTIFICATE
W = WITNESS H.T. = HEAT TREATMENT
V = VERIFY
3 = VENDOR
2 = BHEL AUTHORISED INSPECTION AGENCY (AIA)

विरेन्द्र कुमार/VIRENDRA KU...
प्रबंधक (यो०वि०) / Manager (P...)
भारत हेवी इलेक्ट्रिकल्स लिमिटेड
Bharat Heavy Electricals Ltd.
हर्प, वाराणसी
HERP, Varanasi

635

POSITIONS (QW-405)

Position [s] Groove 1G

Welding Progression : Up ... Down ... ...

Position [s] Fillet ...

[POSTWELD HEAT TREATMENT QW-407

Temperature Range 600-620°C

Time Range One hour

GAS [QW-408]

Percent Composition

Gas [es] [Mixture] Flow Rate

Shielding -

Trailing -

Backing -

PREHEAT [QW-406]

Preheat Temp Min 150°C (For 1st layer only)

Interpass Temp. Max 200°C

Preheat Maintenance -

ELECTRICAL CHARACTERISTICS [QW-409]

Current AC or DC DC Polarity +Ve

Amps [Range] 140-180 Volts Range 22-26

Tungsten Electrode size and type -

Mode of Metal Transfer for GMAW -

Electrode wire feed speed range -

TECHNIQUE [QW-410]

String or Weave Bead String only Orifice or Gas Cup Size -

Initial and Interpass Cleaning By Chipping, Brushing, Grinding

Method of Back Gouging - oscillation -

Contact Tube to Work Distance - Multiple or Single Pass Multi

Multiple or single Electrodes Single Travel Speed [Range] -

Peening No Electrode Spacing -

Other Clean the weld area prior to welding to remove Oil, Rust, Grease etc.

Weld Layer [s]	Process	Filler Metal Class	Filler Metal Dia. mm	Current Type Polar	Current Amp. Range	Volt Range	Travel Speed Range mm/min	Other
1st layer	SMAW	E309Mo-15	5.0	DC+	160-180	22-26	-	String only
subsequent layers	"	E308-L-15	"	"	"	"	-	--do--

CONTROLLED COPY

Prepared by [signature] 14/12/87

MANAGER
WELDING ENGG.

BHARAT HEAVY ELECTRICALS LIMITED

RAMACHANDRAPURAM, HYDERABAD-500 032.

PD - 268

QW-482 WELDING PROCEDURE SPECIFICATION (WPS)

Welding Procedure Specification No. WE055 Date 8.10.82 Supporting PQR No 193

Revision No. 1 Date 01.03.1989

Welding Process (es) SMAW Type (s) Manual

Details

JOINTS (QW 402)

Joint Design S.S.Overlay on P1,

Backing (Yes) - (No) -

Backing Material (Type) -

Metal - non fusing metal -

BASE METALS (QW-403) A8 overlay

P. No. 1 Group No. 1 & 2 to P. No. - Group No. -

OR

Specification type and grade

to Specification type and grade

OR

Chem. Analysis and Mech Prop

to Chem Analysis and Mech Prop

Thickness Range : 25mm & above

Base Metal Groove Fillet -

Pipe Dial Range : Groove - Fillet -

Other -

FILLER METAL (QW-404) 1st layer by E 309 Mo-15

F. No. 5 Other Subsequent layers by E 308L-15

A. No 8 Other (1)

Spec. No. (SFA) 5.4

DEPOSITED WELD METAL

AWS No. (Class) E309Mo-15&E308L-15 Thickness Range : 6mm and above (Overlay)
3mm Max by E 309Mo-15

Size of filler metals ∅ 5.0mm Groove Rest by E308L-15

Electrode-Flux. (Class) Basic Fillet

Flux Trade Name - Max. bead thickness : 5mm

Consumable insert No; Retainer: No.

(1) Rev., Format details added

AUTHORISED SIGN

BHARAT HEAVY ELECTRICALS LIMITED

RAMACHANDRAPURAM, HYDERABAD-500 032.

PD - 268

QW-482 WELDING PROCEDURE SPECIFICATION (WPS)

Welding Procedure Specification No WE.079. Date 31.10.90 Supporting PQR No. 322

Revision No 1 Date 10.03.95

Welding Process (es) SMAW Type (s) Manual

JOINTS (QW 402) Details

Joint Design As per Drawing

Backing (Yes) For double side welds (No) For single side welds

Backing Material (Type) Base metal/Weld metal

Metal Yes Non fusing metal --

Retainer : No

BASE METALS (QW-403)

P. No. - Group No. - to P. No. - Group No. -

OR

Specification type and grade X 12 Cr 13

to Specification type and grade X 12 Cr 13

OR

Chem. Analysis and Mech. Prop. --

to Chem. Analysis and Mech. Prop. --

Thickness Range :

Base Metal : ——— Groove 4.75 to 200mm Fillet All

Pipe Dia. Range : Groove All dia Fillet All

Other Root spacing for backing strip jts : 8-10mm
For others : 2 ± 1mm

FILLER METALS (QW-404)

Spec. No. (SFA)	5.4
AWS No. (Class)	E 410 - 16/15
F. No.	4
A. No	6
Size of Filler Metals	Ø 2.5 to 5.0mm
Deposited Weld Metal	Max head thickness : 5mm
Thickness Range : Groove	200mm Max
Fillet	All
Electrode Flux (Class)	Rutile
Flux Trade Name	--NA-
Consumable Insert	No

POSITIONS (QW-405)

Position [s] Groove All

Welding Progression : Up For V Down —

Position [s] Fillet All

[POSTWELD HEAT TREATMENT QW-407]

Temperature Range 680 - 710

Time Range 1 Hr/25mm upto 50mm. For every Additional 25mm : 15 Minutes

PREHEAT [QW 406]

Preheat Temp Min 280°C

Interpass Temp. Max 350°C

Preheat Maintenance By Oxy Accetalyne or Producer Gas

GAS [QW-408] NA

Percent Composition

Gas [es] [Mixture] Flow Rate

Shielding

Trailing

Backing

ELECTRICAL CHARACTERISTICS [QW-409]

Current AC or DC DC Polarity +Ve (DCEP)

Amps [Range] 60-180 Volts Range 22-26

Tungsten Electrode size and type NA

Mode of Metal Transfer for GMAW NA

Electrode wire feed speed range NA

TECHNIQUE [QW-410]

String or Weave Bead String Orifice or Gas Cup Size NA

Initial and Interpass Cleaning Chipping, Brushing, Grinding

Method of Back Gouging By Grinding oscillation No

Contact Tube to Work Distance NA Multiple or Single Pass Multi

Multiple or sinlge Electrodes Single Travel Speed [Range] --NA-

Peening Not allowe Electrode Spacing NA

Other Clean edges to be welded to remove, Grease, Rust etc. Prior to welding.

Weld Layer [s]	Process	Filler Metal Class	Filler Metal Dia. mm	Current Type Polar	Current Amp. Range	Volt Range	Travel Speed Range mm/min	Other
	SMAW	E410-16	2.5	DC+	60-80	--	--	String
	SMAW	E410-16	3.15	DC+	90-110	--	--	"
	SMAW	E410-16	4.0	DC+	110-140	--	--	"
	SMAW	E410-16	5.0	DC+	140-180	--	--	"

PREPARED BY

SR MANAGER
WELDING ENGG.

BHARAT HEAVY ELECTRICALS LIMITED

Ramachandrapuram, Hyderabad – 500 032.

QW – 482 WELDING PROCEDURE SPECIFICATION (WPS)

Welding Procedure Specification No.: *WE 148* **Date:** *05/01/2004* **Supporting PQR No.: 466**

Revision No.: 0 **Date: --**

Welding Process (es) : SMAW **Type (s) :** *Manual*

JOINTS (QW 402) **Details**

Joint Design : As per manufacturing drawing

Backing (Yes) : BASE MATERIAL

Backing Material (Type) : *Base Metal/weld metal*
Metal : *Yes*
Retainer : *No*

Non-Fusing Metal : *No*

BASE METALS (QW – 403)

P. No. : 6 **Group No. :** *1* **TO** **P. No.: 1** **Group No.1&2**

OR

Specification type & grade : ---
to Specification type & grade : ---

OR

Chemical Analysis & Mechanical Properties : ----
to Chemical Analysis & Mechanical Properties : -----

Thickness Range :
Base Metal : **Groove: 4.75 to 24 mm** **Fillet :** *All sizes*

Pipe Dia. Range : Groove: all dia **Fillet :** *All sizes*

Other : --

Filler Metals (QW – 404)	
Spec. No. (SFA)	*5.4*
AWS No. (Class)	*E309-15*
F. No.	*5*
A. No.	-
Size of Filler Metals	*2.5 – 5.0 mm*
Deposited Weld Metal	-
Thickness Range: Groove	*24 mm*
Fillet	*All*
Electrode Flux (Class)	*Basic*
Flux Trade Name	*NA*
Consumable Insert	*No*
Max. Bead Thickness	5.0 mm max

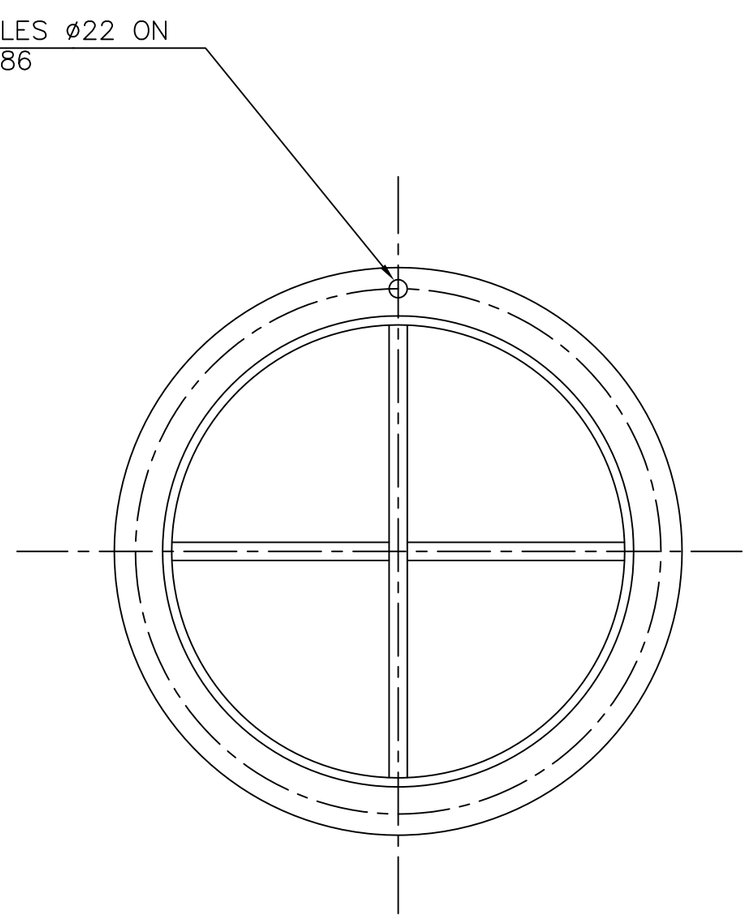
FIRST ANGLE PROJECTION

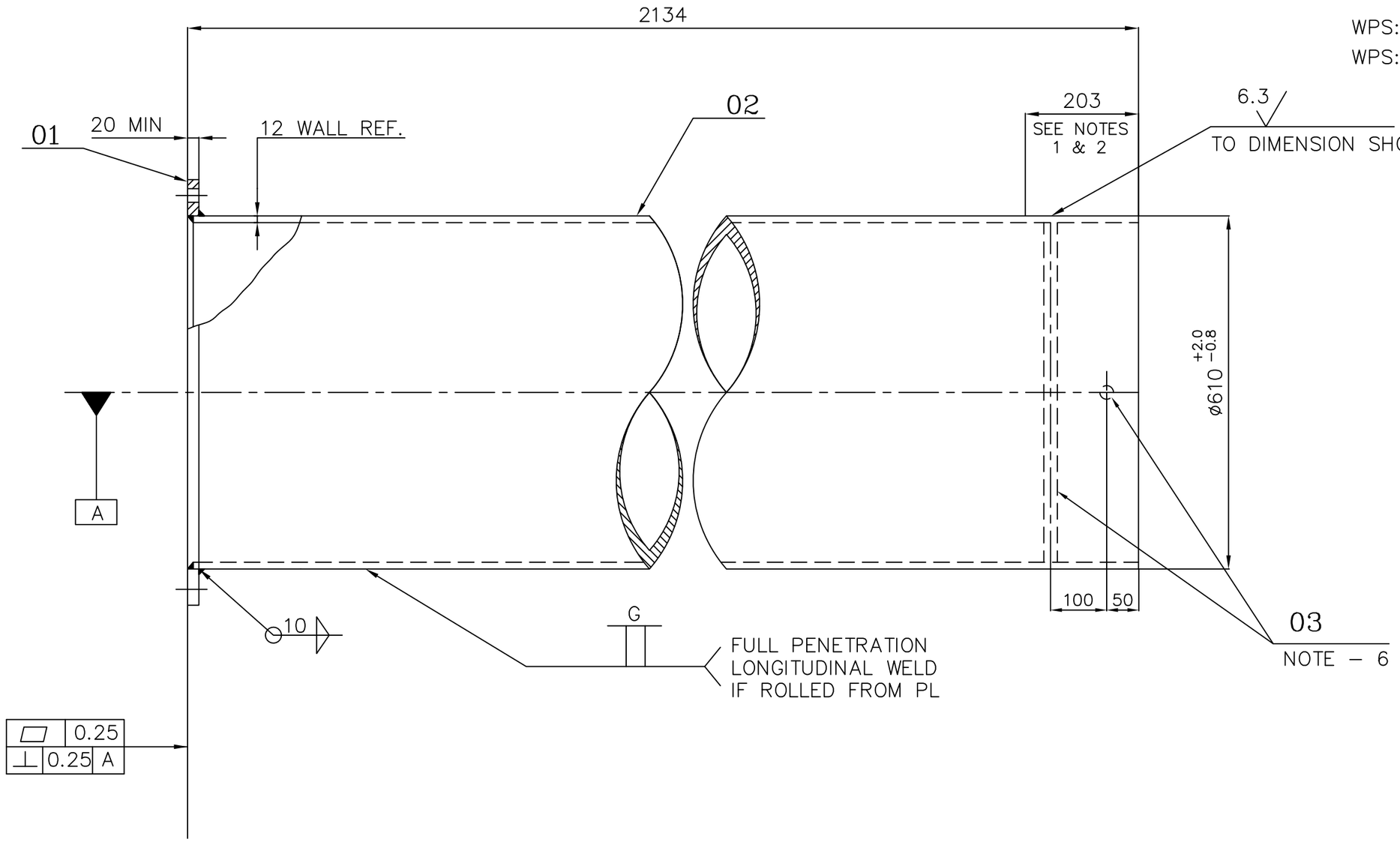
(ALL DIMENSIONS ARE IN mm)

M.E.S

DRG. NO. 2-61-300-00549

SH. OF





6.3

WPS:WE079 (AA10738 TO AA10738)
WPS:WE148 (AA10738 TO AA10119)

NOTE: –

1. THIS PORTION OF PIPE TO BE ROUND & SMOOTH AND FREE FROM BURRS.
2. PIPE OD WITHIN ø610 $^{+2.0}_{-0.8}$ FOR A LENGTH OF 203
3. ~~A GO, NO-GO RING GAUGE BE USED FOR CHECKING ABOVE TOLERANCE.~~
4. FOR CUTTING PLAN REFER DRG. NO. 3-61-300-90088.
5. CUSTOMER APPROVED QUALITY PLAN TO BE FOLLOWED.
6. ITEM 03 (PIPE STIFFENERS) ENDS TO BE TRIMMED SUITABLY TO TACK INSIDE FEED PIPE AS SHOWN. THESE ARE TO AVOID DEFORMATION IN TRANSIT AND TO BE REMOVED AT SITE DURING INSTALLATION.

VARIANT NO	ITEM NO	DESCRIPTION	STD	DRAWING NO.	ITEM NO. / VER NO.	MATL CODE / MATL SPEC	A C	UNIT	UNIT WT / QTY	GS	ZONE
	03	PIPE (STIFFENER) OD 34.2X4.05X590L				AA1011052555 / AA10152			1.70 / 2		
	02	PL 12 X1879 X2124				AA1071838091 / AA10738			377.00 / 1		
	01	PIPE FLANGE		3-61-300-00500		AA1011819155 / AA10119			24.000 / 1		

REV.	DATE	ALTERED	ZONE	
07	12.1.05	CHD/APPD		
		MAT CODE FOR ITEM 02 WAS AA1071831070. WPS ADDED.		
06	28.1.2000	CHD/APPD	ZONE	
		ITEM 03 & NOTE 6 ADDED. WEIGHT WAS 404.00. PL. THK 10 WAS 12	C7 A4	
05	14.1.2000	CHD/APPD	ZONE	
		MACHINING ADDED. NOTE 3 DELETED.	A7 E2	
04	10.03.98	CHD/APPD	ZONE	
		DRG. REDRAWN INCARPORATING ALL PREVIOUS REVISIONS		

THE FOLLOWING CONDITIONS APPLY EXCEPT OTHERWISE STATED.

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

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

BHARAT HEAVY ELECTRICALS LIMITED
HYDERABAD

	NAME	SIGN.	DATE
DRN.	N.D.SAMUEL		10.03.98
CHD.	S.GHATGE		26.9.98
APPD.	K.M.RAO		26.9.98

NO.OF VAR.: /

DEPT.	UNTOL. DIMS.		SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO.OF ITEMS
BMD	GR. ¢/M/F		N.T.S	404.5	C-GP-2638/0	/	/
DEPT CODE. 446							

TITLE: 24"CENTRE FEED PIPE-UPPER

CARD CODE

DRAWING NO. 2-61-300-00549 REV. 07

SHT. No 01 NO. OF SHT. 01

GENERAL DIMENSIONAL LIMITS,FITS & TOLERANCES AS PER HY0230261

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

COMPUTER FILE NAME 261100549.DWG | REF. DRG. NO. | SIGN. AND DATE | INVENTORY NO

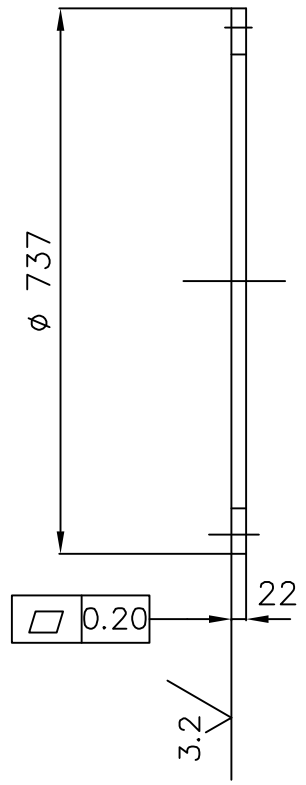
FIRST ANGLE PROJECTION

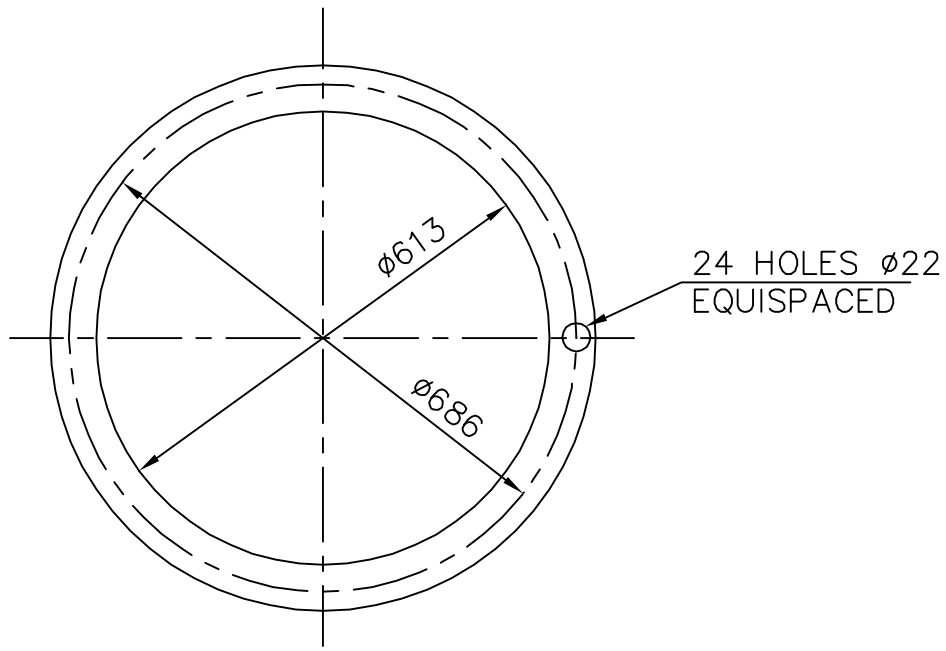
(ALL DIMENSIONS ARE IN mm)

DRG. NO. 3-61-300-00500

SH. OF

12.5 3.2





ITEM NO.	DESCRIPTION	DRAWING NO	IT NO. / VAR NO	MATL CODE / MATL SPCN.	UNIT WT. / QTY	
	PL. 25xø737xø613			AA1011819155 / AA10119	24.000	

THE FOLLOWING CONDITIONS APPLY EXCEPT OTHERWISE STATED.

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

REV.	DATE	ALTERED	CHD/APPD
03	17.01.01	ZONE THICKNES 22 WAS 20	
02	28.03.98	ZONE DRG. REDRAWN INCORPORATING ALL PREVIOUS REVISIONS.	

INVENTORY NO | SIGN. AND DATE | REF. DRG. NO. | COMPUTER FILE NAME 3610050O.DWG

GENERAL DIMENSIONAL LIMITS,FITS & TOLERANCES AS PER HY0230261

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

BHARAT HEAVY ELECTRICALS LIMITED
HYDERABAD

	NAME	SIGN.	DATE
DRN.	N.D.S		28.03.98
CHD.	S.G		26.9.98
APPD.	K.M.R.		29.9.98

NO.OF VAR.

DEPT. / DEPT.CODE	UNTOL. DIMS.	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO.OF ITEMS
BMD / 446	GR. ¢/M/₱	1:10	24.00	B-GP-1463/7		

TITLE: PIPE FLANGE (24" OD PIPE)

DRAWING NO. 3-61-300-00500 REV. 03

SHT. No | NO. OF SHT.

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

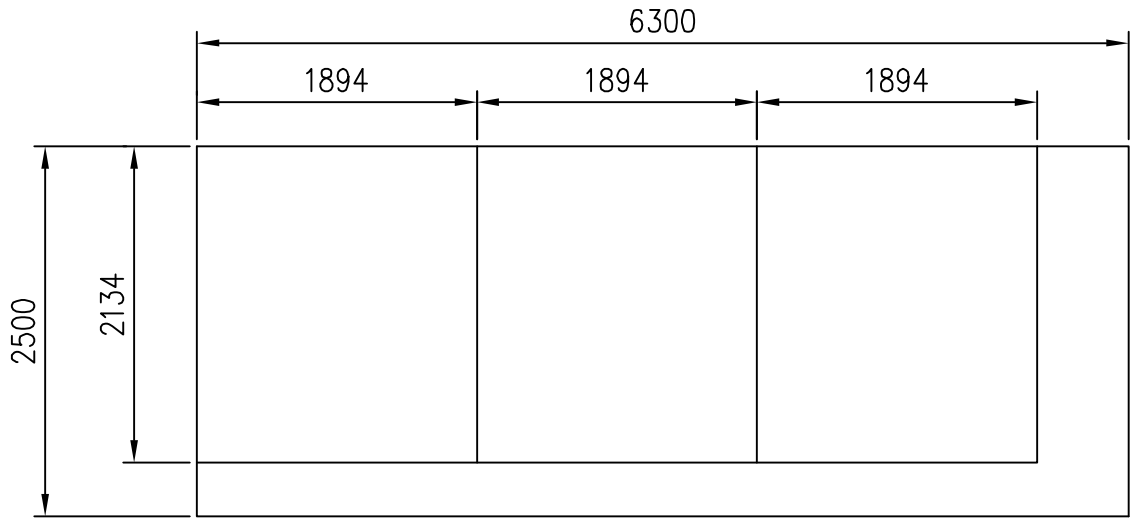
DJC

DRG.NO. 3-61-300-90088

COMP. FILE NAME 36190088.DWG

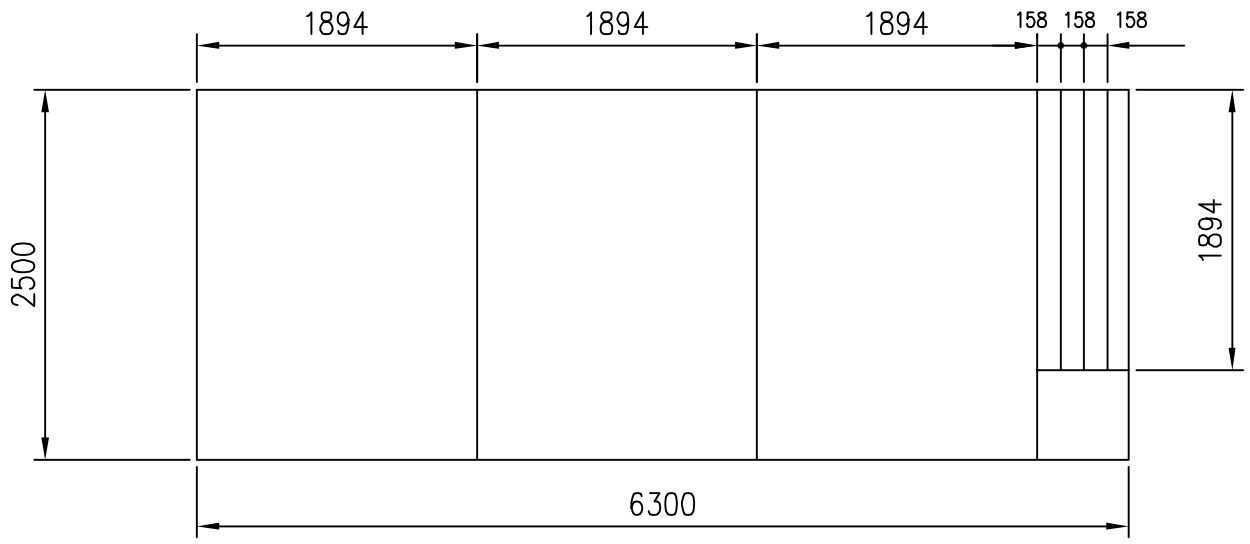
REF.DRG.NO.

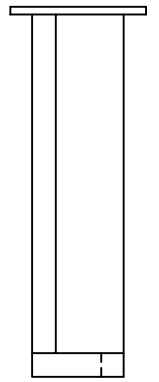
INVENTORY NO.



3 PIPES PER SHEET

CENTRE FEED PIPE-UPPER





3 PIPES PER SHEET

CENTRE FEED PIPE-LOWER

NOTE:-

1. CENTRE FEED PIPE MAY BE MANUFACTURED WITH TWO CIRCULAR PIECES & WITH 'T' JOINT.

01					AA1071831070		
					AA10731		
ITEM No	DESCRIPTION	DRAWING No.	VAR. No.	RAW MATERIAL SIZE OR CASTING DRG.No. OR FORGING DRG. No.	MATERIAL CODE	NET WT.	GROSS WT.
					MATERIAL SPECN.	QUANTITY	

REV.	DATE	ALTERED		REV.	DATE	ALTERED	
		CHECKED	APPD.	02	08.10.98	CHECKED	APPD.

DRAWING REDRAWN ON CAD INCORPORATING ALL THE PREVIOUS REVISIONS.

THE FOLLOWING CONDITIONS APPLY EXCEPT OTHERWISE STATED...

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

TYPE OF PRODUCT
OR
NAME OF CUSTOMER/PROJECT

BHARAT HEAVY ELECTRICALS LTD.
HYDERABAD

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

No.OF VAR. –

DEPT.	GRADE OF TOL. DIM.		SCALE	WEIGHT (KG)	REF. TO ASSY DRG.	ITEM No.	No.OF ITEMS
PULV. ENGG.	¢/M/f		1:50		3-61-300-00548 3-61-300-00549	–	–
CODE 446							

TITLE CUTTING PLAN FOR CENTRE FEED PIPES

DRAWING No. 3-61-300-90088 REV. 02

SHEET No. 1 No. OF SHEETS 1

TD-151/REV. 03 SIZE A3

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

0.0 GENERAL:

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

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

1.0 SCOPE:

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

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

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

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

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

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

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

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

It does not apply for the following dimensions:

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

b) Auxiliary dimensions indicated in brackets.

c) Theoretically exact dimensions indicated in rectangular frames.

2.0 COMPLIANCE WITH STANDARDS:

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

3.0 GENERAL TOLERANCES:

3.1 Linear dimensions are given in Table 1 and 2.

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

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

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

Revision: This standard was based on 1969 version of IS:2102			Approved: INTERPLANT STANDARDIZATION COMMITTEE-WG (DOP + BES)		
Rev.No. 01	Amd.No.	Reaffirmed	Prepared BHOPAL	Issued CORP. R&D	Dt. of 1st issue 22-06-1978
Dt. 1-12-1995	Dt.	Year: 2008			

CORPORATE STANDARD

BHEL

4.0 INDICATIONS ON DRAWINGS:

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

Example: AA 023 02 08 m

5.0 REJECTION:

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

6.0 NOTE:

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

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

Values in millimetres

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

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

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

Values in millimetres

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

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

Table 3 — Permissible deviations of angular dimensions

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

Annex A
(informative)

Concepts behind general tolerancing of linear and angular dimensions

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

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

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

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

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

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

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

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

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

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

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

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

The workshop should therefore

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

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

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

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

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

GENERAL TOLERANCES FOR WELDING CONSTRUCTIONS FOR LENGTHS AND ANGLES

1.0 GENERAL

1.1 General tolerances are permissible variations corresponding to the degrees of accuracy normally observed in workshops where details of tolerances are not provided in the drawings.

1.2 The general tolerances specified in this standard apply to dimensions for which the tolerances are indicated on the nominal dimensions for welded components, welded assemblies and welded structures.

1.3 The variations apply to linear dimensions such as outside dimensions, inside dimensions, stepped dimensions, widths, Centre-to-Centre distances and also angles.

1.4 Special rulings may be stated for linear dimensions of welded structures consisting of several assemblies.

1.5 This standard is based on BS EN ISO 13920-1997

1.6 General tolerances for machined components are covered in Corporate Standard AA0230208.

1.7 Refer Corporate Standard AA0621105 for general tolerances for welded structures - Form and Position.

2.0 SCOPE

2.1 This standard prescribes four degrees of accuracy based on differences arising out of function and manufacture of welded components, assemblies and structures.

2.2 For technical and economic reasons other degrees of accuracy may be appropriate which have to be specifically stated.

3.0 GENERAL TOLERANCES

3.1 Tolerances for linear dimensions are given in Table 1.

3.2 Table 2, for the tolerances on angular dimensions.

4.0 REPRESENTATION ON DRAWINGS

4.1 The required degree of accuracy shall be specified in all fabrication drawings.

For example class 'B' of AA0621104 (BS EN ISO 13920)

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4.2 Figures 1 to 5 give examples of how dimensions (linear & angular) are to be indicated on the drawings. (Refer page 6 of 6 of this standard)

5.0 TESTING

5.1 The actual size of an angular structural component is determined by placing suitable measuring instruments tangentially on the welded part so that the zone affected by the weld is eliminated. The variation is obtained from the difference between the dimension in the drawing and the actual size.

TABLE-1 **TOLERANCE FOR LINEAR DIMENSIONS**

Range of nominal sizes l in mm											
Tolerance Class	2 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	Over 4000 up to 8000	Over 8000 up to 12000	Over 12000 up to 16000	Over 16000 up to 20000	Over 20000
	Tolerances t in mm										
A	± 1	± 1	± 1	± 2	± 3	± 4	± 5	± 6	± 7	± 8	± 9
B		± 2	± 2	± 3	± 4	± 6	± 8	± 10	± 12	± 14	± 16
C		± 3	± 4	± 6	± 8	± 11	± 14	± 18	± 21	± 24	± 27
D		± 4	± 7	± 9	± 12	± 16	± 21	± 27	± 32	± 36	± 40

TABLE-2 **TOLERANCES FOR ANGULAR DIMENSIONS**

Tolerance Class	Range of Nominal sizes l in mm (Length of shorter leg)		
	Up to 400	Over 400 upto 1000	Over 1000
	Tolerance Δα (In degrees and minutes)		
A	± 20’	± 15’	± 10’
B	± 45’	± 30’	± 20’
C	± 1°	± 45’	± 30’
D	± 1°30’	± 1°15’	± 1º
Calculated and rounded tolerances t, in mm/m[a]			
A	± 6	± 4.5	± 3
B	± 13	± 9	± 6
C	± 18	± 13	± 9
D	± 26	± 22	± 18
[a] The value indicated in mm/m correspond to the tangent value of the general tolerance. It is to be multiplied by the length, in m, of the shorter leg.			

NOTE:

1) The permissible variations also apply to unmarked angles of 90º and 180º.
2) The shorter side of the angle is specified as the reference side.
3) Its length can also be taken from a specially indicated reference point to be shown in the drawings.
4) If the drawing contains no angle data, but only linear dimensions, then the permissible variations are to be taken in mm/m.

6.0 Tolerances on dimensions of welded assemblies, the part of which are machined preliminarily and the assembly after welding as per given size not subjected to machining are set 50% lower than the tolerances on dimensions requiring a given accuracy.

7.0 In case of necessity, it is allowed to set as symmetrical tolerances in relation to nominal, but in this case the sum total of the value of the tolerance is to be preserved as per table 1.

8.0 Deformation of welded constructions (not in contact with floor plate) is allowed up to limits given in table 3.

Remarks:

1) The local convexities and concavities of the sheathing surface having smooth transition are allowed up to 4 mm.
2) General bend along the whole length of the sheathing should not exceed W mm per running metre.
3) Bends in the thin walled construction of the type of branch pipes, baffles of air draft hydro-generators are considered separately in every particular case.

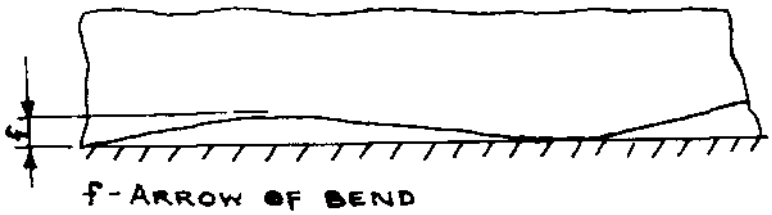

TABLE-3

Type of Construction	Length in mm						
Beams, spokes, stands, guards and similar parts	10000 to 15000	5000 to 10000	3000 to 5000	1500 to 3000	1000 to 1500	500 to 1000	Upto 500
	Allowable bend in mm						
	10.0	8.0	6.0	4.5	3.0	2.5	2.0
Frames, Floor plates dished parts, boxes External covers, bearings and Similar parts.	12.0	10.0	8.0	6.0	4.0	3.0	2.0

9.0 Allowance for machining of welded construction is determined as per table 5.

Remarks:

1) In case of machining of diameters and constructions from two sides the allowance is doubled.

2) For "Dimension as per drawing" is taken the dimension for which the allowance is meant.

10.0 Tolerances on bend "C" shall be as per table 4.

TABLE – 4

Width of flange ''b'' in mm	Thickness of flange ''s'' in mm	Tolerance ''c'' in mm
400-201	60-41	3.0
	40-31	3.5
	30-21	4.0
	20-11	4.5
	10 and lower	5.0
200-150	40-31	3.0
	30-21	3.5
	20-11	4.0
	10 and lower	5.0
149-100	40-31	2.5
	30-21	3.0
	20-11	3.5
	10	4.5
99-50	30-21	2.0
	20-11	2.5
	10	3.0
50 and lower	30-21	1.5
	20-11	2.0
	10	2.5

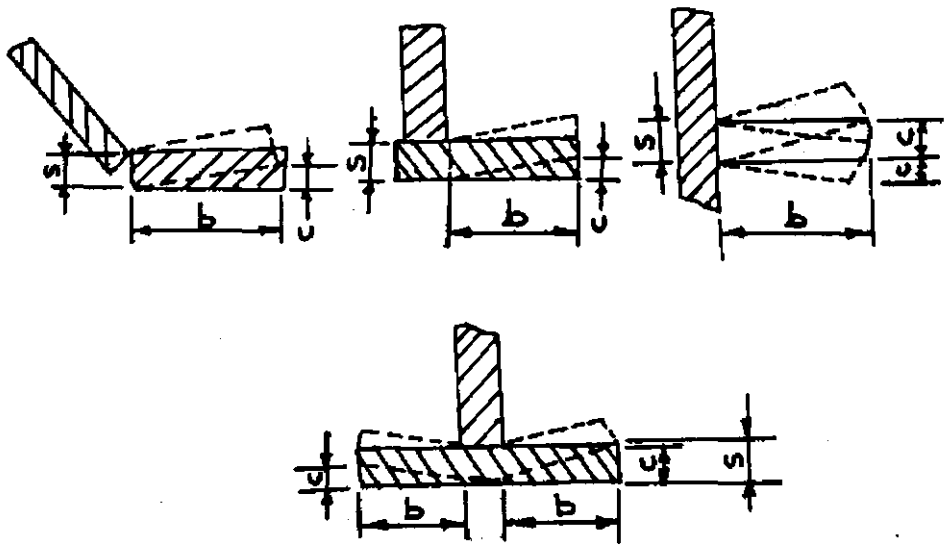

TABLE-5

Dimension as per Drawing (mm)	Machining Allowance per side (mm)
Upto 500	6
More than 500 & upto 1000	8
More than 1000 & upto 2000	10
More than 2000 & upto 4000	12
More than 4000 & upto 6000	14
More than 6000 & upto 10000	18
More than 10000 & upto 15000	22
More than 15000	24

11.0 REFERRED STANDARDS (Latest publications including amendment)

1) AA0230208
2) AA0621105

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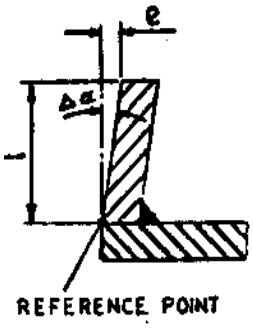

FIG. 1

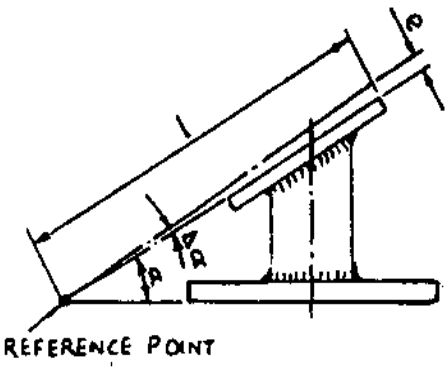

FIG. 2

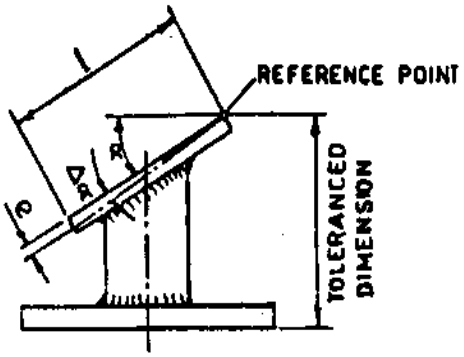

FIG. 3

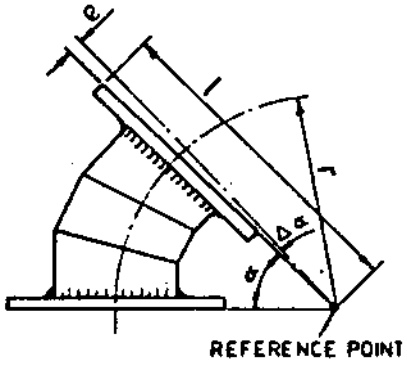

FIG. 4

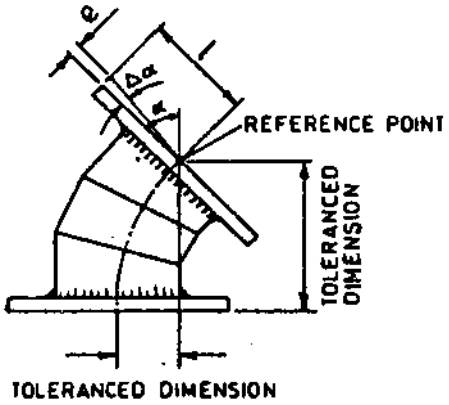

FIG. 5

ACCEPTANCE STANDARDS FOR LIQUID PENETRANT EXAMINATION OF WELDS

1.0 SCOPE:

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

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

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

2. DEFINITION OF IHDICATIONS:

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

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

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

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

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

3. ACCEPTANCE STANDARDS:

All surfaces to be examined shall be free from:

a) relevent linear indications.

b) relevent rounded indications greater than 4.8 mm.

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

PROCEDURE FOR LIQUID PENETRANT EXAMINATION

1.0 SCOPE:

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

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

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

2.0 PERSONNEL REQUIREMENT:

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

3.0 DESCRIPTION:

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

4.0 APPROVED METHODS & MATERIALS:

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

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

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

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

5.0 PROCEDURE:

5.1 Surface Preparation:

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

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

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

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

5.2 **Drying:**

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

5.3 **Application Of Penetrants:**

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

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

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

5.4 **Removal Of Excess Penetrant:**

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

5.4.1 **Postemulsifying Penetrants:**

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

5.4.2 **Solvent Removable Penetrants:**

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

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

5.4.3 **Water Washable Penetrants:**

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

5.5 **Drying:**

Surface shall be dried before the application of developer.

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

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

5.6 **Application Of Developer:**

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

5.6.1 **Application Of Dry Developer:**

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

5.6.2 **Application Of Wet Developer**

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

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(a) **Aqueous Developer Application:**

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

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

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

6.0 **EXAMINATION:**

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

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

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

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

6.2 **Fluorescent Penetrants:**

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

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

7.0 **EVALUATION OF INDICATIONS & INTERPRETATION:**

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

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

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

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

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

8.0 **ACCEPTANCE STANDARDS:**

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

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

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

9.0 **POST EXAMINATION CLEANING:**

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

TABLE - 1 (Clause 5.3.2)

Suggested Penetration Time For Post-emulsified And Solvent Removable Penetrants

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

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TABLE - 1 (Clause 5.3.2) Contd.

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

* For lower temperatures, penetration time should be increased.

ANNEXURE - 1 (Clause 5.3.3)

PROCEDURE FOR NON-STANDARD TEMPERATURES

A.1 **General:**

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

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

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

A.3 **Comparator Application:**

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

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

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

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

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

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

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

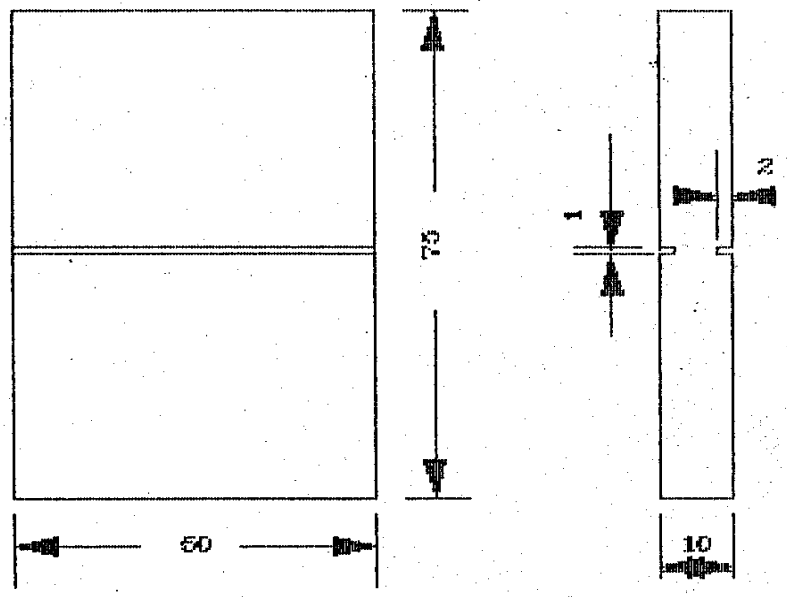


FIGURE: 1-LIQUID PENETRANT COMPARATOR BLOCK

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

ORDERING DESCRIPTION

1.0 GENERAL:

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

2.0 APPLICATION:

For general engineering purposes, suitable for welding.

3.0 CONDITION OF DELIVERY:

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

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

3.3 Any other additional requirement as per BHEL Purchase order.

4.0 DIMENSIONS AND TOLERANCES:

4.1 Sizes:

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

4.2 Tolerances:

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

4.3 Straightness for hot rolled bars:

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

5.0 TEST SAMPLES:

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

Revisions:	APPROVED:
Clause No. 1, 3, 5 & 8 revised (as per MOM of 38th MRC meeting), Clause 10 added	INTERPLANT MATERIAL RATIONALISATION COMMITTEE – MRC(S&GPS)

Rev No.15	Amd No.	Reaffirmed	Prepared	Issued	Dt. of 1st Issue
Dt:11-03-2014	Dt:	Year:	HPEP, Hyderabad	Corp.R&D	June, 1976

CORPORATE PURCHASING SPECIFICATION

6.0 ULTRASONIC EXAMINATION:

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

6.1 For plates above 40 mm thick:

Shall be ultrasonically examined unless when otherwise specified in order.

7.0 TEST CERTIFICATES:

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

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

The test certificate shall bear the following information:

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

BHEL order No.

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

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

8.0 PACKING AND MARKING:

Plates shall be transported suitably to avoid damage during transit.

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

9.0 REJECTION AND REPLACEMENT

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

10.0 REFERRED STANDARDS (Latest publications including amendments):

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

26/6/14

CS-721

STEEL TUBES – ELECTRIC RESISTANCE WELDED / SUBMERGED ARC WELDED

1.0 GENERAL:

This specification governs the quality requirements of light, medium and heavy grades of Electric Resistance Welded/Submerged Arc Welded steel tubes with plain ends in ungalvanized and galvanized condition in the range of 60mm to 150mm NB.

2.0 APPLICATION:

For general purpose, suitable for bending, welding and screwing for flanges and fittings. Not suitable for steam services.

3.0 CONDITION OF DELIVERY:

Tubes shall be supplied with plain ends.

The ends shall be cut cleanly and square with the axis of the tube.

Unless otherwise specified, tubes shall be supplied in ungalvanized condition.

4.0 COMPLIANCE WITH NATIONAL STANDARDS:

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

IS: 1239(part 1) – 2004: Steel Tubes, Tubular and other Wrought Steel Fittings
Gr: ERW.

5.0 DIMENSIONS AND TOLERANCES:

5.1 Sizes:

BHEL order shall clearly state the maximum outside diameter, and wall thickness of the tube.

5.2 Tolerances:

5.2.1 Thickness:

Light tubes	+ not limited − 8 percent
Medium and Heavy tubes	+ not limited − 10 percent

5.2.2 Weight:

Single tube (light series)	+ 10 percent − 8 percent
Single tube (medium and heavy series)	± 10 percent
For quantities per load of 10 tonnes, min (light series)	+ 7.5 percent − 5 percent
For quantities per load of 10 tonnes, min (medium and heavy series)	± 7.5 percent

5.2.3 Internal Weld Fin:

Height of the internal weld fin shall not be greater than 60 percent of the specified thickness.

5.2.4 Length:

5.2.4.1 Random Length:

Tubes shall be supplied in random lengths of 4 to 7 meters, unless otherwise specified and in the line with IS: 1239, Part 1.

5.2.4.2 Exact Length:

When exact lengths are called for, the tolerances shall be + 6 mm, − 0 mm of the specified length.

6.0 MANUFACTURE:

Tubes shall be made from tested quality steel manufactured by any approved process and shall be fully killed.

Tubes shall not be manually welded.

7.0 FREEDOM FOR DEFECTS:

Tubes shall be cleanly finished and reasonably free from injurious defects. They shall be reasonably straight. The ends shall be cut cleanly and reasonably square with the axis of the tube.

8.0 CHEMICAL COMPOSITION:

The melt analysis of steel shall be as follows:

Element	Percent max.	Permissible variation over specified limit, ± max
Carbon	0.20	0.02
Manganese	1.30	0.04
Sulphur	0.040	0.005
Phosphorus	0.040	0.005

9.0 GALVANIZING:

When galvanized tubes are ordered, the Zinc coating on the tubes shall be in accordance with IS: 4736

10.0 TEST SAMPLES:

All tubes bearing the same designation and manufactured under a single process shall be grouped together to constitute a lot. Each lot shall be sampled separately in accordance with IS: 4711

11.0 MECHANICAL PROPERTIES:

11.1 Tensile:

The tensile strength of strips cut form selected tubes, when tested in accordance with IS: 1608 shall be as follows:

Tensile strength : 320 N/mm^2, min.

Elongations on $5.65\sqrt{S_o}$ gauge length:

Up to and including. 25 mm NB : 12 percent, min.
Over 25 mm up to including150 mm NB : 20 percent, min.

Note:

1. For welded tubes, the strip tensile test specimen shall not contain the weld.
2. For galvanized tubes, zinc coating may be removed by stripping prior to tensile test.

11.2 Bend Test (On tubes up to and including 50mm nominal bore):

When tested in accordance with IS: 2329, the tubes shall be capable of withstanding the bend test without showing any signs of fracture or failure.

Tubes shall be bent with the weld at 90^o to the plane of bending. The tubes shall not be filled for this test.

Ungalvanised tubes shall be capable of being bent cold without cracking, through 180^o around a former having a radius at the bottom of groove in the plane of bending equal to at least six times the outside diameter of the tube.

Galvanized tubes shall be capable of being bent cold without cracking of the steel, through 90^o round a former having a radius at the bottom of the groove equal to at least eight times the outside diameter of the tube.

11.3 Flattening Test (On tubes above 50mm nominal bore):

Rings not less than 40mm in length, cut form the end of each selected tubes shall be flattened between parallel plates with the weld at 90^o(point of maximum bending) in accordance with IS:2328. No opening shall occur by fracture in the weld until the distance between the plates is less than 75 percent of the original outside diameter of the tube and no cracks or breaks on the metal elsewhere than in the weld shall occur until the distance between the plates is less than 60 percent of the original outside diameter.

Test rings may have the inner and outer edges rounded.

11.4 Hydraulic Test / Eddy Current Test:

Each tube shall withstand a test pressure of 5 N/mm^2 without showing leakage defects of any kind. The pressure shall be applied and maintained for a minimum period of 3 seconds for proof and inspection.

Note: Eddy current test may be done in place of Hydrostatic test as per the procedure in Annexure – B of IS: 1239, Part-1.

CORPORATE PURCHASING SPECIFICATION

12.0 TEST CERTIFICATES:

Three copies of test certificates shall be supplied, unless otherwise stated on the order.

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

The test certificate shall bear the following information:

AA10152: Rev. No.07: Steel Tubes – ERW/SAW
BHEL order No:

Supplier's Reference:
Name
Identification No.
Melt No.

Results of Tests:
Results of Chemical, Mechanical tests and Hydraulic/Eddy Current test.

13.0 PROTECTIVE COATING:

The tubes shall be protected with a rust preventive coating of varnish, externally throughout the length.

14.0 PACKING AND MARKING:

Each tube shall be plugged at both ends by means of tight fitting end caps.

The tubes shall be suitably packed in bundles/packages to prevent corrosion and damage during transit.

Each bundle/package shall bear the following information:

AA10152: Steel Tubes – ERW/SAW
BHEL Order No.
Consignment/Identification No.
Outside Diameter and Wall Thickness.
Supplier's Name

15.0 REFERRED STANDARDS (Latest Publications Including Amendments):

1) IS: 1608 2) IS: 2328 3) IS: 2329

4) IS: 4736 5) IS: 4711

STAINLESS STEEL SHEETS AND PLATES - ANNEALED ASTM A 240M, TYPE 410 Î

ORDERING DESCRIPTION

1.0 GENERAL :

The sheets and plates shall conform to the latest version of ASTM A 240M, Î Type: 410 and comply with the following additional requirements.

2.0 APPLICATION:

For general engineering purposes, where corrosion resistance is essential.

3.0 CONDITION OF DELIVERY:

Hot Rolled, annealed and descaled (Finish No.1).

Cold rolled, annealed (2B / 2 D).

4.0 DIMENSIONS AND TOLERANCES:

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

5.0 CHEMICAL COMPOSITION:

As per ASTM A 240M, Type 410. Î

6.0 TEST CERTIFICATES :

Three copies of test certificates shall be supplied along with the following information:

BHEL References :

AA 107 38 -Rev. No.07 / ASTM A 240M, Type:410 Î
BHEL order No,

Supplier's References :
Name
Identification No.
Melt No.
Process of manufacture
Details of heat treatment.

Result of Tests:
Dimensional inspection.
Results of chemical analysis, mechanical tests

7.0 PACKING AND MARKING :

Sheets shall be supplied in bundles or in packages each weighing upto a maximum of 3000kg. Plates shall be suitably packed to prevent damage during transit.

For plates below 25 mm thick, each pile (preferably of 16 plates) shall be marked with suppliers identification mark, 'AA 107 38 / ASTM A 240M, Type:410, melt No., BHEL Î order No., on the top plate.

Each plate of 25mm thickness and above shall be stamped/painted with the suppliers identification mark, 'AA 107 38 / ASTM A 240M, Type:410 , melt No., BHEL order Î No., on the top plate.

FOR INFORMATION ONLY

CHEMICAL COMPOSITION

C	Si	Mn	Ni	Cr	S	P	Al
0.08-0.15	≤ 1.0	≤ 1.0	≤ 0.75	11.5-13.5	≤ 0.030	≤ 0.040	-

MECHANICAL PROPERTIES

Hardness, max		0.2% PS min	UTS, min	% El min	Cold Bend. Î
BHN	HRB	N/mm²	N/mm²		
217	96	205	450	20	180^0

RUST PREVENTIVE HARD FILM, BLACK (TRP)

1.0 GENERAL:

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

2.0 APPLICATION:

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

3.0 REMOVAL:

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

4.0 COLOUR : Steel Black.

5.0 COMPLIANCE WITH NATIONAL STANDARDS:

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

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

6.0 COMPOSITION:

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

7.0 TEST SAMPLES:

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

8.0 PROPERTIES:

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

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

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

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

8.4 Weight : 11 ± 0.5 kg per 10 litres.

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

8.6 Test for Adhesion : To pass the test

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

8.8 Protection against corrosion at high temperature and humidity:

To pass the test for 360 hours, minimum..

9.0 TYPE TESTS:

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

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

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

10.0 TEST CERTIFICATES:

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

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

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

11.0 KEEPING PROPERTY:

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

12.0 PACKING & MARKING:

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

Each container shall marked with the following information:

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

8.0 ENVIRONMENTAL REQUIREMENTS:

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

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

13.0 REFERRED STANDARDS (Latest Publications Including Amendments):

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

BHEL HERP VARANASI
QUALITY PLAN

Centre Feed Pipes (Pipe Material AA10738)

SL.NO.	COMPONENT	CHARACTERISTIC CHECKED	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENTS & ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
							P	W	V	
1.0	Raw Material : Plates	i.Chemical & Mechanical properties	Chemical analysis and Mechanical test	1 sample per heat batch	AA10119	TC	3	-	2	Manufacturer's TC is also acceptable for chemical and mechanical properties
		ii.Chemical & Mechanical properties	Chemical analysis and Mechanical test	1 sample per heat batch	AA 10738	TC	3	-	2	Plates AA10738 should be procured from BHEL approved sources only (Specified in Purchase Order)
2.0	Fabrication	ii. Fit up exam and welding	Measurement	100%	Drawing	Dim.report	3	-	2	Tolerance to be maintained as per drg. All welding shall be done by qualified welders only. BHEL WPS nos. WE-079, and WE-148 should be followed for SMAW as per requirement of drawings. Compatible welding electrodes (as mentioned in above WPS) should be used. Job should be preheated to temperature mentioned in WPS no. WE-079. If MIG/MAG welding process is used, prior WPS approval is to be taken from BHEL.
		iii.Post Weld Heat Treatment	Review of HT Chart	100%	As per applicable WPS WE-079		3	-	2	As per WPS WE-079 Following Heat treatment cycle should be followed : 1) Free Heating upto 400°C 2) Rate of Heating 100°C/Hr upto 680°C to 710°C 3) Soaking time 1 hour. 4) Rate of cooling 100°C/Hr upto 400°C 5) Free Cooling in ambient air below 400°C
		iv. D.P.Testing of welded joints	D.P.test	100%	AA0850131 & AA0850129	TC	3	2	-	100% D.P.test shall be witnessed by BHEL AIA
3.0	Final Inspection after Fabrication, Stress relieving and NDT.	i.Dimensions	Measurement	100%	Drawing.	Dimension Report	3	2	-	Unspecified tolerances shall be maintained as follows : a) As per medium tolerance class of Specn. AA0230208 for machined dimensions. b) As per Tolerance class B of specn. AA0621104 for fabricated dimensions.
		ii. Painting & preservation		100%		Insp.Report	3	2	-	All Machined surfaces of material other than SS (AA 10738) shall be protected by applying TRP black paint (specn. AA55154). All threaded holes to be protected by applying grease
		iii.Identification & Marking	Punching of Drg. No., P.O.No., Vendor code no., year, Inspector Seal	100%	Drawing	Inspection Report	3/2	2	-	
			APPROVED BY		MANAGER P&D					
			SIGNATURE & DATE							

QP. NO.	RV/FAB /31
DATE	09/08/2011
PG. NO.	1 OF 1

P = PERFORM.C. = TEST CERTIFICATE
W = WITNESS H.T. = HEAT TREATMENT
V = VERIFY
3 = VENDOR
2 = BHEL AUTHORISED INSPECTION AGENCY (AIA)

विरेन्द्र कुमार/VIRENDRA KU...
प्रबंधक (यो०वि०) / Manager (P...)
भारत हेवी इलेक्ट्रिकल्स लिमिटेड
Bharat Heavy Electricals Ltd.
हर्प, वाराणसी
HERP, Varanasi

635

POSITIONS (QW-405)

Position [s] Groove 1G

Welding Progression : Up ... Down ... ...

Position [s] Fillet ...

[POSTWELD HEAT TREATMENT QW-407

Temperature Range 600-620°C

Time Range One hour

GAS [QW-408]

Percent Composition

Gas [es] [Mixture] Flow Rate

Shielding -

Trailing -

Backing -

PREHEAT [QW-406]

Preheat Temp Min 150°C (For 1st layer only)

Interpass Temp. Max 200°C

Preheat Maintenance -

ELECTRICAL CHARACTERISTICS [QW-409]

Current AC or DC DC Polarity +Ve

Amps [Range] 140-180 Volts Range 22-26

Tungsten Electrode size and type -

Mode of Metal Transfer for GMAW -

Electrode wire feed speed range -

TECHNIQUE [QW-410]

String or Weave Bead String only Orifice or Gas Cup Size -

Initial and Interpass Cleaning By Chipping, Brushing, Grinding

Method of Back Gouging - oscillation -

Contact Tube to Work Distance - Multiple or Single Pass Multi

Multiple or single Electrodes Single Travel Speed [Range] -

Peening No Electrode Spacing -

Other Clean the weld area prior to welding to remove Oil, Rust, Grease etc.

Weld Layer [s]	Process	Filler Metal Class	Filler Metal Dia. mm	Current Type Polar	Current Amp. Range	Volt Range	Travel Speed Range mm/min	Other
1st layer	SMAW	E309Mo-15	5.0	DC+	160-180	22-26	-	String only
subsequent layers	"	E308-L-15	"	"	"	"	-	--do--

CONTROLLED COPY

Prepared by [signature] 14/12/87

MANAGER
WELDING ENGG.

BHARAT HEAVY ELECTRICALS LIMITED

RAMACHANDRAPURAM, HYDERABAD-500 032.

PD - 268

QW-482 WELDING PROCEDURE SPECIFICATION (WPS)

Welding Procedure Specification No. WE055 Date 8.10.82 Supporting PQR No 193

Revision No. 1 Date 01.03.1989

Welding Process (es) SMAW Type (s) Manual

Details

JOINTS (QW 402)

Joint Design S.S.Overlay on P1,

Backing (Yes) - (No) -

Backing Material (Type) -

Metal - non fusing metal -

BASE METALS (QW-403) A8 overlay

P. No. 1 Group No. 1 & 2 to P. No. - Group No. -

OR

Specification type and grade

to Specification type and grade

OR

Chem. Analysis and Mech Prop

to Chem Analysis and Mech Prop

Thickness Range : 25mm & above

Base Metal Groove Fillet -

Pipe Dial Range : Groove - Fillet -

Other -

FILLER METAL (QW-404) 1st layer by E 309 Mo-15

F. No. 5 Other Subsequent layers by E 308L-15

A. No 8 Other (1)

Spec. No. (SFA) 5.4

DEPOSITED WELD METAL

AWS No. (Class) E309Mo-15&E308L-15 Thickness Range : 6mm and above (Overlay)
3mm Max by E 309Mo-15

Size of filler metals ∅ 5.0mm Groove Rest by E308L-15

Electrode-Flux. (Class) Basic Fillet

Flux Trade Name - Max. bead thickness : 5mm

Consumable insert No; Retainer: No.

(1) Rev., Format details added

AUTHORISED SIGN

BHARAT HEAVY ELECTRICALS LIMITED

RAMACHANDRAPURAM, HYDERABAD-500 032.

PD - 268

QW-482 WELDING PROCEDURE SPECIFICATION (WPS)

Welding Procedure Specification No WE.079. Date 31.10.90 Supporting PQR No. 322

Revision No 1 Date 10.03.95

Welding Process (es) SMAW Type (s) Manual

JOINTS (QW 402) Details

Joint Design As per Drawing

Backing (Yes) For double side welds (No) For single side welds

Backing Material (Type) Base metal/Weld metal

Metal Yes Non fusing metal --

Retainer : No

BASE METALS (QW-403)

P. No. - Group No. - to P. No. - Group No. -

OR

Specification type and grade X 12 Cr 13

to Specification type and grade X 12 Cr 13

OR

Chem. Analysis and Mech. Prop. --

to Chem. Analysis and Mech. Prop. --

Thickness Range :

Base Metal : ——— Groove 4.75 to 200mm Fillet All

Pipe Dia. Range : Groove All dia Fillet All

Other Root spacing for backing strip jts : 8-10mm
For others : 2 ± 1mm

FILLER METALS (QW-404)

Spec. No. (SFA)	5.4
AWS No. (Class)	E 410 - 16/15
F. No.	4
A. No	6
Size of Filler Metals	Ø 2.5 to 5.0mm
Deposited Weld Metal	Max head thickness : 5mm
Thickness Range : Groove	200mm Max
Fillet	All
Electrode Flux (Class)	Rutile
Flux Trade Name	--NA-
Consumable Insert	No

POSITIONS (QW-405)

Position [s] Groove All

Welding Progression : Up For V Down —

Position [s] Fillet All

[POSTWELD HEAT TREATMENT QW-407]

Temperature Range 680 - 710

Time Range 1 Hr/25mm upto 50mm. For every Additional 25mm : 15 Minutes

PREHEAT [QW 406]

Preheat Temp Min 280°C

Interpass Temp. Max 350°C

Preheat Maintenance By Oxy Accetalyne or Producer Gas

GAS [QW-408] NA

Percent Composition

Gas [es] [Mixture] Flow Rate

Shielding

Trailing

Backing

ELECTRICAL CHARACTERISTICS [QW-409]

Current AC or DC DC Polarity +Ve (DCEP)

Amps [Range] 60-180 Volts Range 22-26

Tungsten Electrode size and type NA

Mode of Metal Transfer for GMAW NA

Electrode wire feed speed range NA

TECHNIQUE [QW-410]

String or Weave Bead String Orifice or Gas Cup Size NA

Initial and Interpass Cleaning Chipping, Brushing, Grinding

Method of Back Gouging By Grinding oscillation No

Contact Tube to Work Distance NA Multiple or Single Pass Multi

Multiple or sinlge Electrodes Single Travel Speed [Range] --NA-

Peening Not allowe Electrode Spacing NA

Other Clean edges to be welded to remove, Grease, Rust etc. Prior to welding.

Weld Layer [s]	Process	Filler Metal Class	Filler Metal Dia. mm	Current Type Polar	Current Amp. Range	Volt Range	Travel Speed Range mm/min	Other
	SMAW	E410-16	2.5	DC+	60-80	--	--	String
	SMAW	E410-16	3.15	DC+	90-110	--	--	"
	SMAW	E410-16	4.0	DC+	110-140	--	--	"
	SMAW	E410-16	5.0	DC+	140-180	--	--	"

PREPARED BY

SR MANAGER
WELDING ENGG.

BHARAT HEAVY ELECTRICALS LIMITED

Ramachandrapuram, Hyderabad – 500 032.

QW – 482 WELDING PROCEDURE SPECIFICATION (WPS)

Welding Procedure Specification No.: *WE 148* **Date:** *05/01/2004* **Supporting PQR No.: 466**

Revision No.: 0 **Date: --**

Welding Process (es) : SMAW **Type (s) :** *Manual*

JOINTS (QW 402) **Details**

Joint Design : As per manufacturing drawing

Backing (Yes) : BASE MATERIAL

Backing Material (Type) : *Base Metal/weld metal*
Metal : *Yes*
Retainer : *No*

Non-Fusing Metal : *No*

BASE METALS (QW – 403)

P. No. : 6 **Group No. :** *1* **TO** **P. No.: 1** **Group No.1&2**

OR

Specification type & grade : ---
to Specification type & grade : ---

OR

Chemical Analysis & Mechanical Properties : ----
to Chemical Analysis & Mechanical Properties : -----

Thickness Range :
Base Metal : **Groove: 4.75 to 24 mm** **Fillet :** *All sizes*

Pipe Dia. Range : Groove: all dia **Fillet :** *All sizes*

Other : --

Filler Metals (QW – 404)	
Spec. No. (SFA)	*5.4*
AWS No. (Class)	*E309-15*
F. No.	*5*
A. No.	-
Size of Filler Metals	*2.5 – 5.0 mm*
Deposited Weld Metal	-
Thickness Range: Groove	*24 mm*
Fillet	*All*
Electrode Flux (Class)	*Basic*
Flux Trade Name	*NA*
Consumable Insert	*No*
Max. Bead Thickness	5.0 mm max

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

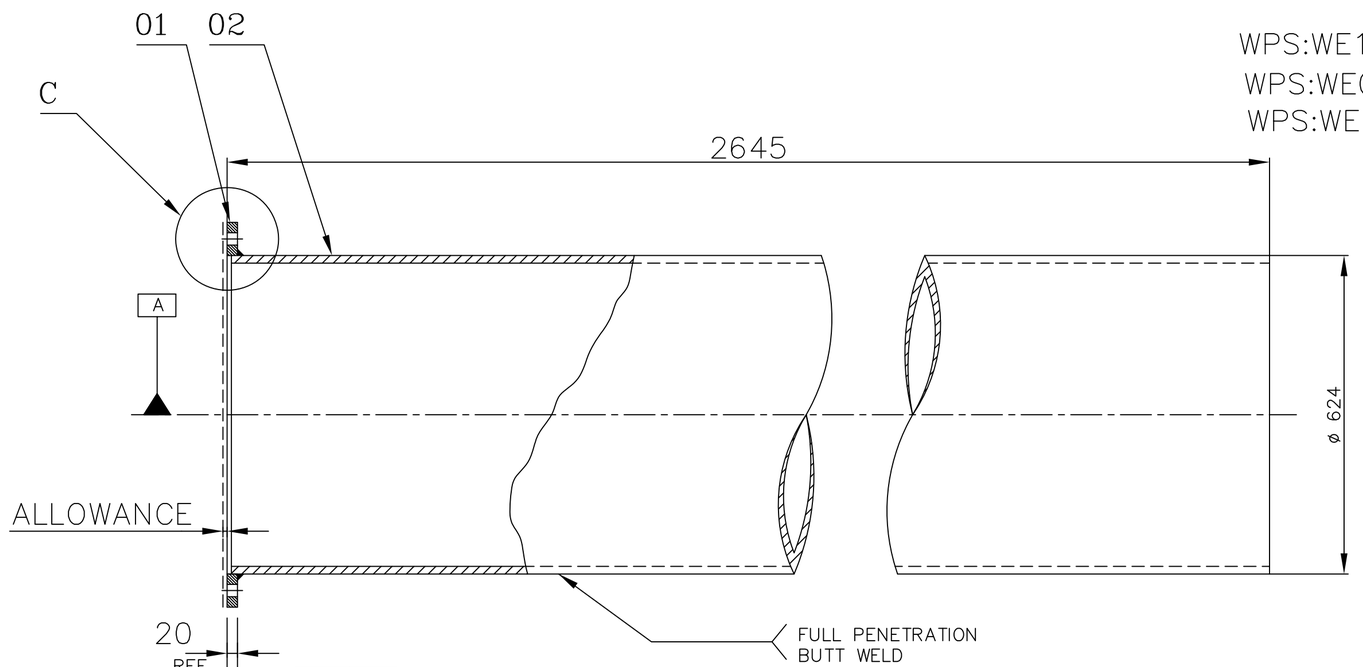
M.E.S

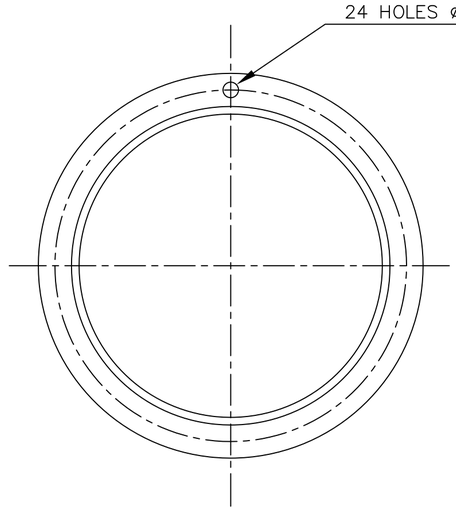
DRG. NO. 2-61-300-02501

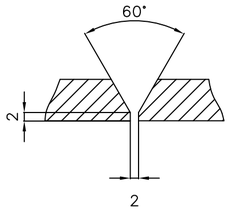
SH. OF

6.3

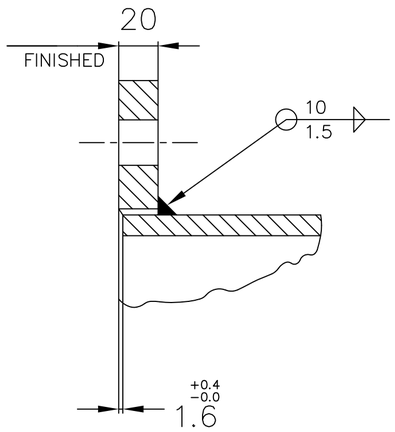
WPS:WE155 (AA10738 to AA10738, SA240 TP410S)
WPS:WE079 (AA10738 TO AA10738, SA240 TP410)
WPS:WE148 (AA10738 TO AA10119)







BUTT WELD–EDGE PREPARATION



DETAIL–C

NOTES: –

1. CUSTOMER APPROVED QUALITY PLAN TO BE FOLLOWED IF APPLICABLE.
2. WELD JOINTS ALLOWED FOR ITEM 02, IF STANDARD PLATE SIZE IS LESS THAN THE REQUIRED SIZE. WELDS TO BE FLUSH GROUND.

VARIANT NO	ITEM NO	DESCRIPTION	DRAWING NO.	ITEM NO.	MATL CODE	UNIT WT
				VER NO.	MATL SPEC	QTY
	02	PL 12X1922X2643			AA1071838091	475.5
					AA10738	1
	01	PIPE FLANGE	3-61-300-02451		AA1011819155	19.64
					AA10119	1

THE FOLLOWING CONDITIONS APPLY EXCEPT OTHERWISE STATED.

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

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

BHARAT HEAVY ELECTRICALS LIMITED HYDERABAD

	NAME	SIGN.	DATE
DRN.	E.M.ASHOK		00.03.24
CHD.	S.GHATGE		00.03.24
APPD.	K M R		00.03.24

NO.OF VAR. NA

DEPT.	UNTOL. DIMS.		SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO.OF ITEMS
PULVE ENGG DEPT CODE. 446	GR. G/M/F		N.T.S	495.14	NA	NA	NA

TITLE: CENTRE FEED PIPE–LOWER

DRAWING NO. 2-61-300-02501 REV. 04

SHT. No NO. OF SHT.

REV.	DATE	ALTERED	EMA
04	23.09.06	CHD/APPD	GK
ZONE A7	WPS: WE155 ADDED.		
03	1.10.04	CHD/APPD	
ZONE	NOTE 2 MODIFIED. R/M FOR 02 WAS PL 10X1927X2643 & CODE WAS AA1071838075. EDGE PREPARATION DETAILS ADDED.		
02	23.10.03	CHD/APPD	
ZONE	WPS WAS WE042 FOR SS TO SS. WPS WAS WE046 FOR SS TO CS .		
01	7.10.03	CHD/APPD	
ZONE	DIMS 10,1929 WERE 12 & 1923. MAT CODE WAS AA1071838091. NOTE 1 MODIFIED. NOTE 2 ADDED. WPS ADDED.		

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COMPUTER FILE NAME 26102501.DWG

REF. DRG. NO. PER HY0230261

SIGN. AND DATE

INVENTORY NO

GENERAL DIMENSIONAL LIMITS, FITS & TOLERANCES AS PER

FIRST ANGLE PROJECTION

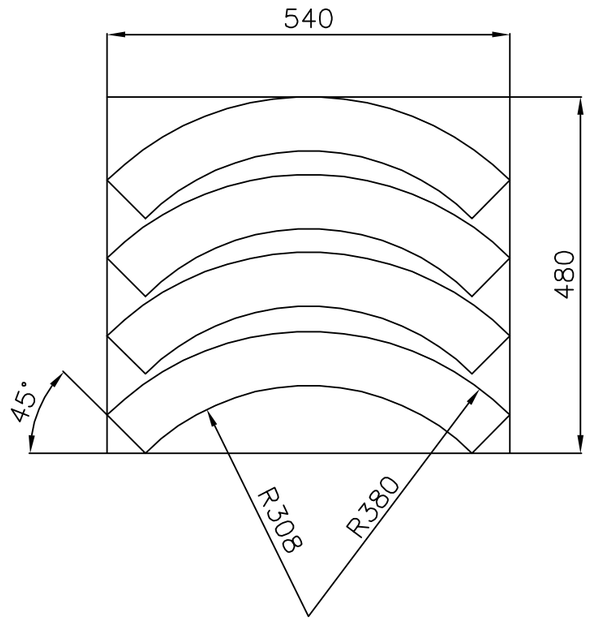
(ALL DIMENSIONS ARE IN mm)

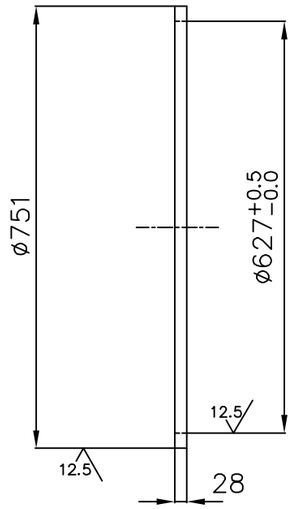
DRG. NO. 3-61-300-02451

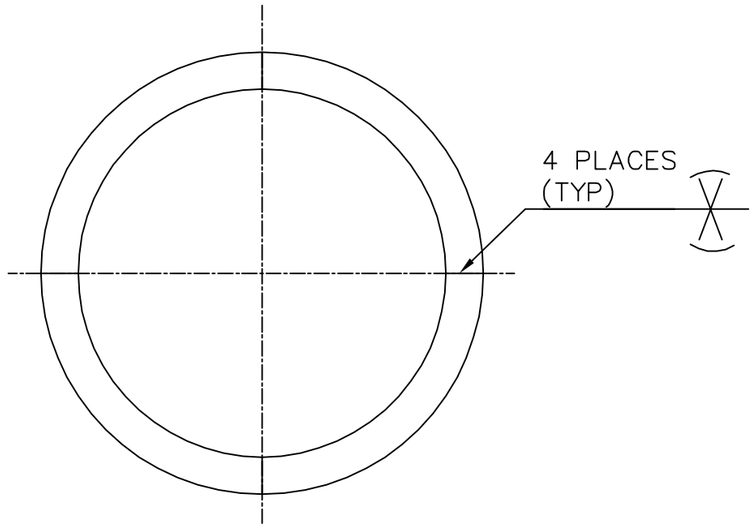
SH. OF

WPS WE - 006

12.5







ITEM NO.	DESCRIPTION	DRAWING NO	IT NO. / VAR NO	MATL CODE / MATL SPCN.	UNIT WT. / QTY	
	PL. 28x540x480			AA1011819163 / AA10119	29.50	

THE FOLLOWING CONDITIONS APPLY EXCEPT OTHERWISE STATED.

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

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

BHARAT HEAVY ELECTRICALS LIMITED
HYDERABAD

	NAME	SIGN.	DATE	NO.OF VAR.
DRN.	B M R		00.03.24	
CHD.	S.G		00.03.24	
APPD.	K.M.R.		00.03.24	

DEPT. / DEPT.CODE	UNTOL. DIMS.	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO.OF ITEMS
BMD / 446	GR. ¢/M/F	1:10	29.50			

TITLE: PIPE FLANGE (CENTRE FEED PIPE)

DRAWING NO. 3-61-300-02451 REV. 1.1

SHT. No | NO. OF SHT.

REV.	DATE	ALTERED	ZONE
1.1	5.11.11	CHD/APPD V.KUMAR	DIM. 480 WAS 680 BOM CORRECTED MACHINING SYMBOL SHOWN ON OD AND ID
01	1.10.04	CHD/APPD	M/C ON FLANGE FACE DELETED. DIM 28 WAS 20. 24 HOLES & PCD 700 DELETED. WT CORRECTED.

INVENTORY NO

SIGN. AND DATE | REF. DRG. NO. | COMPUTER FILE NAME 3610050O.DWG

GENERAL DIMENSIONAL LIMITS,FITS & TOLERANCES AS PER HY0230261

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

0.0 GENERAL:

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

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

1.0 SCOPE:

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

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

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

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

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

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

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

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

It does not apply for the following dimensions:

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

b) Auxiliary dimensions indicated in brackets.

c) Theoretically exact dimensions indicated in rectangular frames.

2.0 COMPLIANCE WITH STANDARDS:

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

3.0 GENERAL TOLERANCES:

3.1 Linear dimensions are given in Table 1 and 2.

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

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

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

Revision: This standard was based on 1969 version of IS:2102			Approved: INTERPLANT STANDARDIZATION COMMITTEE-WG (DOP + BES)		
Rev.No. 01	Amd.No.	Reaffirmed	Prepared BHOPAL	Issued CORP. R&D	Dt. of 1st issue 22-06-1978
Dt. 1-12-1995	Dt.	Year: 2008			

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4.0 INDICATIONS ON DRAWINGS:

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

Example: AA 023 02 08 m

5.0 REJECTION:

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

6.0 NOTE:

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

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

Values in millimetres

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

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

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

Values in millimetres

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

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

Table 3 — Permissible deviations of angular dimensions

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

Annex A
(informative)

Concepts behind general tolerancing of linear and angular dimensions

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

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

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

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

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

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

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

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

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

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

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

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

The workshop should therefore

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

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

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

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

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

GENERAL TOLERANCES FOR WELDING CONSTRUCTIONS FOR LENGTHS AND ANGLES

1.0 GENERAL

1.1 General tolerances are permissible variations corresponding to the degrees of accuracy normally observed in workshops where details of tolerances are not provided in the drawings.

1.2 The general tolerances specified in this standard apply to dimensions for which the tolerances are indicated on the nominal dimensions for welded components, welded assemblies and welded structures.

1.3 The variations apply to linear dimensions such as outside dimensions, inside dimensions, stepped dimensions, widths, Centre-to-Centre distances and also angles.

1.4 Special rulings may be stated for linear dimensions of welded structures consisting of several assemblies.

1.5 This standard is based on BS EN ISO 13920-1997

1.6 General tolerances for machined components are covered in Corporate Standard AA0230208.

1.7 Refer Corporate Standard AA0621105 for general tolerances for welded structures - Form and Position.

2.0 SCOPE

2.1 This standard prescribes four degrees of accuracy based on differences arising out of function and manufacture of welded components, assemblies and structures.

2.2 For technical and economic reasons other degrees of accuracy may be appropriate which have to be specifically stated.

3.0 GENERAL TOLERANCES

3.1 Tolerances for linear dimensions are given in Table 1.

3.2 Table 2, for the tolerances on angular dimensions.

4.0 REPRESENTATION ON DRAWINGS

4.1 The required degree of accuracy shall be specified in all fabrication drawings.

For example class 'B' of AA0621104 (BS EN ISO 13920)

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4.2 Figures 1 to 5 give examples of how dimensions (linear & angular) are to be indicated on the drawings. (Refer page 6 of 6 of this standard)

5.0 TESTING

5.1 The actual size of an angular structural component is determined by placing suitable measuring instruments tangentially on the welded part so that the zone affected by the weld is eliminated. The variation is obtained from the difference between the dimension in the drawing and the actual size.

TABLE-1 **TOLERANCE FOR LINEAR DIMENSIONS**

Range of nominal sizes l in mm											
Tolerance Class	2 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	Over 4000 up to 8000	Over 8000 up to 12000	Over 12000 up to 16000	Over 16000 up to 20000	Over 20000
	Tolerances t in mm										
A	± 1	± 1	± 1	± 2	± 3	± 4	± 5	± 6	± 7	± 8	± 9
B		± 2	± 2	± 3	± 4	± 6	± 8	± 10	± 12	± 14	± 16
C		± 3	± 4	± 6	± 8	± 11	± 14	± 18	± 21	± 24	± 27
D		± 4	± 7	± 9	± 12	± 16	± 21	± 27	± 32	± 36	± 40

TABLE-2 **TOLERANCES FOR ANGULAR DIMENSIONS**

Tolerance Class	Range of Nominal sizes l in mm (Length of shorter leg)		
	Up to 400	Over 400 upto 1000	Over 1000
	Tolerance Δα (In degrees and minutes)		
A	± 20’	± 15’	± 10’
B	± 45’	± 30’	± 20’
C	± 1°	± 45’	± 30’
D	± 1°30’	± 1°15’	± 1º
Calculated and rounded tolerances t, in mm/m[a]			
A	± 6	± 4.5	± 3
B	± 13	± 9	± 6
C	± 18	± 13	± 9
D	± 26	± 22	± 18
[a] The value indicated in mm/m correspond to the tangent value of the general tolerance. It is to be multiplied by the length, in m, of the shorter leg.			

NOTE:

1) The permissible variations also apply to unmarked angles of 90º and 180º.
2) The shorter side of the angle is specified as the reference side.
3) Its length can also be taken from a specially indicated reference point to be shown in the drawings.
4) If the drawing contains no angle data, but only linear dimensions, then the permissible variations are to be taken in mm/m.

6.0 Tolerances on dimensions of welded assemblies, the part of which are machined preliminarily and the assembly after welding as per given size not subjected to machining are set 50% lower than the tolerances on dimensions requiring a given accuracy.

7.0 In case of necessity, it is allowed to set as symmetrical tolerances in relation to nominal, but in this case the sum total of the value of the tolerance is to be preserved as per table 1.

8.0 Deformation of welded constructions (not in contact with floor plate) is allowed up to limits given in table 3.

Remarks:

1) The local convexities and concavities of the sheathing surface having smooth transition are allowed up to 4 mm.
2) General bend along the whole length of the sheathing should not exceed W mm per running metre.
3) Bends in the thin walled construction of the type of branch pipes, baffles of air draft hydro-generators are considered separately in every particular case.

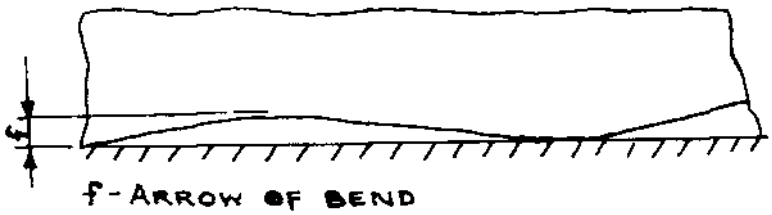

TABLE-3

Type of Construction	Length in mm						
Beams, spokes, stands, guards and similar parts	10000 to 15000	5000 to 10000	3000 to 5000	1500 to 3000	1000 to 1500	500 to 1000	Upto 500
	Allowable bend in mm						
	10.0	8.0	6.0	4.5	3.0	2.5	2.0
Frames, Floor plates dished parts, boxes External covers, bearings and Similar parts.	12.0	10.0	8.0	6.0	4.0	3.0	2.0

9.0 Allowance for machining of welded construction is determined as per table 5.

Remarks:

1) In case of machining of diameters and constructions from two sides the allowance is doubled.

2) For "Dimension as per drawing" is taken the dimension for which the allowance is meant.

10.0 Tolerances on bend "C" shall be as per table 4.

TABLE – 4

Width of flange ''b'' in mm	Thickness of flange ''s'' in mm	Tolerance ''c'' in mm
400-201	60-41	3.0
	40-31	3.5
	30-21	4.0
	20-11	4.5
	10 and lower	5.0
200-150	40-31	3.0
	30-21	3.5
	20-11	4.0
	10 and lower	5.0
149-100	40-31	2.5
	30-21	3.0
	20-11	3.5
	10	4.5
99-50	30-21	2.0
	20-11	2.5
	10	3.0
50 and lower	30-21	1.5
	20-11	2.0
	10	2.5

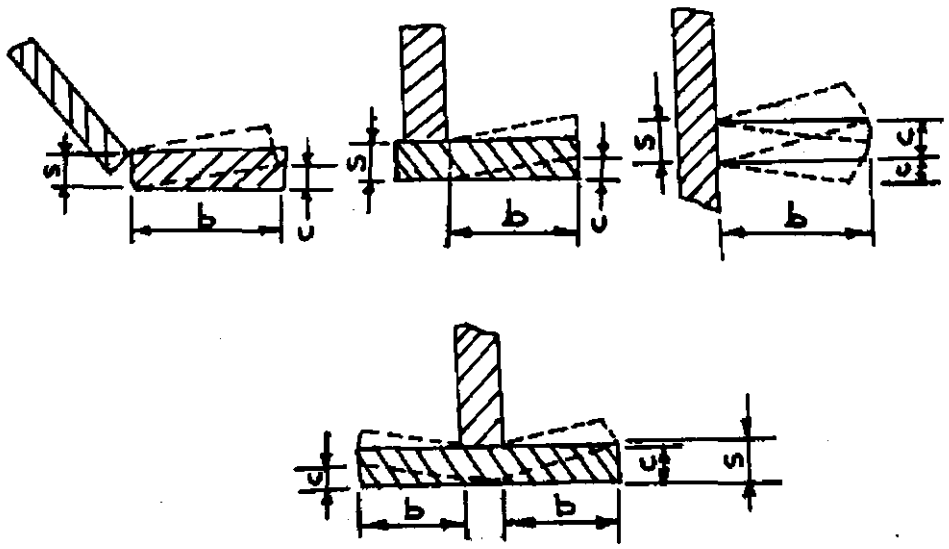

TABLE-5

Dimension as per Drawing (mm)	Machining Allowance per side (mm)
Upto 500	6
More than 500 & upto 1000	8
More than 1000 & upto 2000	10
More than 2000 & upto 4000	12
More than 4000 & upto 6000	14
More than 6000 & upto 10000	18
More than 10000 & upto 15000	22
More than 15000	24

11.0 REFERRED STANDARDS (Latest publications including amendment)

1) AA0230208
2) AA0621105

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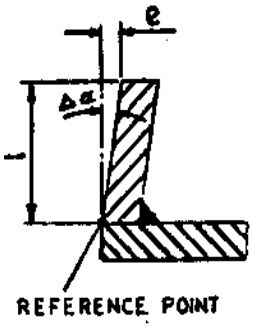

FIG. 1

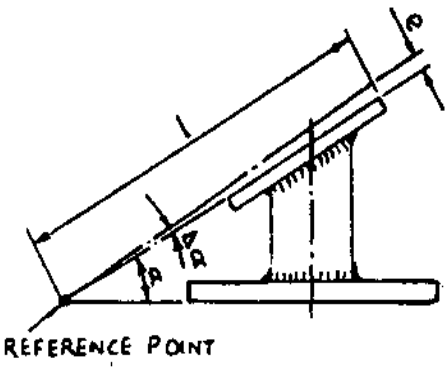

FIG. 2

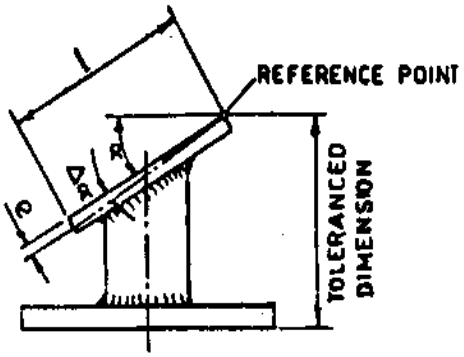

FIG. 3

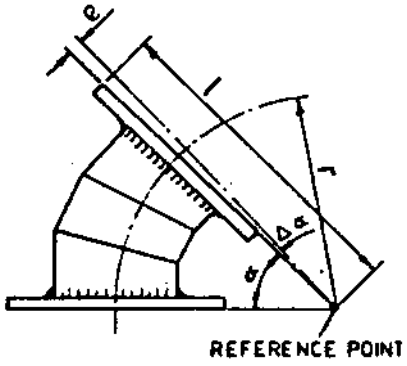

FIG. 4

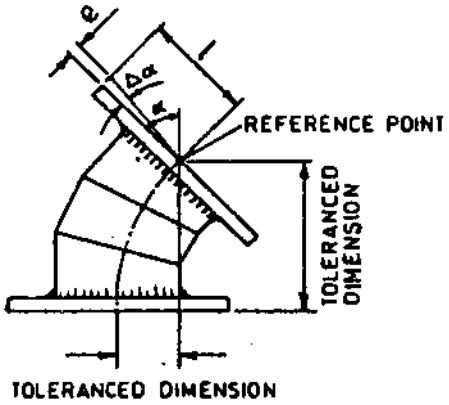

FIG. 5

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

ORDERING DESCRIPTION

1.0 GENERAL:

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

2.0 APPLICATION:

For general engineering purposes, suitable for welding.

3.0 CONDITION OF DELIVERY:

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

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

3.3 Any other additional requirement as per BHEL Purchase order.

4.0 DIMENSIONS AND TOLERANCES:

4.1 Sizes:

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

4.2 Tolerances:

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

4.3 Straightness for hot rolled bars:

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

5.0 TEST SAMPLES:

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

Revisions:	APPROVED:
Clause No. 1, 3, 5 & 8 revised (as per MOM of 38th MRC meeting), Clause 10 added	INTERPLANT MATERIAL RATIONALISATION COMMITTEE – MRC(S&GPS)

Rev No.15	Amd No.	Reaffirmed	Prepared	Issued	Dt. of 1st Issue
Dt:11-03-2014	Dt:	Year:	HPEP, Hyderabad	Corp.R&D	June, 1976

CORPORATE PURCHASING SPECIFICATION

6.0 ULTRASONIC EXAMINATION:

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

6.1 For plates above 40 mm thick:

Shall be ultrasonically examined unless when otherwise specified in order.

7.0 TEST CERTIFICATES:

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

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

The test certificate shall bear the following information:

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

BHEL order No.

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

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

8.0 PACKING AND MARKING:

Plates shall be transported suitably to avoid damage during transit.

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

9.0 REJECTION AND REPLACEMENT

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

10.0 REFERRED STANDARDS (Latest publications including amendments):

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

26/6/14

CS-721

STEEL TUBES – ELECTRIC RESISTANCE WELDED / SUBMERGED ARC WELDED

1.0 GENERAL:

This specification governs the quality requirements of light, medium and heavy grades of Electric Resistance Welded/Submerged Arc Welded steel tubes with plain ends in ungalvanized and galvanized condition in the range of 60mm to 150mm NB.

2.0 APPLICATION:

For general purpose, suitable for bending, welding and screwing for flanges and fittings. Not suitable for steam services.

3.0 CONDITION OF DELIVERY:

Tubes shall be supplied with plain ends.

The ends shall be cut cleanly and square with the axis of the tube.

Unless otherwise specified, tubes shall be supplied in ungalvanized condition.

4.0 COMPLIANCE WITH NATIONAL STANDARDS:

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

IS: 1239(part 1) – 2004: Steel Tubes, Tubular and other Wrought Steel Fittings
Gr: ERW.

5.0 DIMENSIONS AND TOLERANCES:

5.1 Sizes:

BHEL order shall clearly state the maximum outside diameter, and wall thickness of the tube.

5.2 Tolerances:

5.2.1 Thickness:

Light tubes	+ not limited − 8 percent
Medium and Heavy tubes	+ not limited − 10 percent

5.2.2 Weight:

Single tube (light series)	+ 10 percent − 8 percent
Single tube (medium and heavy series)	± 10 percent
For quantities per load of 10 tonnes, min (light series)	+ 7.5 percent − 5 percent
For quantities per load of 10 tonnes, min (medium and heavy series)	± 7.5 percent

5.2.3 Internal Weld Fin:

Height of the internal weld fin shall not be greater than 60 percent of the specified thickness.

5.2.4 Length:

5.2.4.1 Random Length:

Tubes shall be supplied in random lengths of 4 to 7 meters, unless otherwise specified and in the line with IS: 1239, Part 1.

5.2.4.2 Exact Length:

When exact lengths are called for, the tolerances shall be + 6 mm, − 0 mm of the specified length.

6.0 MANUFACTURE:

Tubes shall be made from tested quality steel manufactured by any approved process and shall be fully killed.

Tubes shall not be manually welded.

7.0 FREEDOM FOR DEFECTS:

Tubes shall be cleanly finished and reasonably free from injurious defects. They shall be reasonably straight. The ends shall be cut cleanly and reasonably square with the axis of the tube.

8.0 CHEMICAL COMPOSITION:

The melt analysis of steel shall be as follows:

Element	Percent max.	Permissible variation over specified limit, ± max
Carbon	0.20	0.02
Manganese	1.30	0.04
Sulphur	0.040	0.005
Phosphorus	0.040	0.005

9.0 GALVANIZING:

When galvanized tubes are ordered, the Zinc coating on the tubes shall be in accordance with IS: 4736

10.0 TEST SAMPLES:

All tubes bearing the same designation and manufactured under a single process shall be grouped together to constitute a lot. Each lot shall be sampled separately in accordance with IS: 4711

11.0 MECHANICAL PROPERTIES:

11.1 Tensile:

The tensile strength of strips cut form selected tubes, when tested in accordance with IS: 1608 shall be as follows:

Tensile strength : 320 N/mm^2, min.

Elongations on $5.65\sqrt{S_o}$ gauge length:

Up to and including. 25 mm NB : 12 percent, min.
Over 25 mm up to including150 mm NB : 20 percent, min.

Note:

1. For welded tubes, the strip tensile test specimen shall not contain the weld.
2. For galvanized tubes, zinc coating may be removed by stripping prior to tensile test.

11.2 Bend Test (On tubes up to and including 50mm nominal bore):

When tested in accordance with IS: 2329, the tubes shall be capable of withstanding the bend test without showing any signs of fracture or failure.

Tubes shall be bent with the weld at 90^o to the plane of bending. The tubes shall not be filled for this test.

Ungalvanised tubes shall be capable of being bent cold without cracking, through 180^o around a former having a radius at the bottom of groove in the plane of bending equal to at least six times the outside diameter of the tube.

Galvanized tubes shall be capable of being bent cold without cracking of the steel, through 90^o round a former having a radius at the bottom of the groove equal to at least eight times the outside diameter of the tube.

11.3 Flattening Test (On tubes above 50mm nominal bore):

Rings not less than 40mm in length, cut form the end of each selected tubes shall be flattened between parallel plates with the weld at 90^o(point of maximum bending) in accordance with IS:2328. No opening shall occur by fracture in the weld until the distance between the plates is less than 75 percent of the original outside diameter of the tube and no cracks or breaks on the metal elsewhere than in the weld shall occur until the distance between the plates is less than 60 percent of the original outside diameter.

Test rings may have the inner and outer edges rounded.

11.4 Hydraulic Test / Eddy Current Test:

Each tube shall withstand a test pressure of 5 N/mm^2 without showing leakage defects of any kind. The pressure shall be applied and maintained for a minimum period of 3 seconds for proof and inspection.

Note: Eddy current test may be done in place of Hydrostatic test as per the procedure in Annexure – B of IS: 1239, Part-1.

CORPORATE PURCHASING SPECIFICATION

12.0 TEST CERTIFICATES:

Three copies of test certificates shall be supplied, unless otherwise stated on the order.

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

The test certificate shall bear the following information:

AA10152: Rev. No.07: Steel Tubes – ERW/SAW
BHEL order No:

Supplier's Reference:
Name
Identification No.
Melt No.

Results of Tests:
Results of Chemical, Mechanical tests and Hydraulic/Eddy Current test.

13.0 PROTECTIVE COATING:

The tubes shall be protected with a rust preventive coating of varnish, externally throughout the length.

14.0 PACKING AND MARKING:

Each tube shall be plugged at both ends by means of tight fitting end caps.

The tubes shall be suitably packed in bundles/packages to prevent corrosion and damage during transit.

Each bundle/package shall bear the following information:

AA10152: Steel Tubes – ERW/SAW
BHEL Order No.
Consignment/Identification No.
Outside Diameter and Wall Thickness.
Supplier's Name

15.0 REFERRED STANDARDS (Latest Publications Including Amendments):

1) IS: 1608 2) IS: 2328 3) IS: 2329

4) IS: 4736 5) IS: 4711

STAINLESS STEEL SHEETS AND PLATES - ANNEALED ASTM A 240M, TYPE 410 Î

ORDERING DESCRIPTION

1.0 GENERAL :

The sheets and plates shall conform to the latest version of ASTM A 240M, Î Type: 410 and comply with the following additional requirements.

2.0 APPLICATION:

For general engineering purposes, where corrosion resistance is essential.

3.0 CONDITION OF DELIVERY:

Hot Rolled, annealed and descaled (Finish No.1).

Cold rolled, annealed (2B / 2 D).

4.0 DIMENSIONS AND TOLERANCES:

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

5.0 CHEMICAL COMPOSITION:

As per ASTM A 240M, Type 410. Î

6.0 TEST CERTIFICATES :

Three copies of test certificates shall be supplied along with the following information:

BHEL References :

AA 107 38 -Rev. No.07 / ASTM A 240M, Type:410 Î
BHEL order No,

Supplier's References :
Name
Identification No.
Melt No.
Process of manufacture
Details of heat treatment.

Result of Tests:
Dimensional inspection.
Results of chemical analysis, mechanical tests

7.0 PACKING AND MARKING :

Sheets shall be supplied in bundles or in packages each weighing upto a maximum of 3000kg. Plates shall be suitably packed to prevent damage during transit.

For plates below 25 mm thick, each pile (preferably of 16 plates) shall be marked with suppliers identification mark, 'AA 107 38 / ASTM A 240M, Type:410, melt No., BHEL Î order No., on the top plate.

Each plate of 25mm thickness and above shall be stamped/painted with the suppliers identification mark, 'AA 107 38 / ASTM A 240M, Type:410 , melt No., BHEL order Î No., on the top plate.

FOR INFORMATION ONLY

CHEMICAL COMPOSITION

C	Si	Mn	Ni	Cr	S	P	Al
0.08-0.15	≤ 1.0	≤ 1.0	≤ 0.75	11.5-13.5	≤ 0.030	≤ 0.040	-

MECHANICAL PROPERTIES

Hardness, max		0.2% PS min	UTS, min	% El min	Cold Bend. Î
BHN	HRB	N/mm²	N/mm²		
217	96	205	450	20	180^0

RUST PREVENTIVE HARD FILM, BLACK (TRP)

1.0 GENERAL:

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

2.0 APPLICATION:

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

3.0 REMOVAL:

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

4.0 COLOUR : Steel Black.

5.0 COMPLIANCE WITH NATIONAL STANDARDS:

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

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

6.0 COMPOSITION:

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

7.0 TEST SAMPLES:

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

8.0 PROPERTIES:

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

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

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

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

8.4 Weight : 11 ± 0.5 kg per 10 litres.

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

8.6 Test for Adhesion : To pass the test

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

8.8 Protection against corrosion at high temperature and humidity:

To pass the test for 360 hours, minimum..

9.0 TYPE TESTS:

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

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

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

10.0 TEST CERTIFICATES:

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

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

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

11.0 KEEPING PROPERTY:

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

12.0 PACKING & MARKING:

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

Each container shall marked with the following information:

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

8.0 ENVIRONMENTAL REQUIREMENTS:

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

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

13.0 REFERRED STANDARDS (Latest Publications Including Amendments):

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

BHEL HERP VARANASI
QUALITY PLAN

Centre Feed Pipes (Pipe Material AA10738)

SL.NO.	COMPONENT	CHARACTERISTIC CHECKED	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENTS & ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
							P	W	V	
1.0	Raw Material : Plates	i.Chemical & Mechanical properties	Chemical analysis and Mechanical test	1 sample per heat batch	AA10119	TC	3	-	2	Manufacturer's TC is also acceptable for chemical and mechanical properties
		ii.Chemical & Mechanical properties	Chemical analysis and Mechanical test	1 sample per heat batch	AA 10738	TC	3	-	2	Plates AA10738 should be procured from BHEL approved sources only (Specified in Purchase Order)
2.0	Fabrication	ii. Fit up exam and welding	Measurement	100%	Drawing	Dim.report	3	-	2	Tolerance to be maintained as per drg. All welding shall be done by qualified welders only. BHEL WPS nos. WE-079, and WE-148 should be followed for SMAW as per requirement of drawings. Compatible welding electrodes (as mentioned in above WPS) should be used. Job should be preheated to temperature mentioned in WPS no. WE-079. If MIG/MAG welding process is used, prior WPS approval is to be taken from BHEL.
		iii.Post Weld Heat Treatment	Review of HT Chart	100%	As per applicable WPS WE-079		3	-	2	As per WPS WE-079 Following Heat treatment cycle should be followed : 1) Free Heating upto 400°C 2) Rate of Heating 100°C/Hr upto 680°C to 710°C 3) Soaking time 1 hour. 4) Rate of cooling 100°C/Hr upto 400°C 5) Free Cooling in ambient air below 400°C
		iv. D.P.Testing of welded joints	D.P.test	100%	AA0850131 & AA0850129	TC	3	2	-	100% D.P.test shall be witnessed by BHEL AIA
3.0	Final Inspection after Fabrication, Stress relieving and NDT.	i.Dimensions	Measurement	100%	Drawing.	Dimension Report	3	2	-	Unspecified tolerances shall be maintained as follows : a) As per medium tolerance class of Specn. AA0230208 for machined dimensions. b) As per Tolerance class B of specn. AA0621104 for fabricated dimensions.
		ii. Painting & preservation		100%		Insp.Report	3	2	-	All Machined surfaces of material other than SS (AA 10738) shall be protected by applying TRP black paint (specn. AA55154). All threaded holes to be protected by applying grease
		iii.Identification & Marking	Punching of Drg. No., P.O.No., Vendor code no., year, Inspector Seal	100%	Drawing	Inspection Report	3/2	2	-	
			APPROVED BY		MANAGER P&D					
			SIGNATURE & DATE							

QP. NO.	RV/FAB /31
DATE	09/08/2011
PG. NO.	1 OF 1

P = PERFORM.C. = TEST CERTIFICATE
W = WITNESS H.T. = HEAT TREATMENT
V = VERIFY
3 = VENDOR
2 = BHEL AUTHORISED INSPECTION AGENCY (AIA)

विरेन्द्र कुमार/VIRENDRA KU...
प्रबंधक (यो०वि०) / Manager (P...)
भारत हेवी इलेक्ट्रिकल्स लिमिटेड
Bharat Heavy Electricals Ltd.
हर्प, वाराणसी
HERP, Varanasi

BHARAT HEAVY ELECTRICALS LIMITED

Ramachandrapuram, Hyderabad – 502 032, INDIA

QW – 482 WELDING PROCEDURE SPECIFICATION (WPS)

Welding Procedure Specification No.: WE006 **Date: 02.08.86** **Supporting PQR No.:** 516, **Dt** : 11.05.10

Revision No.: 07 **Date:** 24.04.2016

Welding Process (es) : *SMAW* **Type (s) :** *MANUAL*

JOINTS (QW 402)

Joint Design: *As per manufacturing drawing (groove/fillet)*

Root Spacing : *As per manufacturing drawing*

Backing (Yes) : *for double side butt welds and backing strip joints*

(No) : *for single side welds*

Backing Material (Type) : *Base metal / Weld metal*

Metal: *Yes* **Non-Fusing Metal**: *No*

Retainer: *No*

BASE METALS (QW – 403)

P. No. *: 1* **Group No. :** *1 & 2* **TO** **P. No.:** *1* **Group No.:** *1 & 2*

OR

Specification type & grade: -------- **to** Specification type & grade : -------

OR

Chemical Analysis & Mechanical Properties: --- to Chemical Analysis & Mechanical Properties: ----

Thickness Range :

Base Metal : **Groove:** *5.0 mm to 38 mm* ** **Fillet :** *all sizes*

Deposited pass thickness > 13mm – Not Permitted

Other : None

Filler Metals (QW – 404)

	SMAW
Spec. No. (SFA)	*5.1*
AWS NO (CLASS)	A5.1 (*E 7018*)
F. No.	4
A. No.	*1*
Size of Filler Metals	*Dia 2.5, 3.15, 4.0, 5.0mm*
Filler Metal Product Form	N.A
Supplemental Filler Metal	N.A
Deposited Weld Metal Thickness Range : Groove: Fillet:	38 *mm Max.* *38 mm Max Throat*
Electrode Flux (Class)	*Basic*
Consumable Insert	*No*
Max. Bead Thickness	5 *mm*

** Note : For Unequal thicknesses base material thickness qualified upto 50mm and weld metal thickness limited to 38mm max.

Rev : 07 – Note added regarding base material thickness

POSITIONS (QW-405)

Position(s) Groove : *ALL POSITIONS*
Welding Progression: *UP for Vertical*
Down –Not permitted
Position (s) Fillet: *ALL*
Other : None

POSTWELD HEAT TREATMENT (QW-407)

Not Permitted
Temperature Range: *NA*

Time Range: *NA*
Other : *None*

PREHEAT (QW-406)

Preheat Temp Min: *10 º C min for < 31mm*
100 º C min for 31mm and above
Interpass Temp Max: *300 º C*
Preheat Maintenance: *Minimum specified temperature for every restart*
Other : None

GAS (QW - 408)

	Gas(es)	Percentage Composition Mixture	Flow Rate
Shielding :	N.A	-	-
Trailing :	N.A	-	-
Backing :	N.A	-	-

Other : None

ELECTRICAL CHARACTERISTICS (QW-409)

Weld Pass (es)	Process	Filler Metal		Current type & Polarity	Amps (Range)	Wire feed speed	Energy or Power (Range)	Volts (Range)	Travel speed	Other
		Classification	Diameter							
Root& Subsequent as required	*SMAW*	*E 7018*	*2.5mm*	*DCEP*	*60 – 90A*	N.A	N.A	*22-34V*	N.A	*String for horizontal; Others Weave (Max 3 times Electrode Core Dia)*
	-do-	*-do-*	*3.15mm*	*-do-*	*100-150A*	*-do-*	*-do-*	*-do-*	*-do-*	
	-do-	*-do-*	*4.0mm*	*-do-*	*150-200A*	*-do-*	*-do-*	*-do-*	*-do-*	
		-do-	*5.0mm*	*-do-*	*200-260A*	*-do-*	*-do-*	*-do-*	*-do-*	

Pulsing Current : *N.A*

Heat Input *: N.A*

Tungsten Electrode Size and Type : *N.A*

Mode of Metal Transfer for GMAW (FCAW): *N.A*

Others **:** None

TECHNIQUE (QW-410)

String or Weave Bead: *string and/or weave*

Orifice or Gas Cup Size : *N.A*

Initial / Interpass Cleaning : *chipping / brushing / grinding*

Method of Back Gouging: *grinding/gouging if required*

Oscillation *: N.A*

Contact tube to work distance : N.A

Multiple or Single Pass : *Multiple pass*

Multiple or Single Electrodes : *Single electrode*

Closed to out chamber : *N.A*

Peening : *Not allowed*

Use of thermal processes : *N.A*

Other : *Clean weld area to remove oil, rust, grease, etc. prior to welding.*

Prepared by

Welding Engineer

Approved by

HEAD / Welding Engg

N.A – Not Applicable

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POSITIONS (QW-405)

Position [s] Groove 1G

Welding Progression : Up ... Down ... ...

Position [s] Fillet ...

[POSTWELD HEAT TREATMENT QW-407

Temperature Range 600-620°C

Time Range One hour

GAS [QW-408]

Percent Composition

Gas [es] [Mixture] Flow Rate

Shielding -

Trailing -

Backing -

PREHEAT [QW-406]

Preheat Temp Min 150°C (For 1st layer only)

Interpass Temp. Max 200°C

Preheat Maintenance -

ELECTRICAL CHARACTERISTICS [QW-409]

Current AC or DC DC Polarity +Ve

Amps [Range] 140-180 Volts Range 22-26

Tungsten Electrode size and type -

Mode of Metal Transfer for GMAW -

Electrode wire feed speed range -

TECHNIQUE [QW-410]

String or Weave Bead String only Orifice or Gas Cup Size -

Initial and Interpass Cleaning By Chipping, Brushing, Grinding

Method of Back Gouging - oscillation -

Contact Tube to Work Distance - Multiple or Single Pass Multi

Multiple or single Electrodes Single Travel Speed [Range] -

Peening No Electrode Spacing -

Other Clean the weld area prior to welding to remove Oil, Rust, Grease etc.

Weld Layer [s]	Process	Filler Metal Class	Filler Metal Dia. mm	Current Type Polar	Current Amp. Range	Volt Range	Travel Speed Range mm/min	Other
1st layer	SMAW	E309Mo-15	5.0	DC+	160-180	22-26	-	String only
subsequent layers	"	E308-L-15	"	"	"	"	-	--do--

CONTROLLED COPY

Prepared by [signature] 14/12/87

MANAGER
WELDING ENGG.

BHARAT HEAVY ELECTRICALS LIMITED

RAMACHANDRAPURAM, HYDERABAD-500 032.

PD - 268

QW-482 WELDING PROCEDURE SPECIFICATION (WPS)

Welding Procedure Specification No. WE055 Date 8.10.82 Supporting PQR No 193

Revision No. 1 Date 01.03.1989

Welding Process (es) SMAW Type (s) Manual

Details

JOINTS (QW 402)

Joint Design S.S.Overlay on P1,

Backing (Yes) - (No) -

Backing Material (Type) -

Metal - non fusing metal -

BASE METALS (QW-403) A8 overlay

P. No. 1 Group No. 1 & 2 to P. No. - Group No. -

OR

Specification type and grade

to Specification type and grade

OR

Chem. Analysis and Mech Prop

to Chem Analysis and Mech Prop

Thickness Range : 25mm & above

Base Metal Groove Fillet -

Pipe Dial Range : Groove - Fillet -

Other -

FILLER METAL (QW-404) 1st layer by E 309 Mo-15

F. No. 5 Other Subsequent layers by E 308L-15

A. No 8 Other (1)

Spec. No. (SFA) 5.4

DEPOSITED WELD METAL

AWS No. (Class) E309Mo-15&E308L-15 Thickness Range : 6mm and above (Overlay)
3mm Max by E 309Mo-15

Size of filler metals ∅ 5.0mm Groove Rest by E308L-15

Electrode-Flux. (Class) Basic Fillet

Flux Trade Name - Max. bead thickness : 5mm

Consumable insert No; Retainer: No.

(1) Rev., Format details added

AUTHORISED SIGN

BHARAT HEAVY ELECTRICALS LIMITED

RAMACHANDRAPURAM, HYDERABAD-500 032.

PD - 268

QW-482 WELDING PROCEDURE SPECIFICATION (WPS)

Welding Procedure Specification No WE.079. Date 31.10.90 Supporting PQR No. 322

Revision No 1 Date 10.03.95

Welding Process (es) SMAW Type (s) Manual

JOINTS (QW 402) Details

Joint Design As per Drawing

Backing (Yes) For double side welds (No) For single side welds

Backing Material (Type) Base metal/Weld metal

Metal Yes Non fusing metal --

Retainer : No

BASE METALS (QW-403)

P. No. - Group No. - to P. No. - Group No. -

OR

Specification type and grade X 12 Cr 13

to Specification type and grade X 12 Cr 13

OR

Chem. Analysis and Mech. Prop. --

to Chem. Analysis and Mech. Prop. --

Thickness Range :

Base Metal : ——— Groove 4.75 to 200mm Fillet All

Pipe Dia. Range : Groove All dia Fillet All

Other Root spacing for backing strip jts : 8-10mm
For others : 2 ± 1mm

FILLER METALS (QW-404)

Spec. No. (SFA)	5.4
AWS No. (Class)	E 410 - 16/15
F. No.	4
A. No	6
Size of Filler Metals	Ø 2.5 to 5.0mm
Deposited Weld Metal	Max head thickness : 5mm
Thickness Range : Groove	200mm Max
Fillet	All
Electrode Flux (Class)	Rutile
Flux Trade Name	--NA-
Consumable Insert	No

POSITIONS (QW-405)

Position [s] Groove All

Welding Progression : Up For V Down —

Position [s] Fillet All

[POSTWELD HEAT TREATMENT QW-407]

Temperature Range 680 - 710

Time Range 1 Hr/25mm upto 50mm. For every Additional 25mm : 15 Minutes

PREHEAT [QW 406]

Preheat Temp Min 280°C

Interpass Temp. Max 350°C

Preheat Maintenance By Oxy Accetalyne or Producer Gas

GAS [QW-408] NA

Percent Composition

Gas [es] [Mixture] Flow Rate

Shielding

Trailing

Backing

ELECTRICAL CHARACTERISTICS [QW-409]

Current AC or DC DC Polarity +Ve (DCEP)

Amps [Range] 60-180 Volts Range 22-26

Tungsten Electrode size and type NA

Mode of Metal Transfer for GMAW NA

Electrode wire feed speed range NA

TECHNIQUE [QW-410]

String or Weave Bead String Orifice or Gas Cup Size NA

Initial and Interpass Cleaning Chipping, Brushing, Grinding

Method of Back Gouging By Grinding oscillation No

Contact Tube to Work Distance NA Multiple or Single Pass Multi

Multiple or sinlge Electrodes Single Travel Speed [Range] --NA-

Peening Not allowe Electrode Spacing NA

Other Clean edges to be welded to remove, Grease, Rust etc. Prior to welding.

Weld Layer [s]	Process	Filler Metal Class	Filler Metal Dia. mm	Current Type Polar	Current Amp. Range	Volt Range	Travel Speed Range mm/min	Other
	SMAW	E410-16	2.5	DC+	60-80	--	--	String
	SMAW	E410-16	3.15	DC+	90-110	--	--	"
	SMAW	E410-16	4.0	DC+	110-140	--	--	"
	SMAW	E410-16	5.0	DC+	140-180	--	--	"

PREPARED BY

SR MANAGER
WELDING ENGG.

BHARAT HEAVY ELECTRICALS LIMITED

Ramachandrapuram, Hyderabad – 500 032.

QW – 482 WELDING PROCEDURE SPECIFICATION (WPS)

Welding Procedure Specification No.: *WE 148* **Date:** *05/01/2004* **Supporting PQR No.: 466**

Revision No.: 0 **Date: --**

Welding Process (es) : SMAW **Type (s) :** *Manual*

JOINTS (QW 402) **Details**

Joint Design : As per manufacturing drawing

Backing (Yes) : BASE MATERIAL

Backing Material (Type) : *Base Metal/weld metal*
Metal : *Yes*
Retainer : *No*

Non-Fusing Metal : *No*

BASE METALS (QW – 403)

P. No. : 6 **Group No. :** *1* **TO** **P. No.: 1** **Group No.1&2**

OR

Specification type & grade : ---
to Specification type & grade : ---

OR

Chemical Analysis & Mechanical Properties : ----
to Chemical Analysis & Mechanical Properties : -----

Thickness Range :
Base Metal : **Groove: 4.75 to 24 mm** **Fillet :** *All sizes*

Pipe Dia. Range : Groove: all dia **Fillet :** *All sizes*

Other : --

Filler Metals (QW – 404)	
Spec. No. (SFA)	*5.4*
AWS No. (Class)	*E309-15*
F. No.	*5*
A. No.	-
Size of Filler Metals	*2.5 – 5.0 mm*
Deposited Weld Metal	-
Thickness Range: Groove	*24 mm*
Fillet	*All*
Electrode Flux (Class)	*Basic*
Flux Trade Name	*NA*
Consumable Insert	*No*
Max. Bead Thickness	5.0 mm max

BHARAT HEAVY ELECTRICALS LIMITED

Ramachandrapuram, Hyderabad – 502 032.

QW – 482 WELDING PROCEDURE SPECIFICATION (WPS)

Welding Procedure Specification No.: ***WE 155*** **Date:** **08-09-06** **Supporting PQR No.:** **488**

Revision No.: ***0*** **Date: ----**

Welding Process (es) : ***SMAW*** **Type (s) :** ***MANUAL***

JOINTS (QW 402)

Joint Design : **As per manufacturing drawing (groove / fillet)**

Backing (Yes) : ***for double side and backing strip joints***
(No) : ***for single side joints***
Backing Material (Type) : ***Base metal / Weld metal***

Metal : ***Yes*** **Non-Fusing Metal :** ***No***
Retainer : ***No***

BASE METALS (QW – 403)

P. No. : 7 **Group No. :** 1 **TO** **P. No.: 7** **Group No.:** 1

OR
Specification type & grade : **SA240 TP410S** **to** Specification type & grade **SA240 TP410S**

Thickness Range :
Base Metal : **Groove:** ***4.75 mm to 20 mm*** **Fillet :** ***all sizes***

Pipe Dia. Range : Groove: ***all dia*** **Fillet : :** ***all sizes***

Other : ---

403.13 : not applicable

Filler Metals (QW – 404)	
Spec. No. (SFA)	***5.4***
AWS NO (CLASS)	***E 309-15***
F. No.	**5**
A. No.	**--**
Size of Filler Metals	***Dia 2.5 to5.0 mm***
Deposited Weld Metal	
Thickness Range:Groove: **Fillet :**	***32 mm Max.*** **ALL**
Electrode Flux (Class)	***Basic***
Consumable Insert	***No***
Max. Bead Thickness	---

WPS:WE 155

POSITIONS (QW-405)	POSTWELD HEAT TREATMENT (QW-407)
Position(s) : ALL POSITIONS **Welding Progression : UP for Vertical Down ---** **Position (s) Fillet : ALL**	**Temperature and TimeRange : NIL**
PREHEAT (QW-406)	**GAS (QW-408)**
Preheat Temp Min : 100° C upto 10mm **200° C above 10mm** **Interpass Temp Max : 350 ° C** **Preheat Maintenance : Throughout welding**	**NOT APPLICABLE**

ELECTRICAL CHARACTERISTICS (QW-409)

Current AC or DC : ***DIRECT CURRENT*** **Polarity :** ***ELECTRODE POSITIVE***

Amps [Range] : 60 to 180 A **Volts Range : 22-26 V**

TECHNIQUE (QW-410)

String or Weave Bead : string only
Initial and Interpass Cleaning : chipping ; brushing ; grinding
Method of Back Gouging: by grinding
Multiple or Single Pass : multiple pass
Multiple or Single Electrodes : single electrode
Peening : no

Clean weld area to remove oil, rust, grease, etc. prior to welding.

Weld Layer (s)	Process	Filler Metal		Current		Volt Range	Other
		Class	Dia mm	Type Polar	Amp Range		
1	*SMAW*	*E309_15*	*2.5*	*DC +*	*60-80*	--	*String only*
2	*SMAW*	*E309_15*	*3.15*	*DC +*	*80-110*	--	,,
3	*SMAW*	*E309_15*	*4.0*	*DC +*	*110-140*	--	,,
4	*SMAW*	*E309_15*	*5.0*	*DC +*	*140-180*	--	,,

HEAD / WELDING ENGG

FIRST ANGLE PROJECTION

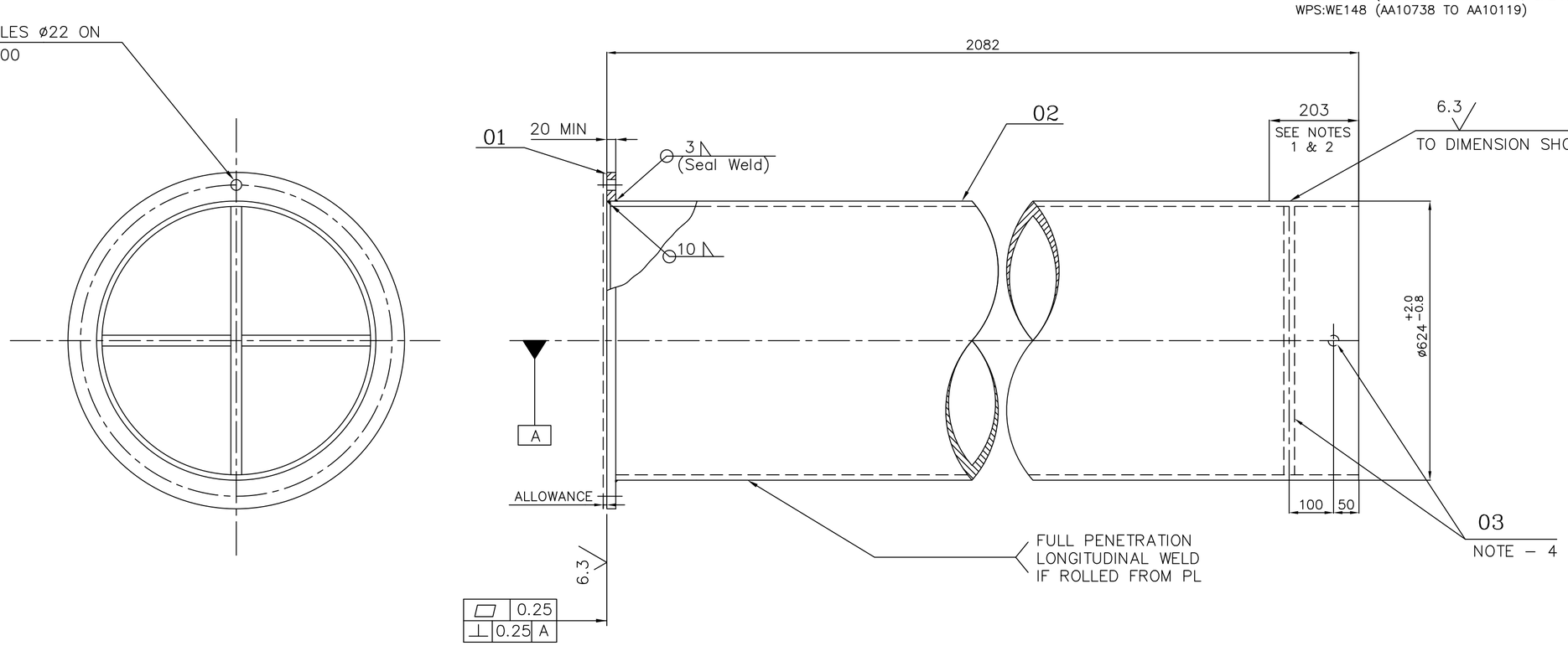
(ALL DIMENSIONS ARE IN mm)

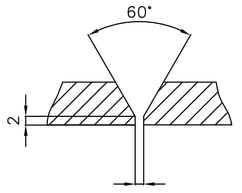
DRG. NO. 2-61-300-02500

SH. OF

WPS:WE155 (AA10738 TO AA10738, SA240 TP410S)
WPS:WE079 (AA10738 TO AA10738, SA240 TP410)
WPS:WE148 (AA10738 TO AA10119)

6.3





BUTT WELD–EDGE PREPARATION

NOTE: –

1. THIS PORTION OF PIPE TO BE ROUND & SMOOTH AND FREE FROM BURRS.
2. PIPE OD WITHIN ø624 $^{+2.0}_{-0.8}$ FOR A LENGTH OF 203
3. CUSTOMER APPROVED QUALITY PLAN TO BE FOLLOWED IF APPLICABLE.
4. ITEM 03 (PIPE STIFFENERS) ENDS TO BE TRIMMED SUITABLY TO TACK WELD INSIDE FEED PIPE AS SHOWN. THESE ARE TO AVOID DEFORMATION IN TRANSIT AND TO BE REMOVED AT SITE DURING INSTALLATION.
5. WELD JOINTS ALLOWED FOR ITEM 02 IF STANDARD PLATE SIZE IS LESS THAN THE REQUIRED.WELDS TO BE FLUSH GROUND. ALL BUTT WELDS TO BE AS PER THE EDGE PREPARATION SHOWN.

VARIANT NO	ITEM NO	DESCRIPTION	STD	DRAWING NO.	ITEM NO. / VER NO.	MATL CODE / MATL SPEC	A C	UNIT	UNIT WT / QTY	GS	ZONE
	03	PIPE (STIFFENER) OD 34.2X4.05X600L				AA1011052555 / AA10152			1.80 / 2		
	02	PL 12 X1922 X2072				AA1071838091 / AA10738			375.00 / 1		
	01	PIPE FLANGE		3-61-300-02451					19.64 / 1		

REV.	DATE	ALTERED	EMA
06	23.09.06	CHD/APPD	GK
ZONE A6	WPS: WE155 ADDED.		

REV.	DATE	ALTERED
05	3.2.05	CHD/APPD
ZONE B4	DIM 2072 WAS 2134. R/M SIZE FOR ITEM 02 WAS 10X1927X2134. TOTAL WT WAS 410 KGS. FILLET WELD POSITION SHIFTED.	

REV.	DATE	ALTERED
04	1.10.04	CHD/APPD
ZONE	R/M SIZE WAS 10X1927X2134. MAT CODE WAS AA1071838075. CUTTING PLAN DELETED.	

REV.	DATE	ALTERED
03	8.12.03	CHD/APPD
ZONE	NOTE 5 MODIFIED. SUGGESTED CUTTING PLANS & EDGE PREPARATION DETAILS ADDED.	

REV.	DATE	ALTERED
02	23.10.03	CHD/APPD
ZONE	WPS WAS WPS: 042 FOR SS TO SS. WPS: 046 (CS TO SS) DELETED.	

THE FOLLOWING CONDITIONS APPLY EXCEPT OTHERWISE STATED.

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

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

BHARAT HEAVY ELECTRICALS LIMITED
HYDERABAD

	NAME	SIGN.	DATE	NO.OF VAR.
DRN.	E.M.ASHOK		00.03.23	
CHD.	S.GHATGE		00.03.24	
APPD.	K.M.RAO		00.03.24	NA

DEPT.	UNTOL. DIMS.		SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO.OF ITEMS
PULVE ENGG DEPT CODE. 446	GR. ø/M/F		N.T.S	398.00	NA	NA	NA

TITLE: CENTRE FEED PIPE-UPPER

CARD CODE: NA

DRAWING NO. 2-61-300-02500 REV. 06

SHT. No 01 NO. OF SHT. 01

COMPUTER FILE NAME 26102500.DWG

REF. DRG. NO. AS PER HY0230261

SIGN. AND DATE

INVENTORY NO

GENERAL DIMENSIONAL LIMITS,FITS & TOLERANCES AS PER

FIRST ANGLE PROJECTION

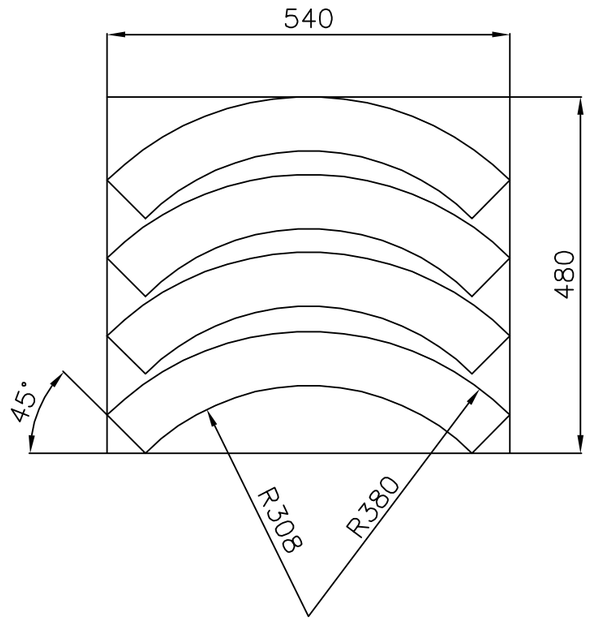
(ALL DIMENSIONS ARE IN mm)

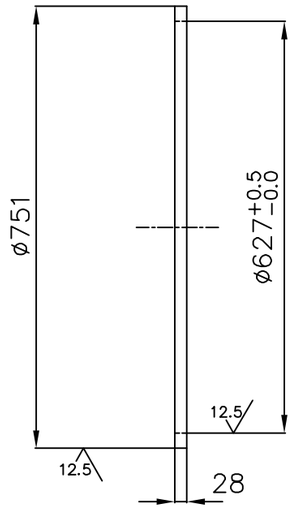
DRG. NO. 3-61-300-02451

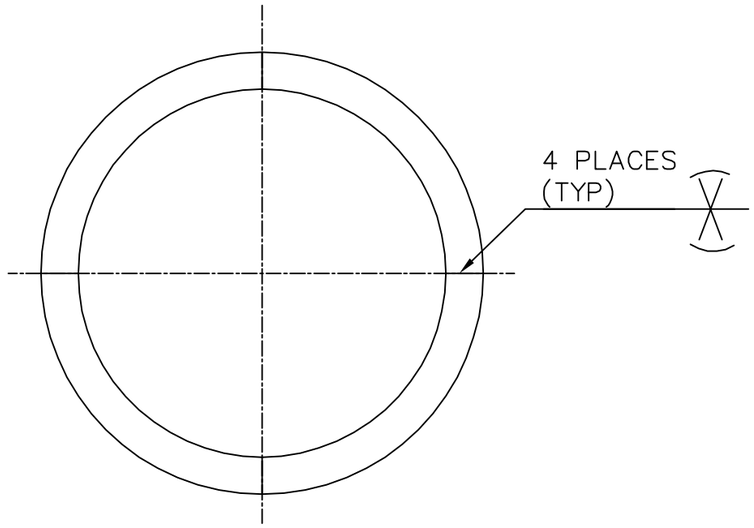
SH. OF

WPS WE - 006

12.5







ITEM NO.	DESCRIPTION	DRAWING NO	IT NO. / VAR NO	MATL CODE / MATL SPCN.	UNIT WT. / QTY	
	PL. 28x540x480			AA1011819163 / AA10119	29.50	

THE FOLLOWING CONDITIONS APPLY EXCEPT OTHERWISE STATED.

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

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

BHARAT HEAVY ELECTRICALS LIMITED
HYDERABAD

	NAME	SIGN.	DATE	NO.OF VAR.
DRN.	B M R		00.03.24	
CHD.	S.G		00.03.24	
APPD.	K.M.R.		00.03.24	

DEPT. / DEPT.CODE	UNTOL. DIMS.	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO.OF ITEMS
BMD / 446	GR. ¢/M/F	1:10	29.50			

TITLE: PIPE FLANGE (CENTRE FEED PIPE)

DRAWING NO. 3-61-300-02451 REV. 1.1

SHT. No | NO. OF SHT.

REV.	DATE	ALTERED	ZONE
1.1	5.11.11	CHD/APPD V.KUMAR	DIM. 480 WAS 680 BOM CORRECTED MACHINING SYMBOL SHOWN ON OD AND ID
01	1.10.04	CHD/APPD	M/C ON FLANGE FACE DELETED. DIM 28 WAS 20. 24 HOLES & PCD 700 DELETED. WT CORRECTED.

INVENTORY NO

SIGN. AND DATE | REF. DRG. NO. | COMPUTER FILE NAME 3610050O.DWG

GENERAL DIMENSIONAL LIMITS,FITS & TOLERANCES AS PER HY0230261

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

0.0 GENERAL:

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

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

1.0 SCOPE:

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

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

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

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

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

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

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

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

It does not apply for the following dimensions:

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

b) Auxiliary dimensions indicated in brackets.

c) Theoretically exact dimensions indicated in rectangular frames.

2.0 COMPLIANCE WITH STANDARDS:

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

3.0 GENERAL TOLERANCES:

3.1 Linear dimensions are given in Table 1 and 2.

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

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

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

Revision: This standard was based on 1969 version of IS:2102			Approved: INTERPLANT STANDARDIZATION COMMITTEE-WG (DOP + BES)		
Rev.No. 01	Amd.No.	Reaffirmed	Prepared BHOPAL	Issued CORP. R&D	Dt. of 1st issue 22-06-1978
Dt. 1-12-1995	Dt.	Year: 2008			

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4.0 INDICATIONS ON DRAWINGS:

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

Example: AA 023 02 08 m

5.0 REJECTION:

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

6.0 NOTE:

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

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

Values in millimetres

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

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

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

Values in millimetres

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

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

Table 3 — Permissible deviations of angular dimensions

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

Annex A
(informative)

Concepts behind general tolerancing of linear and angular dimensions

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

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

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

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

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

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

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

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

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

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

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

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

The workshop should therefore

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

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

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

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

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

GENERAL TOLERANCES FOR WELDING CONSTRUCTIONS FOR LENGTHS AND ANGLES

1.0 GENERAL

1.1 General tolerances are permissible variations corresponding to the degrees of accuracy normally observed in workshops where details of tolerances are not provided in the drawings.

1.2 The general tolerances specified in this standard apply to dimensions for which the tolerances are indicated on the nominal dimensions for welded components, welded assemblies and welded structures.

1.3 The variations apply to linear dimensions such as outside dimensions, inside dimensions, stepped dimensions, widths, Centre-to-Centre distances and also angles.

1.4 Special rulings may be stated for linear dimensions of welded structures consisting of several assemblies.

1.5 This standard is based on BS EN ISO 13920-1997

1.6 General tolerances for machined components are covered in Corporate Standard AA0230208.

1.7 Refer Corporate Standard AA0621105 for general tolerances for welded structures - Form and Position.

2.0 SCOPE

2.1 This standard prescribes four degrees of accuracy based on differences arising out of function and manufacture of welded components, assemblies and structures.

2.2 For technical and economic reasons other degrees of accuracy may be appropriate which have to be specifically stated.

3.0 GENERAL TOLERANCES

3.1 Tolerances for linear dimensions are given in Table 1.

3.2 Table 2, for the tolerances on angular dimensions.

4.0 REPRESENTATION ON DRAWINGS

4.1 The required degree of accuracy shall be specified in all fabrication drawings.

For example class 'B' of AA0621104 (BS EN ISO 13920)

CORPORATE STANDARD

4.2 Figures 1 to 5 give examples of how dimensions (linear & angular) are to be indicated on the drawings. (Refer page 6 of 6 of this standard)

5.0 TESTING

5.1 The actual size of an angular structural component is determined by placing suitable measuring instruments tangentially on the welded part so that the zone affected by the weld is eliminated. The variation is obtained from the difference between the dimension in the drawing and the actual size.

TABLE-1 **TOLERANCE FOR LINEAR DIMENSIONS**

Range of nominal sizes l in mm											
Tolerance Class	2 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	Over 4000 up to 8000	Over 8000 up to 12000	Over 12000 up to 16000	Over 16000 up to 20000	Over 20000
	Tolerances t in mm										
A	± 1	± 1	± 1	± 2	± 3	± 4	± 5	± 6	± 7	± 8	± 9
B		± 2	± 2	± 3	± 4	± 6	± 8	± 10	± 12	± 14	± 16
C		± 3	± 4	± 6	± 8	± 11	± 14	± 18	± 21	± 24	± 27
D		± 4	± 7	± 9	± 12	± 16	± 21	± 27	± 32	± 36	± 40

TABLE-2 **TOLERANCES FOR ANGULAR DIMENSIONS**

Tolerance Class	Range of Nominal sizes l in mm (Length of shorter leg)		
	Up to 400	Over 400 upto 1000	Over 1000
	Tolerance Δα (In degrees and minutes)		
A	± 20’	± 15’	± 10’
B	± 45’	± 30’	± 20’
C	± 1°	± 45’	± 30’
D	± 1°30’	± 1°15’	± 1º
Calculated and rounded tolerances t, in mm/m[a]			
A	± 6	± 4.5	± 3
B	± 13	± 9	± 6
C	± 18	± 13	± 9
D	± 26	± 22	± 18
[a] The value indicated in mm/m correspond to the tangent value of the general tolerance. It is to be multiplied by the length, in m, of the shorter leg.			

NOTE:

1) The permissible variations also apply to unmarked angles of 90º and 180º.
2) The shorter side of the angle is specified as the reference side.
3) Its length can also be taken from a specially indicated reference point to be shown in the drawings.
4) If the drawing contains no angle data, but only linear dimensions, then the permissible variations are to be taken in mm/m.

6.0 Tolerances on dimensions of welded assemblies, the part of which are machined preliminarily and the assembly after welding as per given size not subjected to machining are set 50% lower than the tolerances on dimensions requiring a given accuracy.

7.0 In case of necessity, it is allowed to set as symmetrical tolerances in relation to nominal, but in this case the sum total of the value of the tolerance is to be preserved as per table 1.

8.0 Deformation of welded constructions (not in contact with floor plate) is allowed up to limits given in table 3.

Remarks:

1) The local convexities and concavities of the sheathing surface having smooth transition are allowed up to 4 mm.
2) General bend along the whole length of the sheathing should not exceed W mm per running metre.
3) Bends in the thin walled construction of the type of branch pipes, baffles of air draft hydro-generators are considered separately in every particular case.

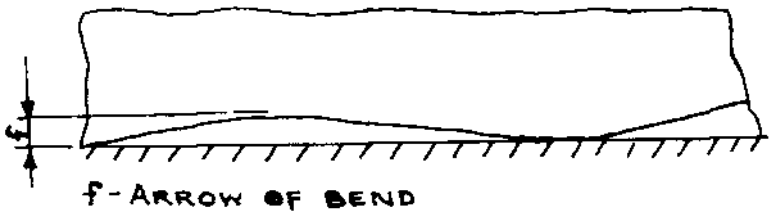


TABLE-3

Type of Construction	Length in mm						
Beams, spokes, stands, guards and similar parts	10000 to 15000	5000 to 10000	3000 to 5000	1500 to 3000	1000 to 1500	500 to 1000	Upto 500
	Allowable bend in mm						
	10.0	8.0	6.0	4.5	3.0	2.5	2.0
Frames, Floor plates dished parts, boxes External covers, bearings and Similar parts.	12.0	10.0	8.0	6.0	4.0	3.0	2.0

9.0 Allowance for machining of welded construction is determined as per table 5.

Remarks:

1) In case of machining of diameters and constructions from two sides the allowance is doubled.

2) For "Dimension as per drawing" is taken the dimension for which the allowance is meant.

10.0 Tolerances on bend "C" shall be as per table 4.

TABLE – 4

Width of flange ''b'' in mm	Thickness of flange ''s'' in mm	Tolerance ''c'' in mm
400-201	60-41	3.0
	40-31	3.5
	30-21	4.0
	20-11	4.5
	10 and lower	5.0
200-150	40-31	3.0
	30-21	3.5
	20-11	4.0
	10 and lower	5.0
149-100	40-31	2.5
	30-21	3.0
	20-11	3.5
	10	4.5
99-50	30-21	2.0
	20-11	2.5
	10	3.0
50 and lower	30-21	1.5
	20-11	2.0
	10	2.5

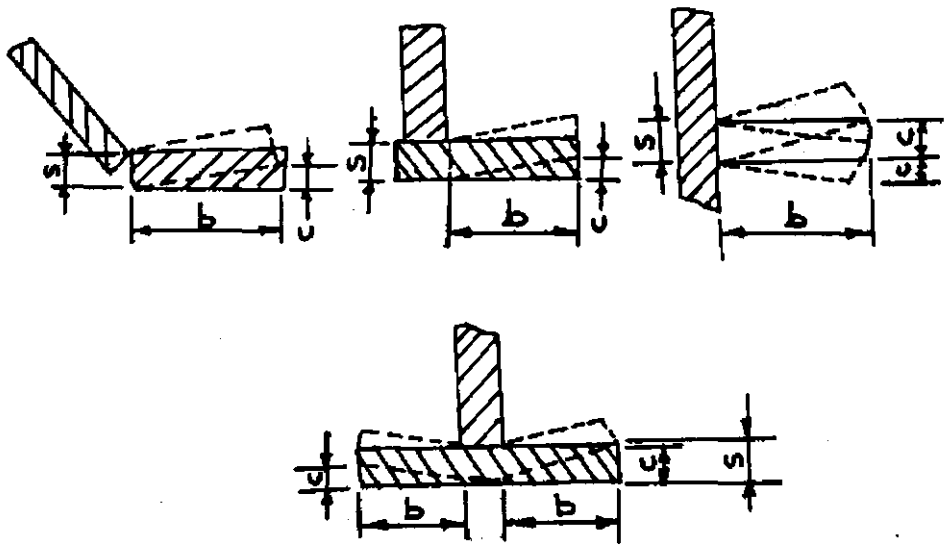


TABLE-5

Dimension as per Drawing (mm)	Machining Allowance per side (mm)
Upto 500	6
More than 500 & upto 1000	8
More than 1000 & upto 2000	10
More than 2000 & upto 4000	12
More than 4000 & upto 6000	14
More than 6000 & upto 10000	18
More than 10000 & upto 15000	22
More than 15000	24

11.0 REFERRED STANDARDS (Latest publications including amendment)

1) AA0230208
2) AA0621105

CORPORATE STANDARD

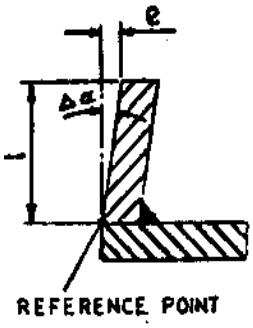


FIG. 1

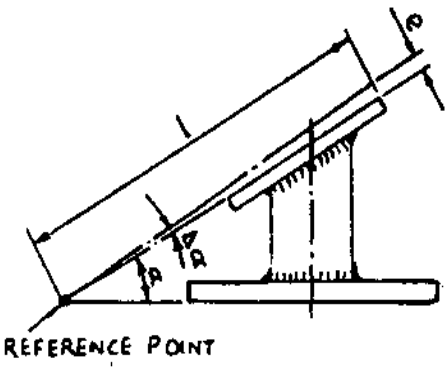


FIG. 2

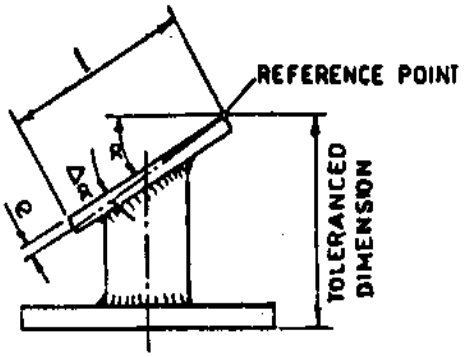


FIG. 3

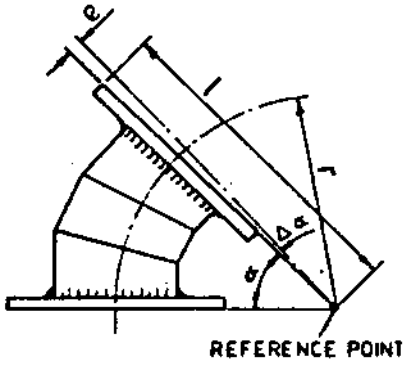


FIG. 4

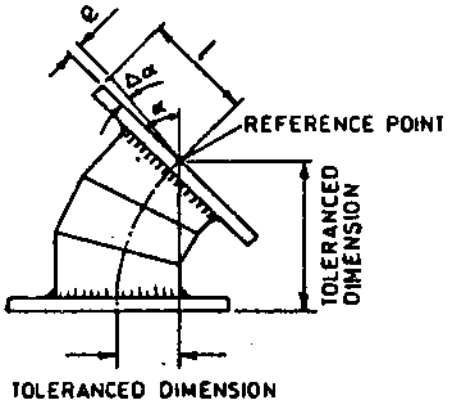


FIG. 5

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

ORDERING DESCRIPTION

1.0 GENERAL:

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

2.0 APPLICATION:

For general engineering purposes, suitable for welding.

3.0 CONDITION OF DELIVERY:

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

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

3.3 Any other additional requirement as per BHEL Purchase order.

4.0 DIMENSIONS AND TOLERANCES:

4.1 Sizes:

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

4.2 Tolerances:

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

4.3 Straightness for hot rolled bars:

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

5.0 TEST SAMPLES:

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

Revisions:	APPROVED:
Clause No. 1, 3, 5 & 8 revised (as per MOM of 38th MRC meeting), Clause 10 added	INTERPLANT MATERIAL RATIONALISATION COMMITTEE – MRC(S&GPS)

Rev No.15	Amd No.	Reaffirmed	Prepared	Issued	Dt. of 1st Issue
Dt:11-03-2014	Dt:	Year:	HPEP, Hyderabad	Corp.R&D	June, 1976

CORPORATE PURCHASING SPECIFICATION

6.0 ULTRASONIC EXAMINATION:

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

6.1 For plates above 40 mm thick:

Shall be ultrasonically examined unless when otherwise specified in order.

7.0 TEST CERTIFICATES:

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

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

The test certificate shall bear the following information:

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

BHEL order No.

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

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

8.0 PACKING AND MARKING:

Plates shall be transported suitably to avoid damage during transit.

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

9.0 REJECTION AND REPLACEMENT

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

10.0 REFERRED STANDARDS (Latest publications including amendments):

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

26/6/14

CS-721

STEEL TUBES – ELECTRIC RESISTANCE WELDED / SUBMERGED ARC WELDED

1.0 GENERAL:

This specification governs the quality requirements of light, medium and heavy grades of Electric Resistance Welded/Submerged Arc Welded steel tubes with plain ends in ungalvanized and galvanized condition in the range of 60mm to 150mm NB.

2.0 APPLICATION:

For general purpose, suitable for bending, welding and screwing for flanges and fittings. Not suitable for steam services.

3.0 CONDITION OF DELIVERY:

Tubes shall be supplied with plain ends.

The ends shall be cut cleanly and square with the axis of the tube.

Unless otherwise specified, tubes shall be supplied in ungalvanized condition.

4.0 COMPLIANCE WITH NATIONAL STANDARDS:

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

IS: 1239(part 1) – 2004: Steel Tubes, Tubular and other Wrought Steel Fittings
Gr: ERW.

5.0 DIMENSIONS AND TOLERANCES:

5.1 Sizes:

BHEL order shall clearly state the maximum outside diameter, and wall thickness of the tube.

5.2 Tolerances:

5.2.1 Thickness:

Light tubes	+ not limited − 8 percent
Medium and Heavy tubes	+ not limited − 10 percent

5.2.2 Weight:

Single tube (light series)	+ 10 percent − 8 percent
Single tube (medium and heavy series)	± 10 percent
For quantities per load of 10 tonnes, min (light series)	+ 7.5 percent − 5 percent
For quantities per load of 10 tonnes, min (medium and heavy series)	± 7.5 percent

5.2.3 Internal Weld Fin:

Height of the internal weld fin shall not be greater than 60 percent of the specified thickness.

5.2.4 Length:

5.2.4.1 Random Length:

Tubes shall be supplied in random lengths of 4 to 7 meters, unless otherwise specified and in the line with IS: 1239, Part 1.

5.2.4.2 Exact Length:

When exact lengths are called for, the tolerances shall be + 6 mm, − 0 mm of the specified length.

6.0 MANUFACTURE:

Tubes shall be made from tested quality steel manufactured by any approved process and shall be fully killed.

Tubes shall not be manually welded.

7.0 FREEDOM FOR DEFECTS:

Tubes shall be cleanly finished and reasonably free from injurious defects. They shall be reasonably straight. The ends shall be cut cleanly and reasonably square with the axis of the tube.

8.0 CHEMICAL COMPOSITION:

The melt analysis of steel shall be as follows:

Element	Percent max.	Permissible variation over specified limit, ± max
Carbon	0.20	0.02
Manganese	1.30	0.04
Sulphur	0.040	0.005
Phosphorus	0.040	0.005

9.0 GALVANIZING:

When galvanized tubes are ordered, the Zinc coating on the tubes shall be in accordance with IS: 4736

10.0 TEST SAMPLES:

All tubes bearing the same designation and manufactured under a single process shall be grouped together to constitute a lot. Each lot shall be sampled separately in accordance with IS: 4711

11.0 MECHANICAL PROPERTIES:

11.1 Tensile:

The tensile strength of strips cut form selected tubes, when tested in accordance with IS: 1608 shall be as follows:

Tensile strength : 320 N/mm^2, min.

Elongations on $5.65\sqrt{S_o}$ gauge length:

Up to and including. 25 mm NB : 12 percent, min.
Over 25 mm up to including150 mm NB : 20 percent, min.

Note:

1. For welded tubes, the strip tensile test specimen shall not contain the weld.
2. For galvanized tubes, zinc coating may be removed by stripping prior to tensile test.

11.2 Bend Test (On tubes up to and including 50mm nominal bore):

When tested in accordance with IS: 2329, the tubes shall be capable of withstanding the bend test without showing any signs of fracture or failure.

Tubes shall be bent with the weld at 90^o to the plane of bending. The tubes shall not be filled for this test.

Ungalvanised tubes shall be capable of being bent cold without cracking, through 180^o around a former having a radius at the bottom of groove in the plane of bending equal to at least six times the outside diameter of the tube.

Galvanized tubes shall be capable of being bent cold without cracking of the steel, through 90^o round a former having a radius at the bottom of the groove equal to at least eight times the outside diameter of the tube.

11.3 Flattening Test (On tubes above 50mm nominal bore):

Rings not less than 40mm in length, cut form the end of each selected tubes shall be flattened between parallel plates with the weld at 90^o(point of maximum bending) in accordance with IS:2328. No opening shall occur by fracture in the weld until the distance between the plates is less than 75 percent of the original outside diameter of the tube and no cracks or breaks on the metal elsewhere than in the weld shall occur until the distance between the plates is less than 60 percent of the original outside diameter.

Test rings may have the inner and outer edges rounded.

11.4 Hydraulic Test / Eddy Current Test:

Each tube shall withstand a test pressure of 5 N/mm^2 without showing leakage defects of any kind. The pressure shall be applied and maintained for a minimum period of 3 seconds for proof and inspection.

Note: Eddy current test may be done in place of Hydrostatic test as per the procedure in Annexure – B of IS: 1239, Part-1.

CORPORATE PURCHASING SPECIFICATION

12.0 TEST CERTIFICATES:

Three copies of test certificates shall be supplied, unless otherwise stated on the order.

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

The test certificate shall bear the following information:

AA10152: Rev. No.07: Steel Tubes – ERW/SAW
BHEL order No:

Supplier's Reference:
Name
Identification No.
Melt No.

Results of Tests:
Results of Chemical, Mechanical tests and Hydraulic/Eddy Current test.

13.0 PROTECTIVE COATING:

The tubes shall be protected with a rust preventive coating of varnish, externally throughout the length.

14.0 PACKING AND MARKING:

Each tube shall be plugged at both ends by means of tight fitting end caps.

The tubes shall be suitably packed in bundles/packages to prevent corrosion and damage during transit.

Each bundle/package shall bear the following information:

AA10152: Steel Tubes – ERW/SAW
BHEL Order No.
Consignment/Identification No.
Outside Diameter and Wall Thickness.
Supplier's Name

15.0 REFERRED STANDARDS (Latest Publications Including Amendments):

1) IS: 1608 2) IS: 2328 3) IS: 2329

4) IS: 4736 5) IS: 4711

STAINLESS STEEL SHEETS AND PLATES - ANNEALED ASTM A 240M, TYPE 410 Î

ORDERING DESCRIPTION

1.0 GENERAL :

The sheets and plates shall conform to the latest version of ASTM A 240M, Î Type: 410 and comply with the following additional requirements.

2.0 APPLICATION:

For general engineering purposes, where corrosion resistance is essential.

3.0 CONDITION OF DELIVERY:

Hot Rolled, annealed and descaled (Finish No.1).

Cold rolled, annealed (2B / 2 D).

4.0 DIMENSIONS AND TOLERANCES:

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

5.0 CHEMICAL COMPOSITION:

As per ASTM A 240M, Type 410. Î

6.0 TEST CERTIFICATES :

Three copies of test certificates shall be supplied along with the following information:

BHEL References :

AA 107 38 -Rev. No.07 / ASTM A 240M, Type:410 Î
BHEL order No,

Supplier's References :
Name
Identification No.
Melt No.
Process of manufacture
Details of heat treatment.

Result of Tests:
Dimensional inspection.
Results of chemical analysis, mechanical tests

7.0 PACKING AND MARKING :

Sheets shall be supplied in bundles or in packages each weighing upto a maximum of 3000kg. Plates shall be suitably packed to prevent damage during transit.

For plates below 25 mm thick, each pile (preferably of 16 plates) shall be marked with suppliers identification mark, 'AA 107 38 / ASTM A 240M, Type:410, melt No., BHEL Î order No., on the top plate.

Each plate of 25mm thickness and above shall be stamped/painted with the suppliers identification mark, 'AA 107 38 / ASTM A 240M, Type:410 , melt No., BHEL order Î No., on the top plate.

FOR INFORMATION ONLY

CHEMICAL COMPOSITION

C	Si	Mn	Ni	Cr	S	P	Al
0.08-0.15	≤ 1.0	≤ 1.0	≤ 0.75	11.5-13.5	≤ 0.030	≤ 0.040	-

MECHANICAL PROPERTIES

Hardness, max		0.2% PS min	UTS, min	% El min	Cold Bend. Î
BHN	HRB	N/mm²	N/mm²		
217	96	205	450	20	180^0

RUST PREVENTIVE HARD FILM, BLACK (TRP)

1.0 GENERAL:

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

2.0 APPLICATION:

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

3.0 REMOVAL:

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

4.0 COLOUR : Steel Black.

5.0 COMPLIANCE WITH NATIONAL STANDARDS:

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

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

6.0 COMPOSITION:

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

7.0 TEST SAMPLES:

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

8.0 PROPERTIES:

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

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

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

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

8.4 Weight : 11 ± 0.5 kg per 10 litres.

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

8.6 Test for Adhesion : To pass the test

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

8.8 Protection against corrosion at high temperature and humidity:

To pass the test for 360 hours, minimum..

9.0 TYPE TESTS:

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

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

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

10.0 TEST CERTIFICATES:

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

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

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

11.0 KEEPING PROPERTY:

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

12.0 PACKING & MARKING:

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

Each container shall marked with the following information:

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

8.0 ENVIRONMENTAL REQUIREMENTS:

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

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

13.0 REFERRED STANDARDS (Latest Publications Including Amendments):

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

BHEL HERP VARANASI
QUALITY PLAN

Centre Feed Pipes (Pipe Material AA10738)

SL.NO.	COMPONENT	CHARACTERISTIC CHECKED	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENTS & ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
							P	W	V	
1.0	Raw Material : Plates	i.Chemical & Mechanical properties	Chemical analysis and Mechanical test	1 sample per heat batch	AA10119	TC	3	-	2	Manufacturer's TC is also acceptable for chemical and mechanical properties
		ii.Chemical & Mechanical properties	Chemical analysis and Mechanical test	1 sample per heat batch	AA 10738	TC	3	-	2	Plates AA10738 should be procured from BHEL approved sources only (Specified in Purchase Order)
2.0	Fabrication	ii. Fit up exam and welding	Measurement	100%	Drawing	Dim.report	3	-	2	Tolerance to be maintained as per drg. All welding shall be done by qualified welders only. BHEL WPS nos. WE-079, and WE-148 should be followed for SMAW as per requirement of drawings. Compatible welding electrodes (as mentioned in above WPS) should be used. Job should be preheated to temperature mentioned in WPS no. WE-079. If MIG/MAG welding process is used, prior WPS approval is to be taken from BHEL.
		iii.Post Weld Heat Treatment	Review of HT Chart	100%	As per applicable WPS WE-079		3	-	2	As per WPS WE-079 Following Heat treatment cycle should be followed : 1) Free Heating upto 400°C 2) Rate of Heating 100°C/Hr upto 680°C to 710°C 3) Soaking time 1 hour. 4) Rate of cooling 100°C/Hr upto 400°C 5) Free Cooling in ambient air below 400°C
		iv. D.P.Testing of welded joints	D.P.test	100%	AA0850131 & AA0850129	TC	3	2	-	100% D.P.test shall be witnessed by BHEL AIA
3.0	Final Inspection after Fabrication, Stress relieving and NDT.	i.Dimensions	Measurement	100%	Drawing.	Dimension Report	3	2	-	Unspecified tolerances shall be maintained as follows : a) As per medium tolerance class of Specn. AA0230208 for machined dimensions. b) As per Tolerance class B of specn. AA0621104 for fabricated dimensions.
		ii. Painting & preservation		100%		Insp.Report	3	2	-	All Machined surfaces of material other than SS (AA 10738) shall be protected by applying TRP black paint (specn. AA55154). All threaded holes to be protected by applying grease
		iii.Identification & Marking	Punching of Drg. No., P.O.No., Vendor code no., year, Inspector Seal	100%	Drawing	Inspection Report	3/2	2	-	
			APPROVED BY		MANAGER P&D					
			SIGNATURE & DATE							

QP. NO.	RV/FAB /31
DATE	09/08/2011
PG. NO.	1 OF 1

P = PERFORM.C. = TEST CERTIFICATE
W = WITNESS H.T. = HEAT TREATMENT
V = VERIFY
3 = VENDOR
2 = BHEL AUTHORISED INSPECTION AGENCY (AIA)

विरेन्द्र कुमार/VIRENDRA KU...
प्रबंधक (यो०वि०) / Manager (P...)
भारत हेवी इलेक्ट्रिकल्स लिमिटेड
Bharat Heavy Electricals Ltd.
हर्प, वाराणसी
HERP, Varanasi

BHARAT HEAVY ELECTRICALS LIMITED

Ramachandrapuram, Hyderabad – 502 032, INDIA

QW – 482 WELDING PROCEDURE SPECIFICATION (WPS)

Welding Procedure Specification No.: WE006 **Date: 02.08.86** **Supporting PQR No.:** 516, **Dt** : 11.05.10

Revision No.: 07 **Date:** 24.04.2016

Welding Process (es) : *SMAW* **Type (s) :** *MANUAL*

JOINTS (QW 402)

Joint Design: *As per manufacturing drawing (groove/fillet)*

Root Spacing : *As per manufacturing drawing*

Backing (Yes) : *for double side butt welds and backing strip joints*

(No) : *for single side welds*

Backing Material (Type) : *Base metal / Weld metal*

Metal: *Yes* **Non-Fusing Metal**: *No*

Retainer: *No*

BASE METALS (QW – 403)

P. No. *: 1* **Group No. :** *1 & 2* **TO** **P. No.:** *1* **Group No.:** *1 & 2*

OR

Specification type & grade: -------- **to** Specification type & grade : -------

OR

Chemical Analysis & Mechanical Properties: --- to Chemical Analysis & Mechanical Properties: ----

Thickness Range :

Base Metal : **Groove:** *5.0 mm to 38 mm* ** **Fillet :** *all sizes*

Deposited pass thickness > 13mm – Not Permitted

Other : None

Filler Metals (QW – 404)

	SMAW
Spec. No. (SFA)	*5.1*
AWS NO (CLASS)	A5.1 (*E 7018*)
F. No.	4
A. No.	*1*
Size of Filler Metals	*Dia 2.5, 3.15, 4.0, 5.0mm*
Filler Metal Product Form	N.A
Supplemental Filler Metal	N.A
Deposited Weld Metal Thickness Range : Groove: Fillet:	38 *mm Max.* *38 mm Max Throat*
Electrode Flux (Class)	*Basic*
Consumable Insert	*No*
Max. Bead Thickness	5 *mm*

** Note : For Unequal thicknesses base material thickness qualified upto 50mm and weld metal thickness limited to 38mm max.

Rev : 07 – Note added regarding base material thickness

POSITIONS (QW-405)

Position(s) Groove : *ALL POSITIONS*
Welding Progression: *UP for Vertical*
Down –Not permitted
Position (s) Fillet: *ALL*
Other : None

POSTWELD HEAT TREATMENT (QW-407)

Not Permitted
Temperature Range: *NA*

Time Range: *NA*
Other : *None*

PREHEAT (QW-406)

Preheat Temp Min: *10 º C min for < 31mm*
100 º C min for 31mm and above
Interpass Temp Max: *300 º C*
Preheat Maintenance: *Minimum specified temperature for every restart*
Other : None

GAS (QW - 408)

	Gas(es)	Percentage Composition Mixture	Flow Rate
Shielding :	N.A	-	-
Trailing :	N.A	-	-
Backing :	N.A	-	-

Other : None

ELECTRICAL CHARACTERISTICS (QW-409)

Weld Pass (es)	Process	Filler Metal		Current type & Polarity	Amps (Range)	Wire feed speed	Energy or Power (Range)	Volts (Range)	Travel speed	Other
		Classification	Diameter							
Root& Subsequent as required	*SMAW*	*E 7018*	*2.5mm*	*DCEP*	*60 – 90A*	N.A	N.A	*22-34V*	N.A	*String for horizontal; Others Weave (Max 3 times Electrode Core Dia)*
	-do-	*-do-*	*3.15mm*	*-do-*	*100-150A*	*-do-*	*-do-*	*-do-*	*-do-*	
	-do-	*-do-*	*4.0mm*	*-do-*	*150-200A*	*-do-*	*-do-*	*-do-*	*-do-*	
		-do-	*5.0mm*	*-do-*	*200-260A*	*-do-*	*-do-*	*-do-*	*-do-*	

Pulsing Current : *N.A*

Heat Input *: N.A*

Tungsten Electrode Size and Type : *N.A*

Mode of Metal Transfer for GMAW (FCAW): *N.A*

Others **:** None

TECHNIQUE (QW-410)

String or Weave Bead: *string and/or weave*

Orifice or Gas Cup Size : *N.A*

Initial / Interpass Cleaning : *chipping / brushing / grinding*

Method of Back Gouging: *grinding/gouging if required*

Oscillation *: N.A*

Contact tube to work distance : N.A

Multiple or Single Pass : *Multiple pass*

Multiple or Single Electrodes : *Single electrode*

Closed to out chamber : *N.A*

Peening : *Not allowed*

Use of thermal processes : *N.A*

Other : *Clean weld area to remove oil, rust, grease, etc. prior to welding.*

Prepared by

Welding Engineer

Approved by

HEAD / Welding Engg

N.A – Not Applicable

635

POSITIONS (QW-405)

Position [s] Groove 1G

Welding Progression : Up ... Down ... ...

Position [s] Fillet ...

[POSTWELD HEAT TREATMENT QW-407

Temperature Range 600-620°C

Time Range One hour

GAS [QW-408]

Percent Composition

Gas [es] [Mixture] Flow Rate

Shielding -

Trailing -

Backing -

PREHEAT [QW-406]

Preheat Temp Min 150°C (For 1st layer only)

Interpass Temp. Max 200°C

Preheat Maintenance -

ELECTRICAL CHARACTERISTICS [QW-409]

Current AC or DC DC Polarity +Ve

Amps [Range] 140-180 Volts Range 22-26

Tungsten Electrode size and type -

Mode of Metal Transfer for GMAW -

Electrode wire feed speed range -

TECHNIQUE [QW-410]

String or Weave Bead String only Orifice or Gas Cup Size -

Initial and Interpass Cleaning By Chipping, Brushing, Grinding

Method of Back Gouging - oscillation -

Contact Tube to Work Distance - Multiple or Single Pass Multi

Multiple or single Electrodes Single Travel Speed [Range] -

Peening No Electrode Spacing -

Other Clean the weld area prior to welding to remove Oil, Rust, Grease etc.

Weld Layer [s]	Process	Filler Metal Class	Filler Metal Dia. mm	Current Type Polar	Current Amp. Range	Volt Range	Travel Speed Range mm/min	Other
1st layer	SMAW	E309Mo-15	5.0	DC+	160-180	22-26	-	String only
subsequent layers	"	E308-L-15	"	"	"	"	-	--do--

CONTROLLED COPY

Prepared by [signature] 14/12/87

MANAGER
WELDING ENGG.

BHARAT HEAVY ELECTRICALS LIMITED

RAMACHANDRAPURAM, HYDERABAD-500 032.

PD - 268

QW-482 WELDING PROCEDURE SPECIFICATION (WPS)

Welding Procedure Specification No. WE055 Date 8.10.82 Supporting PQR No 193

Revision No. 1 Date 01.03.1989

Welding Process (es) SMAW Type (s) Manual

Details

JOINTS (QW 402)

Joint Design S.S.Overlay on P1,

Backing (Yes) - (No) -

Backing Material (Type) -

Metal - non fusing metal -

BASE METALS (QW-403) A8 overlay

P. No. 1 Group No. 1 & 2 to P. No. - Group No. -

OR

Specification type and grade

to Specification type and grade

OR

Chem. Analysis and Mech Prop

to Chem Analysis and Mech Prop

Thickness Range : 25mm & above

Base Metal Groove Fillet -

Pipe Dial Range : Groove - Fillet -

Other -

FILLER METAL (QW-404) 1st layer by E 309 Mo-15

F. No. 5 Other Subsequent layers by E 308L-15

A. No 8 Other (1)

Spec. No. (SFA) 5.4

DEPOSITED WELD METAL

AWS No. (Class) E309Mo-15&E308L-15 Thickness Range : 6mm and above (Overlay)
3mm Max by E 309Mo-15

Size of filler metals ∅ 5.0mm Groove Rest by E308L-15

Electrode-Flux. (Class) Basic Fillet

Flux Trade Name - Max. bead thickness : 5mm

Consumable insert No; Retainer: No.

(1) Rev., Format details added

AUTHORISED SIGN

BHARAT HEAVY ELECTRICALS LIMITED

RAMACHANDRAPURAM, HYDERABAD-500 032.

PD - 268

QW-482 WELDING PROCEDURE SPECIFICATION (WPS)

Welding Procedure Specification No WE.079. Date 31.10.90 Supporting PQR No. 322

Revision No 1 Date 10.03.95

Welding Process (es) SMAW Type (s) Manual

JOINTS (QW 402) Details

Joint Design As per Drawing

Backing (Yes) For double side welds (No) For single side welds

Backing Material (Type) Base metal/Weld metal

Metal Yes Non fusing metal --

Retainer : No

BASE METALS (QW-403)

P. No. - Group No. - to P. No. - Group No. -

OR

Specification type and grade X 12 Cr 13

to Specification type and grade X 12 Cr 13

OR

Chem. Analysis and Mech. Prop. --

to Chem. Analysis and Mech. Prop. --

Thickness Range :

Base Metal : ——— Groove 4.75 to 200mm Fillet All

Pipe Dia. Range : Groove All dia Fillet All

Other Root spacing for backing strip jts : 8-10mm
For others : 2 ± 1mm

FILLER METALS (QW-404)

Spec. No. (SFA)	5.4
AWS No. (Class)	E 410 - 16/15
F. No.	4
A. No	6
Size of Filler Metals	Ø 2.5 to 5.0mm
Deposited Weld Metal	Max head thickness : 5mm
Thickness Range : Groove	200mm Max
Fillet	All
Electrode Flux (Class)	Rutile
Flux Trade Name	--NA-
Consumable Insert	No

POSITIONS (QW-405)

Position [s] Groove All

Welding Progression : Up For V Down —

Position [s] Fillet All

[POSTWELD HEAT TREATMENT QW-407]

Temperature Range 680 - 710

Time Range 1 Hr/25mm upto 50mm. For every Additional 25mm : 15 Minutes

PREHEAT [QW 406]

Preheat Temp Min 280°C

Interpass Temp. Max 350°C

Preheat Maintenance By Oxy Accetalyne or Producer Gas

GAS [QW-408] NA

Percent Composition

Gas [es] [Mixture] Flow Rate

Shielding

Trailing

Backing

ELECTRICAL CHARACTERISTICS [QW-409]

Current AC or DC DC Polarity +Ve (DCEP)

Amps [Range] 60-180 Volts Range 22-26

Tungsten Electrode size and type NA

Mode of Metal Transfer for GMAW NA

Electrode wire feed speed range NA

TECHNIQUE [QW-410]

String or Weave Bead String Orifice or Gas Cup Size NA

Initial and Interpass Cleaning Chipping, Brushing, Grinding

Method of Back Gouging By Grinding oscillation No

Contact Tube to Work Distance NA Multiple or Single Pass Multi

Multiple or sinlge Electrodes Single Travel Speed [Range] --NA-

Peening Not allowe Electrode Spacing NA

Other Clean edges to be welded to remove, Grease, Rust etc. Prior to welding.

Weld Layer [s]	Process	Filler Metal Class	Filler Metal Dia. mm	Current Type Polar	Current Amp. Range	Volt Range	Travel Speed Range mm/min	Other
	SMAW	E410-16	2.5	DC+	60-80	--	--	String
	SMAW	E410-16	3.15	DC+	90-110	--	--	"
	SMAW	E410-16	4.0	DC+	110-140	--	--	"
	SMAW	E410-16	5.0	DC+	140-180	--	--	"

PREPARED BY

SR MANAGER
WELDING ENGG.

BHARAT HEAVY ELECTRICALS LIMITED

Ramachandrapuram, Hyderabad – 500 032.

QW – 482 WELDING PROCEDURE SPECIFICATION (WPS)

Welding Procedure Specification No.: *WE 148* **Date:** *05/01/2004* **Supporting PQR No.: 466**

Revision No.: 0 **Date: --**

Welding Process (es) : SMAW **Type (s) :** *Manual*

JOINTS (QW 402) **Details**

Joint Design : As per manufacturing drawing

Backing (Yes) : BASE MATERIAL

Backing Material (Type) : *Base Metal/weld metal*
Metal : *Yes*
Retainer : *No*

Non-Fusing Metal : *No*

BASE METALS (QW – 403)

P. No. : 6 **Group No. :** *1* **TO** **P. No.: 1** **Group No.1&2**

OR

Specification type & grade : ---
to Specification type & grade : ---

OR

Chemical Analysis & Mechanical Properties : ----
to Chemical Analysis & Mechanical Properties : -----

Thickness Range :
Base Metal : **Groove: 4.75 to 24 mm** **Fillet :** *All sizes*

Pipe Dia. Range : Groove: all dia **Fillet :** *All sizes*

Other : --

Filler Metals (QW – 404)	
Spec. No. (SFA)	*5.4*
AWS No. (Class)	*E309-15*
F. No.	*5*
A. No.	-
Size of Filler Metals	*2.5 – 5.0 mm*
Deposited Weld Metal	-
Thickness Range: Groove	*24 mm*
Fillet	*All*
Electrode Flux (Class)	*Basic*
Flux Trade Name	*NA*
Consumable Insert	*No*
Max. Bead Thickness	5.0 mm max

BHARAT HEAVY ELECTRICALS LIMITED

Ramachandrapuram, Hyderabad – 502 032.

QW – 482 WELDING PROCEDURE SPECIFICATION (WPS)

Welding Procedure Specification No.: ***WE 155*** **Date:** **08-09-06** **Supporting PQR No.:** **488**

Revision No.: ***0*** **Date: ----**

Welding Process (es) : ***SMAW*** **Type (s) :** ***MANUAL***

JOINTS (QW 402)

Joint Design : **As per manufacturing drawing (groove / fillet)**

Backing (Yes) : ***for double side and backing strip joints***
(No) : ***for single side joints***
Backing Material (Type) : ***Base metal / Weld metal***

Metal : ***Yes*** **Non-Fusing Metal :** ***No***
Retainer : ***No***

BASE METALS (QW – 403)

P. No. : 7 **Group No. :** 1 **TO** **P. No.: 7** **Group No.:** 1

OR
Specification type & grade : **SA240 TP410S** **to** Specification type & grade **SA240 TP410S**

Thickness Range :
Base Metal : **Groove:** ***4.75 mm to 20 mm*** **Fillet :** ***all sizes***

Pipe Dia. Range : Groove: ***all dia*** **Fillet : :** ***all sizes***

Other : ---

403.13 : not applicable

Filler Metals (QW – 404)	
Spec. No. (SFA)	***5.4***
AWS NO (CLASS)	***E 309-15***
F. No.	**5**
A. No.	**--**
Size of Filler Metals	***Dia 2.5 to5.0 mm***
Deposited Weld Metal	
Thickness Range:Groove: **Fillet :**	***32 mm Max.*** **ALL**
Electrode Flux (Class)	***Basic***
Consumable Insert	***No***
Max. Bead Thickness	---

WPS:WE 155

POSITIONS (QW-405)	POSTWELD HEAT TREATMENT (QW-407)
Position(s) : ALL POSITIONS **Welding Progression : UP for Vertical Down ---** **Position (s) Fillet : ALL**	**Temperature and TimeRange : NIL**
PREHEAT (QW-406)	**GAS (QW-408)**
Preheat Temp Min : 100° C upto 10mm **200° C above 10mm** **Interpass Temp Max : 350 ° C** **Preheat Maintenance : Throughout welding**	**NOT APPLICABLE**

ELECTRICAL CHARACTERISTICS (QW-409)

Current AC or DC : ***DIRECT CURRENT*** **Polarity :** ***ELECTRODE POSITIVE***

Amps [Range] : 60 to 180 A **Volts Range : 22-26 V**

TECHNIQUE (QW-410)

String or Weave Bead : string only
Initial and Interpass Cleaning : chipping ; brushing ; grinding
Method of Back Gouging: by grinding
Multiple or Single Pass : multiple pass
Multiple or Single Electrodes : single electrode
Peening : no

Clean weld area to remove oil, rust, grease, etc. prior to welding.

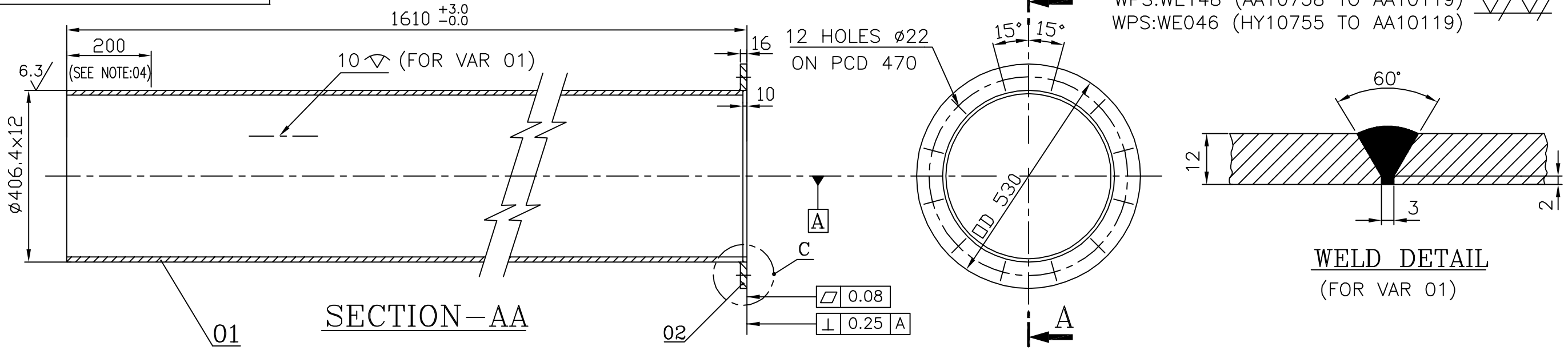
Weld Layer (s)	Process	Filler Metal		Current		Volt Range	Other
		Class	Dia mm	Type Polar	Amp Range		
1	*SMAW*	*E309_15*	*2.5*	*DC +*	*60-80*	--	*String only*
2	*SMAW*	*E309_15*	*3.15*	*DC +*	*80-110*	--	,,
3	*SMAW*	*E309_15*	*4.0*	*DC +*	*110-140*	--	,,
4	*SMAW*	*E309_15*	*5.0*	*DC +*	*140-180*	--	,,

HEAD / WELDING ENGG

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRG.NO.3-61-362-00661

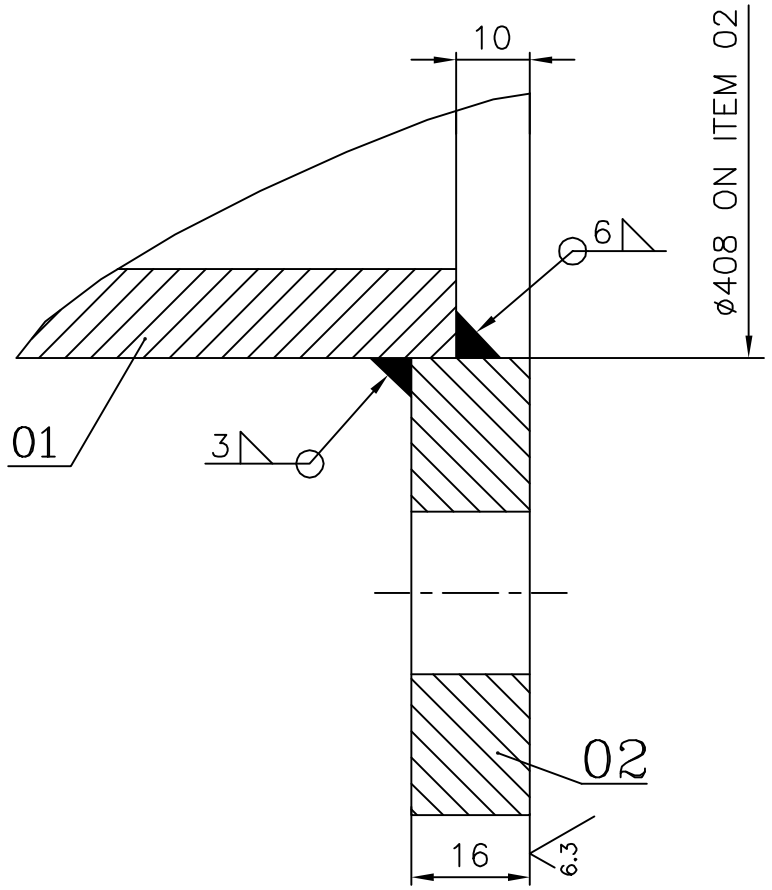


WPS:WE079. (AA10738 TO AA10738)
WPS:WE148 (AA10738 TO AA10119)
WPS:WE046 (HY10755 TO AA10119)

12.5 6.3

WELD DETAIL
(FOR VAR 01)

NOTES:—
01. REMOVE ALL SHARP EDGES
02. MACHINE ITEM NO. 02 AFTER WELDING WITH ITEM NO. 01.
03. THIS PORTION OF THE PIPE TO BE MACHINED TO ø406.4 $^{+0.00}_{-0.5}$
FOR A LENGTH OF 200mm. A 'GO' AND 'NOGO' RING GAUGE BE USED FOR CHECKING THIS TOLERANCE



DETAIL−C
SCALE 1:1

01	PIPE ø406.4X 12X 1600 L		02		HY1071055968	188.00	
					HY10755	1	
02	PLATE 25 THK ID 408 x OD 530				AA1011819155	14.110	
					AA10119	1	
01	STAINLESS STEEL PL12X1239X1600		01		AA1071838091	188.000	
					AA10738	1	
ITEM NO	DESCRIPTION	DRAWING NO.	VAR. NO.	RAW MATERIAL SIZE OR CASTING DRG.NO. OR FORGING DRG.NO.	MATERIAL CODE	NET WT.	GROSS WT.
					MATERIAL SPECN.	QUANTITY	

THE FOLLOWING CONDITIONS APPLY EXCEPT OTHERWISE STATED...

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

REV.	DATE	ALTERED UC		REV.	DATE	ALTERED UC	
05	9.11.04	CHD.	APPD.	04	8.11.03	CHD.	APPD.
ZONE	VAR 02 ADDED FOR ITEM 01 & WPS 046 FOR VAR 02. R/M THK FOR 02 WAS 20.			ZONE	M CODE WAS AA1071831097 & WPS WERE 046 & 043.		

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: 623 XRP BOWL MILL

BHARAT HEAVY ELECTRICALS LTD.
HYDERABAD

	NAME	SIGN.	DATE	NO.OF VAR.
DRN.	UNIC		06.01.97	/
CHD.	B.M.R		27.08.97	
APPD.	K.M.R		27.08.97	

DEPT. PULV ENGG.	SCALE	WEIGHT (KG)	REF. TO ASSY DRG.	ITEM NO.	NO.OF ITEMS
CODE 446	1:1 1:10	200.860	——	/	/

TITLE: CENTRE PIPE UPPER (TALL TOP CLASSIFIER)

DRAWING NO. 3-61-362-00661 REV. 05

SHEET NO. 01 NO OF SHEETS 01

TD-151/REV. 03 SIZE A3

INVENTORY NO. | REF.DRG.NO. | FILE NAME: 36100661.DWG

BHEL	**CORPORATE PURCHASING SPECIFICATION**	AA10119 Rev No.15 PREFACE SHEET

STRUCTURAL STEEL - WELDABLE QUALITY

(PLATES, SECTIONS, STRIPS, FLATS AND BARS)

FOR INTERNAL USE ONLY

REMOVE THIS PREFACE BEFORE ISSUE TO SUPPLIERS

Equivalent/Comparable Standards:

1) IS: 2062 – 2011 : Grade: E250- BR (With impact test)
2) DIN EN 10025-2:2005 : Grade: S275JR

Suggested/Probable Suppliers and Grades:

Refer Plant Vendors List

User Plants and Replaced Plant Specifications/References:

1) HEP, BHOPAL :
2) HEEP, HARDWAR :
3) HPEP, HYDERABAD :

Revisions:			**APPROVED:**		
Clause No. 1, 3, 5 & 8 revised (as per MOM of 38th MRC meeting), Clause 10 added			INTERPLANT MATERIAL RATIONALISATION COMMITTEE – MRC(S&GPS)		
Rev No.15	Amd No.	Reaffirmed	Prepared	Issued	Dt. of 1st Issue
Dt:11-03-2014	Dt:	Year:	HPEP, Hyderabad	Corp.R&D	June, 1976

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

ORDERING DESCRIPTION

1.0 GENERAL:

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

2.0 APPLICATION:

For general engineering purposes, suitable for welding.

3.0 CONDITION OF DELIVERY:

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

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

3.3 Any other additional requirement as per BHEL Purchase order.

4.0 DIMENSIONS AND TOLERANCES:

4.1 Sizes:

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

4.2 Tolerances:

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

4.3 Straightness for hot rolled bars:

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

5.0 TEST SAMPLES:

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

CORPORATE PURCHASING SPECIFICATION

6.0 ULTRASONIC EXAMINATION:

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

6.1 For plates above 40 mm thick:

Shall be ultrasonically examined unless when otherwise specified in order.

7.0 TEST CERTIFICATES:

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

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

The test certificate shall bear the following information:

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

BHEL order No.

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

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

8.0 PACKING AND MARKING:

Plates shall be transported suitably to avoid damage during transit.

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

9.0 REJECTION AND REPLACEMENT

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

10.0 REFERRED STANDARDS (Latest publications including amendments):

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

	CORPORATE PURCHASING SPECIFICATION	AA 107 38
		Rev. No. 06
		PREFACE SHEET

STAINLESS STEEL SHEETS AND PLATES - ANNEALED
ASTM A 240, TYPE 410

FOR INTERNAL USE ONLY
REMOVE THIS PREFACE SHEET BEFORE ISSUE TO SUPPLIERS

Comparable Standards:

1. AMERICAN	:	ASTM A 240 Type: 410, Annealed.
2. INDIAN	:	IS : 6911 - 1992 Gr : X 12Cr 12, Annealed (A2)
3. EUROPEAN	:	EN 10088-2, Gr:X12Cr13.

Suggested/Probable Suppliers And Grades:

Refer Plant Vendors list

User Plant References:

1. HEEP - HARDWAR	:	HW 021 02 99

Revisions : Cl 27.3 of MOM of MRC-S&GPS			APPROVED : Interplant Material Rationalization Committee-MRC (S&GPS)		
Rev. No. 06	Amd.No.	Reaffirmed	Prepared	Issued	Dt. of 1st Issue
Dt.:15.06.2005	Dt :	Year :	HARDWAR	Corp. R&D	JUNE, 1978

STAINLESS STEEL SHEETS AND PLATES - ANNEALED ASTM A 240, TYPE 410

ORDERING DESCRIPTION

1.0 GENERAL :

The sheets and plates shall conform to the latest version of ASTM A 240, Type: 410 and comply with the following additional requirements.

2.0 APPLICATION :

For general engineering purposes, where corrosion resistance is essential.

3.0 CONDITION OF DELIVERY:

Hot, annealed and descaled (Finish No.1).

Cold rolled, annealed (2B / 2 D).

4.0 DIMENSIONS AND TOLERANCES:

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

5.0 CHEMICAL COMPOSITION:

As per ASTM A 240, Type 410.

6.0 TEST CERTIFICATES :

Three copies of test certificates shall be supplied along with the following information:

BHEL References :

AA 107 38 -Rev. No.06 / ASTM A 240, Type:410
BHEL order No,

Supplier's References :
Name
Identification No.
Melt No.
Process of manufacture
Details of heat treatment.

Result of Tests:
Dimensional inspection.
Results of chemical analysis, mechanical tests

7.0 PACKING AND MARKING :

Sheets shall be supplied in bundles or in packages each weighing upto a maximum of 3000kg. Plates shall be suitably packed to prevent damage during transit.

For plates below 25 mm thick, each pile (preferably of 16 plates) shall be marked with suppliers identification mark, 'AA 107 38 / ASTM A 240, Type:410, melt No., BHEL order No., on the top plate.

Each plate of 25mm thickness and above shall be stamped/painted with the suppliers identification mark, 'AA 107 38 / ASTM A 240, Type:410 , melt No., BHEL order No., on the top plate.

FOR INFORMATION ONLY

CHEMICAL COMPOSITION

C	Si	Mn	Ni	Cr	S	P	Al
0.08-0.15	≤ 1.0	≤ 1.0	≤ 0.75	11.5-13.5	≤ 0.030	≤ 0.040	-

MECHANICAL PROPERTIES

Hardness, max		0.2% PS min	UTS, min	% El min	Bend Test
BHN	HRB	N/mm^2	N/mm^2		Dia.
217	96	205	450	20	180^0

	CORPORATE PURCHASING SPECIFICATION	AA 107 55
		Rev. No. 07
		PREFACE SHEET

SEAMLESS STAINLESS STEEL PIPES (AUSTENITIC, Ti STABILIZED) (ASTM A 312, TP 321)

FOR INTERNAL USE ONLY
REMOVE THIS PREFACE SHEET BEFORE ISSUE TO SUPPLIERS

Comparable Standards:

1. AMERICAN	:	ASTM A 312 Gr.: S 32100 (TP 321)
2. EUROPEAN	:	DIN 17458, Gr:X6CrNiTi18-10.

Suggested/Probable Suppliers And Grades:

Refer Plant Vendors list

User Plant References:

1.	HEEP - HARDWAR	:	HW 021 02 99
2.	BHOPAL	:	PS 105 29
3.	HYDERABAD	:	AISI 321, ASTM A 312, Gr.:TP 321
4.	TIRUCHY	:	ASTM A 312, Gr.: TP 321

Revisions :	APPROVED :
Cl 27.6.27 of MOM of MRC-S&GPS	INTERPLANT MATERIAL RATIONALIZATION COMMITTEE (MRC-S&GPS)

Rev.No. 07	Amd.No.	Reaffirmed	Prepared	Issued	Dt. of 1st Issue
Dt.:15.06.2005	Dt :	Year :	HARDWAR	Corp. R&D	JUNE, 1978

SEAMLESS STAINLESS STEEL PIPES (AUSTENITIC, Ti STABILIZED) (ASTM A 312, TP 321)

ORDERING DESCRIPTION FOR ASTM A 312, TP 321

1.0 GENERAL:

The pipes shall conform to the latest version for ASTM A 312, TP 321 and comply with the following additional requirements.

2.0 APPLICATION

For corrosion resistant applications.

3.0 DIMENSIONS AND TOLERANCES:

3.1 Sizes:

Pipe outside diameter and wall thickness shall be as specified in BHEL order. Unless otherwise specified, pipes shall be supplied in lengths of not less than 4.5 metres.

3.2 TOLERANCES:

As per ASTM A 999.

4.0 MANUFACTURE:

Either hot finished or cold drawn.

5.0 CHEMICAL COMPOSITION:

As per ASTM A 312, TP 321.

6.0 MECHANICAL PROPERTIES:

As per ASTM A 312 TP 321.

7.0 HYDROSTATIC TEST / NDT:

Each length of pipe shall be subjected to Hydrostatic test as per ASME SA 530.

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

a) For thickness upto 3.6mm, inclusive, Eddy current test as per ASME SE 309 or for thickness upto 12mm, inclusive, Flux leakage test as per ASME SE 570.

or

b) Ultrasonic test as per ASME SE 213.

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

8.0 INSPECTION AT SUPPLIER'S WORKS:

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

9.0 REPAIRS:

9.1 Repair involving fusion welding is prohibited.

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

10.0 CERTIFICATION:

Test certificate shall be as per ASTM A 999.

11.0 PACKING AND MARKING:

As per BHEL Standard AA 049 00 01.

12.0 REJECTION AND REPLACEMENT:

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

FOR INFORMATAION ONLY

CHEMICAL COMPOSITION

C	Si	Mn	Ni	Cr	S	P	Ti	N
≤ 0.08	≤ 1.0	≤ 2.0	9.0-12.0	17.0-19.0	≤ 0.030	≤ 0.045	5XC - 0.70	≤ 0.10

MECHANICAL PROPERTIES

Wall Thickness	0.2% PS min N/mm²	UTS min N/mm²	% El min	
			Longitudinal	Transverse
≤ 9.52 cm	205	515	35	25
> 9.52 cm	170	415	35	25

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

0.0 GENERAL:

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

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

1.0 SCOPE:

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

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

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

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

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

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

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

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

It does not apply for the following dimensions:

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

b) Auxiliary dimensions indicated in brackets.

c) Theoretically exact dimensions indicated in rectangular frames.

2.0 COMPLIANCE WITH STANDARDS:

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

3.0 GENERAL TOLERANCES:

3.1 Linear dimensions are given in Table 1 and 2.

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

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

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

Revision: This standard was based on 1969 version of IS:2102			Approved: INTERPLANT STANDARDIZATION COMMITTEE-WG (DOP + BES)		
Rev.No. 01	Amd.No.	Reaffirmed	Prepared BHOPAL	Issued CORP. R&D	Dt. of 1st issue 22-06-1978
Dt. 1-12-1995	Dt.	Year: 2008			

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4.0 INDICATIONS ON DRAWINGS:

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

Example: AA 023 02 08 m

5.0 REJECTION:

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

6.0 NOTE:

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

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

Values in millimetres

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

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

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

Values in millimetres

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

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

Table 3 — Permissible deviations of angular dimensions

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

Annex A
(informative)

Concepts behind general tolerancing of linear and angular dimensions

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

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

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

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

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

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

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

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

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

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

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

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

The workshop should therefore

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

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

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

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

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

GENERAL TOLERANCES FOR WELDING CONSTRUCTIONS FOR LENGTHS AND ANGLES

1.0 GENERAL

1.1 General tolerances are permissible variations corresponding to the degrees of accuracy normally observed in workshops where details of tolerances are not provided in the drawings.

1.2 The general tolerances specified in this standard apply to dimensions for which the tolerances are indicated on the nominal dimensions for welded components, welded assemblies and welded structures.

1.3 The variations apply to linear dimensions such as outside dimensions, inside dimensions, stepped dimensions, widths, Centre-to-Centre distances and also angles.

1.4 Special rulings may be stated for linear dimensions of welded structures consisting of several assemblies.

1.5 This standard is based on BS EN ISO 13920-1997

1.6 General tolerances for machined components are covered in Corporate Standard AA0230208.

1.7 Refer Corporate Standard AA0621105 for general tolerances for welded structures - Form and Position.

2.0 SCOPE

2.1 This standard prescribes four degrees of accuracy based on differences arising out of function and manufacture of welded components, assemblies and structures.

2.2 For technical and economic reasons other degrees of accuracy may be appropriate which have to be specifically stated.

3.0 GENERAL TOLERANCES

3.1 Tolerances for linear dimensions are given in Table 1.

3.2 Table 2, for the tolerances on angular dimensions.

4.0 REPRESENTATION ON DRAWINGS

4.1 The required degree of accuracy shall be specified in all fabrication drawings.

For example class 'B' of AA0621104 (BS EN ISO 13920)

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4.2 Figures 1 to 5 give examples of how dimensions (linear & angular) are to be indicated on the drawings. (Refer page 6 of 6 of this standard)

5.0 TESTING

5.1 The actual size of an angular structural component is determined by placing suitable measuring instruments tangentially on the welded part so that the zone affected by the weld is eliminated. The variation is obtained from the difference between the dimension in the drawing and the actual size.

TABLE-1 **TOLERANCE FOR LINEAR DIMENSIONS**

Range of nominal sizes l in mm											
Tolerance Class	2 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	Over 4000 up to 8000	Over 8000 up to 12000	Over 12000 up to 16000	Over 16000 up to 20000	Over 20000
	Tolerances t in mm										
A	± 1	± 1	± 1	± 2	± 3	± 4	± 5	± 6	± 7	± 8	± 9
B		± 2	± 2	± 3	± 4	± 6	± 8	± 10	± 12	± 14	± 16
C		± 3	± 4	± 6	± 8	± 11	± 14	± 18	± 21	± 24	± 27
D		± 4	± 7	± 9	± 12	± 16	± 21	± 27	± 32	± 36	± 40

TABLE-2 **TOLERANCES FOR ANGULAR DIMENSIONS**

Tolerance Class	Range of Nominal sizes l in mm (Length of shorter leg)		
	Up to 400	Over 400 upto 1000	Over 1000
	Tolerance Δα (In degrees and minutes)		
A	± 20’	± 15’	± 10’
B	± 45’	± 30’	± 20’
C	± 1°	± 45’	± 30’
D	± 1°30’	± 1°15’	± 1º
Calculated and rounded tolerances t, in mm/m[a]			
A	± 6	± 4.5	± 3
B	± 13	± 9	± 6
C	± 18	± 13	± 9
D	± 26	± 22	± 18
[a] The value indicated in mm/m correspond to the tangent value of the general tolerance. It is to be multiplied by the length, in m, of the shorter leg.			

NOTE:

1) The permissible variations also apply to unmarked angles of 90º and 180º.
2) The shorter side of the angle is specified as the reference side.
3) Its length can also be taken from a specially indicated reference point to be shown in the drawings.
4) If the drawing contains no angle data, but only linear dimensions, then the permissible variations are to be taken in mm/m.

6.0 Tolerances on dimensions of welded assemblies, the part of which are machined preliminarily and the assembly after welding as per given size not subjected to machining are set 50% lower than the tolerances on dimensions requiring a given accuracy.

7.0 In case of necessity, it is allowed to set as symmetrical tolerances in relation to nominal, but in this case the sum total of the value of the tolerance is to be preserved as per table 1.

8.0 Deformation of welded constructions (not in contact with floor plate) is allowed up to limits given in table 3.

Remarks:

1) The local convexities and concavities of the sheathing surface having smooth transition are allowed up to 4 mm.
2) General bend along the whole length of the sheathing should not exceed W mm per running metre.
3) Bends in the thin walled construction of the type of branch pipes, baffles of air draft hydro-generators are considered separately in every particular case.

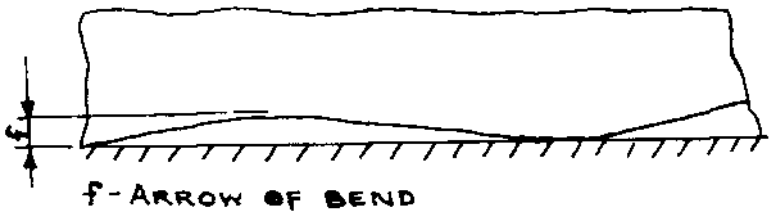

TABLE-3

Type of Construction	Length in mm						
Beams, spokes, stands, guards and similar parts	10000 to 15000	5000 to 10000	3000 to 5000	1500 to 3000	1000 to 1500	500 to 1000	Upto 500
	Allowable bend in mm						
	10.0	8.0	6.0	4.5	3.0	2.5	2.0
Frames, Floor plates dished parts, boxes External covers, bearings and Similar parts.	12.0	10.0	8.0	6.0	4.0	3.0	2.0

9.0 Allowance for machining of welded construction is determined as per table 5.

Remarks:

1) In case of machining of diameters and constructions from two sides the allowance is doubled.

2) For "Dimension as per drawing" is taken the dimension for which the allowance is meant.

10.0 Tolerances on bend "C" shall be as per table 4.

TABLE – 4

Width of flange ''b'' in mm	Thickness of flange ''s'' in mm	Tolerance ''c'' in mm
400-201	60-41	3.0
	40-31	3.5
	30-21	4.0
	20-11	4.5
	10 and lower	5.0
200-150	40-31	3.0
	30-21	3.5
	20-11	4.0
	10 and lower	5.0
149-100	40-31	2.5
	30-21	3.0
	20-11	3.5
	10	4.5
99-50	30-21	2.0
	20-11	2.5
	10	3.0
50 and lower	30-21	1.5
	20-11	2.0
	10	2.5

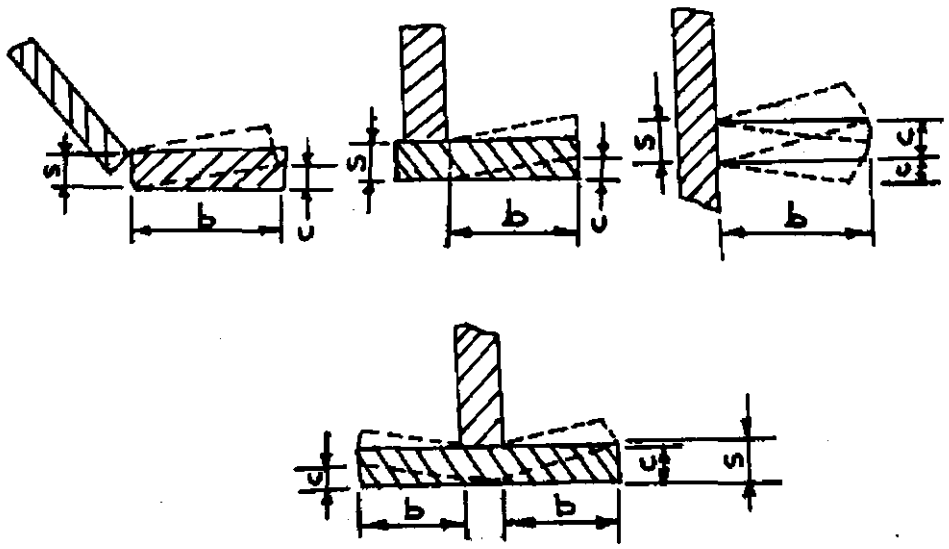

TABLE-5

Dimension as per Drawing (mm)	Machining Allowance per side (mm)
Upto 500	6
More than 500 & upto 1000	8
More than 1000 & upto 2000	10
More than 2000 & upto 4000	12
More than 4000 & upto 6000	14
More than 6000 & upto 10000	18
More than 10000 & upto 15000	22
More than 15000	24

11.0 REFERRED STANDARDS (Latest publications including amendment)

1) AA0230208
2) AA0621105

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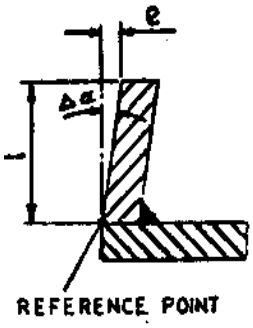

FIG. 1

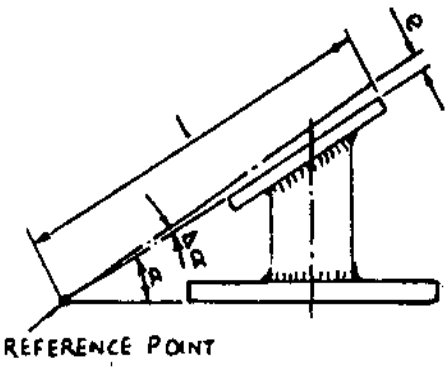

FIG. 2

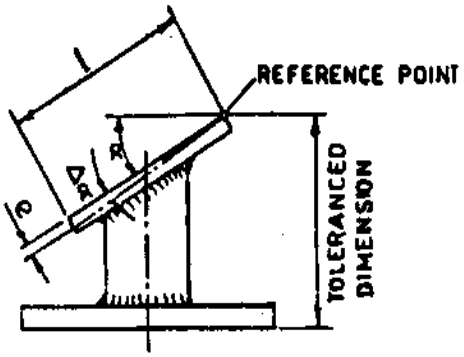

FIG. 3

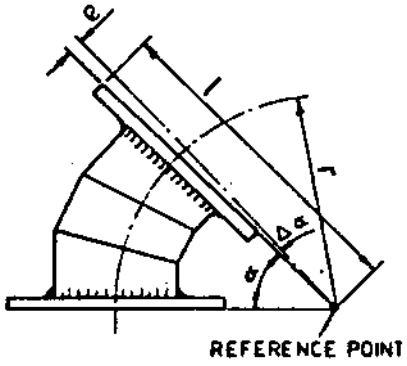

FIG. 4

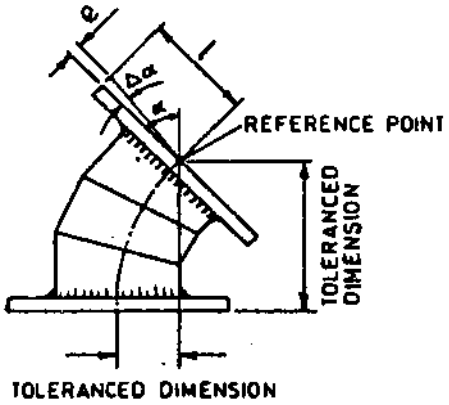

FIG. 5

RUST PREVENTIVE HARD FILM, BLACK (TRP)

1.0 GENERAL:

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

2.0 APPLICATION:

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

3.0 REMOVAL:

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

4.0 COLOUR : Steel Black.

5.0 COMPLIANCE WITH NATIONAL STANDARDS:

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

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

6.0 COMPOSITION:

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

7.0 TEST SAMPLES:

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

8.0 PROPERTIES:

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

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

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

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

8.4 Weight : 11 ± 0.5 kg per 10 litres.

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

8.6 Test for Adhesion : To pass the test

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

8.8 Protection against corrosion at high temperature and humidity:

To pass the test for 360 hours, minimum..

9.0 TYPE TESTS:

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

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

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

10.0 TEST CERTIFICATES:

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

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

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

11.0 KEEPING PROPERTY:

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

12.0 PACKING & MARKING:

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

Each container shall marked with the following information:

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

8.0 ENVIRONMENTAL REQUIREMENTS:

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

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

13.0 REFERRED STANDARDS (Latest Publications Including Amendments):

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

BHEL HERP VARANASI
QUALITY PLAN

Centre Feed Pipes (Pipe Material AA10738)

SL.NO.	COMPONENT	CHARACTERISTIC CHECKED	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENTS & ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
							P	W	V	
1.0	Raw Material : Plates	i.Chemical & Mechanical properties	Chemical analysis and Mechanical test	1 sample per heat batch	AA10119	TC	3	-	2	Manufacturer's TC is also acceptable for chemical and mechanical properties
		ii.Chemical & Mechanical properties	Chemical analysis and Mechanical test	1 sample per heat batch	AA 10738	TC	3	-	2	Plates AA10738 should be procured from BHEL approved sources only (Specified in Purchase Order)
2.0	Fabrication	ii. Fit up exam and welding	Measurement	100%	Drawing	Dim.report	3	-	2	Tolerance to be maintained as per drg. All welding shall be done by qualified welders only. BHEL WPS nos. WE-079, and WE-148 should be followed for SMAW as per requirement of drawings. Compatible welding electrodes (as mentioned in above WPS) should be used. Job should be preheated to temperature mentioned in WPS no. WE-079. If MIG/MAG welding process is used, prior WPS approval is to be taken from BHEL.
		iii.Post Weld Heat Treatment	Review of HT Chart	100%	As per applicable WPS WE-079		3	-	2	As per WPS WE-079 Following Heat treatment cycle should be followed : 1) Free Heating upto 400°C 2) Rate of Heating 100°C/Hr upto 680°C to 710°C 3) Soaking time 1 hour. 4) Rate of cooling 100°C/Hr upto 400°C 5) Free Cooling in ambient air below 400°C
		iv. D.P.Testing of welded joints	D.P.test	100%	AA0850131 & AA0850129	TC	3	2	-	100% D.P.test shall be witnessed by BHEL AIA
3.0	Final Inspection after Fabrication, Stress relieving and NDT.	i.Dimensions	Measurement	100%	Drawing.	Dimension Report	3	2	-	Unspecified tolerances shall be maintained as follows : a) As per medium tolerance class of Specn. AA0230208 for machined dimensions. b) As per Tolerance class B of specn. AA0621104 for fabricated dimensions.
		ii. Painting & preservation		100%		Insp.Report	3	2	-	All Machined surfaces of material other than SS (AA 10738) shall be protected by applying TRP black paint (specn. AA55154). All threaded holes to be protected by applying grease
		iii.Identification & Marking	Punching of Drg. No., P.O.No., Vendor code no., year, Inspector Seal	100%	Drawing	Inspection Report	3/2	2	-	
			APPROVED BY		MANAGER P&D					
			SIGNATURE & DATE							

QP. NO.	RV/FAB /31
DATE	09/08/2011
PG. NO.	1 OF 1

P = PERFORM.C. = TEST CERTIFICATE
W = WITNESS H.T. = HEAT TREATMENT
V = VERIFY
3 = VENDOR
2 = BHEL AUTHORISED INSPECTION AGENCY (AIA)

विरेन्द्र कुमार/VIRENDRA KU...
प्रबंधक (यो०वि०) / Manager (P...)
भारत हेवी इलेक्ट्रिकल्स लिमिटेड
Bharat Heavy Electricals Ltd.
हर्प, वाराणसी
HERP, Varanasi

BHARAT HEAVY ELECTRICALS LIMITED

Ramachandrapuram, Hyderabad – 502 032, INDIA

QW – 482 WELDING PROCEDURE SPECIFICATION (WPS)

Welding Procedure Specification No.: WE006 **Date: 02.08.86** **Supporting PQR No.:** 516, **Dt** : 11.05.10

Revision No.: 07 **Date:** 24.04.2016

Welding Process (es) : *SMAW* **Type (s) :** *MANUAL*

JOINTS (QW 402)

Joint Design: *As per manufacturing drawing (groove/fillet)*

Root Spacing : *As per manufacturing drawing*

Backing (Yes) : *for double side butt welds and backing strip joints*

(No) : *for single side welds*

Backing Material (Type) : *Base metal / Weld metal*

Metal: *Yes* **Non-Fusing Metal**: *No*

Retainer: *No*

BASE METALS (QW – 403)

P. No. *: 1* **Group No. :** *1 & 2* **TO** **P. No.:** *1* **Group No.:** *1 & 2*

OR

Specification type & grade: -------- **to** Specification type & grade : -------

OR

Chemical Analysis & Mechanical Properties: --- to Chemical Analysis & Mechanical Properties: ----

Thickness Range :

Base Metal : **Groove:** *5.0 mm to 38 mm* ** **Fillet :** *all sizes*

Deposited pass thickness > 13mm – Not Permitted

Other : None

Filler Metals (QW – 404)

	SMAW
Spec. No. (SFA)	*5.1*
AWS NO (CLASS)	A5.1 (*E 7018*)
F. No.	4
A. No.	*1*
Size of Filler Metals	*Dia 2.5, 3.15, 4.0, 5.0mm*
Filler Metal Product Form	N.A
Supplemental Filler Metal	N.A
Deposited Weld Metal Thickness Range : Groove: Fillet:	38 *mm Max.* *38 mm Max Throat*
Electrode Flux (Class)	*Basic*
Consumable Insert	*No*
Max. Bead Thickness	5 *mm*

** Note : For Unequal thicknesses base material thickness qualified upto 50mm and weld metal thickness limited to 38mm max.

Rev : 07 – Note added regarding base material thickness

POSITIONS (QW-405)

Position(s) Groove : *ALL POSITIONS*
Welding Progression: *UP for Vertical*
Down –Not permitted
Position (s) Fillet: *ALL*
Other : None

POSTWELD HEAT TREATMENT (QW-407)

Not Permitted
Temperature Range: *NA*

Time Range: *NA*
Other : *None*

PREHEAT (QW-406)

Preheat Temp Min: *10 º C min for < 31mm*
100 º C min for 31mm and above
Interpass Temp Max: *300 º C*
Preheat Maintenance: *Minimum specified temperature for every restart*
Other : None

GAS (QW - 408)

	Gas(es)	Percentage Composition Mixture	Flow Rate
Shielding :	N.A	-	-
Trailing :	N.A	-	-
Backing :	N.A	-	-

Other : None

ELECTRICAL CHARACTERISTICS (QW-409)

Weld Pass (es)	Process	Filler Metal		Current type & Polarity	Amps (Range)	Wire feed speed	Energy or Power (Range)	Volts (Range)	Travel speed	Other
		Classification	Diameter							
Root& Subsequent as required	*SMAW*	*E 7018*	*2.5mm*	*DCEP*	*60 – 90A*	N.A	N.A	*22-34V*	N.A	*String for horizontal; Others Weave (Max 3 times Electrode Core Dia)*
	-do-	*-do-*	*3.15mm*	*-do-*	*100-150A*	*-do-*	*-do-*	*-do-*	*-do-*	
	-do-	*-do-*	*4.0mm*	*-do-*	*150-200A*	*-do-*	*-do-*	*-do-*	*-do-*	
		-do-	*5.0mm*	*-do-*	*200-260A*	*-do-*	*-do-*	*-do-*	*-do-*	

Pulsing Current : *N.A*

Heat Input *: N.A*

Tungsten Electrode Size and Type : *N.A*

Mode of Metal Transfer for GMAW (FCAW): *N.A*

Others **:** None

TECHNIQUE (QW-410)

String or Weave Bead: *string and/or weave*

Orifice or Gas Cup Size : *N.A*

Initial / Interpass Cleaning : *chipping / brushing / grinding*

Method of Back Gouging: *grinding/gouging if required*

Oscillation *: N.A*

Contact tube to work distance : N.A

Multiple or Single Pass : *Multiple pass*

Multiple or Single Electrodes : *Single electrode*

Closed to out chamber : *N.A*

Peening : *Not allowed*

Use of thermal processes : *N.A*

Other : *Clean weld area to remove oil, rust, grease, etc. prior to welding.*

Prepared by

Welding Engineer

Approved by

HEAD / Welding Engg

N.A – Not Applicable

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POSITIONS (QW-405)

Position [s] Groove 1G

Welding Progression : Up ... Down ... ...

Position [s] Fillet ...

[POSTWELD HEAT TREATMENT QW-407

Temperature Range 600-620°C

Time Range One hour

GAS [QW-408]

Percent Composition

Gas [es] [Mixture] Flow Rate

Shielding -

Trailing -

Backing -

PREHEAT [QW-406]

Preheat Temp Min 150°C (For 1st layer only)

Interpass Temp. Max 200°C

Preheat Maintenance -

ELECTRICAL CHARACTERISTICS [QW-409]

Current AC or DC DC Polarity +Ve

Amps [Range] 140-180 Volts Range 22-26

Tungsten Electrode size and type -

Mode of Metal Transfer for GMAW -

Electrode wire feed speed range -

TECHNIQUE [QW-410]

String or Weave Bead String only Orifice or Gas Cup Size -

Initial and Interpass Cleaning By Chipping, Brushing, Grinding

Method of Back Gouging - oscillation -

Contact Tube to Work Distance - Multiple or Single Pass Multi

Multiple or single Electrodes Single Travel Speed [Range] -

Peening No Electrode Spacing -

Other Clean the weld area prior to welding to remove Oil, Rust, Grease etc.

Weld Layer [s]	Process	Filler Metal Class	Filler Metal Dia. mm	Current Type Polar	Current Amp. Range	Volt Range	Travel Speed Range mm/min	Other
1st layer	SMAW	E309Mo-15	5.0	DC+	160-180	22-26	-	String only
subsequent layers	"	E308-L-15	"	"	"	"	-	--do--

CONTROLLED COPY

Prepared by [signature] 14/12/87

MANAGER
WELDING ENGG.

BHARAT HEAVY ELECTRICALS LIMITED

RAMACHANDRAPURAM, HYDERABAD-500 032.

PD - 268

QW-482 WELDING PROCEDURE SPECIFICATION (WPS)

Welding Procedure Specification No. WE055 Date 8.10.82 Supporting PQR No 193

Revision No. 1 Date 01.03.1989

Welding Process (es) SMAW Type (s) Manual

Details

JOINTS (QW 402)

Joint Design S.S.Overlay on P1,

Backing (Yes) - (No) -

Backing Material (Type) -

Metal - non fusing metal -

BASE METALS (QW-403) A8 overlay

P. No. 1 Group No. 1 & 2 to P. No. - Group No. -

OR

Specification type and grade

to Specification type and grade

OR

Chem. Analysis and Mech Prop

to Chem Analysis and Mech Prop

Thickness Range : 25mm & above

Base Metal Groove Fillet -

Pipe Dial Range : Groove - Fillet -

Other -

FILLER METAL (QW-404) 1st layer by E 309 Mo-15

F. No. 5 Other Subsequent layers by E 308L-15

A. No 8 Other (1)

Spec. No. (SFA) 5.4

DEPOSITED WELD METAL

AWS No. (Class) E309Mo-15&E308L-15 Thickness Range : 6mm and above (Overlay)
3mm Max by E 309Mo-15

Size of filler metals ∅ 5.0mm Groove Rest by E308L-15

Electrode-Flux. (Class) Basic Fillet

Flux Trade Name - Max. bead thickness : 5mm

Consumable insert No; Retainer: No.

(1) Rev., Format details added

AUTHORISED SIGN

BHARAT HEAVY ELECTRICALS LIMITED

RAMACHANDRAPURAM, HYDERABAD-500 032.

PD - 268

QW-482 WELDING PROCEDURE SPECIFICATION (WPS)

Welding Procedure Specification No WE.079. Date 31.10.90 Supporting PQR No. 322

Revision No 1 Date 10.03.95

Welding Process (es) SMAW Type (s) Manual

JOINTS (QW 402) Details

Joint Design As per Drawing

Backing (Yes) For double side welds (No) For single side welds

Backing Material (Type) Base metal/Weld metal

Metal Yes Non fusing metal --

Retainer : No

BASE METALS (QW-403)

P. No. - Group No. - to P. No. - Group No. -

OR

Specification type and grade X 12 Cr 13

to Specification type and grade X 12 Cr 13

OR

Chem. Analysis and Mech. Prop. --

to Chem. Analysis and Mech. Prop. --

Thickness Range :

Base Metal : ——— Groove 4.75 to 200mm Fillet All

Pipe Dia. Range : Groove All dia Fillet All

Other Root spacing for backing strip jts : 8-10mm
For others : 2 ± 1mm

FILLER METALS (QW-404)

Spec. No. (SFA)	5.4
AWS No. (Class)	E 410 - 16/15
F. No.	4
A. No	6
Size of Filler Metals	Ø 2.5 to 5.0mm
Deposited Weld Metal	Max head thickness : 5mm
Thickness Range : Groove	200mm Max
Fillet	All
Electrode Flux (Class)	Rutile
Flux Trade Name	--NA-
Consumable Insert	No

POSITIONS (QW-405)

Position [s] Groove All

Welding Progression : Up For V Down —

Position [s] Fillet All

[POSTWELD HEAT TREATMENT QW-407]

Temperature Range 680 - 710

Time Range 1 Hr/25mm upto 50mm. For every Additional 25mm : 15 Minutes

PREHEAT [QW 406]

Preheat Temp Min 280°C

Interpass Temp. Max 350°C

Preheat Maintenance By Oxy Accetalyne or Producer Gas

GAS [QW-408] NA

Percent Composition

Gas [es] [Mixture] Flow Rate

Shielding

Trailing

Backing

ELECTRICAL CHARACTERISTICS [QW-409]

Current AC or DC DC Polarity +Ve (DCEP)

Amps [Range] 60-180 Volts Range 22-26

Tungsten Electrode size and type NA

Mode of Metal Transfer for GMAW NA

Electrode wire feed speed range NA

TECHNIQUE [QW-410]

String or Weave Bead String Orifice or Gas Cup Size NA

Initial and Interpass Cleaning Chipping, Brushing, Grinding

Method of Back Gouging By Grinding oscillation No

Contact Tube to Work Distance NA Multiple or Single Pass Multi

Multiple or sinlge Electrodes Single Travel Speed [Range] --NA-

Peening Not allowe Electrode Spacing NA

Other Clean edges to be welded to remove, Grease, Rust etc. Prior to welding.

Weld Layer [s]	Process	Filler Metal Class	Filler Metal Dia. mm	Current Type Polar	Current Amp. Range	Volt Range	Travel Speed Range mm/min	Other
	SMAW	E410-16	2.5	DC+	60-80	--	--	String
	SMAW	E410-16	3.15	DC+	90-110	--	--	"
	SMAW	E410-16	4.0	DC+	110-140	--	--	"
	SMAW	E410-16	5.0	DC+	140-180	--	--	"

PREPARED BY

SR MANAGER
WELDING ENGG.

BHARAT HEAVY ELECTRICALS LIMITED

Ramachandrapuram, Hyderabad – 500 032.

QW – 482 WELDING PROCEDURE SPECIFICATION (WPS)

Welding Procedure Specification No.: *WE 148* **Date:** *05/01/2004* **Supporting PQR No.: 466**

Revision No.: 0 **Date: --**

Welding Process (es) : SMAW **Type (s) :** *Manual*

JOINTS (QW 402) **Details**

Joint Design : As per manufacturing drawing

Backing (Yes) : BASE MATERIAL

Backing Material (Type) : *Base Metal/weld metal*
Metal : *Yes*
Retainer : *No*

Non-Fusing Metal : *No*

BASE METALS (QW – 403)

P. No. : 6 **Group No. :** *1* **TO** **P. No.: 1** **Group No.1&2**

OR

Specification type & grade : ---
to Specification type & grade : ---

OR

Chemical Analysis & Mechanical Properties : ----
to Chemical Analysis & Mechanical Properties : -----

Thickness Range :
Base Metal : **Groove: 4.75 to 24 mm** **Fillet :** *All sizes*

Pipe Dia. Range : Groove: all dia **Fillet :** *All sizes*

Other : --

Filler Metals (QW – 404)	
Spec. No. (SFA)	*5.4*
AWS No. (Class)	*E309-15*
F. No.	*5*
A. No.	-
Size of Filler Metals	*2.5 – 5.0 mm*
Deposited Weld Metal	-
Thickness Range: Groove	*24 mm*
Fillet	*All*
Electrode Flux (Class)	*Basic*
Flux Trade Name	*NA*
Consumable Insert	*No*
Max. Bead Thickness	5.0 mm max

FIRST ANGLE PROJECTION

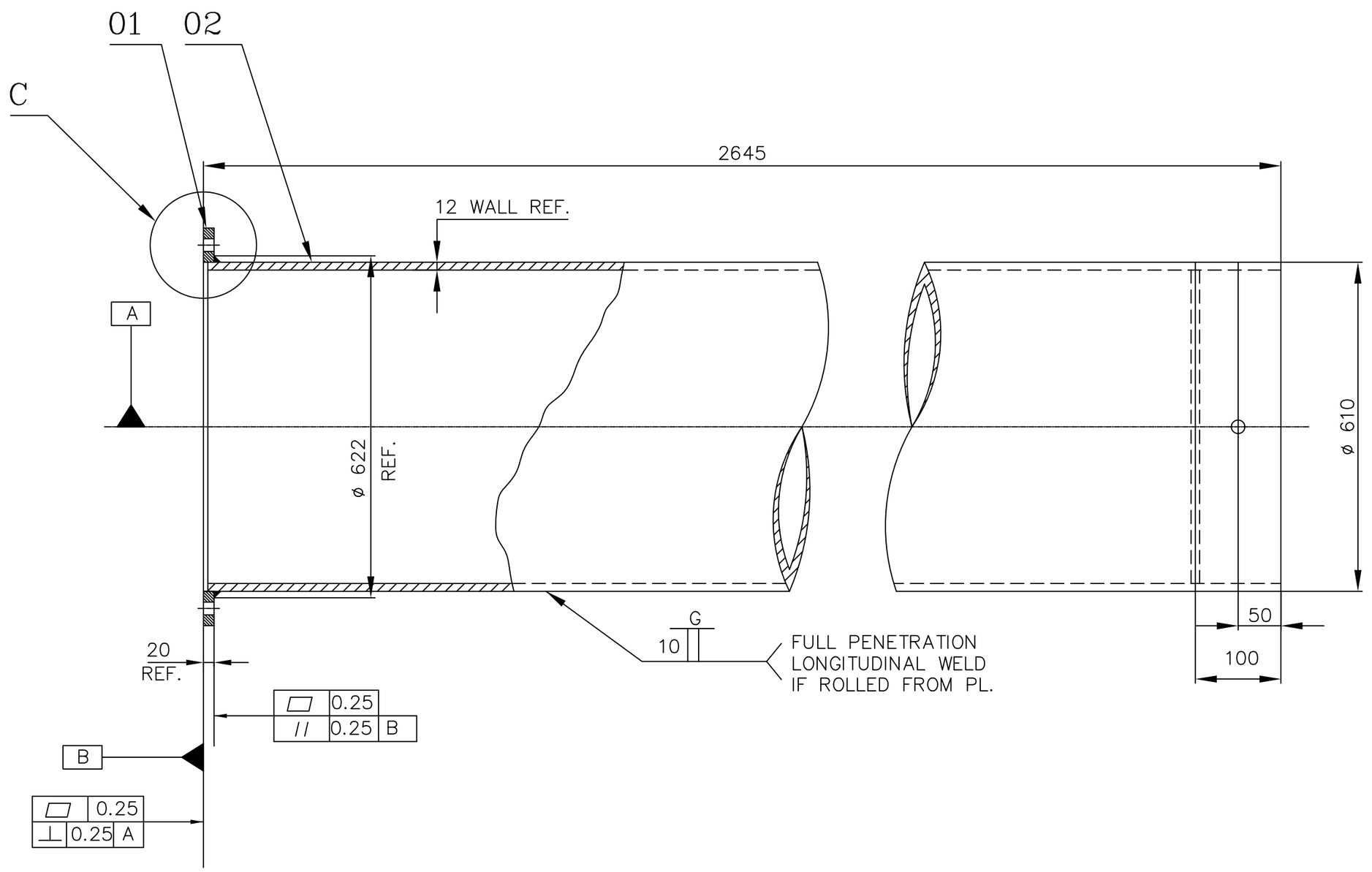
(ALL DIMENSIONS ARE IN mm)

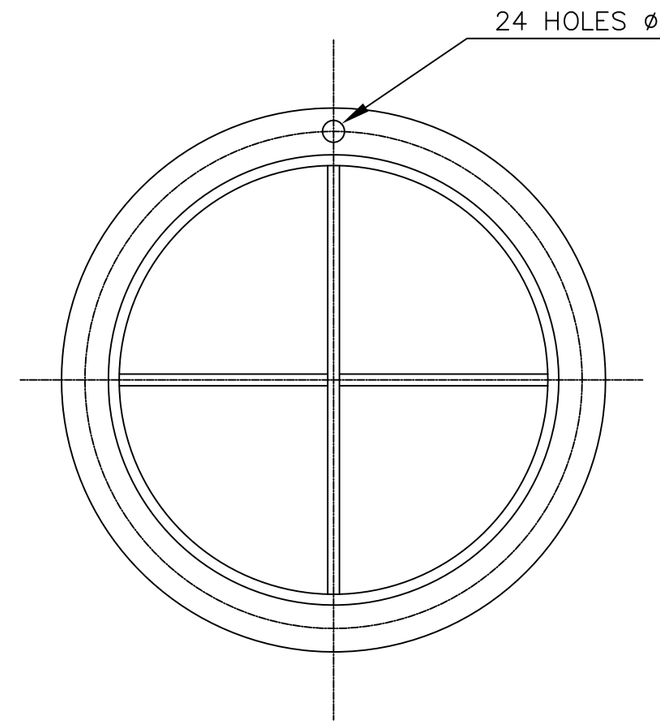
M.E.S

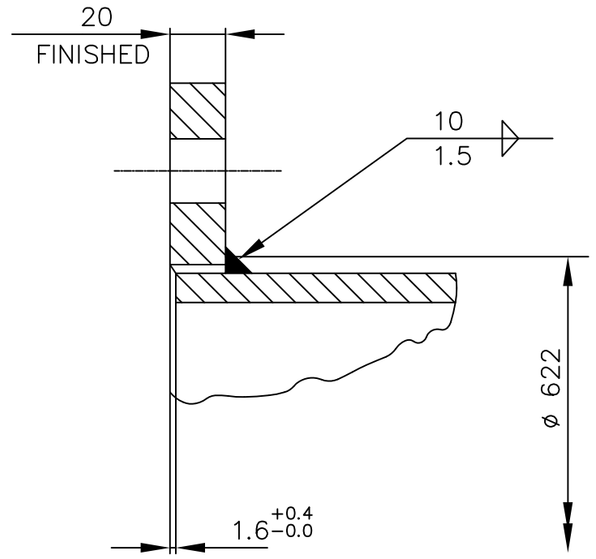
DRG. NO. 2-61-300-00548

SH. 1 OF 2

WPS:WE079 (AA10738 TO AA10738)
WPS:WE148 (AA10738 TO AA10119)







DETAIL–C

NOTE: 1. FOR CUTTING PLAN REFER DRG NO 3-61-300-90088
2. CUSTOMER APPROVED QUALITY PLAN TO BE FOLLOWED

VARIANT NO	ITEM NO	DESCRIPTION	DRAWING NO.	ITEM NO.	MATL CODE	UNIT WT
				VER NO.	MATL SPEC	QTY
	03	PIPE (STIFFENER) OD 34.2X4.05X590L			AA1011052555	1.70
					AA10152	2
	02	PL 12X1879X2643			AA1071838091	468.000
					AA10738	1
	01	PIPE FLANGE	3-61-300-00500		AA1011819155	24.000
					AA10119	1

THE FOLLOWING CONDITIONS APPLY EXCEPT OTHERWISE STATED.

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

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

BHARAT HEAVY ELECTRICALS LIMITED HYDERABAD

	NAME	SIGN.	DATE
DRN.			31.03.98
CHD.			
APPD.			

NO.OF VAR.: /

DEPT.	UNTOL. DIMS. GR.		SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO.OF ITEMS
BMD	¢/M/F		N.T.S	492.00	C-GP-2637/0	/	/
DEPT CODE. 446							

TITLE: 24"CENTRE FEED PIPE- LOWER

DRAWING NO. 2-61-300-00548 REV. 04

SHT. No | NO. OF SHT.

REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED
		CHD/APPD	04	12.1.05	CHD/APPD	03	31.03.98	CHD/APPD	03	31.03.98	CHD/APPD
ZONE		MAT CODE WAS AA1071831070. WPS ADDED.	ZONE		PL. 10 THK. WAS 12	ZONE		DRG. REDRAWN INCORPORATING ALL PREVIOUS REVISIONS			

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COMPUTER FILE NAME 26100548.DWG

REF. DRG. NO.

SIGN. AND DATE

INVENTORY NO

GENERAL DIMENSIONAL LIMITS,FITS & TOLERANCES AS PER HY0230261

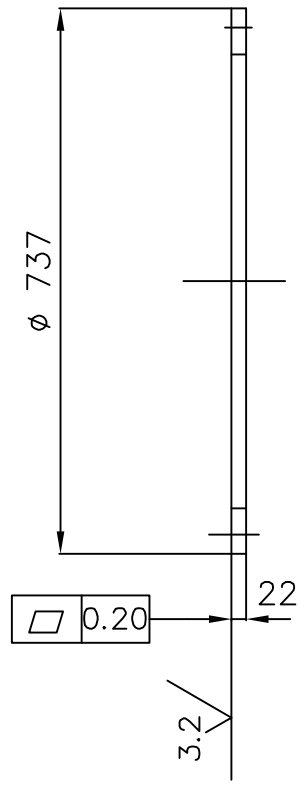
FIRST ANGLE PROJECTION

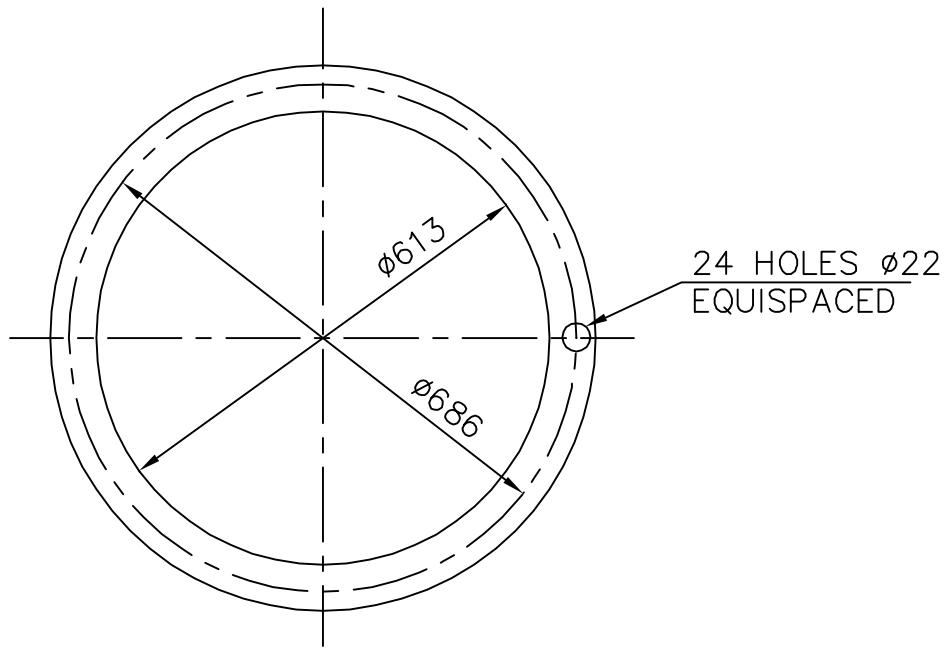
(ALL DIMENSIONS ARE IN mm)

DRG. NO. 3-61-300-00500

SH. OF

12.5 3.2





ITEM NO.	DESCRIPTION	DRAWING NO	IT NO. / VAR NO	MATL CODE / MATL SPCN.	UNIT WT. / QTY	
	PL. 25xø737xø613			AA1011819155 / AA10119	24.000	

THE FOLLOWING CONDITIONS APPLY EXCEPT OTHERWISE STATED.

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

REV.	DATE	ALTERED	CHD/APPD
03	17.01.01	ZONE THICKNES 22 WAS 20	
02	28.03.98	ZONE DRG. REDRAWN INCORPORATING ALL PREVIOUS REVISIONS.	

INVENTORY NO | SIGN. AND DATE | REF. DRG. NO. | COMPUTER FILE NAME 3610050O.DWG

GENERAL DIMENSIONAL LIMITS,FITS & TOLERANCES AS PER HY0230261

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

BHARAT HEAVY ELECTRICALS LIMITED
HYDERABAD

	NAME	SIGN.	DATE
DRN.	N.D.S		28.03.98
CHD.	S.G		26.9.98
APPD.	K.M.R.		29.9.98

NO.OF VAR.

DEPT. / DEPT.CODE	UNTOL. DIMS.	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO.OF ITEMS
BMD / 446	GR. ¢/M/₱	1:10	24.00	B-GP-1463/7		

TITLE: PIPE FLANGE (24" OD PIPE)

DRAWING NO. 3-61-300-00500 REV. 03

SHT. No | NO. OF SHT.

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

0.0 GENERAL:

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

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

1.0 SCOPE:

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

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

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

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

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

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

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

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

It does not apply for the following dimensions:

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

b) Auxiliary dimensions indicated in brackets.

c) Theoretically exact dimensions indicated in rectangular frames.

2.0 COMPLIANCE WITH STANDARDS:

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

3.0 GENERAL TOLERANCES:

3.1 Linear dimensions are given in Table 1 and 2.

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

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

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

Revision: This standard was based on 1969 version of IS:2102			Approved: INTERPLANT STANDARDIZATION COMMITTEE-WG (DOP + BES)		
Rev.No. 01	Amd.No.	Reaffirmed	Prepared BHOPAL	Issued CORP. R&D	Dt. of 1st issue 22-06-1978
Dt. 1-12-1995	Dt.	Year: 2008			

CORPORATE STANDARD

BHEL

4.0 INDICATIONS ON DRAWINGS:

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

Example: AA 023 02 08 m

5.0 REJECTION:

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

6.0 NOTE:

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

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

Values in millimetres

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

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

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

Values in millimetres

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

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

Table 3 — Permissible deviations of angular dimensions

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

Annex A
(informative)

Concepts behind general tolerancing of linear and angular dimensions

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

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

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

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

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

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

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

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

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

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

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

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

The workshop should therefore

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

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

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

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

A.4 The tolerance the function allows is often greater than the general tolerances. The function of the part is, therefore, not always impaired when the general tolerance is (occasionally) exceeded at any feature of the workpiece. Exceeding the general tolerance should lead to a rejection of the workpiece only if the function is impaired.

GENERAL TOLERANCES FOR WELDING CONSTRUCTIONS FOR LENGTHS AND ANGLES

1.0 GENERAL

1.1 General tolerances are permissible variations corresponding to the degrees of accuracy normally observed in workshops where details of tolerances are not provided in the drawings.

1.2 The general tolerances specified in this standard apply to dimensions for which the tolerances are indicated on the nominal dimensions for welded components, welded assemblies and welded structures.

1.3 The variations apply to linear dimensions such as outside dimensions, inside dimensions, stepped dimensions, widths, Centre-to-Centre distances and also angles.

1.4 Special rulings may be stated for linear dimensions of welded structures consisting of several assemblies.

1.5 This standard is based on BS EN ISO 13920-1997

1.6 General tolerances for machined components are covered in Corporate Standard AA0230208.

1.7 Refer Corporate Standard AA0621105 for general tolerances for welded structures - Form and Position.

2.0 SCOPE

2.1 This standard prescribes four degrees of accuracy based on differences arising out of function and manufacture of welded components, assemblies and structures.

2.2 For technical and economic reasons other degrees of accuracy may be appropriate which have to be specifically stated.

3.0 GENERAL TOLERANCES

3.1 Tolerances for linear dimensions are given in Table 1.

3.2 Table 2, for the tolerances on angular dimensions.

4.0 REPRESENTATION ON DRAWINGS

4.1 The required degree of accuracy shall be specified in all fabrication drawings.

For example class 'B' of AA0621104 (BS EN ISO 13920)

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4.2 Figures 1 to 5 give examples of how dimensions (linear & angular) are to be indicated on the drawings. (Refer page 6 of 6 of this standard)

5.0 TESTING

5.1 The actual size of an angular structural component is determined by placing suitable measuring instruments tangentially on the welded part so that the zone affected by the weld is eliminated. The variation is obtained from the difference between the dimension in the drawing and the actual size.

TABLE-1 **TOLERANCE FOR LINEAR DIMENSIONS**

Range of nominal sizes l in mm											
Tolerance Class	2 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	Over 4000 up to 8000	Over 8000 up to 12000	Over 12000 up to 16000	Over 16000 up to 20000	Over 20000
	Tolerances t in mm										
A	± 1	± 1	± 1	± 2	± 3	± 4	± 5	± 6	± 7	± 8	± 9
B		± 2	± 2	± 3	± 4	± 6	± 8	± 10	± 12	± 14	± 16
C		± 3	± 4	± 6	± 8	± 11	± 14	± 18	± 21	± 24	± 27
D		± 4	± 7	± 9	± 12	± 16	± 21	± 27	± 32	± 36	± 40

TABLE-2 **TOLERANCES FOR ANGULAR DIMENSIONS**

Tolerance Class	Range of Nominal sizes l in mm (Length of shorter leg)		
	Up to 400	Over 400 upto 1000	Over 1000
	Tolerance Δα (In degrees and minutes)		
A	± 20’	± 15’	± 10’
B	± 45’	± 30’	± 20’
C	± 1°	± 45’	± 30’
D	± 1°30’	± 1°15’	± 1º
Calculated and rounded tolerances t, in mm/m[a]			
A	± 6	± 4.5	± 3
B	± 13	± 9	± 6
C	± 18	± 13	± 9
D	± 26	± 22	± 18
[a] The value indicated in mm/m correspond to the tangent value of the general tolerance. It is to be multiplied by the length, in m, of the shorter leg.			

NOTE:

1) The permissible variations also apply to unmarked angles of 90º and 180º.
2) The shorter side of the angle is specified as the reference side.
3) Its length can also be taken from a specially indicated reference point to be shown in the drawings.
4) If the drawing contains no angle data, but only linear dimensions, then the permissible variations are to be taken in mm/m.

6.0 Tolerances on dimensions of welded assemblies, the part of which are machined preliminarily and the assembly after welding as per given size not subjected to machining are set 50% lower than the tolerances on dimensions requiring a given accuracy.

7.0 In case of necessity, it is allowed to set as symmetrical tolerances in relation to nominal, but in this case the sum total of the value of the tolerance is to be preserved as per table 1.

8.0 Deformation of welded constructions (not in contact with floor plate) is allowed up to limits given in table 3.

Remarks:

1) The local convexities and concavities of the sheathing surface having smooth transition are allowed up to 4 mm.
2) General bend along the whole length of the sheathing should not exceed W mm per running metre.
3) Bends in the thin walled construction of the type of branch pipes, baffles of air draft hydro-generators are considered separately in every particular case.

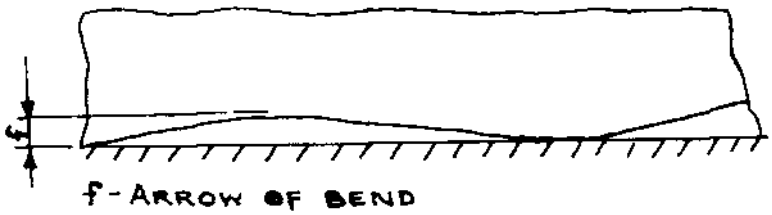

TABLE-3

Type of Construction	Length in mm						
Beams, spokes, stands, guards and similar parts	10000 to 15000	5000 to 10000	3000 to 5000	1500 to 3000	1000 to 1500	500 to 1000	Upto 500
	Allowable bend in mm						
	10.0	8.0	6.0	4.5	3.0	2.5	2.0
Frames, Floor plates dished parts, boxes External covers, bearings and Similar parts.	12.0	10.0	8.0	6.0	4.0	3.0	2.0

9.0 Allowance for machining of welded construction is determined as per table 5.

Remarks:

1) In case of machining of diameters and constructions from two sides the allowance is doubled.

2) For "Dimension as per drawing" is taken the dimension for which the allowance is meant.

10.0 Tolerances on bend "C" shall be as per table 4.

TABLE – 4

Width of flange ''b'' in mm	Thickness of flange ''s'' in mm	Tolerance ''c'' in mm
400-201	60-41	3.0
	40-31	3.5
	30-21	4.0
	20-11	4.5
	10 and lower	5.0
200-150	40-31	3.0
	30-21	3.5
	20-11	4.0
	10 and lower	5.0
149-100	40-31	2.5
	30-21	3.0
	20-11	3.5
	10	4.5
99-50	30-21	2.0
	20-11	2.5
	10	3.0
50 and lower	30-21	1.5
	20-11	2.0
	10	2.5

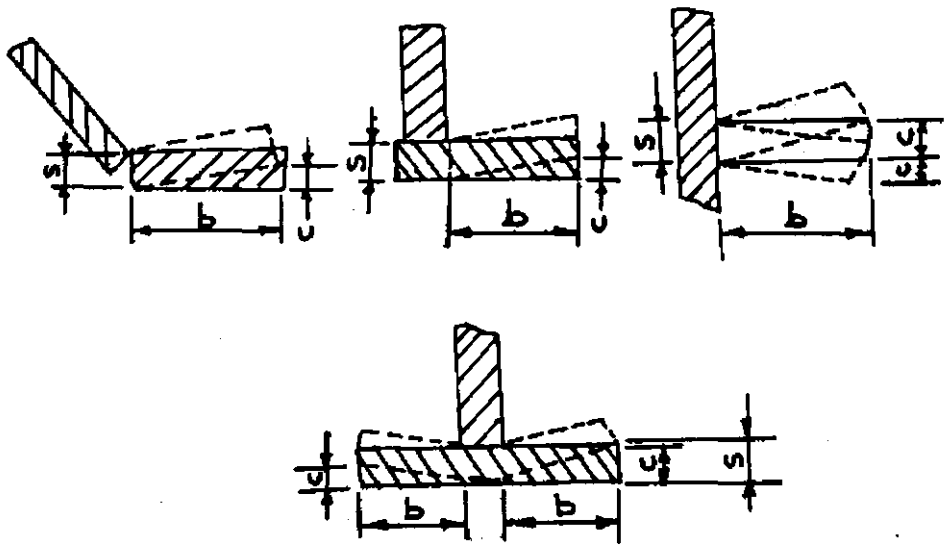

TABLE-5

Dimension as per Drawing (mm)	Machining Allowance per side (mm)
Upto 500	6
More than 500 & upto 1000	8
More than 1000 & upto 2000	10
More than 2000 & upto 4000	12
More than 4000 & upto 6000	14
More than 6000 & upto 10000	18
More than 10000 & upto 15000	22
More than 15000	24

11.0 REFERRED STANDARDS (Latest publications including amendment)

1) AA0230208
2) AA0621105

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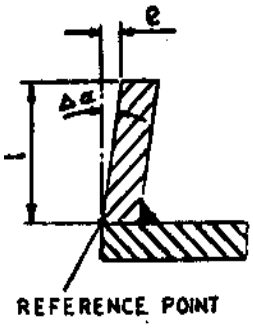

FIG. 1

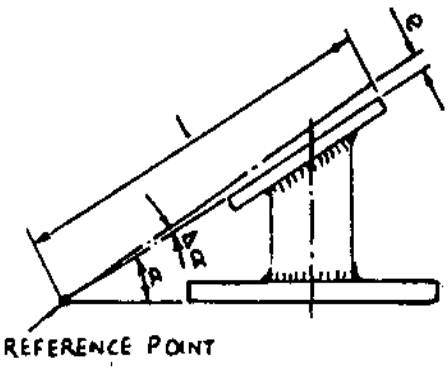

FIG. 2

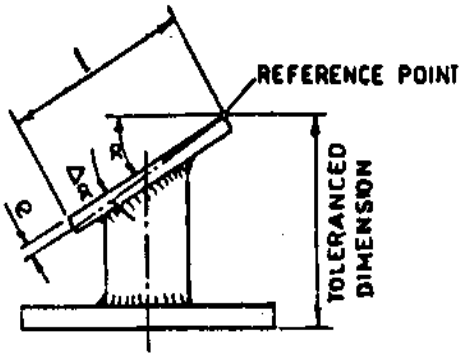

FIG. 3

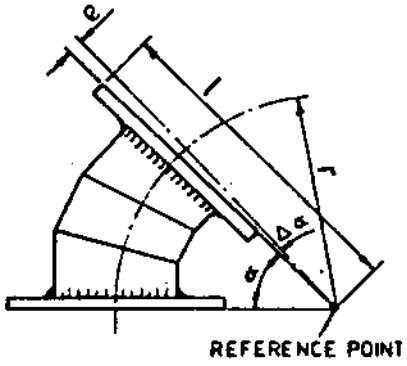

FIG. 4

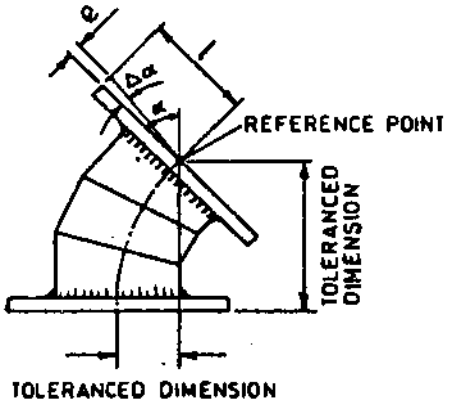

FIG. 5

ACCEPTANCE STANDARDS FOR LIQUID PENETRANT EXAMINATION OF WELDS

1.0 SCOPE:

1.1 This standard covers the "Acceptance Standards For Liquid Penetrant Eamination Of Wleds' .

1.2 The procedure for liquid penetrant examination shall be as per Corporate Standard AA 085 01 31: Procedure For Liquid Penetrant Examination.

1.3 This standard is based on ASME Section 8, Division 1, Appendix 8.

2. DEFINITION OF IHDICATIONS:

Relevant indications are those which result from mechanical discontinuities. Indications with major dimensions greater than 1.6 mm only shall be considered relevant.

2.1 Linear indications are those indications in which the length is more than three times the width.

2.2 Rounded indications are those indications which are circular or elliptical with the length equal to or less than 3 times the width.

2.3 Any questionable or doubtful indications shall be retested to verify whether or not they are relevant.

2.4 Localised surface imperfections, such as may occur from machining marks, surface conditions or incomplete bond between base metal and cladding may produce similar indications which are not relevent to the detection of unacceptable discontinuities.

3. ACCEPTANCE STANDARDS:

All surfaces to be examined shall be free from:

a) relevent linear indications.

b) relevent rounded indications greater than 4.8 mm.

c) four or more rounded defects in line separated by 1.6 mm or less (edge to edge) except where the specification for the material establishes different requirements for acceptance so far as defects are concerned.

PROCEDURE FOR LIQUID PENETRANT EXAMINATION

1.0 SCOPE:

1.1 This standard details the procedure for liquid penetrant examination of non-porous ferrous and non-ferrous and non-metallic materials such as ceramics, plastics, glass, etc.

1.2 Typical surface discontinuities detectable by this method are cracks, seams, laps, cold shuts, porosity, laminations, etc.

1.3 This standard conforms substantially with ASTM E 165 ~~-1980 (Reapproved 1985)~~ and ASME code section V, Article 6. (01)

2.0 PERSONNEL REQUIREMENT:

Personnel performig non-destructive examination and evaluation shall be qualified to the recommended practice SNT-TC-1A or any other recognised practice.

3.0 DESCRIPTION:

In principle a liquid penetrant is applied to the surface to be examined and allowed to enter discontinuities, excess penetrant removed, the part dried and a developer applied. The developer functions both as a blotter to absorb penetrant that has been trapped in discontinuities and as a contrasting back ground to enhance the visibility of penetrant indications.

4.0 APPROVED METHODS & MATERIALS:

4.1 Either a colour contrast or fluorescent penetrant method may be used. Any one of the following penetrants shall be used:

(a) Solvent Removable
(b) Post Emulsifying
(c) Water Washable

4.2 For nickel base alloys and/or for stainless steel materials used in nuclear components the penetrant materials, cleaner, penetrant developer, etc., used shall not contain sulphur or halogen above 1% by weight.

4.3 Selection of liquid penetrant material shall be from the same family (brand). Inter-mixing of family of liquid penetrant materials is not allowed.

5.0 PROCEDURE:

5.1 Surface Preparation:

5.1.1 Surface preparation by grinding or machining or other method may be employed where surface irregularities may mask indications of unacceptable discontinuities.

5.1.2 The surface to be examined and all adjacent areas within at least 25 mm shall be dry and free from any dirt, lint, scale, rust, welding flux, weld spatter, grease, oil or other extraneous matter that could obscure surface openings or otherwise interfere with examination.

5.1.3 The surface to be examined shall be cleaned with detergents, organic solvents, descaling solutions or paint removers. Degreasing and ultrasonic cleaning may be employed to increase cleaning efficiency. Cleaning method employed is an important part of the examination procedure. Cleaning solvents shall meet the requirements of Cl.4.2

Caution: Blasting with shot or dull sand, rotofinishing, buffing, wire brusing the soft material or machining with dull tools shall not be used as they may peen the discontinuities at the surface.

5.2 **Drying:**

Drying, after cleaning the surface to be examined, shall be accomplished by normal evaporation or with forced hot air, as appropriate. A minimum period of time shall be established to ensure that the cleaning solution has evaporated prior to application of the penetrant.

5.3 **Application Of Penetrants:**

5.3.1 The penetrant shall be applied by dipping, brushing or spraying. If the penetrant is applied by spraying using compressed air type apparatus, filters shall be placed at the air inlet to preclude contamination of penetrant by oil, water or dirt sediment that may have collected in the lines. Spraying should only be performed in a booth equipped with exhaust system.

5.3.2 The length of penetration time is critical and depends upon the material being inspected, the process through which it has passed and the type of discontinuities expected. The recommended penetration time is given in Table 1.

5.3.3 The temperature of the penetrant and the surface of the part to be examined shall not be below 10°C(50°F) nor above 50°C(125°F) throughout the examination period. Local heating or cooling is permitted provided the temperatures remain in the range of 10 to 50°C during the examination. Where it is not practical to comply with these temperature limitations, other temperatures and times shall be used provided the procedures are qualified as described in Annexure-I.

5.4 **Removal Of Excess Penetrant:**

After the penetration time specified in the procedure has elapsed, any penetrant remaining on the surface shall be removed, taking care to minimise removal of penetrant from discontinuities.

5.4.1 **Postemulsifying Penetrants:**

The emulsifier shall be applied by spraying or dipping. The emulsifying time shall not exceed 5 minutes. After emulsification, the mixture shall be removed by water spray.

5.4.2 **Solvent Removable Penetrants:**

Excess penetrant shall be removed by wiping with a cloth or absorbent paper repeating the operation until most tracesof penetrants have been removed. The remaining traces shall be removed by wiping the surface lightly with cloth or absorbent paper moistened with solvent.

Caution: Care shall be taken to avoid excess solvent as this may remove penetrants from discontinuities. Flushing the surface with solvent following the application of the penetrant and prior to developing is prohibited.

5.4.3 **Water Washable Penetrants:**

Excess water washable penetrant shall be removed with a water spray. The water pressure shall not exceed 0.35 N/mm² (50 Psi) and the water temperature shall not exceed 43.3°C (110°F).

5.5 **Drying:**

Surface shall be dried before the application of developer.

5.5.1 a) If postemulsifying or water washable method is used, the surface shall be dried by blotting with clean materials or by using circulating warm air, provided the temperature of the surface is not raised above 50°C (125°F).

b) For solvent removable method, the surface may be dried by normal evaporation, blotting, wiping or forced air.

5.6 **Application Of Developer:**

The developer shall be applied as soon as possible after the removal of the excess penetrant. Two types of developer, dry or wet,shall be used with fluorescent penetrant. With colour contrast penetrants, only wet developer shall be used.

5.6.1 **Application Of Dry Developer:**

Dry developer shall be applied by a soft brush, a hand operated powder bulb or a powder gun or other means provided the powder is dusted evenly over the entire surface being examined.

5.6.2 **Application Of Wet Developer**

Prior to applying suspension type wet developer to the surface, the developer must be thoroughly agitated to ensure adequate dispersion of suspended particles.

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(a) **Aqueous Developer Application:**

Aqueous developer may be applied to either a wet or dry surface. It shall be applied by dipping, spraying or other means provided a thin coating is obtained over the entire surface being examined. Drying time may be decreased by using warm air, provided the surface temperature of the part is not raised above 50°C.

(b) **Non-aqueous Developer Application:**

Non-aqueous developer shall be applied only on a dry surface. It shall be applied by spraying, except where safety or restricted access preclude it. Under such conditions developer may be applied by brushing. Drying shall be by normal evaporation.

6.0 **EXAMINATION:**

Observe the surface during the application of the developer to detect nature of any indications which tend to bleed out profusely. Final examination shall be done between 7 minutes at the earliest and 30 minutes at the latest after application of the developer. The nature of discontinuities corresponding to the indications shall be defined depending upon the method of setting, appearance, direction, shape and dimensions of the same. If the bleed out does not alter the examination results, longer periods are permitted. If the surface to be examined is large enough to preclude complete examination within the prescribed time the surface shall be examined in increments.

6.1 **Colour Contrast Penetrants (Visible Dye Penetrants):**

6.1.1 With colour contrast penetrants the developer forms a reasonably uniform coating. Surface discontinuities are indicated by bleeding out of the penetrant which is normally of a deep red colour. Indication with a light pink colour may indicate excessive cleaning. Inadequate cleaning may leave an excessive background making interpretation difficult.

6.1.2 Adequate illumination is required to ensure no loss of the sensitivity in the examination. Examination shall be done under natural or suitable light (illumination level shall be in the order of 500 LUX).

6.2 **Fluorescent Penetrants:**

Examination of the surface shall be carried out with a high intensity black light in a darkened area or booth. Black light shall have a wave length of 3650 A°. The bulbs shall be allowed to warm up for not less than 5 minutes prior to use in the examination. The black light intensity shall be at least of 800 uW/cm^2 on the surface of the part being examined and the light source being kept at a distance of at least 375 mm from the surface being examined. The operator should allow his eyes to become accustomed to the darkness of the inspection booth for at least 5 minutes before inspecting the parts. He should avoid looking directly into the black light and also avoid going from the darkness to

the light and back again without allowing sufficient time for his eyes to adjust to the darkness. The intensity shall be measured at least once every 8 hours and whenever the work station is changed.

7.0 **EVALUATION OF INDICATIONS & INTERPRETATION:**

7.1 As the developer dries to a smooth, even white coating, indications will appear at the locations of discontinuities. Depth of surface discontinuities may be correlated with the richness of colour and speed of bleeding out. However, localised surface imperfections such as may occur from machining marks or surface conditions may produce similar indications which are non-relevant.

7.2 Usually, a crack or similar opening will show a line and light cracks or partially welded lap will show a broken line. Gross porosity may produce large indications covering an entire area. Very fine porosity is indicated by random dots.

7.3 Any non-relevant indication shall be regarded as a defect until the indication is either eliminated by surface conditioning or it is Proved non-relevant by other NDT methods.

7.4 Linear indications are those indications in which the length is more than three times the width. Rounded indications are indications which are circular or elliptical with the length less than three times the width.

7.5 All indications shall be evaluated in terms of the acceptance standards of the referencing documents.

8.0 **ACCEPTANCE STANDARDS:**

8.1 For castings - Refer Corporate Standard AA 085 01 32.

8.2 For Austenitic Forgings - Refer Corporate Standard AA 085 01 30.

8.3 For Welds - Refer Corporate Standard AA 085 01 29.

9.0 **POST EXAMINATION CLEANING:**

Surfaces examined shall be cleaned after evaluation of the test with dry cotton rag with or without water rinse.

TABLE - 1 (Clause 5.3.2)

Suggested Penetration Time For Post-emulsified And Solvent Removable Penetrants

Material	Form	Type of discontinuity	*Penetration time (min.)
Aluminium	Castings	Porosity	5
		Cold shut	5
	Extrusions & Forgings	Laps	10
		Lack of fusion	5
	Welds	Porosity	5
	All forms	Cracks	10

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TABLE - 1 (Clause 5.3.2) Contd.

Material	Form	Type of discontinuity	*Penetration time (min.)
Magnesium	Castings	Porosity	5
		Cold shut	5
	Extrusions & Forgings	Laps	10
		Lack of fusion	10
	Welds	Porosity	10
	All forms	Cracks	10
Steel	Castings	Porosity	10
		Cold shut	10
	Extrusions & Forgings	Laps	10
		Lack of fusion	20
	Welds	Porosity	20
	All forms	Cracks	20
Brass & Bronze	Castings	Porosity	5
		Cold shut	5
	Extrusions & Forgings	Laps	10
		Lack of fusion	10
	Brazed parts	Porosity	10
	All forms	Cracks	10
Plastics	All forms	Cracks	5
Glass	All forms	Cracks	5
Carbide tipped tools	All forms	Lack of fusion	5
		Porosity	5
		Crack	20
Titanium & high temperature alloys	All forms		20 to 30
Ceramic	All forms	Cracks	5
		Porosity	5

* For lower temperatures, penetration time should be increased.

ANNEXURE - 1 (Clause 5.3.3)

PROCEDURE FOR NON-STANDARD TEMPERATURES

A.1 **General:**

When it is not practical to conduct a liquid penetrant examination within the temperature range of 15.6 to 51.6°C (60 to 125°F), the examination procedure at the proposed lower or higher temperature range requires qualification. This shall require the use of a quench cracked aluminium block, which is designated as 'Liquid Penetrant Comparator Block'.

A.2 **Liquid Penetrant Comparator Block:**

The liquid penetrant comparator block shall be made of aluminum, ASTM B209, Type 2024 or SB-211. Type 2024, 10 mm (3/8 in.) thick, and shall have approximate face dimensions of 50 mm x 75 mm (2 in. x 3 in.). At the centre of each face, an area approximately 25 mm in diameter shall be marked with a 510°C (950°F) temperature indicating crayon or paint. The marked area shall be heated with a blow torch, a Bunsen burner or similar device to a temperature between 510°C (950°F) and 524°C (975°F). The specimen shall then be immediately quenched in cold water which produces a network of the fine cracks on each face. The block shall then be dried by heating to approximately 149°C (300°F). After cooling, the block shall be cut into two halves. One half of the specimen shall be designated block 'A' and the other block 'B' for identification in subsequent processing. Figure 1 illustrates the comparator blocks "A" and "B". As an alternate to cutting the block in half to make blocks "A" and "B", separate blocks 50 mm x 75 mm (2 in. x 3 in.) can be made using the heating and quenching technique as described above. Two comparator blocks with closely matched crack patterns may be used. The blocks shall be marked "A" and "B".

A.3 **Comparator Application:**

(a) If it is desired to qualify a liquid penetrant examination procedure at a temperature of less than 15.6°C (60°F) the proposed procedure shall be applied to block "B" after the block and all materials have been cooled and held at the proposed examination temperature until the comparison is completed. A standard procedure which has previously been demonstrated as suitable for use shall be applied to block "A" in the 15.6 to 51.6°C (60 to 125°F) temperature range. The indications of cracks shall be compared between blocks "A" and "B". If the indications obtained under the proposed condition on block "B" are essentially the same as obtained on block "A" during examination at 15.6 to 51.6°C (60 to 125°F), the proposed procedure shall be considered qualified for use.

(b) If the proposed temperature for the examination is above 51.6°C (125°F), block "B" shall be held at this temperature throughout the examination. The indication of cracks shall be compared as described in T-647.3(a) while block "B" is at the proposed temperature and block "A" is at the 15.6 to 51.6°C (60 to 125°F) temperature range.

(c) A procedure qualified at a temperature lower than 15.6°C (60°F) shall be qualified from that temperature to 15.6°C (60°F).

(d) To qualify a Procedure for temperatures above 51.6°C (125°F), the upper and lower temperature limits shall be established and the procedure qualified at these temperatures.

(e) As an alternate to the requirements of (a) and (b) when using color contrast penetrants, it is permissible to use a single comparator block for the standard and non-standard temperatures and to make the comparison by photography.

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(f) When the single comparator block and photographic technique is used, the processing details (as applicable) described in (a) and (b) above shall apply. The block shall be thoroughly cleaned between the two processing steps. Photographs shall be taken after processing at the nonstandard temperature and then after processing at the standard temperature. The indication of cracks shall be compared between the two photographs. The same criteria for qualification as (a) above shall apply.

(g) Identical photographic techniques shall be used to make the comparison photographs.

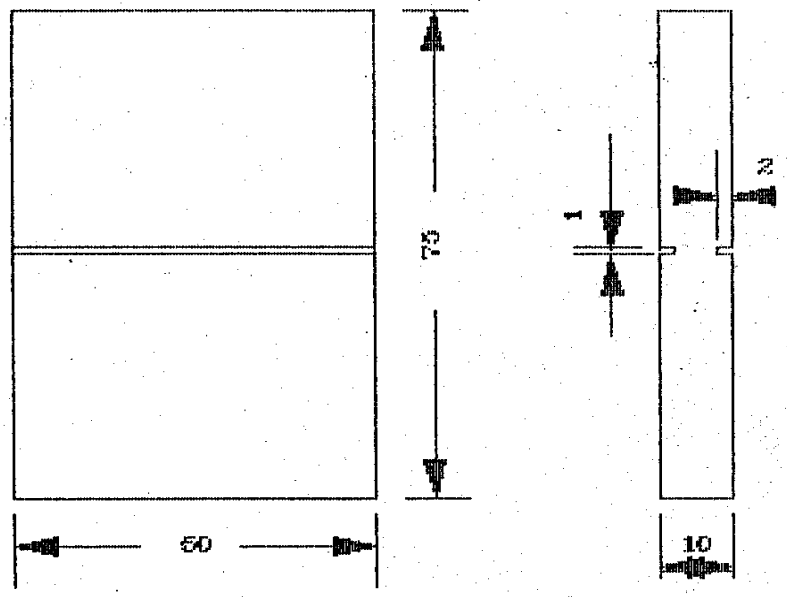

FIGURE: 1-LIQUID PENETRANT COMPARATOR BLOCK

STRUCTURAL STEEL - WELDABLE QUALITY
(PLATES, SECTIONS, STRIPS, FLATS AND BARS)

ORDERING DESCRIPTION

1.0 GENERAL:

The material shall conform to IS 2062 – 2011, E250-Gr.BR (with mandatory Impact Test) or DIN EN 10025-2:2005, Gr. S275JR and comply with following additional requirements.

2.0 APPLICATION:

For general engineering purposes, suitable for welding.

3.0 CONDITION OF DELIVERY:

3.1 Bars & Sections shall be supplied in Hot rolled in straight lengths without twists and bends.

3.2 The material shall be supplied as per IS: 2062 – 2011, E250 Gr.BR (with mandatory Impact Test) or as per DIN EN 10025-2:2005 Gr. 275JR.

3.3 Any other additional requirement as per BHEL Purchase order.

4.0 DIMENSIONS AND TOLERANCES:

4.1 Sizes:

Material shall be supplied to the dimensions specified in BHEL Order.

4.2 Tolerances:

The tolerances on hot rolled material shall comply with IS: 1852 or any other equivalent national standard.

4.3 Straightness for hot rolled bars:

Unless otherwise specified, the permissible deviation in straightness shall not exceed 5 mm in any 1000 mm length.

5.0 TEST SAMPLES:

The selection of test pieces for all tests like Chemical, Mechanical etc. shall be as per IS: 2062, E250-Gr.BR or DIN EN 10025-2, Gr. S275JR.

Revisions:	APPROVED:
Clause No. 1, 3, 5 & 8 revised (as per MOM of 38th MRC meeting), Clause 10 added	INTERPLANT MATERIAL RATIONALISATION COMMITTEE – MRC(S&GPS)

Rev No.15	Amd No.	Reaffirmed	Prepared	Issued	Dt. of 1st Issue
Dt:11-03-2014	Dt:	Year:	HPEP, Hyderabad	Corp.R&D	June, 1976

CORPORATE PURCHASING SPECIFICATION

6.0 ULTRASONIC EXAMINATION:

Plates shall be ultrasonically examined in accordance with BHEL standard AA0850120 (or ASTM-A435) as detailed below and shall comply with the acceptance standards specified therein.

6.1 For plates above 40 mm thick:

Shall be ultrasonically examined unless when otherwise specified in order.

7.0 TEST CERTIFICATES:

Unless otherwise specified, three copies of test certificates shall be supplied.

In addition, the supplier shall ensure to enclose one copy of the test certificate along with their dispatch documents to facilitate quick clearance of the material.

The test certificate shall bear the following information:

AA10119 - Rev.No.15/ IS: 2062-Gr: BR (with mandatory Impact test) or DIN EN 10025-2, Gr. S275JR,

BHEL order No.

Melt No, Size & Quantity, Batch No with heat treatment details, Results of Chemical analysis,

Mechanical tests & NDT, Supplier's name, Identification No, TC No, Signature of Competent Authority, etc.

8.0 PACKING AND MARKING:

Plates shall be transported suitably to avoid damage during transit.

Each plate shall be marked with Melt No. Material grade and specification, BHEL Order No, Supplier's Name Identification No, Size & weight, on any one corner and encircled with paint preferably of white colour.

9.0 REJECTION AND REPLACEMENT

If the material does not comply with the requirements of this specification during receipt inspection at BHEL or if any defect is found during further processing of material, BHEL reserves the right to reject the whole consignment and the supplier shall replace the material free of cost. The rejected material shall be taken back by the supplier after fulfilling the commercial terms and conditions.

10.0 REFERRED STANDARDS (Latest publications including amendments):

1) IS: 1852 2) ASTM - A435 3) AA0850120

26/6/14

CS-721

STEEL TUBES – ELECTRIC RESISTANCE WELDED / SUBMERGED ARC WELDED

1.0 GENERAL:

This specification governs the quality requirements of light, medium and heavy grades of Electric Resistance Welded/Submerged Arc Welded steel tubes with plain ends in ungalvanized and galvanized condition in the range of 60mm to 150mm NB.

2.0 APPLICATION:

For general purpose, suitable for bending, welding and screwing for flanges and fittings. Not suitable for steam services.

3.0 CONDITION OF DELIVERY:

Tubes shall be supplied with plain ends.

The ends shall be cut cleanly and square with the axis of the tube.

Unless otherwise specified, tubes shall be supplied in ungalvanized condition.

4.0 COMPLIANCE WITH NATIONAL STANDARDS:

The material shall comply with the requirements of the following National standard and also meet the requirements of this specification.

IS: 1239(part 1) – 2004: Steel Tubes, Tubular and other Wrought Steel Fittings
Gr: ERW.

5.0 DIMENSIONS AND TOLERANCES:

5.1 Sizes:

BHEL order shall clearly state the maximum outside diameter, and wall thickness of the tube.

5.2 Tolerances:

5.2.1 Thickness:

Light tubes	+ not limited − 8 percent
Medium and Heavy tubes	+ not limited − 10 percent

5.2.2 Weight:

Single tube (light series)	+ 10 percent − 8 percent
Single tube (medium and heavy series)	± 10 percent
For quantities per load of 10 tonnes, min (light series)	+ 7.5 percent − 5 percent
For quantities per load of 10 tonnes, min (medium and heavy series)	± 7.5 percent

5.2.3 Internal Weld Fin:

Height of the internal weld fin shall not be greater than 60 percent of the specified thickness.

5.2.4 Length:

5.2.4.1 Random Length:

Tubes shall be supplied in random lengths of 4 to 7 meters, unless otherwise specified and in the line with IS: 1239, Part 1.

5.2.4.2 Exact Length:

When exact lengths are called for, the tolerances shall be + 6 mm, − 0 mm of the specified length.

6.0 MANUFACTURE:

Tubes shall be made from tested quality steel manufactured by any approved process and shall be fully killed.

Tubes shall not be manually welded.

7.0 FREEDOM FOR DEFECTS:

Tubes shall be cleanly finished and reasonably free from injurious defects. They shall be reasonably straight. The ends shall be cut cleanly and reasonably square with the axis of the tube.

8.0 CHEMICAL COMPOSITION:

The melt analysis of steel shall be as follows:

Element	Percent max.	Permissible variation over specified limit, ± max
Carbon	0.20	0.02
Manganese	1.30	0.04
Sulphur	0.040	0.005
Phosphorus	0.040	0.005

9.0 GALVANIZING:

When galvanized tubes are ordered, the Zinc coating on the tubes shall be in accordance with IS: 4736

10.0 TEST SAMPLES:

All tubes bearing the same designation and manufactured under a single process shall be grouped together to constitute a lot. Each lot shall be sampled separately in accordance with IS: 4711

11.0 MECHANICAL PROPERTIES:

11.1 Tensile:

The tensile strength of strips cut form selected tubes, when tested in accordance with IS: 1608 shall be as follows:

Tensile strength : 320 N/mm^2, min.

Elongations on $5.65\sqrt{S_o}$ gauge length:

Up to and including. 25 mm NB : 12 percent, min.
Over 25 mm up to including150 mm NB : 20 percent, min.

Note:

1. For welded tubes, the strip tensile test specimen shall not contain the weld.
2. For galvanized tubes, zinc coating may be removed by stripping prior to tensile test.

11.2 Bend Test (On tubes up to and including 50mm nominal bore):

When tested in accordance with IS: 2329, the tubes shall be capable of withstanding the bend test without showing any signs of fracture or failure.

Tubes shall be bent with the weld at 90^o to the plane of bending. The tubes shall not be filled for this test.

Ungalvanised tubes shall be capable of being bent cold without cracking, through 180^o around a former having a radius at the bottom of groove in the plane of bending equal to at least six times the outside diameter of the tube.

Galvanized tubes shall be capable of being bent cold without cracking of the steel, through 90^o round a former having a radius at the bottom of the groove equal to at least eight times the outside diameter of the tube.

11.3 Flattening Test (On tubes above 50mm nominal bore):

Rings not less than 40mm in length, cut form the end of each selected tubes shall be flattened between parallel plates with the weld at 90^o(point of maximum bending) in accordance with IS:2328. No opening shall occur by fracture in the weld until the distance between the plates is less than 75 percent of the original outside diameter of the tube and no cracks or breaks on the metal elsewhere than in the weld shall occur until the distance between the plates is less than 60 percent of the original outside diameter.

Test rings may have the inner and outer edges rounded.

11.4 Hydraulic Test / Eddy Current Test:

Each tube shall withstand a test pressure of 5 N/mm^2 without showing leakage defects of any kind. The pressure shall be applied and maintained for a minimum period of 3 seconds for proof and inspection.

Note: Eddy current test may be done in place of Hydrostatic test as per the procedure in Annexure – B of IS: 1239, Part-1.

CORPORATE PURCHASING SPECIFICATION

12.0 TEST CERTIFICATES:

Three copies of test certificates shall be supplied, unless otherwise stated on the order.

In addition, to the above, the supplier shall ensure to enclose one copy of the test certificate along with their dispatch documents to facilitate quick clearance of the material.

The test certificate shall bear the following information:

AA10152: Rev. No.07: Steel Tubes – ERW/SAW
BHEL order No:

Supplier's Reference:
Name
Identification No.
Melt No.

Results of Tests:
Results of Chemical, Mechanical tests and Hydraulic/Eddy Current test.

13.0 PROTECTIVE COATING:

The tubes shall be protected with a rust preventive coating of varnish, externally throughout the length.

14.0 PACKING AND MARKING:

Each tube shall be plugged at both ends by means of tight fitting end caps.

The tubes shall be suitably packed in bundles/packages to prevent corrosion and damage during transit.

Each bundle/package shall bear the following information:

AA10152: Steel Tubes – ERW/SAW
BHEL Order No.
Consignment/Identification No.
Outside Diameter and Wall Thickness.
Supplier's Name

15.0 REFERRED STANDARDS (Latest Publications Including Amendments):

1) IS: 1608 2) IS: 2328 3) IS: 2329

4) IS: 4736 5) IS: 4711

STAINLESS STEEL SHEETS AND PLATES - ANNEALED ASTM A 240M, TYPE 410 Î

ORDERING DESCRIPTION

1.0 GENERAL :

The sheets and plates shall conform to the latest version of ASTM A 240M, Î Type: 410 and comply with the following additional requirements.

2.0 APPLICATION:

For general engineering purposes, where corrosion resistance is essential.

3.0 CONDITION OF DELIVERY:

Hot Rolled, annealed and descaled (Finish No.1).

Cold rolled, annealed (2B / 2 D).

4.0 DIMENSIONS AND TOLERANCES:

Material shall be supplied to the dimensions specified in BHEL order.

5.0 CHEMICAL COMPOSITION:

As per ASTM A 240M, Type 410. Î

6.0 TEST CERTIFICATES :

Three copies of test certificates shall be supplied along with the following information:

BHEL References :

AA 107 38 -Rev. No.07 / ASTM A 240M, Type:410 Î
BHEL order No,

Supplier's References :
Name
Identification No.
Melt No.
Process of manufacture
Details of heat treatment.

Result of Tests:
Dimensional inspection.
Results of chemical analysis, mechanical tests

7.0 PACKING AND MARKING :

Sheets shall be supplied in bundles or in packages each weighing upto a maximum of 3000kg. Plates shall be suitably packed to prevent damage during transit.

For plates below 25 mm thick, each pile (preferably of 16 plates) shall be marked with suppliers identification mark, 'AA 107 38 / ASTM A 240M, Type:410, melt No., BHEL Î order No., on the top plate.

Each plate of 25mm thickness and above shall be stamped/painted with the suppliers identification mark, 'AA 107 38 / ASTM A 240M, Type:410 , melt No., BHEL order Î No., on the top plate.

FOR INFORMATION ONLY

CHEMICAL COMPOSITION

C	Si	Mn	Ni	Cr	S	P	Al
0.08-0.15	≤ 1.0	≤ 1.0	≤ 0.75	11.5-13.5	≤ 0.030	≤ 0.040	-

MECHANICAL PROPERTIES

Hardness, max		0.2% PS min	UTS, min	% El min	Cold Bend. Î
BHN	HRB	N/mm²	N/mm²		
217	96	205	450	20	180^0

RUST PREVENTIVE HARD FILM, BLACK (TRP)

1.0 GENERAL:

This specification governs the quality requirements of temporary rust preventive (TRP), coating a hard film on drying. The material consists of film forming ingredients dissolved in solvents to give a low viscous liquid at room temperature. On evaluation of solvents, a thin though abrasion resistant film capable of being handled without damage shall be obtained. Normally this material gives protection upto six months and thereafter requires inspection and reapplication, if necessary.

2.0 APPLICATION:

Depending upon components and their sizes, the rust preventive can be applied by brush, dip or spray. Two liberal coats are desirable for adequate protection. The surface to be coated with anti rust solution should be absolutely clean and free from rust.

3.0 REMOVAL:

This TRP can be removed by cotton cloth soaked in white spirit to BHEL specification AA 56701.

4.0 COLOUR : Steel Black.

5.0 COMPLIANCE WITH NATIONAL STANDARDS:

The material shall comply with the requirements of the following national standards and also meet the requirements of this specification.

IS: 1153 - 2000:RA-2005 Temporary Corrosion Preventive, Fluid, Hard Film, Solvent deposited,

6.0 COMPOSITION:

The composition shall be based on asphalt, mineral oil and inhibitive pigments with suitable additives.

7.0 TEST SAMPLES:

Half a litre of sample shall be taken for testing and approval.

8.0 PROPERTIES:

When tested in accordance with the relevant clauses of BHEL standard AA 085 00 01, the test sample shall show the following properties:

8.1 Consistency : 90 ± 10 seconds in Ford Cup No.4 at 27± 0.5^{0}C.

8.2 Drying Time : Tack free: Within one hour
Hard dry : 16 hours

8.3 Flash Point : 32^{0}C, min.

8.4 Weight : 11 ± 0.5 kg per 10 litres.

8.5 Non-volatile Matter : 58 ± 2% by mass.

8.6 Test for Adhesion : To pass the test

8.7 Spreading Capacity : 8.0 sq.meter/litre, minimum

8.8 Protection against corrosion at high temperature and humidity:

To pass the test for 360 hours, minimum..

9.0 TYPE TESTS:

Whenever specified, the following tests shall be carried out, as per the methods mentioned against each:

i) **Protection against corrosion under conditions of condensation (IS:101, part 6/sec.1):**

No sign of corrosion on the surface after 21 days of exposure.

10.0 TEST CERTIFICATES:

Three copies of test certificates shall be supplied alongwith each consignment, giving the following information:

In addition, the supplier shall ensure to enclose one copy of the test certificate alongwith the despatch documents to facilitate quick clearance of the material.

AA 551 54, Rev. 03 : Rust preventive hard film, black (TRP)
BHEL Order No.
Batch / Lot No.
Supplier's/ Manufacturer's Name and Trade mark, if any
Date of manufacture and expiry
Test results of clause 8.0 & 9.0.

11.0 KEEPING PROPERTY:

When stored in a covered dry place in the original sealed containers under normal temperature conditions, the material shall retain the properties prescribed in this specification for a period of not less than 12 months after the date of manufacture which shall be subsequent to the date of placing the order.

12.0 PACKING & MARKING:

Unless otherwise specified, the material shall be supplied in 4 kg steel containers, which shall be leak free, dry and clean.

Each container shall marked with the following information:

AA 551 54: Rust preventive hard film, black (TRP)
BHEL Order No.
Supplier's / Manufacturer's Name and Trade mark, if any
Batch No./Lot No.
Date of manufacture and expiry
Quantity supplied

8.0 ENVIRONMENTAL REQUIREMENTS:

The supplier shall furnish Material Safety Data Sheet **(MSDS)** covering all information relating to human safety and environmental impacts of the hazardous materials particularly during their transportation, storage, handling and disposal alongwith each supply.

Each container shall be marked with corresponding symbol and minimum worded cautionary notice for flammable / corrosive / toxic / harmful / irritant and oxidizing etc. as applicable

13.0 REFERRED STANDARDS (Latest Publications Including Amendments):

1. AA 085 00 01 2. AA 56701 3. IS: 1153

BHEL HERP VARANASI
QUALITY PLAN

Centre Feed Pipes (Pipe Material AA10738)

SL.NO.	COMPONENT	CHARACTERISTIC CHECKED	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENTS & ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
							P	W	V	
1.0	Raw Material : Plates	i.Chemical & Mechanical properties	Chemical analysis and Mechanical test	1 sample per heat batch	AA10119	TC	3	-	2	Manufacturer's TC is also acceptable for chemical and mechanical properties
		ii.Chemical & Mechanical properties	Chemical analysis and Mechanical test	1 sample per heat batch	AA 10738	TC	3	-	2	Plates AA10738 should be procured from BHEL approved sources only (Specified in Purchase Order)
2.0	Fabrication	ii. Fit up exam and welding	Measurement	100%	Drawing	Dim.report	3	-	2	Tolerance to be maintained as per drg. All welding shall be done by qualified welders only. BHEL WPS nos. WE-079, and WE-148 should be followed for SMAW as per requirement of drawings. Compatible welding electrodes (as mentioned in above WPS) should be used. Job should be preheated to temperature mentioned in WPS no. WE-079. If MIG/MAG welding process is used, prior WPS approval is to be taken from BHEL.
		iii.Post Weld Heat Treatment	Review of HT Chart	100%	As per applicable WPS WE-079		3	-	2	As per WPS WE-079 Following Heat treatment cycle should be followed : 1) Free Heating upto 400°C 2) Rate of Heating 100°C/Hr upto 680°C to 710°C 3) Soaking time 1 hour. 4) Rate of cooling 100°C/Hr upto 400°C 5) Free Cooling in ambient air below 400°C
		iv. D.P.Testing of welded joints	D.P.test	100%	AA0850131 & AA0850129	TC	3	2	-	100% D.P.test shall be witnessed by BHEL AIA
3.0	Final Inspection after Fabrication, Stress relieving and NDT.	i.Dimensions	Measurement	100%	Drawing.	Dimension Report	3	2	-	Unspecified tolerances shall be maintained as follows : a) As per medium tolerance class of Specn. AA0230208 for machined dimensions. b) As per Tolerance class B of specn. AA0621104 for fabricated dimensions.
		ii. Painting & preservation		100%		Insp.Report	3	2	-	All Machined surfaces of material other than SS (AA 10738) shall be protected by applying TRP black paint (specn. AA55154). All threaded holes to be protected by applying grease
		iii.Identification & Marking	Punching of Drg. No., P.O.No., Vendor code no., year, Inspector Seal	100%	Drawing	Inspection Report	3/2	2	-	
			APPROVED BY		MANAGER P&D					
			SIGNATURE & DATE							

QP. NO.	RV/FAB /31
DATE	09/08/2011
PG. NO.	1 OF 1

P = PERFORM.C. = TEST CERTIFICATE
W = WITNESS H.T. = HEAT TREATMENT
V = VERIFY
3 = VENDOR
2 = BHEL AUTHORISED INSPECTION AGENCY (AIA)

विरेन्द्र कुमार/VIRENDRA KU...
प्रबंधक (यो०वि०) / Manager (P...)
भारत हेवी इलेक्ट्रिकल्स लिमिटेड
Bharat Heavy Electricals Ltd.
हर्प, वाराणसी
HERP, Varanasi

635

POSITIONS (QW-405)

Position [s] Groove 1G

Welding Progression : Up ... Down ... ...

Position [s] Fillet ...

[POSTWELD HEAT TREATMENT QW-407

Temperature Range 600-620°C

Time Range One hour

GAS [QW-408]

Percent Composition

Gas [es] [Mixture] Flow Rate

Shielding -

Trailing -

Backing -

PREHEAT [QW-406]

Preheat Temp Min 150°C (For 1st layer only)

Interpass Temp. Max 200°C

Preheat Maintenance -

ELECTRICAL CHARACTERISTICS [QW-409]

Current AC or DC DC Polarity +Ve

Amps [Range] 140-180 Volts Range 22-26

Tungsten Electrode size and type -

Mode of Metal Transfer for GMAW -

Electrode wire feed speed range -

TECHNIQUE [QW-410]

String or Weave Bead String only Orifice or Gas Cup Size -

Initial and Interpass Cleaning By Chipping, Brushing, Grinding

Method of Back Gouging - oscillation -

Contact Tube to Work Distance - Multiple or Single Pass Multi

Multiple or single Electrodes Single Travel Speed [Range] -

Peening No Electrode Spacing -

Other Clean the weld area prior to welding to remove Oil, Rust, Grease etc.

Weld Layer [s]	Process	Filler Metal Class	Filler Metal Dia. mm	Current Type Polar	Current Amp. Range	Volt Range	Travel Speed Range mm/min	Other
1st layer	SMAW	E309Mo-15	5.0	DC+	160-180	22-26	-	String only
subsequent layers	"	E308-L-15	"	"	"	"	-	--do--

CONTROLLED COPY

Prepared by [signature] 14/12/87

MANAGER
WELDING ENGG.

BHARAT HEAVY ELECTRICALS LIMITED

RAMACHANDRAPURAM, HYDERABAD-500 032.

PD - 268

QW-482 WELDING PROCEDURE SPECIFICATION (WPS)

Welding Procedure Specification No. WE055 Date 8.10.82 Supporting PQR No 193

Revision No. 1 Date 01.03.1989

Welding Process (es) SMAW Type (s) Manual

Details

JOINTS (QW 402)

Joint Design S.S.Overlay on P1,

Backing (Yes) - (No) -

Backing Material (Type) -

Metal - non fusing metal -

BASE METALS (QW-403) A8 overlay

P. No. 1 Group No. 1 & 2 to P. No. - Group No. -

OR

Specification type and grade

to Specification type and grade

OR

Chem. Analysis and Mech Prop

to Chem Analysis and Mech Prop

Thickness Range : 25mm & above

Base Metal Groove Fillet -

Pipe Dial Range : Groove - Fillet -

Other -

FILLER METAL (QW-404) 1st layer by E 309 Mo-15

F. No. 5 Other Subsequent layers by E 308L-15

A. No 8 Other (1)

Spec. No. (SFA) 5.4

DEPOSITED WELD METAL

AWS No. (Class) E309Mo-15&E308L-15 Thickness Range : 6mm and above (Overlay)
3mm Max by E 309Mo-15

Size of filler metals ∅ 5.0mm Groove Rest by E308L-15

Electrode-Flux. (Class) Basic Fillet

Flux Trade Name - Max. bead thickness : 5mm

Consumable insert No; Retainer: No.

(1) Rev., Format details added

AUTHORISED SIGN

BHARAT HEAVY ELECTRICALS LIMITED

RAMACHANDRAPURAM, HYDERABAD-500 032.

PD - 268

QW-482 WELDING PROCEDURE SPECIFICATION (WPS)

Welding Procedure Specification No WE.079. Date 31.10.90 Supporting PQR No. 322

Revision No 1 Date 10.03.95

Welding Process (es) SMAW Type (s) Manual

JOINTS (QW 402) Details

Joint Design As per Drawing

Backing (Yes) For double side welds (No) For single side welds

Backing Material (Type) Base metal/Weld metal

Metal Yes Non fusing metal --

Retainer : No

BASE METALS (QW-403)

P. No. - Group No. - to P. No. - Group No. -

OR

Specification type and grade X 12 Cr 13

to Specification type and grade X 12 Cr 13

OR

Chem. Analysis and Mech. Prop. --

to Chem. Analysis and Mech. Prop. --

Thickness Range :

Base Metal : ——— Groove 4.75 to 200mm Fillet All

Pipe Dia. Range : Groove All dia Fillet All

Other Root spacing for backing strip jts : 8-10mm
For others : 2 ± 1mm

FILLER METALS (QW-404)

Spec. No. (SFA)	5.4
AWS No. (Class)	E 410 - 16/15
F. No.	4
A. No	6
Size of Filler Metals	Ø 2.5 to 5.0mm
Deposited Weld Metal	Max head thickness : 5mm
Thickness Range : Groove	200mm Max
Fillet	All
Electrode Flux (Class)	Rutile
Flux Trade Name	--NA-
Consumable Insert	No

POSITIONS (QW-405)

Position [s] Groove All

Welding Progression : Up For V Down —

Position [s] Fillet All

[POSTWELD HEAT TREATMENT QW-407]

Temperature Range 680 - 710

Time Range 1 Hr/25mm upto 50mm. For every Additional 25mm : 15 Minutes

PREHEAT [QW 406]

Preheat Temp Min 280°C

Interpass Temp. Max 350°C

Preheat Maintenance By Oxy Accetalyne or Producer Gas

GAS [QW-408] NA

Percent Composition

Gas [es] [Mixture] Flow Rate

Shielding

Trailing

Backing

ELECTRICAL CHARACTERISTICS [QW-409]

Current AC or DC DC Polarity +Ve (DCEP)

Amps [Range] 60-180 Volts Range 22-26

Tungsten Electrode size and type NA

Mode of Metal Transfer for GMAW NA

Electrode wire feed speed range NA

TECHNIQUE [QW-410]

String or Weave Bead String Orifice or Gas Cup Size NA

Initial and Interpass Cleaning Chipping, Brushing, Grinding

Method of Back Gouging By Grinding oscillation No

Contact Tube to Work Distance NA Multiple or Single Pass Multi

Multiple or sinlge Electrodes Single Travel Speed [Range] --NA-

Peening Not allowe Electrode Spacing NA

Other Clean edges to be welded to remove, Grease, Rust etc. Prior to welding.

Weld Layer [s]	Process	Filler Metal Class	Filler Metal Dia. mm	Current Type Polar	Current Amp. Range	Volt Range	Travel Speed Range mm/min	Other
	SMAW	E410-16	2.5	DC+	60-80	--	--	String
	SMAW	E410-16	3.15	DC+	90-110	--	--	"
	SMAW	E410-16	4.0	DC+	110-140	--	--	"
	SMAW	E410-16	5.0	DC+	140-180	--	--	"

PREPARED BY

SR MANAGER
WELDING ENGG.

BHARAT HEAVY ELECTRICALS LIMITED

Ramachandrapuram, Hyderabad – 500 032.

QW – 482 WELDING PROCEDURE SPECIFICATION (WPS)

Welding Procedure Specification No.: *WE 148* **Date:** *05/01/2004* **Supporting PQR No.: 466**

Revision No.: 0 **Date: --**

Welding Process (es) : SMAW **Type (s) :** *Manual*

JOINTS (QW 402) **Details**

Joint Design : As per manufacturing drawing

Backing (Yes) : BASE MATERIAL

Backing Material (Type) : *Base Metal/weld metal*
Metal : *Yes*
Retainer : *No*

Non-Fusing Metal : *No*

BASE METALS (QW – 403)

P. No. : 6 **Group No. :** *1* **TO** **P. No.: 1** **Group No.1&2**

OR

Specification type & grade : ---
to Specification type & grade : ---

OR

Chemical Analysis & Mechanical Properties : ----
to Chemical Analysis & Mechanical Properties : -----

Thickness Range :
Base Metal : **Groove: 4.75 to 24 mm** **Fillet :** *All sizes*

Pipe Dia. Range : Groove: all dia **Fillet :** *All sizes*

Other : --

Filler Metals (QW – 404)	
Spec. No. (SFA)	*5.4*
AWS No. (Class)	*E309-15*
F. No.	*5*
A. No.	-
Size of Filler Metals	*2.5 – 5.0 mm*
Deposited Weld Metal	-
Thickness Range: Groove	*24 mm*
Fillet	*All*
Electrode Flux (Class)	*Basic*
Flux Trade Name	*NA*
Consumable Insert	*No*
Max. Bead Thickness	5.0 mm max

GENERAL TOLERANCES – TOLERANCES FOR LINEAR AND ANGULAR DIMENSIONS WITHOUT INDIVIDUAL TOLERANCE INDICATIONS

0.0 GENERAL:

When selecting the tolerance class, the respective customary workshop accuracy has to be taken into consideration. If smaller tolerances are required or larger tolerances are permissible and more economical for any individual feature, such tolerances should be indicated to the relevant nominal dimension(s).

General tolerances for linear and angular dimensions apply when drawings or associated specifications refer to this standard in accordance with clauses 3 and 4. If there are general tolerances for other processes, as specified in other International standards, reference shall be made to them on the drawings or associated specifications. For a dimension between an unfinished and a finished surface, e.g. of cast or forged parts, for which no individual tolerance is directly indicated, the larger of the two general tolerances in question applies, e.g. for castings, see ISO 8062, Castings - System of Dimensional Tolerances.

1.0 SCOPE:

The standard is intended to simplify drawing indications and it specifies general tolerances for linear and angular dimensions without individual tolerance indications in four tolerance classes.

It applies to the dimensions of parts that are produced by metal removal or parts that are formed from sheet metal.

NOTE: 1. The concepts behind the general tolerancing of linear and angular dimensions are described in Annex - A.

2. These tolerances may be suitable for use with materials other than metals.

This standard only applies for the following dimensions which do not have an individual tolerance indication:

a) Linear dimensions (e.g. external sizes, internal sizes, step sizes, diameters, radii, distances, external radii and chamfer heights for broken edges).

b) Angular dimensions, including angular dimensions usually not indicated, e.g. right angles (90°), unless reference to IS:2102(Pt.2) is made, or angles of uniform polygons.

c) Linear and angular dimensions produced by machining assembled parts.

It does not apply for the following dimensions:

a) Linear and angular dimensions which are covered by reference to other standards on general tolerances.

b) Auxiliary dimensions indicated in brackets.

c) Theoretically exact dimensions indicated in rectangular frames.

2.0 COMPLIANCE WITH STANDARDS:

This standard is based on IS:2102 (Pt.1)-1993 {ISO:2768-1}.

3.0 GENERAL TOLERANCES:

3.1 Linear dimensions are given in Table 1 and 2.

3.2 Angular dimensions: General tolerance specified in angular units control only the general orientation of lines or line elements of surfaces, but not their form deviations.

The general orientation of the line derived from the actual surface is the orientation of the contracting line of ideal geometrical form. The maximum distance between the contacting line and the actual line shall be the least possible value (see IS:12160).

The permissible deviations of angular dimensions are given in Table - 3.

Revision: This standard was based on 1969 version of IS:2102			Approved: INTERPLANT STANDARDIZATION COMMITTEE-WG (DOP + BES)		
Rev.No. 01	Amd.No.	Reaffirmed	Prepared BHOPAL	Issued CORP. R&D	Dt. of 1st issue 22-06-1978
Dt. 1-12-1995	Dt.	Year: 2008			

CORPORATE STANDARD

BHEL

4.0 INDICATIONS ON DRAWINGS:

If general tolerances in accordance with this standard shall apply, the following information shall be indicated.

Example: AA 023 02 08 m

5.0 REJECTION:

Unless otherwise stated, work pieces exceeding the general tolerance shall not lead to automatic rejection provided that the ability of the work piece to function is not impaired (see clause A4).

6.0 NOTE:

6.1 For "Permissible deviations for untoleranced dimensions of castings" refer AA 023 04 02.
6.2 For "Tolerances and machining allowances for flame cutting" refer AA 062 11 01.
6.3 For "General tolerances for welding construction for length and angles" refer AA 062 11 04.
6.4 For "General tolerances for welded structures form and position" refer AA 062 11 05.

Table 1 — Permissible deviations for linear dimensions except for broken edges (external radii and chamfer heights, see table 2)

Values in millimetres

Tolerance class		Permissible deviations for basic size range							
Designation	Description	0.5[1] up to 3	over 3 up to 6	over 6 up to 30	over 30 up to 120	over 120 up to 400	over 400 up to 1 000	over 1 000 up to 2 000	over 2 000 up to 4 000
f	fine	± 0,05	± 0,05	± 0,1	± 0,15	± 0,2	± 0,3	± 0,5	–
m	medium	± 0,1	± 0,1	± 0,2	± 0,3	± 0,5	± 0,8	± 1,2	± 2
c	coarse	± 0,2	± 0,3	± 0,5	± 0,8	± 1,2	± 2	± 3	± 4
v	very coarse	–	± 0,5	± 1	± 1,5	± 2,5	± 4	± 6	± 8

1) For nominal sizes below 0,5 mm, the deviations shall be indicated adjacent to the relevant nominal size(s).

Table 2 — Permissible deviations for broken edges (external radii and chamfer heights)

Values in millimetres

Tolerance class		Permissible deviations for basic size range		
Designation	Description	0,5[1] up to 3	over 3 up to 6	over 6
f	fine	± 0,2	± 0,5	± 1
m	medium			
c	coarse	± 0,4	± 1	± 2
v	very coarse			

1) For nominal sizes below 0,5 mm, the deviations shall be indicated adjacent to the relevant nominal size(s).

Table 3 — Permissible deviations of angular dimensions

Tolerance class		Permissible deviations for ranges of lengths, in millimetres, of the shorter side of the angle concerned				
Designation	Description	up to 10	over 10 up to 50	over 50 up to 120	over 120 up to 400	over 400
f	fine	± 1°	± 0°30'	± 0°20'	± 0°10'	± 0°5'
m	medium					
c	coarse	± 1°30'	± 1°	± 0°30'	± 0°15'	± 0°10'
v	very coarse	± 3°	± 2°	± 1°	± 0°30'	± 0°20'

Annex A
(informative)

Concepts behind general tolerancing of linear and angular dimensions

A.1 General tolerances should be indicated on the drawing by reference to this standard in accordance with clause 4.

The values of general tolerances correspond to tolerance classes of customary workshop accuracy, the appropriate tolerance class being selected and indicated on the drawing according to the requirement of the components.

A.2 Above certain tolerance values, there is usually no gain in manufacturing economy by enlarging the tolerance. For example, a feature having a 35mm diameter could be manufactured to a high level of conformance in a workshop with "customary medium accuracy". Specifying a tolerance of ± 1mm would be of no benefit in this particular workshop, as the general tolerance values of ±0.3mm would be quite adequate.

However, if, for functional reasons, a feature requires a smaller tolerance value than the general tolerance values, these should not be indicated adjacent to the dimension but should be stated on the drawing as described in clause 4. This type of tolerance allows full use of the concept of general tolerancing.

There will be "exceptions to the rule" where the function of the feature allows a larger tolerance than the general tolerances, and the larger tolerance will provide manufacturing economy. In these special cases, the larger tolerance should be indicated individually adjacent to the dimension for the particular feature. e.g. the depth of blind holes drilled at assembly.

A.3 Using general tolerances leads to the following advantages:

a) drawings are easier to read and thus communication is made more effective to the user of the drawing;

b) the design draughtsman saves time by avoiding detailed tolerance calculations as it is sufficient to know that the function allows a tolerance grater than or equal to the general tolerance;

c) the drawing readily indicates which feature can be produced by normal process capitability, which also assists quality engineering by reducing inspection levels;

d) those dimensions remaining, which have individually indicated tolerances, will, for the most part, be those controlling features for which the function requires relatively small tolerances and which therefore may require special effort in the production - this will be helpful for production planning and will assist quality control services in their analysis of inspection requirements;

e) purchase and sub-contract supply engineers can negotiate orders more readily since the "customary workshop accuracy" is known before the contract is placed; this also avoids arguments on delivery between the buyer and supplier, since in this respect the drawing is complete.

These advantages are fully obtained only when there is sufficient reliability that the general tolerances will not be exceeded, i.e. when the customary workshop accuracy of the particular workshop is equal to or finer than the general tolerances indicated in the drawing .

The workshop should therefore

- find out by measurements what is customary workshop accuracy is;

- accept only those drawings having general tolerances equal to or greater than its customary workshop accuracy;

- check by sampling that its customary workshop accuracy does not deteriorate.

Relying on underlined "good workmanship" with all its uncertainties and misunderstandings is no longer necessary with the concept of general geometrical tolerances. The general geometrical tolerances defines the required accuracy of "good workmanship".

A.4 The tolerance the function allows is often greater than the general tolerances. The function of the part is, therefore, not always impaired when the general tolerance is (occasionally) exceeded at any feature of the workpiece. Exceeding the general tolerance should lead to a rejection of the workpiece only if the function is impaired.

GENERAL TOLERANCES FOR WELDING CONSTRUCTIONS FOR LENGTHS AND ANGLES

1.0 GENERAL

1.1 General tolerances are permissible variations corresponding to the degrees of accuracy normally observed in workshops where details of tolerances are not provided in the drawings.

1.2 The general tolerances specified in this standard apply to dimensions for which the tolerances are indicated on the nominal dimensions for welded components, welded assemblies and welded structures.

1.3 The variations apply to linear dimensions such as outside dimensions, inside dimensions, stepped dimensions, widths, Centre-to-Centre distances and also angles.

1.4 Special rulings may be stated for linear dimensions of welded structures consisting of several assemblies.

1.5 This standard is based on BS EN ISO 13920-1997

1.6 General tolerances for machined components are covered in Corporate Standard AA0230208.

1.7 Refer Corporate Standard AA0621105 for general tolerances for welded structures - Form and Position.

2.0 SCOPE

2.1 This standard prescribes four degrees of accuracy based on differences arising out of function and manufacture of welded components, assemblies and structures.

2.2 For technical and economic reasons other degrees of accuracy may be appropriate which have to be specifically stated.

3.0 GENERAL TOLERANCES

3.1 Tolerances for linear dimensions are given in Table 1.

3.2 Table 2, for the tolerances on angular dimensions.

4.0 REPRESENTATION ON DRAWINGS

4.1 The required degree of accuracy shall be specified in all fabrication drawings.

For example class 'B' of AA0621104 (BS EN ISO 13920)

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4.2 Figures 1 to 5 give examples of how dimensions (linear & angular) are to be indicated on the drawings. (Refer page 6 of 6 of this standard)

5.0 TESTING

5.1 The actual size of an angular structural component is determined by placing suitable measuring instruments tangentially on the welded part so that the zone affected by the weld is eliminated. The variation is obtained from the difference between the dimension in the drawing and the actual size.

TABLE-1 **TOLERANCE FOR LINEAR DIMENSIONS**

Range of nominal sizes l in mm											
Tolerance Class	2 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	Over 4000 up to 8000	Over 8000 up to 12000	Over 12000 up to 16000	Over 16000 up to 20000	Over 20000
	Tolerances t in mm										
A	± 1	± 1	± 1	± 2	± 3	± 4	± 5	± 6	± 7	± 8	± 9
B		± 2	± 2	± 3	± 4	± 6	± 8	± 10	± 12	± 14	± 16
C		± 3	± 4	± 6	± 8	± 11	± 14	± 18	± 21	± 24	± 27
D		± 4	± 7	± 9	± 12	± 16	± 21	± 27	± 32	± 36	± 40

TABLE-2 **TOLERANCES FOR ANGULAR DIMENSIONS**

Tolerance Class	Range of Nominal sizes l in mm (Length of shorter leg)		
	Up to 400	Over 400 upto 1000	Over 1000
	Tolerance Δα (In degrees and minutes)		
A	± 20’	± 15’	± 10’
B	± 45’	± 30’	± 20’
C	± 1°	± 45’	± 30’
D	± 1°30’	± 1°15’	± 1º
Calculated and rounded tolerances t, in mm/m[a]			
A	± 6	± 4.5	± 3
B	± 13	± 9	± 6
C	± 18	± 13	± 9
D	± 26	± 22	± 18
[a] The value indicated in mm/m correspond to the tangent value of the general tolerance. It is to be multiplied by the length, in m, of the shorter leg.			

NOTE:

1) The permissible variations also apply to unmarked angles of 90º and 180º.
2) The shorter side of the angle is specified as the reference side.
3) Its length can also be taken from a specially indicated reference point to be shown in the drawings.
4) If the drawing contains no angle data, but only linear dimensions, then the permissible variations are to be taken in mm/m.

6.0 Tolerances on dimensions of welded assemblies, the part of which are machined preliminarily and the assembly after welding as per given size not subjected to machining are set 50% lower than the tolerances on dimensions requiring a given accuracy.

7.0 In case of necessity, it is allowed to set as symmetrical tolerances in relation to nominal, but in this case the sum total of the value of the tolerance is to be preserved as per table 1.

8.0 Deformation of welded constructions (not in contact with floor plate) is allowed up to limits given in table 3.

Remarks:

1) The local convexities and concavities of the sheathing surface having smooth transition are allowed up to 4 mm.
2) General bend along the whole length of the sheathing should not exceed W mm per running metre.
3) Bends in the thin walled construction of the type of branch pipes, baffles of air draft hydro-generators are considered separately in every particular case.

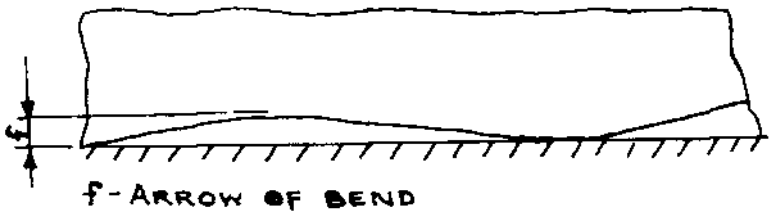

TABLE-3

Type of Construction	Length in mm						
Beams, spokes, stands, guards and similar parts	10000 to 15000	5000 to 10000	3000 to 5000	1500 to 3000	1000 to 1500	500 to 1000	Upto 500
	Allowable bend in mm						
	10.0	8.0	6.0	4.5	3.0	2.5	2.0
Frames, Floor plates dished parts, boxes External covers, bearings and Similar parts.	12.0	10.0	8.0	6.0	4.0	3.0	2.0

9.0 Allowance for machining of welded construction is determined as per table 5.

Remarks:

1) In case of machining of diameters and constructions from two sides the allowance is doubled.

2) For "Dimension as per drawing" is taken the dimension for which the allowance is meant.

10.0 Tolerances on bend "C" shall be as per table 4.

TABLE – 4

Width of flange ''b'' in mm	Thickness of flange ''s'' in mm	Tolerance ''c'' in mm
400-201	60-41	3.0
	40-31	3.5
	30-21	4.0
	20-11	4.5
	10 and lower	5.0
200-150	40-31	3.0
	30-21	3.5
	20-11	4.0
	10 and lower	5.0
149-100	40-31	2.5
	30-21	3.0
	20-11	3.5
	10	4.5
99-50	30-21	2.0
	20-11	2.5
	10	3.0
50 and lower	30-21	1.5
	20-11	2.0
	10	2.5

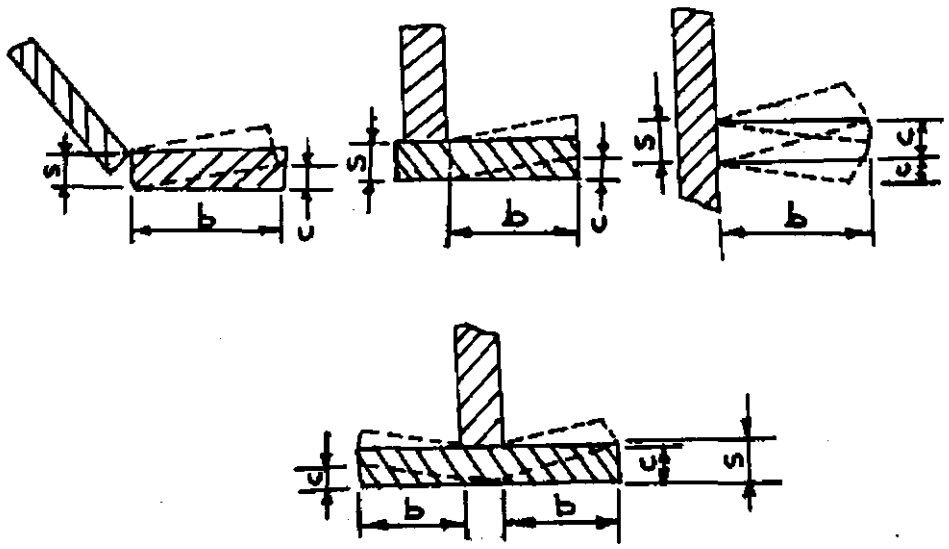

TABLE-5

Dimension as per Drawing (mm)	Machining Allowance per side (mm)
Upto 500	6
More than 500 & upto 1000	8
More than 1000 & upto 2000	10
More than 2000 & upto 4000	12
More than 4000 & upto 6000	14
More than 6000 & upto 10000	18
More than 10000 & upto 15000	22
More than 15000	24

11.0 REFERRED STANDARDS (Latest publications including amendment)

1) AA0230208
2) AA0621105

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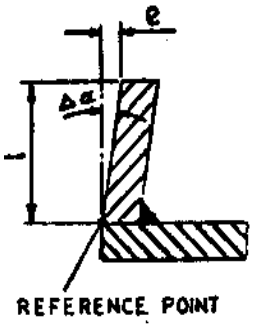

FIG. 1

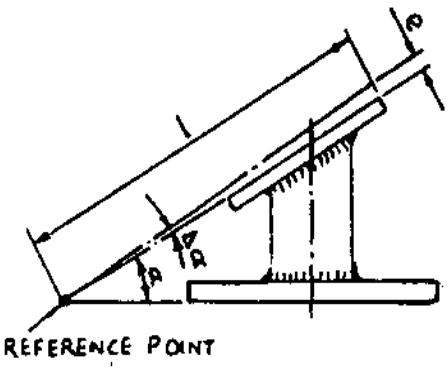

FIG. 2

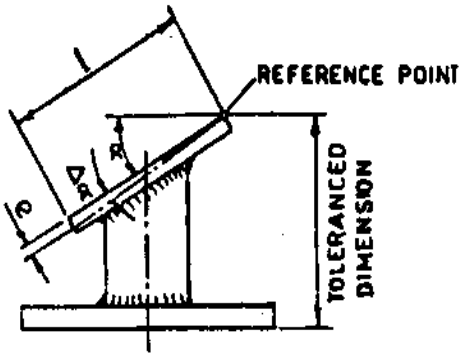

FIG. 3

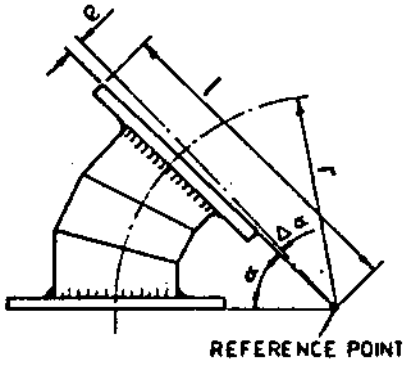

FIG. 4

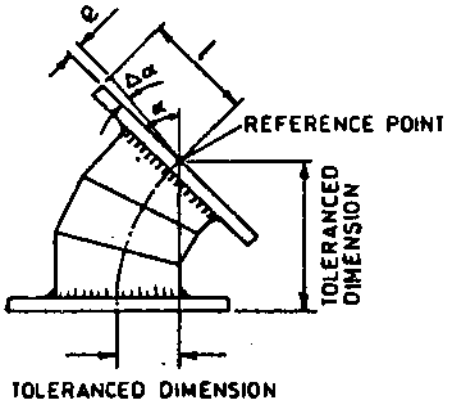

FIG. 5

ACCEPTANCE STANDARDS FOR LIQUID PENETRANT EXAMINATION OF WELDS

1.0 SCOPE:

1.1 This standard covers the "Acceptance Standards For Liquid Penetrant Eamination Of Wleds' .

1.2 The procedure for liquid penetrant examination shall be as per Corporate Standard AA 085 01 31: Procedure For Liquid Penetrant Examination.

1.3 This standard is based on ASME Section 8, Division 1, Appendix 8.

2. DEFINITION OF IHDICATIONS:

Relevant indications are those which result from mechanical discontinuities. Indications with major dimensions greater than 1.6 mm only shall be considered relevant.

2.1 Linear indications are those indications in which the length is more than three times the width.

2.2 Rounded indications are those indications which are circular or elliptical with the length equal to or less than 3 times the width.

2.3 Any questionable or doubtful indications shall be retested to verify whether or not they are relevant.

2.4 Localised surface imperfections, such as may occur from machining marks, surface conditions or incomplete bond between base metal and cladding may produce similar indications which are not relevent to the detection of unacceptable discontinuities.

3. ACCEPTANCE STANDARDS:

All surfaces to be examined shall be free from:

a) relevent linear indications.

b) relevent rounded indications greater than 4.8 mm.

c) four or more rounded defects in line separated by 1.6 mm or less (edge to edge) except where the specification for the material establishes different requirements for acceptance so far as defects are concerned.

PROCEDURE FOR LIQUID PENETRANT EXAMINATION

1.0 SCOPE:

1.1 This standard details the procedure for liquid penetrant examination of non-porous ferrous and non-ferrous and non-metallic materials such as ceramics, plastics, glass, etc.

1.2 Typical surface discontinuities detectable by this method are cracks, seams, laps, cold shuts, porosity, laminations, etc.

1.3 This standard conforms substantially with ASTM E 165 ~~-1980 (Reapproved 1985)~~ and ASME code section V, Article 6. (01)

2.0 PERSONNEL REQUIREMENT:

Personnel performig non-destructive examination and evaluation shall be qualified to the recommended practice SNT-TC-1A or any other recognised practice.

3.0 DESCRIPTION:

In principle a liquid penetrant is applied to the surface to be examined and allowed to enter discontinuities, excess penetrant removed, the part dried and a developer applied. The developer functions both as a blotter to absorb penetrant that has been trapped in discontinuities and as a contrasting back ground to enhance the visibility of penetrant indications.

4.0 APPROVED METHODS & MATERIALS:

4.1 Either a colour contrast or fluorescent penetrant method may be used. Any one of the following penetrants shall be used:

(a) Solvent Removable
(b) Post Emulsifying
(c) Water Washable

4.2 For nickel base alloys and/or for stainless steel materials used in nuclear components the penetrant materials, cleaner, penetrant developer, etc., used shall not contain sulphur or halogen above 1% by weight.

4.3 Selection of liquid penetrant material shall be from the same family (brand). Inter-mixing of family of liquid penetrant materials is not allowed.

5.0 PROCEDURE:

5.1 Surface Preparation:

5.1.1 Surface preparation by grinding or machining or other method may be employed where surface irregularities may mask indications of unacceptable discontinuities.

5.1.2 The surface to be examined and all adjacent areas within at least 25 mm shall be dry and free from any dirt, lint, scale, rust, welding flux, weld spatter, grease, oil or other extraneous matter that could obscure surface openings or otherwise interfere with examination.

5.1.3 The surface to be examined shall be cleaned with detergents, organic solvents, descaling solutions or paint removers. Degreasing and ultrasonic cleaning may be employed to increase cleaning efficiency. Cleaning method employed is an important part of the examination procedure. Cleaning solvents shall meet the requirements of Cl.4.2

Caution: Blasting with shot or dull sand, rotofinishing, buffing, wire brusing the soft material or machining with dull tools shall not be used as they may peen the discontinuities at the surface.

5.2 **Drying:**

Drying, after cleaning the surface to be examined, shall be accomplished by normal evaporation or with forced hot air, as appropriate. A minimum period of time shall be established to ensure that the cleaning solution has evaporated prior to application of the penetrant.

5.3 **Application Of Penetrants:**

5.3.1 The penetrant shall be applied by dipping, brushing or spraying. If the penetrant is applied by spraying using compressed air type apparatus, filters shall be placed at the air inlet to preclude contamination of penetrant by oil, water or dirt sediment that may have collected in the lines. Spraying should only be performed in a booth equipped with exhaust system.

5.3.2 The length of penetration time is critical and depends upon the material being inspected, the process through which it has passed and the type of discontinuities expected. The recommended penetration time is given in Table 1.

5.3.3 The temperature of the penetrant and the surface of the part to be examined shall not be below 10°C(50°F) nor above 50°C(125°F) throughout the examination period. Local heating or cooling is permitted provided the temperatures remain in the range of 10 to 50°C during the examination. Where it is not practical to comply with these temperature limitations, other temperatures and times shall be used provided the procedures are qualified as described in Annexure-I.

5.4 **Removal Of Excess Penetrant:**

After the penetration time specified in the procedure has elapsed, any penetrant remaining on the surface shall be removed, taking care to minimise removal of penetrant from discontinuities.

5.4.1 **Postemulsifying Penetrants:**

The emulsifier shall be applied by spraying or dipping. The emulsifying time shall not exceed 5 minutes. After emulsification, the mixture shall be removed by water spray.

5.4.2 **Solvent Removable Penetrants:**

Excess penetrant shall be removed by wiping with a cloth or absorbent paper repeating the operation until most tracesof penetrants have been removed. The remaining traces shall be removed by wiping the surface lightly with cloth or absorbent paper moistened with solvent.

Caution: Care shall be taken to avoid excess solvent as this may remove penetrants from discontinuities. Flushing the surface with solvent following the application of the penetrant and prior to developing is prohibited.

5.4.3 **Water Washable Penetrants:**

Excess water washable penetrant shall be removed with a water spray. The water pressure shall not exceed 0.35 N/mm² (50 Psi) and the water temperature shall not exceed 43.3°C (110°F).

5.5 **Drying:**

Surface shall be dried before the application of developer.

5.5.1 a) If postemulsifying or water washable method is used, the surface shall be dried by blotting with clean materials or by using circulating warm air, provided the temperature of the surface is not raised above 50°C (125°F).

b) For solvent removable method, the surface may be dried by normal evaporation, blotting, wiping or forced air.

5.6 **Application Of Developer:**

The developer shall be applied as soon as possible after the removal of the excess penetrant. Two types of developer, dry or wet,shall be used with fluorescent penetrant. With colour contrast penetrants, only wet developer shall be used.

5.6.1 **Application Of Dry Developer:**

Dry developer shall be applied by a soft brush, a hand operated powder bulb or a powder gun or other means provided the powder is dusted evenly over the entire surface being examined.

5.6.2 **Application Of Wet Developer**

Prior to applying suspension type wet developer to the surface, the developer must be thoroughly agitated to ensure adequate dispersion of suspended particles.

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(a) **Aqueous Developer Application:**

Aqueous developer may be applied to either a wet or dry surface. It shall be applied by dipping, spraying or other means provided a thin coating is obtained over the entire surface being examined. Drying time may be decreased by using warm air, provided the surface temperature of the part is not raised above 50°C.

(b) **Non-aqueous Developer Application:**

Non-aqueous developer shall be applied only on a dry surface. It shall be applied by spraying, except where safety or restricted access preclude it. Under such conditions developer may be applied by brushing. Drying shall be by normal evaporation.

6.0 **EXAMINATION:**

Observe the surface during the application of the developer to detect nature of any indications which tend to bleed out profusely. Final examination shall be done between 7 minutes at the earliest and 30 minutes at the latest after application of the developer. The nature of discontinuities corresponding to the indications shall be defined depending upon the method of setting, appearance, direction, shape and dimensions of the same. If the bleed out does not alter the examination results, longer periods are permitted. If the surface to be examined is large enough to preclude complete examination within the prescribed time the surface shall be examined in increments.

6.1 **Colour Contrast Penetrants (Visible Dye Penetrants):**

6.1.1 With colour contrast penetrants the developer forms a reasonably uniform coating. Surface discontinuities are indicated by bleeding out of the penetrant which is normally of a deep red colour. Indication with a light pink colour may indicate excessive cleaning. Inadequate cleaning may leave an excessive background making interpretation difficult.

6.1.2 Adequate illumination is required to ensure no loss of the sensitivity in the examination. Examination shall be done under natural or suitable light (illumination level shall be in the order of 500 LUX).

6.2 **Fluorescent Penetrants:**

Examination of the surface shall be carried out with a high intensity black light in a darkened area or booth. Black light shall have a wave length of 3650 A°. The bulbs shall be allowed to warm up for not less than 5 minutes prior to use in the examination. The black light intensity shall be at least of 800 uW/cm^2 on the surface of the part being examined and the light source being kept at a distance of at least 375 mm from the surface being examined. The operator should allow his eyes to become accustomed to the darkness of the inspection booth for at least 5 minutes before inspecting the parts. He should avoid looking directly into the black light and also avoid going from the darkness to

the light and back again without allowing sufficient time for his eyes to adjust to the darkness. The intensity shall be measured at least once every 8 hours and whenever the work station is changed.

7.0 **EVALUATION OF INDICATIONS & INTERPRETATION:**

7.1 As the developer dries to a smooth, even white coating, indications will appear at the locations of discontinuities. Depth of surface discontinuities may be correlated with the richness of colour and speed of bleeding out. However, localised surface imperfections such as may occur from machining marks or surface conditions may produce similar indications which are non-relevant.

7.2 Usually, a crack or similar opening will show a line and light cracks or partially welded lap will show a broken line. Gross porosity may produce large indications covering an entire area. Very fine porosity is indicated by random dots.

7.3 Any non-relevant indication shall be regarded as a defect until the indication is either eliminated by surface conditioning or it is Proved non-relevant by other NDT methods.

7.4 Linear indications are those indications in which the length is more than three times the width. Rounded indications are indications which are circular or elliptical with the length less than three times the width.

7.5 All indications shall be evaluated in terms of the acceptance standards of the referencing documents.

8.0 **ACCEPTANCE STANDARDS:**

8.1 For castings - Refer Corporate Standard AA 085 01 32.

8.2 For Austenitic Forgings - Refer Corporate Standard AA 085 01 30.

8.3 For Welds - Refer Corporate Standard AA 085 01 29.

9.0 **POST EXAMINATION CLEANING:**

Surfaces examined shall be cleaned after evaluation of the test with dry cotton rag with or without water rinse.

TABLE - 1 (Clause 5.3.2)

Suggested Penetration Time For Post-emulsified And Solvent Removable Penetrants

Material	Form	Type of discontinuity	*Penetration time (min.)
Aluminium	Castings	Porosity	5
		Cold shut	5
	Extrusions & Forgings	Laps	10
		Lack of fusion	5
	Welds	Porosity	5
	All forms	Cracks	10

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TABLE - 1 (Clause 5.3.2) Contd.

Material	Form	Type of discontinuity	*Penetration time (min.)
Magnesium	Castings	Porosity	5
		Cold shut	5
	Extrusions & Forgings	Laps	10
		Lack of fusion	10
	Welds	Porosity	10
	All forms	Cracks	10
Steel	Castings	Porosity	10
		Cold shut	10
	Extrusions & Forgings	Laps	10
		Lack of fusion	20
	Welds	Porosity	20
	All forms	Cracks	20
Brass & Bronze	Castings	Porosity	5
		Cold shut	5
	Extrusions & Forgings	Laps	10
		Lack of fusion	10
	Brazed parts	Porosity	10
	All forms	Cracks	10
Plastics	All forms	Cracks	5
Glass	All forms	Cracks	5
Carbide tipped tools	All forms	Lack of fusion	5
		Porosity	5
		Crack	20
Titanium & high temperature alloys	All forms		20 to 30
Ceramic	All forms	Cracks	5
		Porosity	5

* For lower temperatures, penetration time should be increased.

ANNEXURE - 1 (Clause 5.3.3)

PROCEDURE FOR NON-STANDARD TEMPERATURES

A.1 **General:**

When it is not practical to conduct a liquid penetrant examination within the temperature range of 15.6 to 51.6°C (60 to 125°F), the examination procedure at the proposed lower or higher temperature range requires qualification. This shall require the use of a quench cracked aluminium block, which is designated as 'Liquid Penetrant Comparator Block'.

A.2 **Liquid Penetrant Comparator Block:**

The liquid penetrant comparator block shall be made of aluminum, ASTM B209, Type 2024 or SB-211. Type 2024, 10 mm (3/8 in.) thick, and shall have approximate face dimensions of 50 mm x 75 mm (2 in. x 3 in.). At the centre of each face, an area approximately 25 mm in diameter shall be marked with a 510°C (950°F) temperature indicating crayon or paint. The marked area shall be heated with a blow torch, a Bunsen burner or similar device to a temperature between 510°C (950°F) and 524°C (975°F). The specimen shall then be immediately quenched in cold water which produces a network of the fine cracks on each face. The block shall then be dried by heating to approximately 149°C (300°F). After cooling, the block shall be cut into two halves. One half of the specimen shall be designated block 'A' and the other block 'B' for identification in subsequent processing. Figure 1 illustrates the comparator blocks "A" and "B". As an alternate to cutting the block in half to make blocks "A" and "B", separate blocks 50 mm x 75 mm (2 in. x 3 in.) can be made using the heating and quenching technique as described above. Two comparator blocks with closely matched crack patterns may be used. The blocks shall be marked "A" and "B".

A.3 **Comparator Application:**

(a) If it is desired to qualify a liquid penetrant examination procedure at a temperature of less than 15.6°C (60°F) the proposed procedure shall be applied to block "B" after the block and all materials have been cooled and held at the proposed examination temperature until the comparison is completed. A standard procedure which has previously been demonstrated as suitable for use shall be applied to block "A" in the 15.6 to 51.6°C (60 to 125°F) temperature range. The indications of cracks shall be compared between blocks "A" and "B". If the indications obtained under the proposed condition on block "B" are essentially the same as obtained on block "A" during examination at 15.6 to 51.6°C (60 to 125°F), the proposed procedure shall be considered qualified for use.

(b) If the proposed temperature for the examination is above 51.6°C (125°F), block "B" shall be held at this temperature throughout the examination. The indication of cracks shall be compared as described in T-647.3(a) while block "B" is at the proposed temperature and block "A" is at the 15.6 to 51.6°C (60 to 125°F) temperature range.

(c) A procedure qualified at a temperature lower than 15.6°C (60°F) shall be qualified from that temperature to 15.6°C (60°F).

(d) To qualify a Procedure for temperatures above 51.6°C (125°F), the upper and lower temperature limits shall be established and the procedure qualified at these temperatures.

(e) As an alternate to the requirements of (a) and (b) when using color contrast penetrants, it is permissible to use a single comparator block for the standard and non-standard temperatures and to make the comparison by photography.

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CORPORATE STANDARD

(f) When the single comparator block and photographic technique is used, the processing details (as applicable) described in (a) and (b) above shall apply. The block shall be thoroughly cleaned between the two processing steps. Photographs shall be taken after processing at the nonstandard temperature and then after processing at the standard temperature. The indication of cracks shall be compared between the two photographs. The same criteria for qualification as (a) above shall apply.

(g) Identical photographic techniques shall be used to make the comparison photographs.

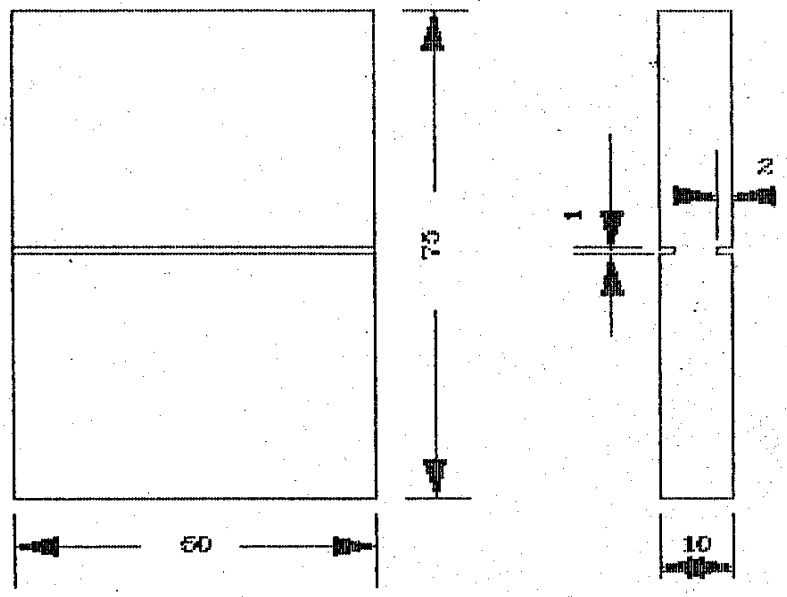


FIGURE: 1-LIQUID PENETRANT COMPARATOR BLOCK

STRUCTURAL STEEL - WELDABLE QUALITY
(PLATES, SECTIONS, STRIPS, FLATS AND BARS)

ORDERING DESCRIPTION

1.0 GENERAL:

The material shall conform to IS 2062 – 2011, E250-Gr.BR (with mandatory Impact Test) or DIN EN 10025-2:2005, Gr. S275JR and comply with following additional requirements.

2.0 APPLICATION:

For general engineering purposes, suitable for welding.

3.0 CONDITION OF DELIVERY:

3.1 Bars & Sections shall be supplied in Hot rolled in straight lengths without twists and bends.

3.2 The material shall be supplied as per IS: 2062 – 2011, E250 Gr.BR (with mandatory Impact Test) or as per DIN EN 10025-2:2005 Gr. 275JR.

3.3 Any other additional requirement as per BHEL Purchase order.

4.0 DIMENSIONS AND TOLERANCES:

4.1 Sizes:

Material shall be supplied to the dimensions specified in BHEL Order.

4.2 Tolerances:

The tolerances on hot rolled material shall comply with IS: 1852 or any other equivalent national standard.

4.3 Straightness for hot rolled bars:

Unless otherwise specified, the permissible deviation in straightness shall not exceed 5 mm in any 1000 mm length.

5.0 TEST SAMPLES:

The selection of test pieces for all tests like Chemical, Mechanical etc. shall be as per IS: 2062, E250-Gr.BR or DIN EN 10025-2, Gr. S275JR.

Revisions:	APPROVED:
Clause No. 1, 3, 5 & 8 revised (as per MOM of 38th MRC meeting), Clause 10 added	INTERPLANT MATERIAL RATIONALISATION COMMITTEE – MRC(S&GPS)

Rev No.15	Amd No.	Reaffirmed	Prepared	Issued	Dt. of 1st Issue
Dt:11-03-2014	Dt:	Year:	HPEP, Hyderabad	Corp.R&D	June, 1976

CORPORATE PURCHASING SPECIFICATION

6.0 ULTRASONIC EXAMINATION:

Plates shall be ultrasonically examined in accordance with BHEL standard AA0850120 (or ASTM-A435) as detailed below and shall comply with the acceptance standards specified therein.

6.1 For plates above 40 mm thick:

Shall be ultrasonically examined unless when otherwise specified in order.

7.0 TEST CERTIFICATES:

Unless otherwise specified, three copies of test certificates shall be supplied.

In addition, the supplier shall ensure to enclose one copy of the test certificate along with their dispatch documents to facilitate quick clearance of the material.

The test certificate shall bear the following information:

AA10119 - Rev.No.15/ IS: 2062-Gr: BR (with mandatory Impact test) or DIN EN 10025-2, Gr. S275JR,

BHEL order No.

Melt No, Size & Quantity, Batch No with heat treatment details, Results of Chemical analysis,

Mechanical tests & NDT, Supplier's name, Identification No, TC No, Signature of Competent Authority, etc.

8.0 PACKING AND MARKING:

Plates shall be transported suitably to avoid damage during transit.

Each plate shall be marked with Melt No. Material grade and specification, BHEL Order No, Supplier's Name Identification No, Size & weight, on any one corner and encircled with paint preferably of white colour.

9.0 REJECTION AND REPLACEMENT

If the material does not comply with the requirements of this specification during receipt inspection at BHEL or if any defect is found during further processing of material, BHEL reserves the right to reject the whole consignment and the supplier shall replace the material free of cost. The rejected material shall be taken back by the supplier after fulfilling the commercial terms and conditions.

10.0 REFERRED STANDARDS (Latest publications including amendments):

1) IS: 1852 2) ASTM - A435 3) AA0850120

26/6/14

CS-721

STAINLESS STEEL SHEETS AND PLATES - ANNEALED ASTM A 240M, TYPE 410 Î

ORDERING DESCRIPTION

1.0 GENERAL :

The sheets and plates shall conform to the latest version of ASTM A 240M, Î Type: 410 and comply with the following additional requirements.

2.0 APPLICATION:

For general engineering purposes, where corrosion resistance is essential.

3.0 CONDITION OF DELIVERY:

Hot Rolled, annealed and descaled (Finish No.1).

Cold rolled, annealed (2B / 2 D).

4.0 DIMENSIONS AND TOLERANCES:

Material shall be supplied to the dimensions specified in BHEL order.

5.0 CHEMICAL COMPOSITION:

As per ASTM A 240M, Type 410. Î

6.0 TEST CERTIFICATES :

Three copies of test certificates shall be supplied along with the following information:

BHEL References :

AA 107 38 -Rev. No.07 / ASTM A 240M, Type:410 Î
BHEL order No,

Supplier's References :
Name
Identification No.
Melt No.
Process of manufacture
Details of heat treatment.

Result of Tests:
Dimensional inspection.
Results of chemical analysis, mechanical tests

7.0 PACKING AND MARKING :

Sheets shall be supplied in bundles or in packages each weighing upto a maximum of 3000kg. Plates shall be suitably packed to prevent damage during transit.

For plates below 25 mm thick, each pile (preferably of 16 plates) shall be marked with suppliers identification mark, 'AA 107 38 / ASTM A 240M, Type:410, melt No., BHEL Î order No., on the top plate.

Each plate of 25mm thickness and above shall be stamped/painted with the suppliers identification mark, 'AA 107 38 / ASTM A 240M, Type:410 , melt No., BHEL order Î No., on the top plate.

FOR INFORMATION ONLY

CHEMICAL COMPOSITION

C	Si	Mn	Ni	Cr	S	P	Al
0.08-0.15	≤ 1.0	≤ 1.0	≤ 0.75	11.5-13.5	≤ 0.030	≤ 0.040	-

MECHANICAL PROPERTIES

Hardness, max		0.2% PS min	UTS, min	% El min	Cold Bend. Î
BHN	HRB	N/mm²	N/mm²		
217	96	205	450	20	180^0

RUST PREVENTIVE HARD FILM, BLACK (TRP)

1.0 GENERAL:

This specification governs the quality requirements of temporary rust preventive (TRP), coating a hard film on drying. The material consists of film forming ingredients dissolved in solvents to give a low viscous liquid at room temperature. On evaluation of solvents, a thin though abrasion resistant film capable of being handled without damage shall be obtained. Normally this material gives protection upto six months and thereafter requires inspection and reapplication, if necessary.

2.0 APPLICATION:

Depending upon components and their sizes, the rust preventive can be applied by brush, dip or spray. Two liberal coats are desirable for adequate protection. The surface to be coated with anti rust solution should be absolutely clean and free from rust.

3.0 REMOVAL:

This TRP can be removed by cotton cloth soaked in white spirit to BHEL specification AA 56701.

4.0 COLOUR : Steel Black.

5.0 COMPLIANCE WITH NATIONAL STANDARDS:

The material shall comply with the requirements of the following national standards and also meet the requirements of this specification.

IS: 1153 - 2000:RA-2005 Temporary Corrosion Preventive, Fluid, Hard Film, Solvent deposited,

6.0 COMPOSITION:

The composition shall be based on asphalt, mineral oil and inhibitive pigments with suitable additives.

7.0 TEST SAMPLES:

Half a litre of sample shall be taken for testing and approval.

8.0 PROPERTIES:

When tested in accordance with the relevant clauses of BHEL standard AA 085 00 01, the test sample shall show the following properties:

8.1 Consistency : 90 ± 10 seconds in Ford Cup No.4 at 27± 0.5^{0}C.

8.2 Drying Time : Tack free: Within one hour
Hard dry : 16 hours

8.3 Flash Point : 32^{0}C, min.

8.4 Weight : 11 ± 0.5 kg per 10 litres.

8.5 Non-volatile Matter : 58 ± 2% by mass.

8.6 Test for Adhesion : To pass the test

8.7 Spreading Capacity : 8.0 sq.meter/litre, minimum

8.8 Protection against corrosion at high temperature and humidity:

To pass the test for 360 hours, minimum..

9.0 TYPE TESTS:

Whenever specified, the following tests shall be carried out, as per the methods mentioned against each:

i) **Protection against corrosion under conditions of condensation (IS:101, part 6/sec.1):**

No sign of corrosion on the surface after 21 days of exposure.

10.0 TEST CERTIFICATES:

Three copies of test certificates shall be supplied alongwith each consignment, giving the following information:

In addition, the supplier shall ensure to enclose one copy of the test certificate alongwith the despatch documents to facilitate quick clearance of the material.

AA 551 54, Rev. 03 : Rust preventive hard film, black (TRP)
BHEL Order No.
Batch / Lot No.
Supplier's/ Manufacturer's Name and Trade mark, if any
Date of manufacture and expiry
Test results of clause 8.0 & 9.0.

11.0 KEEPING PROPERTY:

When stored in a covered dry place in the original sealed containers under normal temperature conditions, the material shall retain the properties prescribed in this specification for a period of not less than 12 months after the date of manufacture which shall be subsequent to the date of placing the order.

12.0 PACKING & MARKING:

Unless otherwise specified, the material shall be supplied in 4 kg steel containers, which shall be leak free, dry and clean.

Each container shall marked with the following information:

AA 551 54: Rust preventive hard film, black (TRP)
BHEL Order No.
Supplier's / Manufacturer's Name and Trade mark, if any
Batch No./Lot No.
Date of manufacture and expiry
Quantity supplied

8.0 ENVIRONMENTAL REQUIREMENTS:

The supplier shall furnish Material Safety Data Sheet **(MSDS)** covering all information relating to human safety and environmental impacts of the hazardous materials particularly during their transportation, storage, handling and disposal alongwith each supply.

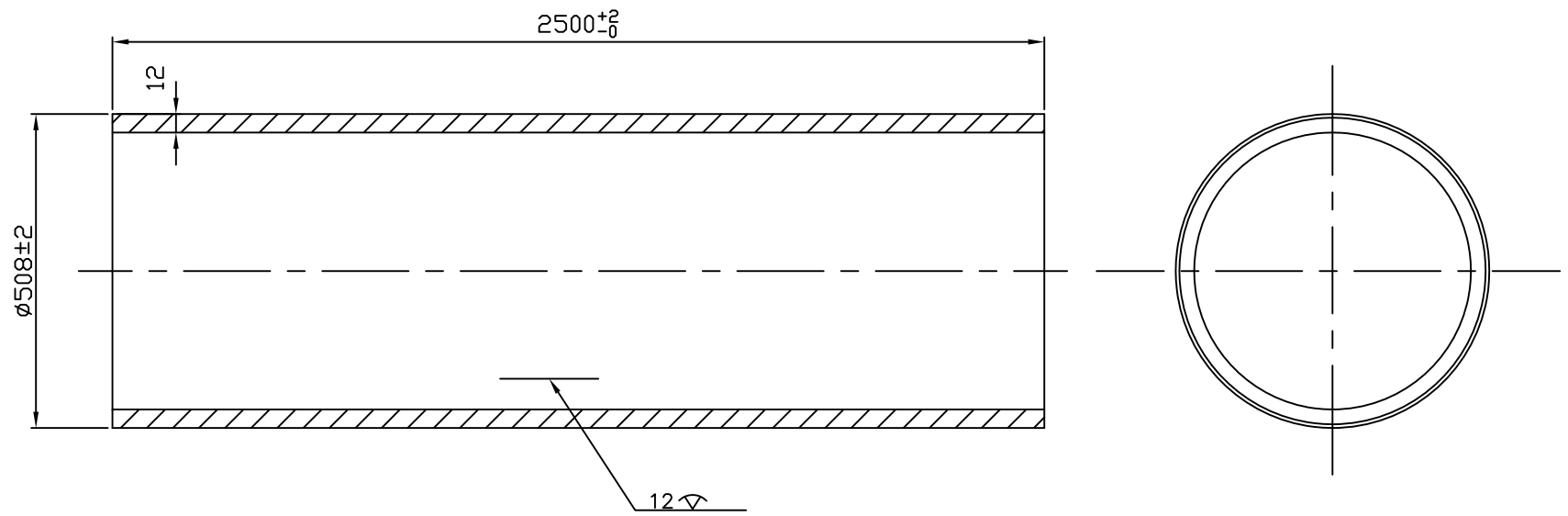
Each container shall be marked with corresponding symbol and minimum worded cautionary notice for flammable / corrosive / toxic / harmful / irritant and oxidizing etc. as applicable

13.0 REFERRED STANDARDS (Latest Publications Including Amendments):

1. AA 085 00 01 2. AA 56701 3. IS: 1153

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN mm)

DRG. NO. HY-925.A.04 SHEET NO. 1 OF 1



NOTE:
BREAK ALL SHARP CORNERS

ITEM NO.	DESCRIPTION	DRAWING NO.	VAR. NO.	RAW MATERIAL SIZE OR CASTING DRG. NO. OR FORGING DRG. NO.	MATERIAL CODE	NET WT.	GROSS WT.
01	PL. 12X1556X2500				AA10738	370	
					MATERIAL SPECN.	QUANTITY	1

THE FOLLOWING CONDITIONS APPLY EXCEPT OTHERWISE STATED.

1. REF. TO HY0230261 FOR UNSPECIFIED TOLERANCES.
2. CHAMFER M/CD. SHARP EDGES 1.2 TO 1.0 AT 45°.
3. INTERNAL M/CD. CORNER RADII 1 TO 0.7
4. THE SURFACE ROUGHNESS WHERE-EVER NOT SHOWN SHALL BE TAKEN FROM THE SURFACE ROUGHNESS SHOWN OUT SIDE THE BACK SLASH GIVEN OR THE TOP MOST RIGHT CORNER OF THE DRG.

TYPE OF PRODUCT

NAME OF CUSTOMER/PROJECT

BHARAT HEAVY ELECTRICALS LIMITED
VARANASI

	NAME	SIGN.	DATE	NO.OF VAR.
DRN.	PKP	-sd-	20.05.10	0
CHD.	CKP	-sd-	20.05.10	
APPD.	V.KUMAR	-sd-	20.05.10	

DEPT.	UNTOL. DIMS. GR.	SCALE	WEIGHT (KG)	REF. TO ASSY DRG.	ITEM NO.	NO.OF ITEMS
PULV.ENGG. CODE 446	¢/M/f	NTS	370			

TITLE: PIPE ø508X12-2500 LONG

CARD CODE

DRAWING NO. HY-925.A.04 REV. 00

SHEET NO. 1 NO OF SHEETS 1

REV.	DATE	ALTERED	APPD.	REV.	DATE	ALTERED	APPD.
		CHD.				CHD.	
ZONE				ZONE			

INVENTORY NO | SIGN. AND DATE | REF. DRG. NO. | COMPUTER FILE NAME

BHEL HERP VARANASI
QUALITY PLAN

Centre Feed Pipes (Pipe Material AA10738)

SL.NO.	COMPONENT	CHARACTERISTIC CHECKED	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENTS & ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
							P	W	V	
1.0	Raw Material : Plates	i.Chemical & Mechanical properties	Chemical analysis and Mechanical test	1 sample per heat batch	AA10119	TC	3	-	2	Manufacturer's TC is also acceptable for chemical and mechanical properties
		ii.Chemical & Mechanical properties	Chemical analysis and Mechanical test	1 sample per heat batch	AA 10738	TC	3	-	2	Plates AA10738 should be procured from BHEL approved sources only (Specified in Purchase Order)
2.0	Fabrication	ii. Fit up exam and welding	Measurement	100%	Drawing	Dim.report	3	-	2	Tolerance to be maintained as per drg. All welding shall be done by qualified welders only. BHEL WPS nos. WE-079, and WE-148 should be followed for SMAW as per requirement of drawings. Compatible welding electrodes (as mentioned in above WPS) should be used. Job should be preheated to temperature mentioned in WPS no. WE-079. If MIG/MAG welding process is used, prior WPS approval is to be taken from BHEL.
		iii.Post Weld Heat Treatment	Review of HT Chart	100%	As per applicable WPS WE-079		3	-	2	As per WPS WE-079 Following Heat treatment cycle should be followed : 1) Free Heating upto 400°C 2) Rate of Heating 100°C/Hr upto 680°C to 710°C 3) Soaking time 1 hour. 4) Rate of cooling 100°C/Hr upto 400°C 5) Free Cooling in ambient air below 400°C
		iv. D.P.Testing of welded joints	D.P.test	100%	AA0850131 & AA0850129	TC	3	2	-	100% D.P.test shall be witnessed by BHEL AIA
3.0	Final Inspection after Fabrication, Stress relieving and NDT.	i.Dimensions	Measurement	100%	Drawing.	Dimension Report	3	2	-	Unspecified tolerances shall be maintained as follows : a) As per medium tolerance class of Specn. AA0230208 for machined dimensions. b) As per Tolerance class B of specn. AA0621104 for fabricated dimensions.
		ii. Painting & preservation		100%		Insp.Report	3	2	-	All Machined surfaces of material other than SS (AA 10738) shall be protected by applying TRP black paint (specn. AA55154). All threaded holes to be protected by applying grease
		iii.Identification & Marking	Punching of Drg. No., P.O.No., Vendor code no., year, Inspector Seal	100%	Drawing	Inspection Report	3/2	2	-	
			APPROVED BY		MANAGER P&D					
			SIGNATURE & DATE							

QP. NO.	RV/FAB /31
DATE	09/08/2011
PG. NO.	1 OF 1

P = PERFORM.C. = TEST CERTIFICATE
W = WITNESS H.T. = HEAT TREATMENT
V = VERIFY
3 = VENDOR
2 = BHEL AUTHORISED INSPECTION AGENCY (AIA)

विरेन्द्र कुमार/VIRENDRA KU...
प्रबंधक (यो०वि०) / Manager (P...)
भारत हेवी इलेक्ट्रिकल्स लिमिटेड
Bharat Heavy Electricals Ltd.
हर्प, वाराणसी
HERP, Varanasi

635

POSITIONS (QW-405)

Position [s] Groove 1G

Welding Progression : Up ... Down ... ...

Position [s] Fillet ...

[POSTWELD HEAT TREATMENT QW-407

Temperature Range 600-620°C

Time Range One hour

GAS [QW-408]

Percent Composition

Gas [es] [Mixture] Flow Rate

Shielding -

Trailing -

Backing -

PREHEAT [QW-406]

Preheat Temp Min 150°C (For 1st layer only)

Interpass Temp. Max 200°C

Preheat Maintenance -

ELECTRICAL CHARACTERISTICS [QW-409]

Current AC or DC DC Polarity +Ve

Amps [Range] 140-180 Volts Range 22-26

Tungsten Electrode size and type -

Mode of Metal Transfer for GMAW -

Electrode wire feed speed range -

TECHNIQUE [QW-410]

String or Weave Bead String only Orifice or Gas Cup Size -

Initial and Interpass Cleaning By Chipping, Brushing, Grinding

Method of Back Gouging - oscillation -

Contact Tube to Work Distance - Multiple or Single Pass Multi

Multiple or single Electrodes Single Travel Speed [Range] -

Peening No Electrode Spacing -

Other Clean the weld area prior to welding to remove Oil, Rust, Grease etc.

Weld Layer [s]	Process	Filler Metal Class	Filler Metal Dia. mm	Current Type Polar	Current Amp. Range	Volt Range	Travel Speed Range mm/min	Other
1st layer	SMAW	E309Mo-15	5.0	DC+	160-180	22-26	-	String only
subsequent layers	"	E308-L-15	"	"	"	"	-	--do--

CONTROLLED COPY

Prepared by [signature] 14/12/87

MANAGER
WELDING ENGG.

BHARAT HEAVY ELECTRICALS LIMITED

RAMACHANDRAPURAM, HYDERABAD-500 032.

PD - 268

QW-482 WELDING PROCEDURE SPECIFICATION (WPS)

Welding Procedure Specification No. WE055 Date 8.10.82 Supporting PQR No 193

Revision No. 1 Date 01.03.1989

Welding Process (es) SMAW Type (s) Manual

Details

JOINTS (QW 402)

Joint Design S.S.Overlay on P1,

Backing (Yes) - (No) -

Backing Material (Type) -

Metal - non fusing metal -

BASE METALS (QW-403) A8 overlay

P. No. 1 Group No. 1 & 2 to P. No. - Group No. -

OR

Specification type and grade

to Specification type and grade

OR

Chem. Analysis and Mech Prop

to Chem Analysis and Mech Prop

Thickness Range : 25mm & above

Base Metal Groove Fillet -

Pipe Dial Range : Groove - Fillet -

Other -

FILLER METAL (QW-404) 1st layer by E 309 Mo-15

F. No. 5 Other Subsequent layers by E 308L-15

A. No 8 Other (1)

Spec. No. (SFA) 5.4

DEPOSITED WELD METAL

AWS No. (Class) E309Mo-15&E308L-15 Thickness Range : 6mm and above (Overlay)
3mm Max by E 309Mo-15

Size of filler metals ∅ 5.0mm Groove Rest by E308L-15

Electrode-Flux. (Class) Basic Fillet

Flux Trade Name - Max. bead thickness : 5mm

Consumable insert No; Retainer: No.

(1) Rev., Format details added

AUTHORISED SIGN

BHARAT HEAVY ELECTRICALS LIMITED

RAMACHANDRAPURAM, HYDERABAD-500 032.

PD - 268

QW-482 WELDING PROCEDURE SPECIFICATION (WPS)

Welding Procedure Specification No WE.079. Date 31.10.90 Supporting PQR No. 322

Revision No 1 Date 10.03.95

Welding Process (es) SMAW Type (s) Manual

JOINTS (QW 402) Details

Joint Design As per Drawing

Backing (Yes) For double side welds (No) For single side welds

Backing Material (Type) Base metal/Weld metal

Metal Yes Non fusing metal --

Retainer : No

BASE METALS (QW-403)

P. No. - Group No. - to P. No. - Group No. -

OR

Specification type and grade X 12 Cr 13

to Specification type and grade X 12 Cr 13

OR

Chem. Analysis and Mech. Prop. --

to Chem. Analysis and Mech. Prop. --

Thickness Range :

Base Metal : ——— Groove 4.75 to 200mm Fillet All

Pipe Dia. Range : Groove All dia Fillet All

Other Root spacing for backing strip jts : 8-10mm
For others : 2 ± 1mm

FILLER METALS (QW-404)

Spec. No. (SFA)	5.4
AWS No. (Class)	E 410 - 16/15
F. No.	4
A. No	6
Size of Filler Metals	Ø 2.5 to 5.0mm
Deposited Weld Metal	Max head thickness : 5mm
Thickness Range : Groove	200mm Max
Fillet	All
Electrode Flux (Class)	Rutile
Flux Trade Name	--NA-
Consumable Insert	No

POSITIONS (QW-405)

Position [s] Groove All

Welding Progression : Up For V Down —

Position [s] Fillet All

[POSTWELD HEAT TREATMENT QW-407]

Temperature Range 680 - 710

Time Range 1 Hr/25mm upto 50mm. For every Additional 25mm : 15 Minutes

PREHEAT [QW 406]

Preheat Temp Min 280°C

Interpass Temp. Max 350°C

Preheat Maintenance By Oxy Accetalyne or Producer Gas

GAS [QW-408] NA

Percent Composition

Gas [es] [Mixture] Flow Rate

Shielding

Trailing

Backing

ELECTRICAL CHARACTERISTICS [QW-409]

Current AC or DC DC Polarity +Ve (DCEP)

Amps [Range] 60-180 Volts Range 22-26

Tungsten Electrode size and type NA

Mode of Metal Transfer for GMAW NA

Electrode wire feed speed range NA

TECHNIQUE [QW-410]

String or Weave Bead String Orifice or Gas Cup Size NA

Initial and Interpass Cleaning Chipping, Brushing, Grinding

Method of Back Gouging By Grinding oscillation No

Contact Tube to Work Distance NA Multiple or Single Pass Multi

Multiple or sinlge Electrodes Single Travel Speed [Range] --NA-

Peening Not allowe Electrode Spacing NA

Other Clean edges to be welded to remove, Grease, Rust etc. Prior to welding.

Weld Layer [s]	Process	Filler Metal Class	Filler Metal Dia. mm	Current Type Polar	Current Amp. Range	Volt Range	Travel Speed Range mm/min	Other
	SMAW	E410-16	2.5	DC+	60-80	--	--	String
	SMAW	E410-16	3.15	DC+	90-110	--	--	"
	SMAW	E410-16	4.0	DC+	110-140	--	--	"
	SMAW	E410-16	5.0	DC+	140-180	--	--	"

PREPARED BY

SR MANAGER
WELDING ENGG.

BHARAT HEAVY ELECTRICALS LIMITED

Ramachandrapuram, Hyderabad – 500 032.

QW – 482 WELDING PROCEDURE SPECIFICATION (WPS)

Welding Procedure Specification No.: *WE 148* **Date:** *05/01/2004* **Supporting PQR No.: 466**

Revision No.: 0 **Date: --**

Welding Process (es) : SMAW **Type (s) :** *Manual*

JOINTS (QW 402) **Details**

Joint Design : As per manufacturing drawing

Backing (Yes) : BASE MATERIAL

Backing Material (Type) : *Base Metal/weld metal*
Metal : *Yes*
Retainer : *No*

Non-Fusing Metal : *No*

BASE METALS (QW – 403)

P. No. : 6 **Group No. :** *1* **TO** **P. No.: 1** **Group No.1&2**

OR

Specification type & grade : ---
to Specification type & grade : ---

OR

Chemical Analysis & Mechanical Properties : ----
to Chemical Analysis & Mechanical Properties : -----

Thickness Range :
Base Metal : **Groove: 4.75 to 24 mm** **Fillet :** *All sizes*

Pipe Dia. Range : Groove: all dia **Fillet :** *All sizes*

Other : --

Filler Metals (QW – 404)	
Spec. No. (SFA)	*5.4*
AWS No. (Class)	*E309-15*
F. No.	*5*
A. No.	-
Size of Filler Metals	*2.5 – 5.0 mm*
Deposited Weld Metal	-
Thickness Range: Groove	*24 mm*
Fillet	*All*
Electrode Flux (Class)	*Basic*
Flux Trade Name	*NA*
Consumable Insert	*No*
Max. Bead Thickness	5.0 mm max

On Bidder's office letter pad

Make in India (Model Certificate) Annexure-I

Self-Declaration

Enquiry No.	
Enquiry Date	

In line with Government public procurement order Number P-45021/2/2017-B.E-II dated 15.06.2017, and further modified order dt. 28.05.2018, 29.05-2019 and 04.06.2020

I / We hereby declare that I / We are a "Local Supplier" meeting the requirement of minimum local content (…….%) defined in the above government notification for the goods against above mentioned enquiry Number.

Details of location at which local value addition will be made is as follows:

Door No.	
Street / Address 1	
Street / Address 2	
District	
State	
Country	
PIN Code	

We also understand that the false declarations will be considered as breach of Integrity and liable for action.

For Company Name:
Seal:
Signature:

Date:
Place:

(Please fill all Yellow color field)