QWI GENERAL

Ranipet	Procedure for KEROSENE LEAK TEST	Doc. No	PRQA: 076
		Rev	01
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1.0 SCOPE

1.1 This procedure details the requirements of Kerosene leak test.

1.2 Kerosene leak test shall be carried out for welds if it is required as per drawing.

2.0 PREPARATION

2.1 Prior to kerosene leak test, it shall be ensured that welds are fully completed with respect to size and location.

2.2 Welds shall be thoroughly cleaned by hand wire brush or rotary wire brush to remove slag etc.

2.3 Welds shall be inspected visually.

2.4 Unacceptable defects found by visual inspection shall be repaired by grinding/welding and grinding.

2.5 Kerosene leak test shall be started only after the welds have been cooled to room temperature.

3.0 TESTING.

3.1 One side of the weld shall be applied with chalk powder mixed with water.

3.2 This coat of chalk powder shall be dried before leak test.

3.3 Kerosene shall be applied from the other side of the weld.

3.4 Check up the side of weld on which chalk is applied for any indication of kerosene absorption after 5 minutes of application.

4.0 REPAIRS.

4.1 The place having indication shall be marked for repair.

4.2 Repair shall be carried out by grinding and welding.

4.3 Retest shall be carried out on repairing areas.

5.0 CLEANING.

5.1 After testing is completed, the chalk powder shall be cleaned off from the welds.

6.0 PAINTING.

6.1 Cleaned surfaces shall be painted as per contract requirements.

Revision Number/Date	*Changes made*
00/01 10 88	Original issue
01/20 09 06	Cl 1.2 deleted and other clauses renumbered Cl 1.3,2.2,3.2,3.3 and 3.4 are modified

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QUALITY CONTROL PROCEDURE FOR MANUFACTURE OF NON PRESSURE PARTS

QCP:002 / 02

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Reviewed by	Signature	
Engineering	Structures	Fuel Firing
O P & C		
Manufacturing	Shops	Ancillary Development
Quality Assurance		
Quality Control	RM Area	O L I

Revision No.	Date	Approved by	Signature
00	01/04/93	SM / QA	-sd-
01	01/01/95	SM / QA	-sd-
02	**24/04/04**	**SDGM /QA**	

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RECORD OF REVISIONS

Rev No...	Clause No	Details of revision
00	--	This document consolidates all the general requirements and technical disciplines covered in the various previous
01	--	All amendments issued has been regularized and editorial correction made for better clarity. Scope of machining added in this document.
02		**Shaded clauses are Revised /added**

1.0 SCOPE

1.1 This procedure details out the process control and quality requirements for manufacture of Non Pressure Parts.

2.0 REFERENCE DOCUMENTS

2.1 AWS D.1.1, D1.6, IS 7215 and CE: M&P 5.11.1.1, 5.11.2.1 & 5.11.2.2 as guidelines.

3.0 MATERIALS

3.1 CLASSIFICATION OF MATERIALS (commonly used):

P No. Group	Specifications
P1 - Group 1 -	Carbon steel IS 2062 Gr A & B, IS 1239, IS 1161, A 36, SA 515 Gr 60.
P1 - Group 2 -	H.Strength CS :SA105, SA 515 Gr 70, SA 299, SA 516 Gr 70, IS 8500.
P4 - Alloy Steel	SA 387 Gr 11 & Gr 12, SA 182 Gr F 11 & F 12.
P5 – Gr A,	SA 387 Gr 22, SA 182 Gr F 22
P6 -	SA 240-410,429
P8 - Stainless steel	SA 240 - 304 ,309,310, 316, 321, 347

Any other materials as specified in the drawings.

3.2 Raw materials used shall conform to the relevant specification as given in drawings and applicable TDC/PO. Any substitution of materi-als shall be done only with prior approval of engineering through applicable documents. Where subcontractors procure the raw materials, the same shall have valid test certificates.

3.3 Raw materials shall be free from visual defects like cracks, seams, laps, laminations,heavy pitting etc. When defects are noticed in visual inspection the same shall be confirmed using appropriate NDE techniques and repaired using applicable approved process .

3.4 All materials are procured with permitted dimensional tolerances of the material speci-fications and / or TDC. Wherever required, the raw materials shall be corrected prior to fabrication to achieve the required product tolerances.

3.5 Customer supplied materials are to be verified as per SP 0626.

3.6 The requirements of material traceability shall be as indicated in the respective drawings.

3.6.1 Product Attest “P” items indicated as in drawings are traceable to the test certificates and identified with material Specification, grade and melt number by stamping.

3.6.2 CERTIFIED items indicated as "C" in drawings are traceable to material Specification / grade only and identified by stamping / engraving / stenciling / painting.

3.6.3 Raw materials not covered by the above shall be identified by its W.O.No / material code / Specification / grade by painting / stenciling / engraving.

3.6.4 All subdeliveries shall be identified by its material code by painting or through name plates / tags.

3.7 When materials (including stock) are to be upgraded for special contract requirements QC shall ensure that the respective specification / contract TDC (as applicable) are complied..

4.0 FABRICATION

4.1 MARKING, CUTTING AND PREPARATION

4.1.1 Raw material shall be marked and cut to size by shearing, machining, saw cutting , flame or plasma (for SS materials) cutting. Flame cut edges shall be cleaned to remove slag. Uneven edges shall be dressed by grinding. Gas cutting notches shall be filled up by welding using compatible electrodes and ground before taking up for further fabrication.

4.1.2 Wherever raw materials supplied / available are not sufficient for the sizes required, the same can be built up using the splicing instructions given in the respective SQPs/ Drawings (Incl. Production Notes) / DCN.

4.1.3 Layout for size and shape shall be marked before cutting (for other than CNC applications) The tolerance for marking shall be maintained within + 2mm unless otherwise specified. The diagonal difference shall be within 3 mm.

4.1.4 The markings shall be punched at convenient intervals and bordered with white paint.

4.1.5 Stainless Steel (SS) materials shall be cut using plasma cutting or shearing only. Any further dressing/ grinding of cut surfaces should be done with separate and clean abrasive wheels.

4.1.5.1 The cut edges should be smoothly ground.

4.1.5.2 Notches above 3 mm or 20 % 'T' shall be thoroughly cleaned and welded by using a qualified WPS and examined visually and by LPI . The repaired surfaces are to be cleaned to bright metal surface.

4.1.6 Clip / Cleat angles above 10mm thick used for beam connections which are sheared to length shall require heat treatment.

4.1.7 Heat treatment shall be done after shearing for P4 materials t>12.5mm and for P5 materials t>10mm.

4.1.8 The requirements of preheat for gas cutting are as follows:

Carbon steel	t <= 50mm :	: Nil
Carbon steel	t > 50mm :	: 100 º C.min.
Alloy steel (P4)	t < =25mm :	: Nil
Alloy steel (P4)	t > 25mm :	: 150 º C
Alloy steel (P5)	All	: 150 º C
Stainless steel	Not applicable	

4.1.8.1 Stress relieving for gas cut edges shall be as follows.

Material	Thickness	Heat treatment cycle
P1	> 50 mm	600 º - 650 º C for 30 minutes . Furnace cool (Alternatively, the cut surface can be ground / machined upto 3 mm to remove HAZ)
P4	> 16 mm	650 º – 700 º C for 30 minutes . Furnace cool
P5	All	680 º - 730 º C for 30 minutes . Furnace cool
SS (plasma)	Any	Not required

4.1.9 The prepared plates shall be visually inspected and repaired if required as per SIP:NP:06.

4.1.10 The raw materials after cutting shall be identified with relevant WO No., DU No., Part No. and Material Spec / Grade (transferred).

4.2 FORMING

4.2.1 Forming shall be done using proper tooling free from damages. Method of forming and work centre shall be identified in OPS / relevant QWI refered in PO.

4.2.2 Forming operations of sheets / plates shall be done by rolling / pressing. Circularity of rolled shells shall be checked using templates (of length > ¼ of ID).

4.2.3 Suitable nonmetallic padding shall be provided while forming of stainless steels to avoid contamination.

4.2.4 All formed components shall be checked for orientation, angle, and other dimensions as per drg. All formed parts shall have smooth finish and shall be free from bends, folds and sudden transitions.

4.2.5 Minimum thickness after forming shall be ensured whenever specified in drg.

4.2.6 Tolerances for formed components when not specified in drg. Shall be as follows

a) St.Length / Dia, Width & Height : + 1 mm / M, 5 mm Max
b) Verticality : 1 mm / M, 5 mm Max
c) Squareness : 1 mm / M of length / Dia
d) Straightness : 1 mm / M, 5 mm Max
e) Radius : + 5 mm
f) Bend Angle : + 2º
g) Ovality : 1%
h) E.P Angle : + 5º / - 2.5º
i) Diagonal diff : 3 mm

4.3 WELDING

4.3.1 WELDING CONSUMABLES

4.3.1.1 Welding consumables conforming to the qualified welding procedures shall be used. However the following guide lines are provided.

4.3.1.2 Only Basic coated electrodes shall be used in the following cases:-

a. All Strength welds like welds in main ceiling girders, flange butt welds in other beams, columns etc.
b. For all structural welds, or when thickness of any one member of the weld joint is > 12 mm (unless otherwise indicated in the drawings / Qualified WPS).
c. For welding of high tensile steels like IS 8500, SA299, SA515 Gr.70, SA516 Gr.70.

4.3.1.3 Rutile electrodes may be used for other weld joints.

4.3.1.4 All low hydrogen electrodes (EXX 16 & EXX 18) shall be dried in the baking oven at 350 deg.C for 2 hours and the electrodes shall be held at 100 deg.C until they are used.

4.3.1.5 All rutile electrodes (EXX 13) shall be dried at 100 deg. C for 1 hour min. and held at 100 deg.C till use.

4.3.1.6 Fluxes for SAW shall be dried at 200 deg.C for 1 hour min. before use. Height of flux bed while drying in pan or oven, shall not be more than 100mm.

4.3.1.7 Unless otherwise specified , SS consumable shall be baked as per Electrode manufacturer's recommendations and stored at 120 º - 150 º C until use.

4.3.2 FIT UP

4.3.2.1 Proper fit up shall be ensured before welding as per Drawing. Tack welding or mechanical clampings shall be used to maintain the fit up requirements before and during welding.Bridge pieces used during fit up shall be of ferritic for ferritic materials and stainless for stainless steel materials.

4.3.2.2 Dimensions of the cross sections of groove welded joint shall be within the following tolerances w.r.t . drawing requirements:

	Root not back gouged	Root back gouged
1. Root face of joint(land)	± 2 mm	Not limited
2. Root opening of joint (with out backing)	± 2 mm	+ 2 mm - 3 mm
Root opening of joint* with backing)	+ 6 mm - 2 mm	Not Applicable
3. Groove angle of of joint	+ 10º - 5º	+ 10º - 5º

*(NOTE): Root opening wider than permitted by above tolerances but not greater than twice the thickness of the thinner part or 19mm,whichever is less may be corrected by edge buildup to acceptable dimensions prior to welding. Such build up edge shall be MPI / LPI checked.

4.3.2.3 For C. S. fillet welds, the parts shall be as close as practicable and gap shall be limited to 5 mm (If gap exceeds 2 mm, the leg of fillet shall be increased by the amount of gap but in no case shall exceed 4.8 mm). For thickness 75 mm and above gap up to 8 mm can be permitted provided suitable backing is used.

4.3.2.4 For S. S. fillet welds, the parts shall be as close as practicable. Gaps 2 mm and above upto 5mm are acceptable if the fillet size is increased by an amount equal to the gap.

4.3.2.4 Parts to be joined by butt welds shall be properly aligned. An offset not exceeding 10% of the thickness of the thinner part joined can be permitted, but in no case more than 3.2 mm, is permitted.

4.3.3 PRE HEATING

4.3.3.1 Pre heating requirements for welding shall be as per Clause 4.6.7 and controls shall be exercised as detailed below. No preheating is required for stainless steels.

4.3.3.2 Preheating shall be maintained during the entire process of welding.

4.3.3.3 Preheating is to be done using gas burner or induction / resistance heating. The temperature must be uniform and verified using thermal chalks or thermocouples prior to start of welding as well as during welding for a width of 't' (maximum) or 75 mm whichever is less.

4.3.3.4 Where interpass temperature control is required during welding, the temperature must be ensured using thermal chalks / thermocouples. Inter pass nitrogen / air cooling can be adopted to maintain inter pass temperature in case of stainless steels.

4.3.3.5 Wherever post heating is specified, the preheating shall be continued after welding till attaining the post heat temperature and maintained for the required time and cooled slowly by wrapping suitable insulating blankets like asbestos.

4.3.4 Welding shall be performed using qualified procedures and qualified personnel. Edge preparation and welding details shall be as per drawing.

4.3.5 For items to be manufactured at subcontractor's works , for requirements of qualification of procedure and personnel as per SIP:NP: 07 shall be followed.

4.3.6 When double bevel welding is adopted, back gouging and grinding is to be done. Back gouged groove shall be checked with PT / MT before welding from second side.

4.3.7 Proper sequence of welding shall be adopted to minimise distortion. The distortion of the finished jobs, if any may be corrected by mechanical means / hot correction.

4.3.7.1 For welding of SS extreme care is to be taken in weld sequencing to minimize the weld distortion and shrinkage. For complex weldments a weld sequence instructions may be prepared by contractor prior to work commencement. Weld joints likely to have high shrinkage should be welded (with minimum restraints) before welding other joints providing allowance for shrinkage.

4.3.7.2 While cutting long web plates suitable camber may berequired to compensate for the distorion during cutting and welding.

4.3.8 All butt welds of divider plate and guide vanes in ducts shall be flush ground inside.

4.3.9 The use of jigs and fixtures is recommended where ever practicable. Suitable allowances shall be provided for weld shrinkage. Proper sequence of welding shall be followed to control the distortion during welding.

4.3.10 All temporary attachments shall be welded with the required preheat. After their removal welded spots shall be ground flush and LPI checked.

4.3.11 Groove welds shall preferably be made with minimum reinforcement unless and otherwise specified in drawing / SQP. In case of butt welds, reinforcement shall not exceed 3.2 mm. and shall have gradual transition to the plane of the base material surface.

4.3.12 The surface of the welds shall be free from coarse ripples, overlaps, undercuts and abrupt ridges to avoid stress raisers.

4.3.13 Where parts of different thicknesses are welded or surface offset is more, the transition shall be made gradual by grinding / machining with 1: 2.5 taper.

4.3.14 Stray arcs shall be avoided to the extent possible. Arc spots if noticed shall be ground and checked by LPI / MPI. Thickness requirements shall be ensured after grinding.

4.4 WELD REPAIRS

4.4.1 Removal of defective weld / portions of the base material may be done by machining, grinding, chipping, gas cutting, oxygen gouging or carbon arc gouging. Defective portions of the weld shall be removed without substantial removal of sound base metal.

4.4.2 For under sized welds additional weld metal shall be deposited using an electrode preferably smaller than that used for making original weld limited to 4mm in diameter. The surfaces shall be cleaned thoroughly before deposition.

4.4.3 Defective welds/base metal shall be repaired by removing or/and rewelding as follows:

4.4.3.1 Overlap / excess weld metal shall be removed by grinding.

4.4.3.2 For excess concavity, crater, undersize & undercuts, deposit additional weld metal after cleaning the weld surface.

4.4.3.3 For Cracks in weld or base metal, ascertain the extent of crack by suitable NDE / acid etching, remove the crack to sound metal upto each end of the crack by arresting the ends for further propagation and reweld.

4.4.3.4 For weld porosity, slag inclusions & lack of fusion remove defective portions & reweld

4.5 HOT CORRECTION

4.5.1 Members which require hot correction are to be supported at suitable locations and mark the locations for heating.

4.5.2 Heat the locations marked by using neutral flame. Torches used for heating shall be moved continuously & uniformly over selected area to avoid localised over heating.

4.5.3 For Carbon steels the maximum temperature shall not exceed 650 ° C and shall be ensured using thermal chalks / thermocouples.

For alloy steels P4 – 705º C , P5 – 735º C temperatures are to be maintained for hot corrections

4.5.3.1 For Austenitice stainless steels the maximum temperature shall not exceed 430 ° C and shall be made known to inspection authorities . Otherwise , after hot correction solution annealing at 1050 – 1100 deg C is to be done.

4.5.3.2 For Ferritic/Martensitic/Duplex stainless steels the maximum temperature shall not exceed 315º C and shall be made known to inspection authorities . The temperature shall be ensured using thermal chalks / thermocouples.

4.5.4 Additional dead weights may be placed over the positive side of the bend depending upon the requirement to accelerate hot correction.

4.5.5 Allow for natural cooling. Accelerated cooling shall not be adopted. Remove the dead weights used after cooling.

4.5.6 Wherever the correction for distortion affects the weld joints, applicable NDE shall be repeated after the correction.

4.6 POST WELD HEAT TREATMENT (PWHT)

4.6.1 The process controls (temperature control and recording) for heat treatment shall cover the activities before, during and after heat treatment.

4.6.2 The weldment shall be cleaned to free of grease, oil etc. prior to heat treatment.

4.6.3 PWHT shall be done in a furnace or by local heating a band (including the entire weld and adjacent area of the base metal) .

4.6.4 The thermocouples and recording instruments shall be calibrated as per applicable standards and records maintained. The furnace shall have been qualified and calibrated.

4.6.5 All materials to be heat treated in furnace shall be loaded in such a way that they shall not be subjected to direct flame impingement. Jobs shall be preferably loaded on raised plat forms so that no material projects into the plane of burners. Alternatively flame deflectors may be provided in front of the burners to avoid direct flame impingement. Ensure loading of test coupons wherever applicable. The furnace temperature shall not exceed 315 º C at the time of loading material / weldment.

4.6.6 Number of thermocouples and their location shall be decided covering maximum and minimum thickness and covering all the zones. The temperature variation within 5 meters shall not exceed 140 º C during heating period (above 315 º C).

4.6.7 The **temperature requirements** for Pre heating, Post Weld Heat Treatment(PWHT) & temperatures are as below.(Unless otherwise specified.)

Material	Thickness	Pre heating	PWHT Temp.	Remarks
P1 Gr 1&2	t < 38	Nil	600 – 650 º C	a) For all butt welds in plate welded girders when t > 50mm.
	T= 39-62	100 º C		
	t> 63	150 º C		
P4 Gr 1&2	All	150 º C	680 – 700 º C	a)All butt welds in tension member b)All fabricated components when t>16mm(Note1)
P5 Gr 1&2	All	150 º C (Note2)	680 – 730 º C	All welds (Note 3)
P8	300 type 400type	120 º C 205 º C	- -	

Note 1 All fabricated structural components of P4 materials with any member above 16mm thickness, the entire assembly shall be post weld heat treated. However when size of fillet weld is less than 12 mm, PWHT is not required for non load carrying members.

Note 2 All welds on P5 material shall be post heated at 250 º C for 2 hrs or 150 º C for 4 Hrs, immediately following welding.

Note 3 All welds of P5 material shall be post weld heat treated. In case where the size of fillet is less than 12 mm, PWHT is not required for non load carrying members.

4.6.7.1 The **soaking time** shall be as follows:

a. For P1 materials the soaking time shall be 1 hr/inch of thickness(t) (2.5 mts / mm) upto 2" and 2 hrs + 15 minutes for each additional inch for t > 2".
b. For P4 & P5 materials the soaking time shall be 1 hr/inch of thickness (2.5 mts / mm) upto 5" and 5 hrs + 15 minutes for each additional inch for t > 5".

c. For comb ination cycles mentioned above, calculate the minimum soaking time for individual components as 2.5 minutes/mm of the thickness of weld/material whichever is applicable. Soaking time selected for the cycle shall not exceed the limits given below:

Material	Thickness (mm)	Max. soaking time (minutes)
P1 (A,B,C), P4, P5A, P1 (A,B) + P4, P4 + P5A	Up to 25 mm	125
	26 - 50 mm	200
	51 - 80 mm	250
	81 - 150mm	375
P1C + P4, P1 + P3	Up to 25 mm	65
	26 - 50 mm	125

4.6.7.2 Unless otherwise specified, in case of mixed loads of materials not covered under simulation HT, the following heat treatment temperatures shall be followed. In such cases, guidelines for soaking can be taken from Clause 4.6.9.

For components having butt joint between P1 & P4, or P3 & P4, the cycle shall be 630 - 670º C.

Where a component has a butt joint between P4 & P5A, the cycle shall be 680 - 710º . C.

Where a component has a butt joint between P1 & P3, the cycle shall be 620-660 º. C

For P1+P5A material combination, follow the WPS requirements

The following jobs shall not be combined in the same cycle during PWHT.

Separate jobs of P1 and P4 Separate jobs of P4 and P5

4.6.8 The following rules shall apply to establish the thickness to be used in determining the soaking time for PWHT.

4.6.8.1 For Butt welds, the thickness shall be the thickness of the material at the weld. For bar stock, the thickness shall be the diameter.

4.6.8.2 For fillet welds, the thickness shall be the throat thickness. If a fillet weld is used in conjunction with a groove weld, the thickness shall be the greater of the depth of the groove or the throat thickness.

4.6.8.3 For partial penetration branch welds, the thickness shall be the depth of the groove prior to welding.

4.6.8.4 For repairs, thickness shall be the depth of the groove as prepared for repair welding.

4.6.8.5 For combination of different welds in a component, maximum thickness of weld shall govern.

4.6.9 Requirements of Rate of Heating (ROH) above loading temperature 315 º C and Rate of Cooling (ROC) are as given below. During heating and cooling, variation in temperature between thermocouples shall be 85 º C maximum, unless otherwise specified.

Thickness	ROH / ROC (Max) Above / upto 315 º C
Up to 25mm	220 º C / hour
26 - 50 mm	95 º C / hour
50 – 75 mm	70º C / hour
Above 75 mm	55 º C
For S.S Matl	200 º C / hour min (Forced air cooling)

4.6.10 In case of interruption during Heat treatment the following action has to be taken depending on the stage of occurrence:

Type of Heat treatment	Stage of interruption	Action
Annealing & stress relieving	Heating	Heat treat subsequently as specified
	Soaking	Heat treat subsequently for balance soaking
	Cooling	If the ROC during interruption period meets the specified rate, cool subsequently at required rate upto 400º C. Otherwise, reheat to the soaking temperature, hold for 15 minutes and then cool at the specified rate
Normalising(N) Tempering (T) &, Soln. annealing (S)	Heating	Heat treat subsequently as specified
	Soaking	Heat treat subsequently for full soaking(N,S) / Balance soaking (T)
	Cooling	Not applicable

4.6.11 Local heat treatment can be carried out by Resistance heating or Induction heating. For local heat treatment of weld joints, width of the heated band on either side of the weld must be at least 3 times the width of the weld groove of the thickest part or 3 times the highest section thickness, whichever is greater.

4.6.11.1 The width of the insulation band beyond the heating band shall be at least twice the total width of the heating band.

4.6.11.2 A minimum of three thermocouples shall be placed such that at least one is on the weldment and the other two on the base material on either side of the weldment.

4.6.11.3 The winding arrangement shall be established to attain the required temperature. The initial rate of heating shall be minimum such that it stabilises at the required rate of heating before reaching 400 deg C.

4.6.12 After heat treatment, the charts shall be correlated with the job and cleared by QC. The chart shall contain cycle no, Date, W.O and DU details. Temperature, ROH, ROC and soaking time shall be calculated, entered in the chart and signed off by QC.

4.6.13 Wherever applicable the test coupons shall be tested and reports obtained to complete the clearance of heat treatment operation.

5.0 NON-DESTRUCTIVE TESTING

5.1 The requirement of NDE, extent and type of examination shall be as per respective product SQP and / or CQP .Wherever product SQP is not existing the following requirements shall apply.

5.2 Visual inspection shall be performed as per SIP:NP:06

5.3 RADIOGRAPHY.

a. All Butt welds of Carbon steel for thickness t >= 32mm
b. All butt welds of alloy steels for thickness t >12.0mm for P5 and T > 16mm for P4.
c. All butt welds in monorails.
d. SS butt welds of T > 16mm unless otherwise specified.

5.3.1 All radiographic films shall possess Firm code , RT agency, Cust. No, Part No, RT reference No. and weld location reference no. The job shall be numbered with Radiograph no.

5.4 MPI / LPI BEFORE PWHT

a. All flame cut edges of Carbon steel for t > 37.5 mm and alloy steels for t > 12mm.
b. All butt welds joining plate members in which one of the plate member is over 25 mm thick for Carbon steel and over 12 mm thick for alloy steel.
c. All fillet welds between tension flange and web.
d. All fillet welds joining plate members in which both the plate members are over 25 mm thick for Carbon steel and over 12 mm thick for alloy steel.
e. For all butt welds of CS & AS weld groove after back chipping prior to welding from second side.
f. All main fillet welds for SS require LPI
g. MPI/LPI for all fillet welds & HAZ of SA387 Gr.22 materials after HT.

5.5 All NDE shall be carried out by qualified personnel as per BHEL NDT procedures. Where subcontractors use their own procedures for NDE the same shall have the approval of BHEL NDTL.

6.0 MACHINING

6.1 GENERAL

6.1.1 Ensure of raw material identification throughout the machining process. Traceability to the contract shall be ensured by stamping or marking / painting or by tags(WO No.and DU / Part no.)

6.1.2 Where the material identification is likely to be removed during cutting or machining , the transfer of material identification shall be ensured.

6.1.3 In case of components / part processed items received from Subcontracting / other shops, ensure the completeness and clearance by QC / Customer Inspector through Inspection Reports / OPS.

6.1.4 Proper care shall be taken during handling of materials at all stages of manufacture. Items stored in the shop floor shall be properly identified and preserved to prevent mixup and damages / rusting / warpages.

6.1.5 All Machined surfaces shall be properly protected and stored. Wherever long storage is envisaged, they shall be preserved with grease / rust preventive oils and protected suitably with polythene / gunny bag or plastic peel off coatings.

6.2 MARKING

6.2.1 The marking on machined components shall be in such a location which will not be detrimental to the surface finish requirements of the component.

6.2.2 Purpose of marking is to:

1. Ensure availability of machining allowance.
2. Identify locations for machining.
3. Provide reference for setting and inspection.

6.3 PROCESS CONTROLS

6.3.1 The following shall be ensured for selection of work centers, tools, jigs and fixtures:

a The work centre for machining shall be identified in OPS / loading sheet based on the process capability of the machine or Machine accuracy established to suit the tolerances.

b Test hardwares (Jigs, Fixtures and Templates) used as a means of inspection / process control shall have been qualified through first off trials and shall be regulated through valid number. The same shall be reflected in the OPS / loading sheet .

c Softwares used in case of CNC / NC machines shall have been validated through trials or inspection of similar components produced and accepted.

d All cutting tools shall have been ensured for its correctness before use. In case of regrinding of tools they shall be verified after regrinding.

6.3.2 The following shall be ensured before setting the job on the machine, during processing and after completion of machining:

a Ensure the verticality and flatness of the job after clamping by using the reference markings or dialing the surfaces. Ensure the adequacy of clamping.

b Ensure proper clamping of the correct tool in to the tool holders.

c After machining the machined surfaces shall be cleaned and all corners shall be deburred. After removing from the machine they shall be properly stored.

d Before starting reaming ensure proper material allowance for finish operation.

e During drilling, reaming and tapping the removal of chips shall be done periodically to prevent clogging of chips. For deep drilling ensure that run out and drill travel are verified in free condition and ensure proper clamping of the tools.

6.4 INSPECTION

6.4.1 Ensure completeness of all final machining operations. Dimensional inspection shall be done with relevant drawings. Ensure use of calibrated instruments / gauges.

6.4.2 Unless otherwise specified in the drawing or SQP, the following tolerances can be used for untoleranced dimensions.

1.Linear Tolerance (:millimeters) - Medium

PERMISSIBLE DEVIATIONS FOR BASIC SIZE RANGE						
Up to 6	From 6 TO 30	from 30-120	From 120-400	From 400-1000	From 1000-2000	Above 2000
± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2	± 2.0

2. Angular Tolerance

a. Assembly characteristics ± 0.5º
b. Other characteristics ± 1º

7.0 FINAL INSPECTION

7.1 All dimension shall be inspected as per relevant drawings. Tolerances for fabricated items when not specified in drawings shall be as per clause 4.2.6.

8.0 CLEANING AND PAINTING

8.1 All the temporary cleats, bridge pieces shall be removed carefully so as to avoid damage to parent material. Temporary tack welds shall be ground smooth. Complete assembly shall be cleaned to remove mill scales, spatter, slag, rust, oil or grease.Surfaces shall be prepared and painted as per SIP:PP:22 (latest). Site EPs shall be applied with weldeable primer . All site EP shall be protected suitably from mechanical damage.

8.2 All temporary stiffeners / attachments used for transportation and handling that are removed after site assembly shall be painted with yellow paint.

8.3 Match marking and flow direction for applicable components shall be as per the respective product SQP./Drawing

8.4 The following details shall be clearly marked with relavant details by paint, bordered and covered by one coat of transparent varnish

Project Name :
Work order number :
Component / Assly. Designation :
DU Number :
Weight :
Sub-contractor Name / Code :

8.5 Tension flanges in girders are to be identified by hard punching indicating `TENSION FLANGE'.

8.6 For subcontracted items the firm code shall be punched and bordered with white paint.

BHARAT HEAVY ELECTRICALS LIMITED
TIRUCHIRAPALLI 620 014
QUALITY ASSURANCE

SIP: NP: 06/02

PROCEDURE FOR VISUAL INSPECTION OF NON PRESSURE PARTS

REV.	DATE	PREPARED BY	REVIEWED BY	APPROVED BY
00	15/07/96	-Sd- P.S.Narayanan	-Sd- A.R.Reddy	-Sd- V.Raghavendran
01	28/03/04	-Sd- A Francis	-Sd- G S N Murthy	-Sd- C R Raju
02	11/03/2017	11/03/2017 K.Nagarajan, Sr.Engineer/QA	11/03/2017 J.V.V.Aruna Kumar, DGM/QA	U.Revisankaran, 11/03/17 AGM/QA&BE

Record of Revisions

Revision No.	**Clause No.**	**Details of revision**
00		PR:QE:021/02renumbered as SIP:NP:06
		Editorial corrections for clarity
		Clause 3.1 modified
01	3.1	Code related change
	3.2	For better clarity
	3.2.1	For better clarity
	3.2.3	Code related change
	3.2.5	For better clarity
	4.4	Code related change
02	*3.2.2,3.2.4, 4.4 (3),4.4 (5)*	*Clauses modified based on AWS D 1.1 /D1.1M:2015 Standard.*

1.0 SCOPE

This procedure details out the visual inspection of all base metal surfaces and weld joints of Non Pressure Parts.

2.0 REFERENCE DOCUMENTS

AWS D 1.1 /D1.1M:2015 & relevant drawings.

3.0 VISUAL INSPECTION OF GAS CUT EDGES

3.1 Limits on acceptability and repair of mill induced laminar discontinuities in cut surfaces

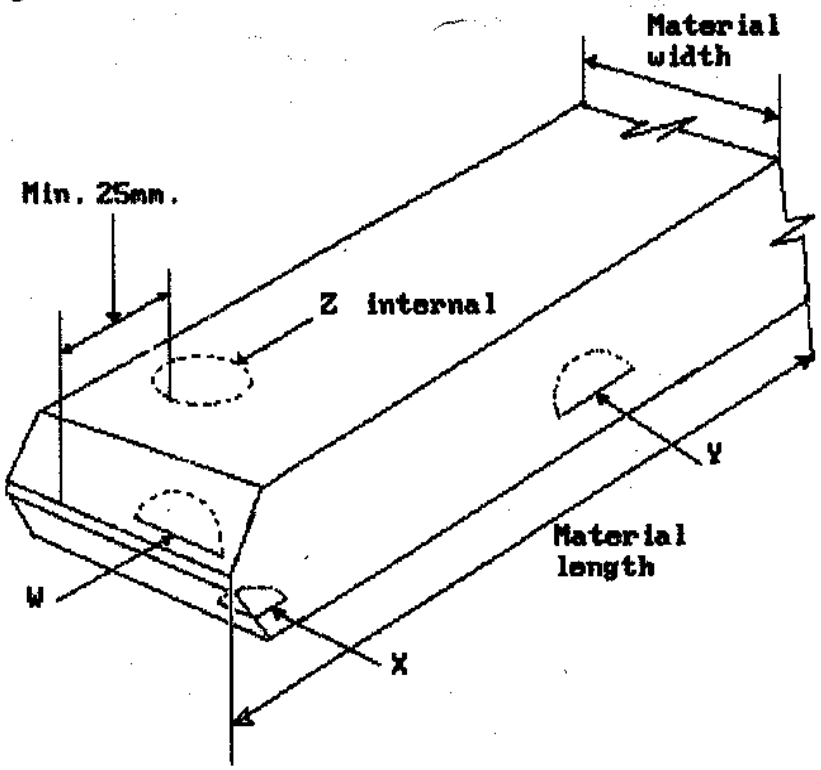
Description of Discontinuity	**Repair Required**
Any discontinuity 25mm in length or less	No repair required
Any discontinuity over 25mm in length and 3mm max. depth (after grinding & confirmation of depth on 10% of total such locations)	No repair required
Any discontinuity over 25mm in length with depth over 3mm but not greater than 6mm	Remove by grinding and weld.
Any discontinuity over 25mm in length with depth over 6mm but not greater than 25mm	Completely remove and weld.
Any discontinuity over 25mm in length with depth greater than 25mm.	Refer Clause 3.2

3.2 For discontinuities over 25mm in length with depth greater than 25mm, discovered by visual inspection(and subsequent grinding for depth assessment) of plate cut edges/ bevel edges before welding or during examination of welded joints by radiography or ultrasonic inspection, following procedure shall be followed:

3.2.1 Where discontinuities such as W, X or Y in Fig.1 are observed prior to completing the joint, the size, shape and area of the discontinuity shall be determined by UT.

3.2.2 The repair of the discontinuity by welding shall be allowed in case area of discontinuity does not exceed 4% of the cut area with the following exceptions: if the *length* of the discontinuity or the aggregate width of discontinuities on any transverse section, as measured perpendicular to the plate length, exceeds 20% of the plate width, the limit of 4% area shall be reduced by percentage amount of the width exceeding 20% (e.g., if the discontinuity is 30% of plate width, the area of discontinuity cannot exceed 3.6% of the plate area). The discontinuity on the cut edge of the plate shall be gouged out to a depth of 25mm beyond its intersection of the surface by chipping, or carbon arc gouging, or grinding and blocked off by welding with manual shielded metal arc process in layers not exceeding 3mm in thickness.

Fig.1 **EDGE DISCONTINUITIES IN CUT PLATE**



3.2.3 If discontinuity (Z) not exceeding the allowable area in Clause 3.2.2, is discovered after the joint has been completed and is determined to be 25mm or more away from the face of the weld, as measured on the plate surface, no repair of discontinuity is required. If the discontinuity (Z) is less than 25mm away from the weld, it shall be removed to a distance of 25mm from the fusion zone of the weld by chipping, air carbon arc gouging or grinding. It shall then be blocked off by welding with low hydrogen SMAW process in layers not exceeding 3mm in thickness for at least four layers. Submerged arc or other welding process may be used for remaining layers.

3.2.4 If the area of discontinuity (W), (X), (Y) or (Z) exceeds the allowable limits of Clause 3.2.2, the plate or sub-component shall be rejected and *replaced.*

3.2.5 The aggregate length of weld repair shall not exceed 20% of length of plate surface being repaired.

4.0 VISUAL INSPECTION OF WELDS

4.1 Visual examination of welds shall be performed after completion of welding and subsequent cooling to room temperature. However for ASTM A514 and A517 steels *(whenever used),* visual examination of welds shall be performed only after 48 hours of completion of welding.

4.2 All welds shall be cleaned to remove slag, spatter etc. and visually examined for defects like crack, undercut, porosity, lack of fusion etc.

4.3 The welds shall also be examined for size, shape and reinforcement.

4.4 **ACCEPTANCE CRITERIA AND DISPOSITION DETAILS ARE AS FOLLOWS:**

Sl.No.	Nature of defects	Acceptance norms	Disposition
1.	Crack, Lack of fusion, Overlap	Not accepted	Confirm by LPI/MPI, repair and retest.
2.	Crater (Except at the ends of stitch welds outside the required length)	Not accepted	Fill by weld deposit.
3.	<u>Under cut:</u> For T < 25 mm For T => *25 mm*	Up to 1.0 mm accepted. (Up to 2.0 mm if within 50mm for any 300 mm weld Length.) Up to 2 .0 mm accepted.	To be ground and merged/ welded. >2.0mm to be ground and merged/welded.
4.	<u>Porosity:</u> Transverse Butt welds Porosity for other Groove/Fillet welds	Piping porosity not permitted. One pore of ≤ 2.5 mm for each 100 mm of Weld length is permitted (*). *sum of diameters of piping porosity in fillet welds in web to stiffener: 10mm for 25 mm weld & 20mm for 300mm weld is however acceptable.	
5.	<u>Weld profile:</u> (i)Face of fillet (ii) Size (Minimum) (iii)Reinforcement (groove)	Flat or concave (meeting the throat) accepted. convexity is acceptable as below: 2mm for weld width ≤ 8mm 3mm for weld width > 8mm < 25 mm 5mm for weld width ≥ 25 mm As per drawing. Under size permitted as below(#) 2mm for nominal size < 5mm 2.5mm for nominal size 6mm 3mm for nominal size > 8 mm #In all case, undersized weld length shall not exceed 10% of the total weld length. *3mm (max.) for t ≤ 25mm ; 5mm(max.) for t > 25mm* *t= thickness of thicker plate for CJP; t= weld size for PJP*	

BHARAT HEAVY ELECTRICALS LIMITED

TIRUCHIRAPALLI 620 014

QUALITY ASSURANCE

QUALITY ASSURANCE

SIP: NP: 07/02

WELDING/WELDER QUALIFICATION FOR STRUCTURAL APPLICATIONS

REV.	DATE	PREPARED	REVIEWED	APPROVED
00	15/07/96	P.S.Narayanan	A.R.Reddy	V.Raghavendran
01	13/10/03	A Francis	GSN Murthy	C R Raju
02	25/11/09	T. Palanisamy	Bikramaditya Roy	Ravikumar V

Revision no	Clause no	Revision details
00	--	--
01	--	1.PR:QE:172/00 Renumbered as SIP:NP:07
		2.Editorial corrections for bettor clarity
02	--	1.Completely modified

1.0 SCOPE

1.1 This procedure details out the requirements of Welding procedure qualification/ Performance Qualification tests for welders and welding operators/ Welding procedure specification and maintenance of records for the same at sub Vendor works for structural application.

1.2 REFERENCE DOCUMENTS

1.2.1 AWS D1.1/D1.1M:2008.

2.0 WELDING PROCESS

a. **SMAW** -Shielded Metal Arc Welding.
b. **SAW** --Submerged Arc Welding.
c. **#GMAW** –Gas Metal Arc welding. (Note 1to3 to be strictly followed)

#Note,

1. Prior approval for GMAW to be obtained from BHEL/quality.
2. Gas Mixture of 80% Argon & 20% CO2 to be ensured.
3. All Production welds shall be done inside the closed shed only.

3.0 WELDING PROCEEDURE QUALIFICATION

3.1 Prepare draft WPS and get it approved by BHEL WTC.

3.2 Consumable selected for draft WPS shall be as per BHEL approved brand.

3.2.1 All NDE and pre treatment for plate before/after cutting & during/ after welding shall be as per the respective QCP & SQP.

3.3 Test plate of size 180x380mm of Specified thickness-2 nos for all butt (fig 5), corner (Fig 9) & fillet (fig 2) weld joints.

3.4 Minimum procedure qualification test requirement for Structural Fabrication : Carbon Steel to IS 2062 E250 GR A OR B.

Sl. NO	Process	PL. thick	Pre-heat	PWHT	Type of Jt.	Test-position	Position qualified
1	SMAW	25mm	NIL	NIL	Groove butt weld	1G	1G,1F
2	SMAW	40mm	YES 100deg.C	NIL	Groove butt Weld	2G	1G,2G,1F,2F
3	SMAW	56mm	Yes 100deg.C	Yes	Groove Butt weld	1G	1G,1F
4	SMAW	10mm	NIL	NIL	Corner weld	3G	3G, 3F
5	SMAW	*	NIL	NIL	Fillet	3F	3F
6	SAW	25mm	NIL	NIL	Butt weld	1G	1G,1F
7	SAW	25	Yes 100deg.C	NIL	Butt weld	1G	1G & 1F
8	SAW	56mm	YES 100deg.C	NIL	Corner weld	1G	1G & 1F
9	SAW	*	NIL	NIL	Fillet	1F	1F
10	SAW	*	NIL	NIL	Fillet	1F	1F
11	GMAW	10mm	NIL	NIL	fillet	3F	1F
12	GMAW	10mm	NIL	NIL	Groove butt weld	2G	1G,2G,1F,2F

Note:

1.0 * Ref fig 8 for size of test plates for fillet welds.

2.0 For all other material combinations separate procedure to the relevant code/standard shall be qualified before start of production welds.

3.0 SAW corner groove weld qualification with 15°+30° groove angle (ref fig9) shall be done along with plate groove butt weld.

4.0 For pipe WPS qualification Dia. 2 inch of schedule 80 and 6 inch of schedule 120 are to be welded in 5G & 2G position respectively. This qualifies for all sizes, positions and unlimited thickness of pipes and tubes.

3.5 Base material other than Carbon steel, applicable welding process is SMAW only. In such cases PQR shall be qualified as per AWS D.1.1.

3.6 Test shall be done in presence of BHEL/ QC or BHEL nominated AIA.

4.0 **BASE MATERIAL.**

4.1 Test plate base material shall match with drawing or other engineering Documents.

4.2 Test plate weld surface shall be ground smooth and free from Oil & scales.

5.0 WELDING REQUIREMENT

5.1 Weld groove configuration and dimensions shall be as shown in the Draft WPS, drawing or Sketch authorized by engineering for processing.

5.2 All Procedure qualification and production welds of SAW process shall be done in 1G/1F position only.

5.3 Details of process and consumable used for welding such as Preheat, consumable size, brand name, AWS classification for electrode, Wire and flux, Shielding gas etc shall be recorded and maintained.

5.4 Details of the welding parameters Such as Welding current, voltage, travel speed, wire feed, shielding gas mixture & gas flow rate etc shall be recorded and maintained.

5.5 Details of number of layers and passes of groove or fillet welds (fig6) shall be recorded.

5.6 Back gouge/grind the second side as applicable and ensure weld soundness by MT/PT before second side weld.

5.7 Complete the weld and ensure weld soundness by applicable NDE (MT, PT, and RT or UT).

5.8 Necessary PWHT (as per draft WPS) shall be done before marking the test Specimen for mechanical test.

5.9 The defective portion of the welds in the test plate shall be discarded and not repaired

6.0 Test plate Specimen & test requirement:

6.1 Test Specimen for butt welded test plate as per fig 5 and Fillet/ corner welded test plate as per fig 7 shall be punched with inspecting engineer's stamp before cutting the test specimen.(No. of test specimen shall be as per table-2)

6.2 WPS test specimen requirement for mechanical test are as follows:

Table 2

Test pl. thickness & dia. In mm	***Reduced Section tensile***	***Bend test 4t,180^0***			***Macro***	***thick qualified***		***Dia. Qualified***
		Root	*face*	*Side*		*Min.*	*Max.*	
T 3 to 10	***2***	***2***	***2***	*******	***--***	***3mm***	***2T***	***--***
T>10 T < 25	***2***	***--***	***--***	***4***	***--***	***3mm***	***2T***	***--***
T25 & over	***2***	***--***	***--***	***4***	***----***	***3mm***	***Unlimited***	***--***
Dia. 50 & t6	***2***	***2***	***2***	***-***	***--***	***3mm***	***20mm***	***Dia.20-100***
Dia. 150 t12	***2***	***2***	***2***	***-***	***--***	***5mm***	***Unlimited***	***Dia.>100mm***
Corner/ fillet weld	***--***	***--***	***--***	***--***	***3***	***5mm***	***Unlimited***	***--***

**For 10mm plate or wall thickness, a side bend test may be substituted for each of the required face- and root- bend tests.*

7.0 Mechanical test

7.1 Prepare the test specimen as per AWS D1.1 and move to BHEL Lab or NABL accredited lab for mechanical testing.

7.2 Mechanical test to be done in presence of BHEL/QC or BHEL nominated AIA.

8.0 Preparation of PQR & WPS

8.1 Generate qualified WPS and PQR (as per the format enclosed in page 9 and 10) indicating all process parameters, Mechanical/ NDE test results, reports as applicable and submit to inspection engineer for verification and approval.

9.0 Welder/ Welding operator qualification (WQ)

9.1 The welder/ welding operators engaged for procedure qualification tests are automatically qualified for production welding.

9.2 Test material: for carbon and alloy steel respective materials shall be used for test.

9.3 Test plate size: 200x200x25 mm or 200x200 and respective plate thicknesses.

9.4 WQ Test and production position qualified are as follows.

Table 3.

Weld type	Test Position	Production position qualified
Plate Groove	3G	1G, 2G, 3G, 1F, 2F & 3F
Plate groove	1G	1G & 1F
Plate fillet	1F	1F
Plate Fillet	3F	1F, 2F & 3F
Pipe Groove	2G & 5G	All position.
Pipe fillet	4F	1F,2F & 4F

Note: Additional position can be qualified if required. Only qualified personnel shall be engaged in respective positions for production weld.

9.5 WQ Test requirement: Two Nos of side bend tests or 100% RT for butt welded test piece. Macro examination at three faces for fillet welds as per fig 7.

9.6 On successful test results WQR (as per the format enclosed in page 8) to be prepared & countersigned by inspection engineer and maintained for verification.

9.7 **WQ period of effectiveness:**

Qualification is effective unless : 1) The operator or welder is not engaged in welding for a period exceeding six months or unless 2) There is a specific reason to question his ability.

10 **Documentation:**

10.1 Prepare consolidated list of qualified WPS, Welder and Welding operator qualification records and maintain.

11 **Qualification–Types & Limitations**

11.1 Requalification of WPS is required in the following cases

Sl. No	Welding variable	SMAW	SAW	GMAW
1.	Change from Low hydrogen to non low hydrogen electrode	Yes	--	--
2.	Change from wire & flux combination	--	Yes	--
3.	Change in nominal filler metal diameter by	>0.8mm	Increase	yes
4.	>7% Change in voltage each dia. used	--	Yes	Yes
5.	% change in travel speed	--	>15	>25
6.	Change in position qualified	Yes	Yes	Yes
7.	A decrease in Groove angle	Yes	Yes	Yes
8.	A decrease in Root gap	Yes	Yes	Yes
9.	An increase in root face	Yes	Yes	Yes
10.	Addition or deletion of PWHT	Yes	Yes	Yes

12 **PQR/ WPS requirement for Different strength Base materials**

12.1 For dissimilar composition of Low strength to high strength welded connections separate PQR and WPS shall be qualified.

12.2 In such cases Low hydrogen electrodes shall only be used. (Preheat,Post heat and PWHT as per applicable SQP and draft WPS).

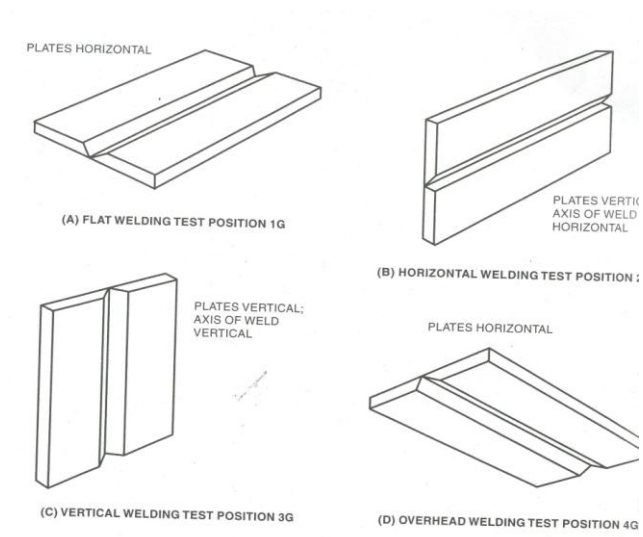


Figure 1

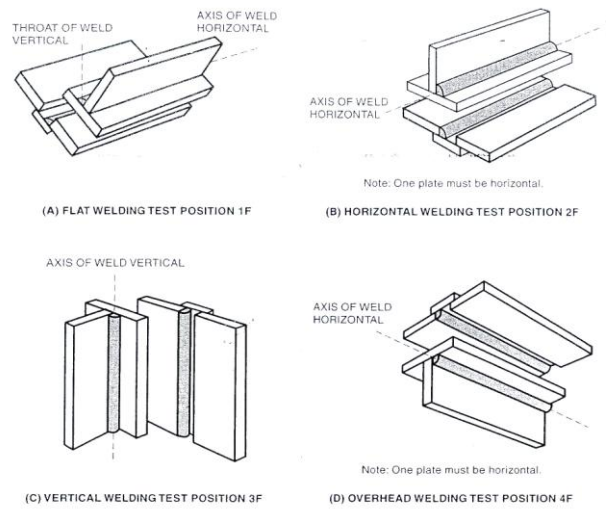


Figure 2

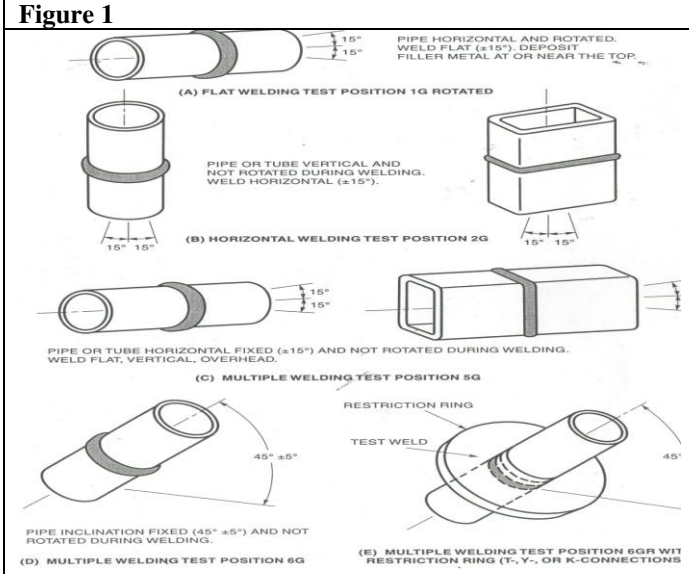


Figure 3

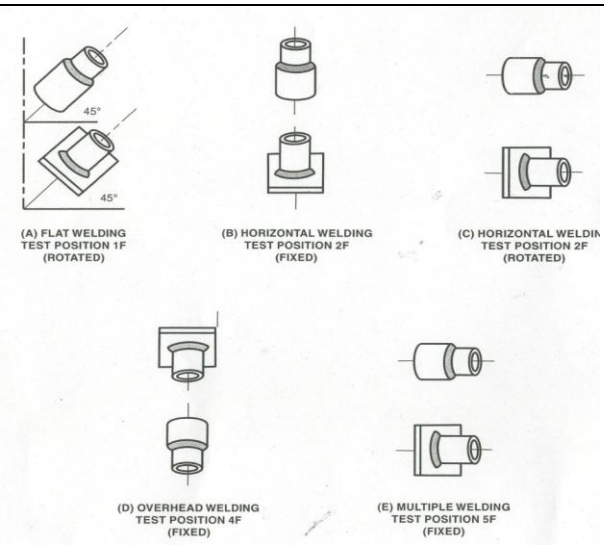


Figure 4

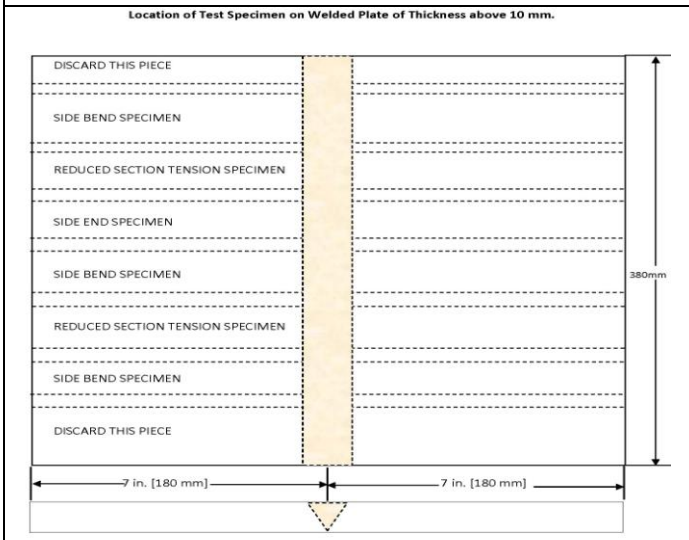


Figure 5

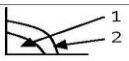
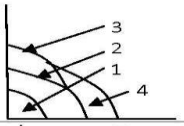
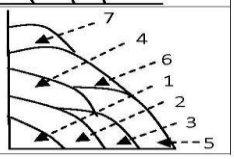
Fillet size	No. of layer	No. of Passes	Joint layer & passes
Up to 10mm	1	1	
12	1 2	1 2	
16	1 2 2	1 2 3	
20	1 2 3 3	1 2 3 4	
25	1 2 3 3 4 4 4	1 2 3 4 5 6 7	

Figure 6

Figure 7 Fillet weld test specimen Details

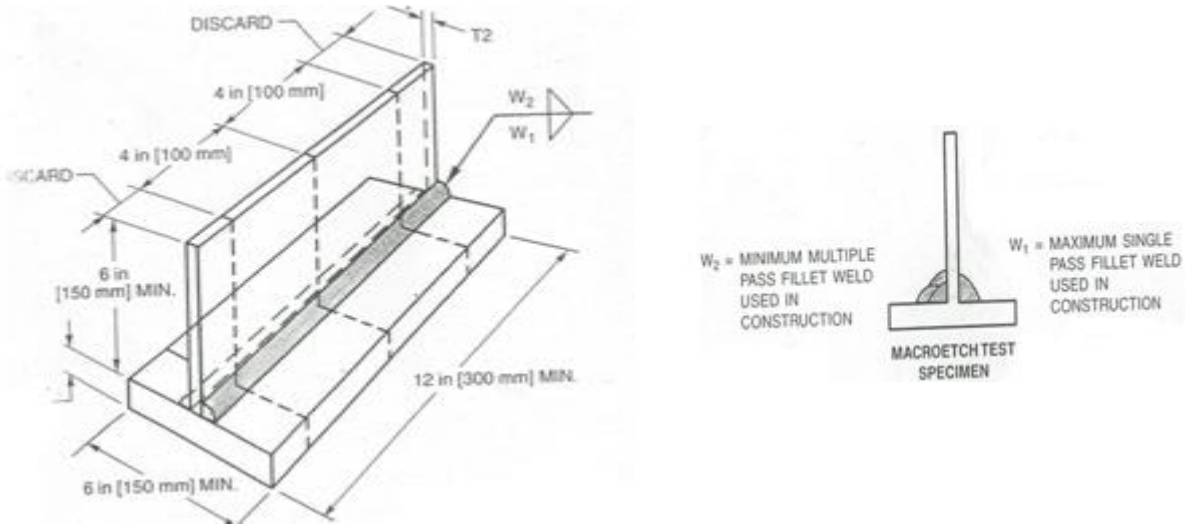
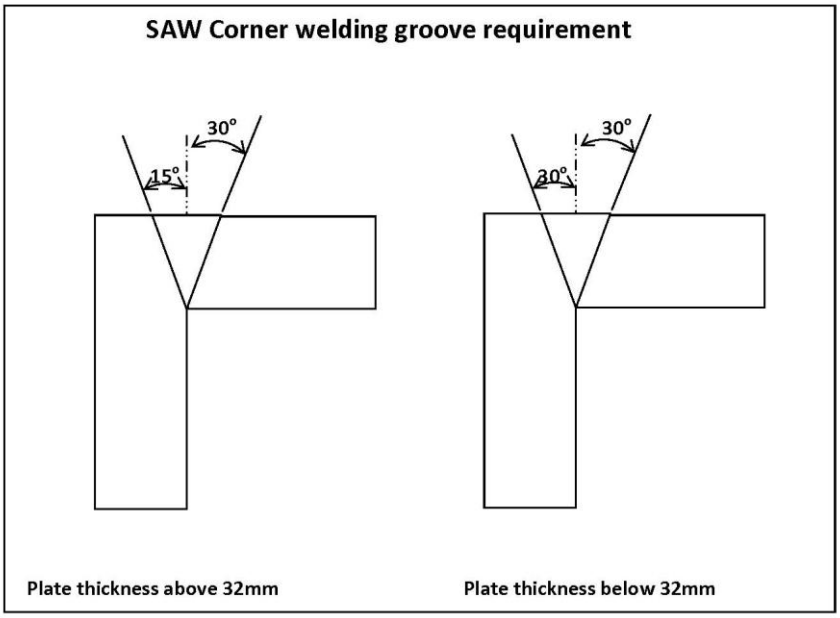


Figure 8 Fillet weld Test plate Selection details

Weld Size in mm	T1 minimum	T2 minimum
5	12	5
6	20	6
8	25	8
10	25	10
12	25	12
16	25	16
20	25	20
>20	25	25
Note: Where the maximum plate thickness used in Production is less than the value shown above, the Maximum thickness of the production plates may be Substituted for T1 & T2.		

Figure 9



WELDER, WELDING OPERATOR, OR TACK WELDER QUALIFICATION TEST RECORD

Type of Welder _____

Name _____ Identification No. _____

Welding Procedure Specification No. _____ Rev _____ Date _____

Variables	Record Actual Values Used in Qualification	Qualification Range
Process/Type [Table 4.12, Item (1)]		
Electrode (single or multiple) [Table 4.12, Item (7)]		
Current/Polarity		
Position [Table 4.12, Item (4)]		
Weld Progression [Table 4.12, Item (5)]		
Backing (YES or NO) [Table 4.12, Item (6)]		
Material/Spec.	to	
Base Metal		
Thickness: (Plate)		
Groove		
Fillet		
Thickness: (Pipe/tube)		
Groove		
Fillet		
Diameter: (Pipe)		
Groove		
Fillet		
Filler Metal (Table 4.12)		
Spec. No.		
Class		
F-No. [Table 4.12, Item (2)]		
Gas/Flux Type (Table 4.12)		
Other		

VISUAL INSPECTION (4.8.1)

Acceptable YES or NO _____

Guided Bend Test Results (4.30.5)

Type	Result	Type	Result

Fillet Test Results (4.30.2.3 and 4.30.4.1)

Appearance _____ Fillet Size _____

Fracture Test Root Penetration _____ Macroetch _____

(Describe the location, nature, and size of any crack or tearing of the specimen.)

Inspected by _____ Test Number _____

Organization _____ Date _____

RADIOGRAPHIC TEST RESULTS (4.30.3.2)

Film Identification Number	Results	Remarks	Film Identification Number	Results	Remarks

Interpreted by _____ Test Number _____

Organization _____ Date _____

We, the undersigned, certify that the statements in this record are correct and that the test welds were prepared, welded, and tested in conformance with the requirements of Clause 4 of AWS D1.1/D1.1M, (_____) *Structural Welding Code—Steel.*
(year)

Manufacturer or Contractor _____ Authorized By _____

Form N-4 Date _____

WELDING PROCEDURE SPECIFICATION (WPS) Yes ☐
PREQUALIFIED _____ QUALIFIED BY TESTING _____
or PROCEDURE QUALIFICATION RECORDS (PQR) Yes ☐

Identification # _____
Revision _____ Date _____ By _____
Authorized by _____ Date _____
Type—Manual ☐ Semiautomatic ☐
Machine ☐ Automatic ☐

Company Name _____
Welding Process(es) _____
Supporting PQR No.(s) _____

JOINT DESIGN USED
Type:
Single ☐ Double Weld ☐
Backing: Yes ☐ No ☐
Backing Material:
Root Opening _____ Root Face Dimension _____
Groove Angle: _____ Radius (J–U) _____
Back Gouging: Yes ☐ No ☐ Method _____

BASE METALS
Material Spec. _____
Type or Grade _____
Thickness: Groove _____ Fillet _____
Diameter (Pipe) _____

FILLER METALS
AWS Specification _____
AWS Classification _____

SHIELDING
Flux _____ Gas _____
Composition _____
Electrode-Flux (Class) _____ Flow Rate _____
Gas Cup Size _____

PREHEAT
Preheat Temp., Min. _____
Interpass Temp., Min. _____ Max. _____

POSITION
Position of Groove: _____ Fillet: _____
Vertical Progression: Up ☐ Down ☐

ELECTRICAL CHARACTERISTICS
Transfer Mode (GMAW) Short-Circuiting ☐
Globular ☐ Spray ☐
Current: AC ☐ DCEP ☐ DCEN ☐ Pulsed ☐
Power Source: CC ☐ CV ☐
Other _____
Tungsten Electrode (GTAW)
Size: _____
Type: _____

TECHNIQUE
Stringer or Weave Bead: _____
Multi-pass or Single Pass (per side) _____
Number of Electrodes _____
Electrode Spacing Longitudinal _____
Lateral _____
Angle _____
Contact Tube to Work Distance _____
Peening _____
Interpass Cleaning: _____

POSTWELD HEAT TREATMENT
Temp. _____
Time _____

WELDING PROCEDURE

Pass or Weld Layer(s)	Process	Filler Metals		Current		Volts	Travel Speed	Joint Details
		Class	Diam.	Type & Polarity	Amps or Wire Feed Speed			

Form N-1 (Front)

Procedure Qualification Record (PQR) # _____
Test Results

TENSILE TEST

Specimen No.	Width	Thickness	Area	Ultimate Tensile Load, lb	Ultimate Unit Stress, psi	Character of Failure and Location

GUIDED BEND TEST

Specimen No.	Type of Bend	Result	Remarks

VISUAL INSPECTION
Appearance _____
Undercut _____
Piping porosity _____
Convexity _____
Test date _____
Witnessed by _____

Radiographic-ultrasonic examination
RT report no.: _____ Result _____
UT report no.: _____ Result _____

FILLET WELD TEST RESULTS

Minimum size multiple pass		Maximum size single pass	
Macroetch		Macroetch	
1. _____	3. _____	1. _____	3. _____
2. _____		2. _____	

Other Tests

All-weld-metal tension test
Tensile strength, psi _____
Yield point/strength, psi _____
Elongation in 2 in, % _____
Laboratory test no. _____

Welder's name _____ Clock no. _____ Stamp no. _____

Tests conducted by _____ Laboratory

Test number _____

Per _____

We, the undersigned, certify that the statements in this record are correct and that the test welds were prepared, welded, an tested in conformance with the requirements of Clause 4 of AWS D1.1/D1.1M, (_____) *Structural Welding Code—Steel*
(year)

Signed _____
Manufacturer or Contractor

By _____

Title _____

Date _____

Form N-1 (Back)

BHARAT HEAVY ELECTRICALS LIMITED
TIRUCHIRAPPALLI - 620 014
QUALITY ASSURANCE DEPARTMENT

AMENDMENT TO QUALITY WORK INSTRUCTIONS (QWI)

QWI NO: QP NO. : SIP:PP: 22 REV.: 03

AMENDMENT SL NO: A1 DATE: 01/12/2004

PROCEDURE FOR SURFACE PREPARATION AND PAINTING
(Boilers and Valve Components)

Clause No	Amended as...	Basis for amendment
Annexure II & Annexure IV	As below	Decision taken at FB Operations Review meeting on Dt: 01/12/04

ANNEXURE - I I : PAINTING SCHEME FOR FOSSIL BOILER PGMAs

PG Description	PGMA(s)	Surface preparation	Painting Scheme
Columns	35 - 1xx	SSPC SP 3	1a
Ceiling Girders, Cross Beams	35 - 2xx		
Columns	36 - 1xx		
Columns	38 - 1xx		
Columns	39- 1xx		

ANNEXURE - IV : PAINTING SCHEME FOR FBC & HRSG PGMAs

PG Description	PGMA(s)	Surface preparation	Painting Scheme
Bunker Structure	34 - xxx	SSPC SP 3	1a
Columns	35 - 1xx		
Ceiling Girders, Cross Beams	35 - 2xx		

NOTE	The above-mentioned changes will be incorporated in the relevant QWI during the next revision of the document.

Prepared by: V Jayaraman	Approved by: V Thyagarajan
Signature & Dt: V. Jayaraman 1/12/04	Signature & Dt: V Thyagarajan 1/12/04

Bharat Heavy Electricals Ltd. Tiruchirappalli 620014 QUALITY ASSURANCE	

SIP:PP:22/03	PAGE : 1 of 14

PROCEDURE FOR SURFACE PREPARATION AND PAINTING

(Boilers and Valve Components)

REV	DATE	PREPARED	REVIEWED	APPROVED
03	10/05/03	Manager Plant Lab	DGM/ Plant Lab (R. VEERARAGHAVAN)	AGM / QA & Labs (A.V. KRISHNAN)
			Sr. Manager/PE (FB) (BV NARAYANAN)	
			DGM/PE (IPP) (S. SHANMUGAM)	
		Manager Quality Assurance (R.SN MURTHY)	DGM /PE(Valves) (P. LOGANATHAN)	
			SDGM/QC (J. KANNAN)	
			SDGM/QA (S. VISWANATHAN)	

RECORD OF REVISIONS

Rev.No.	Date	Details of revision	Remarks
00	15.07.96	PR:QE:104/05 was revised totally and renamed as SIP:PP:22. Content of PR:QE:185 /00 is also merged with this document.	
01	16.07.98	The document has been revised to incorporate service condition oriented painting selection scheme for components PGMA wise. SIP : VS : 09 and SIP : VS : 18 are merged with this document.	
02	02.08.99	Editorial changes in several clauses based on feedback. Annexure - VI & VIII of Revn 01 removed. Annexure VII added. Clauses renumbered. Sub clauses added in CL. 5.0 based on feed back. Annexure- III painting schemes changed.	
03	23.04.03	Completely modified	

1.0 SCOPE

1.1 This procedure covers the requirements of Surface preparation and application of Primer and Finish paints for components of FB, IPP, Valves and Spares based on environmental and service conditions.

1.2 **Special Contractual requirements, if any, will be indicated in a) the respective Drawings (when customer approval is required) b) through a separate Contract Specific Document (with customer approval wherever called for) .** The Contract Specific Document will be initiated by the concerned Engineering/ Commercial/Contracts/ Marketing group and further details filled in by Plant Laboratory). The linkage will be provided in the CQR issued by QA.

2.0 GENERAL

2.1 This procedure specifies the painting requirements to a) provide adequate surface protection of components under good storage conditions at Site b) temporary protection for components coming inside the boiler in flue gas path till they are erected inside the boiler and c) protection for a reasonable time till completion of erection for components continuously exposed to atmospheric environment.

2.2 However, sites shall assess the need and carry out cosmetic re-preservation as required when components are received at site and subsequently, at a predetermined periodicity based on site storage conditions..

2.3 For bought-out items, the painting scheme shall be as specified in Engineering Drawing / Specification. Wherever it is not specified, it shall be as per the painting scheme of the applicable PGMA in this document.

2.4 In case of any non-clarity / missing PGMAs in painting scheme, the concerned Engineering Group may be contacted for clarification.

3.0 PAINTING SCHEME

3.1 The surface preparation, primer coat and finish coat requirements for various painting schemes are given in Annexures I to IV

3.2 The Paints envisaged in this document are coded as Pa XX and the details of the paint specification are given in Annexure - I (b).

4.0 SURFACE PREPARATION

4.1 Surfaces of components shall be thoroughly cleaned before the application of primer paint and shall be free from grease, oil, dust, rust, weld slag, spatters etc..

4.2 Abrasive blast cleaning to SSPC-SP6 (Sa 2)grade shall be done to prepare the surface of hot worked pipes prior to application of primer.

5.0 APPLICATION OF PAINT

5.1 Primer paint shall be applied within 4 hours in the case of shot blast cleaning and within 8 hours for mechanical cleaning.

5.2 Wherever tubes / pipes are not either shot blasted or heat treated during manufacture, the rust preventive coating provided by the tube / pipe mill shall be treated as base for primer coating for subsequent painting of alkyd base paints like one coat of redoxide zinc chrome (when called for). When special paint is specified in the painting scheme, the existing Rust preventive fluid is to be removed by blast cleaning. However, the rusted areas are to be cleaned free of oil, grease, rust etc. thoroughly using emery paper/ wire brush and making the rust preventive coated surfaces coarse.

5.3 Ready mixed paints shall be used as supplied by the supplier **without any addition of thinner unless otherwise specified.** Two pack systems are to be used as per supplier's instructions.

5.4 Wherever Second coat or Finish coat is to be applied in succession, 12 hours minimum drying time shall be provided between each coat for single pack paints. For two pack system refer paint supplier's catalogue.

5.5 No painting is required in case of Stainless Steel, Aluminum and Galvanized components, unless otherwise specified in contracts.

5.6 For all machined components, rust preventive fluids shall be applied .

5.7 All weld edge preparations for site welding shall be applied with one coat of Weldable primer. For small components having weld ends on both sides, full surface can be painted with weldable primer.

5.8 Part processed items meant for shop assembly shall be painted at sub-contractors works with primer / special paints (when called for in the painting scheme) based on the scope of the indent/Purchase Order. Further paint touchup / Coating shall be given appropriately during assembly.

5.9 All threaded components of spring assemblies and turn buckles shall be galvanized and achromatized to 15 microns minimum thickness

5.10 For items meant for Spares and subcontracting where no further processing is involved, , the painting scheme selected shall be the same as that of similar product configuration / description and not with respect to PGMA. All running meter items for spares one coat of Red Oxide primer is sufficient.

5.11 Assemblies consisting of machined components and special equipments shall not be shot blasted wherever it may affect the system. In such cases power tool cleaning may be adopted for the localized areas only.

5.12 In components (For example: Expansion Joints), wherever plates / sheets of thickness less than or equal to 5mm is used, power tool or Sand /emery paper cleaning can be adopted with painting scheme 3, or alternate scheme as specified in the contract painting scheme.

5.13 Wherever inside surfaces of components need protection till erection (for example inside surfaces of ducts and dampers), two coats of primer (Pa 8) are to be applied.

6.0 INTERNAL PROTECTION

6.1 For internal protection of Pipes , tubes, headers and other pressure parts , VCI pellets shall be put (after sponge testing / draining and /or drying) and subsequently end capped.

6.2 The dosage of Volatile Corrosion Inhibitor (VCI) pellets shall be approximately 100 grams/ m^3 For tubes typically 4 -5 tablets per end are to be put.

6.3 For C & I items the dosage of self indicating Silica gel (color less) shall be 250 grams per Cubic meter. (about 2 to 3 bags weighing approximately 100 grams each) .

6.4 **VCI pellets shall not be used for stainless steel components and its composite assemblies**.

7.0 CLEANING OF PAINTED & RUST PREVENTIVE COATED SURFACES

Wherever required, paints and rust preventive protection can be removed either by using the following commercial solvents or by flame cleaning/ blasting.

For Rust preventive	Acetone, Carbon Tetra Chloride or Tri-Chloro Ethylene
For all paints	Alkaline paint strippers or Solvent based paint strippers

COMPARATIVE CHART FOR SURFACE PREPARATION SCHEME

DESCRIPTION	SSPC Scheme	Swedish Standard SIS - 05 - 5900
Solvent cleaning	SSPC-SP1	-
Hand tool cleaning	SSPC-SP2	St2
Power tool cleaning	SSPC-SP3	St3
Flame cleaning	SSPC-SP4	Fl
Blast cleaning to white metal	SSPC-SP5	Sa3
Commercial blast cleaning	SSPC-SP6	Sa2
Brush off blast cleaning	SSPC-SP7	Sa1
Pickling	SSPC-SP8	-
Blast Cleaning to near white metal	SSPC-SP10	Sa2½

ABRASIVE BLAST CLEANING

To get a profile of 25-50 microns, the following sand , grit or shot sizes are to be used for getting optimum results.

ABRASIVE	Size in mm	Proportion by% Mass
River Sand (ASTM 16-30 mesh)	0.6 to 1.2 mm	95 % minimum
Cast steel shots to SAE 230	+ 1.00 + 0.85 + 0.60 + 0.50	0 % <0.10% 85.0% 97.0% (Cumulative)
Steel Grits to SAE G 40	+ 0.425 + 0.30 + 1.00	>70.0% >80.0% (Cumulative) 0.0 %

ANNEXURE - I (a) GUIDELINES FOR PAINTING SCHEME SELECTION

Painting Scheme No	Anticipated Service Condition	Primer Coat			Finish Coat			Total DFT µm	Remarks
		Paint	No. of coats	DFT per Coat-µm	Paint	No. of coats	DFT per Coat-µm		
1a	Permanently exposed to atmosphere in service - Normal industrial atmosphere	Pa 1	1	30	Pa2	2	20	70	
1b	Permanently exposed to corrosive atmosphere in service - Coastal / refinery environment	Pa3	2	50	Pa4	2	30	160	
1c	Permanently exposed to atmosphere in service, but painting / difficult-to-remove-coatings not preferred.	Pa5	1	--	--	--	--	--	
2	Temporary Protection till erection - exposed to flue gas in service	Pa7	1	35	--	--	--	35	Dip / Brush Coat
3	Temporary Protection till erection - fully insulated (not in the flue gas path) high temperature service	Pa1	2	30	--	--	--	60	
4	Temporary Protection till erection - where painting is not recommended, but coating of oil is preferred	Pa9	1	25	--	--	--	25	
5	Temporary Protection till erection - where painting is not recommended, but rust preventive coating is preferred	Pa9	1	25	--	--	--	25	
6	Protection by galvanizing	Galvanizing to 610 gm / m^3 (85 µm approximately)							
7	Protection by Phosphating	Phosphating to 1500 mg/ ft^2 (16.15 gm / m^2) is recommended by Seven Tank method							
8	Non-insulated components, externally visible, facing high temperature service upto 200 ° C	Pa10	1	15	Pa10	1	15	30	
9	Non-insulated components, externally visible, facing high temperature service from 200 ° C to 400 ° C	Pa11	1	15	Pa11	1	15	30	
10	Non-insulated components, externally visible, facing high temperature service from 400 ° C to 600 ° C	Pa12	1	15	Pa12	1	15	30	
11	No need for any surface protection	--	--	--	--	--	--	--	
12	Sea Water carrying pipes requiring internal protection	Pa13	1	200	--	--	--	200	
13	Paints for off-shore applications	Pa14	1	100	Pa15	1	30	130	
14	Specific painting based on contract requirements	Contract Painting Scheme shall be adopted in total							
15	Lesiga Practice	Pa 18	1	35	Pa 15	1	30	65	
16	Permanently exposed to atmosphere in service – Atmospheric Temperature is sub-zero (as low as – 30 C	Pa 3	2	50	Pa 4	2	30	160	
17	Permanently exposed to atmosphere in service - Requiring fire retardant protection	Pa 6	1	40	Pa 16	1	40	80	Sub-delivery items

ANNEXURE - I (b) : PAINT SPECIFICATIONS

Paint Specification code	PAINT DESCRIPTION
Pa 1	Red oxide Zinc phosphate primer (Alkyd Base) to IS 12744 by brush /spray
Pa 2	Synthetic Enamel long oil Alkyd to IS 2932 (latest)
Pa 3	High Build Chlorinated Rubber based Zinc Phosphate Primer % Volume Solids = 40 (min), DFT= 50µm / Coat (min)
Pa 4	Chlorinated Rubber based Finish Paint % Volume Solids = 30 (min), DFT= 30µm / Coat (min)
Pa 5	Non drying type rust preventive fluid to IS 1154 (latest)
Pa 6	Inorganic Ethyl Zinc Silicate Primer to IS 14946 % Volume Solids = 60 (min), DFT= 65µm / Coat (min)
Pa 7	Zinc chrome Primer (Alkyd base) by Dip Coat. (Shade : Yellow) BHEL specification PR:CHEM:09-03 (latest) *Red oxide Zinc phosphate primer (Alkyd Base) to IS 12744 by dip coat to BHEL specification PR:CHEM:09-03 (latest) –* ***after consumption / usage of existing paint stocks confirming to Zinc chrome Primer (Alkyd base - Shade : Yellow)***
Pa 8	*Deleted and replaced by Pa 1*
Pa 9	Rust preventive fluid by spray, dip or brush. BHEL specification PR:CHEM:09-04 (latest)
Pa 10	Heat Resistant Aluminum paint to IS 13183 - Grade 3 (latest)
Pa 11	Heat Resistant Aluminum paint to IS 13183 - Grade 2 (latest)
Pa 12	Heat Resistant Aluminum paint to IS 13183 - Grade 1 (latest)
Pa 13	High Build Polyamine cured Coal Tar Epoxy Primer to IS 14948 % Volume Solids = 75 (min), DFT= 200µm / Coat (min)
Pa 14	High Build Aluminum Epoxy Mastic Primer to IS 13184 % Volume Solids = 80 (min), DFT= 100µm / Coat (min)
Pa 15	Aliphatic Acrylic Polyurethane Paint to IS 13213 % Volume Solids = 40 (min), DFT= 30µm / Coat (min)
Pa 16	Epoxy Polyamide cured Finish Paint to IS 14209 % Volume Solids = 40 (min), DFT= 35µm / Coat (min)
Pa17	General Purpose Aluminum Paint to IS 2339(latest)
Pa 18	Epoxy Zinc rich Primer to IS 14589 Grade. II % VS=35 (min) DFT= 40 mic. (min)

ANNEXURE - I I : PAINTING SCHEME FOR FOSSIL BOILER PGMAs

PG Description	PGMA(s)	Surface preparation	Painting Scheme	Color/Shade (See Note 3) / Remarks
Drum & suspension rods	04-XXX (Except internals)	SSPC SP 3	1a	International Orange Shade 592
Drum internals	04-XXX	SSPC SP 3	5	
Loose components in drum & drum transport structure *	04-1XX, 04-196 *	SSPC SP 3	3	* Finish coat : Yellow enamel
Headers & Loose tubes	05-XXX	SSPC SP 3	3	
WW , SH Panels	06-XXX, 11-XXX	SSPC SP 3	3	
DC, Riser, Suction Manifold	07-1XX, 07-201,215,218	SSPC SP 3	3	For raisers having RPF one coat of primer is sufficient.
Loose Tubes, Pr. Part Seals	07-2XX , 07-501,601	SSPC SP 3	2 /3*	*07-216, 217
Hanger & Supports - WW	07-40X,431 07-410	SSPC SP 6 SSPC SP 10	1a, 15	 15=CLH
Buck stays	08-XXX	SSPC SP 3	1a,	1a=VLH,
Seal Boxes	09-XXX	SSPC SP 3	1a	
SH Headers & Loose tubes	10-XXX	SSPC SP 3	3	
SH Coils, Elements	11-XXX,12 XXX	SSPC SP 3	2	
SH Lines & Links (Including DESH)	12-XXX, 12-903 (Other than hangers and Supports)	SSPC SP 3	3	
Hanger & Supports - SH	12-9XX (Except 12-903)	SSPC SP 6	1a,	1a=VLH,
Misc. components	12-903,17-903, 19-903	SSPC SP 3	3	
RH Headers & Loose tubes	15-XXX	SSPC SP 3	3	
RH Coils , Elements	16-XXX	SSPC SP 3	2	
RH Lines and Links (Including DESH)	17-XXX , 17-903 (Other than hangers and Supports)	SSPC SP 3	3	
Hanger & Supports - RH	17-9XX (Except 17-903)	SSPC SP 6	1a,	1a=VLH,
Hanger & Supports - Eco	19-9XX (Except 19-903)	SSPC SP 6 SSPC SP 10	1a, 15	1a=VLH, 15=CLH
Hanger & Supports - Others	PGs 21,24, 47, 48, 80 *80-8XX* *	SSPC SP 6 SSPC SP 10	1a, 15	1a=VLH, 15=CLH * *Piping Center scope*
Roof Skin casing	18-XXX	SSPC SP 3	3	
Economizer Coils/Elements /Headers , Loose tubes	19-XXX , 19-903 (Other than hangers and Supports)	SSPC SP 3	2,3	2=Coils /Elements 3=Headers ,Loose tunes
Economizer Links	19-850,851	SSPC SP 3	3	
S.B. Piping	21-600	SSPC SP 3	3	
S.B. Piping supports	21-601	SSPC SP 3	1a	
S.B. Components	21-700	SSPC SP 3	1a	
S.B. Valves	21-800	*	*	*Refer to valves scheme
S.B. Safety Valves	21-850	*	*	*Refer to valves scheme
Condenser Pipe & Fittings	24-370	SSPC SP 3	8	
Cooler & Strainer assembly for circulating pump	24-374	SSPC SP 3	1a	
Trim Pipe Supports	24-X00, 24-X75, 24-X95, 24-X15,	SSPC SP 3	1a	
Trim Piping , Fittings & Headers & Loose tubes	24-X00, 24-X75, 24-X95	SSPC SP 3	3	
Valves/Trim pipes/SV/DWLG	24-X60,X73,X80	SSPC SP 3	3	

PG Description	PGMA(s)	Surface preparation	Painting Scheme	Color/Shade (See Note 3) / Remarks
Silencer * S.V. Escape Pipes	24-X20, 24-X85 & 24-X90	SSPC SP 6	9	*Refer to valves scheme
Manhole Doors	28-220	SSPC SP 3	10	
Fixing components (Boiler)	30-XXX	SSPC SP 3 SSPC SP 3	3 5	Threaded portions / Fasteners are to be applied with Rust preventive coating
Boiler Skin casing	31-XXX	SSPC SP 3	3	
Fixing components (Auxiliaries)	32-XXX	SSPC SP 3 SSPC SP 3	3 5	Threaded portions / Fasteners are to be applied with Rust preventive coating. Outer casing sheets of GI/Aluminium should both be painted.
Woven Wire cloth	33-970 (Stain less steel)	--	11	
Columns	35-1xx (Except 35-190)	SSPC SP 6	1a	
Ceiling Girders, Cross Beams	35-2xx	SSPC SP 6	1a	
Foundation materials	35-010,	--	11	
Boiler Supporting Structures (Other than columns ,ceiling girders, Floor grills, stairs, ladders hand rails/posts, and foundation materials)	35-XXX , 36-XXX, 38-XXX, & 39-XXX	SSPC SP 3	1a	
Boiler Roof Sheeting (Vendor Item) AC Sheets / GI Sheets	35-611	--	11	
Burner Roof Sheeting (Vendor item) AC Sheets / GI Sheets	36-611	--	11	
Floor grills (Including Guard plates),	35-811, 36-811,813,814 38-810 & 39-810	SSPC SP 3	1a	Black Shade
Stair and Ladders	35-822 ,823 ,36-820 38-820,39-820	SSPC SP 3	1a	Black Shade (for step threads)
Hand rails and posts Columns	34-850, 35-851 36-850,851,852,853 38-850, 39-850 36-1xx	SSPC SP 3 SSPC SP 6	1a 1a	Black Shade No painting required below “0” level.
Galleries and stair-ways	36-XXX (Except 36-8XX & 36-611)	SSPC SP 3	1a	
Boiler outer casing components	37-010	SSPC SP 3 SSPC SP 3	3 5	Threaded portions / Fasteners are to be applied with Rust preventive coating
Columns	38-1xx	SSPC SP 6	1a	No painting required below “0” level.
Foundation Material	38-010		11	
Interconnecting Walkways	38-XXX (Except 38-010)		1a	

PG Description	PGMA(s)	Surface preparation	Painting Scheme	Shade/Shade (See Note 3) / Remarks
Columns	39-1xx	SSPC SP 6	1a	No painting required below "0" level.
Foundation Material	35-010, 38-010, 39-010,39-012,	--	11	
Floor grills (Including Guard plates), ID System	39-810	SSPC SP 3	1a	Black shade
I.D. System structures	39-XXX (Except 39-010 & 39-8XX)	SSPC SP 3	1a	
Recovery Boiler System Components	40-XXX	SSPC SP 3	1a	
Oil & Gas burners and ignitors & scanners	41-XXX	SSPC SP 3	1a	
Oil & Gas System	42-XXX (Except 42-030)	SSPC SP 3	1a	
Oil preheating system	42-030	SSPC SP 3	3	
Ignitor , Scanner & Seal air system	43-XXX	SSPC SP 3	1a	
Coal Burner System	45-XXX	SSPC SP 3	3	
Stoker system	46-XXX	SSPC SP 3	3	
Pulverized fuel piping	47-XXX	SSPC SP 3	1a	
Expansion Joints	48-XX4	SSPC SP 3	3	
Duct Supports	48-XX5	SSPC SP 3	3	
Cold air Ducts/	48-0X2, 48-1X2	SSPC SP 3	1a	
Cold air Dampers	48-013, 033,113,143	SSPC SP 3	1a	
Dampers	48-XX3 (except 48-013,033,113,143)	SSPC SP 3	3	
Gates	48-XX0	SSSP SP3	1a	
Hot air/Flue Ducts/	48-2X2 ,48-3X2, 48-4X2 ,5X2 ,6X2	SSPC SP 3	3	
Foundation Material	48-019	--	11	
Gravimetric Feeders	65-XXX	SSPC SP 3	1a	Admiralty Gray
Coal Valve / feeder	67-XXX	SSPC SP 3	1a	
MS/HRH/ CRH/Aux./Feed lines	80-3XX	*SSPC SP 3*	3	See Clause 4.2
*HPBP/LPBP**	*80-733*	*SSPC SP 3*	*3*	** Piping Center scope*
Feed / Condensate lines	80-4XX,5XX,6XX	SSPC SP 3	3	
CLH	*80-8XX,9XX*	*SSPC-SP10*	*15*	** Piping Center scope*
VLH	*80-8XX,9XX*	*SSPC-SP6*	*1a*	** Piping Center scope*
Auxiliary Structure	*80-8XX,9XX*	*SSPC-SP6*	*1a*	** Piping Center scope*
Service water and condensate	*80-400 to 418,429, 436, 457 to 499*	*SSPC SP 3*	*1a*	** Piping Center scope*
Acid cleaning lube oil	*80-600,601,604,673*	*SSPC SP 3*	*1a*	** Piping Center scope*
IBD, CBD tanks	*81-XXX*	*SSPC SP 3*	*3*	** Piping Center scope*
Storage tanks(Un insulated)	*81-XXX*	*SSPC SP 3*	*1a*	** Piping Center scope*
Fuel Oil piping	*80-650*	*SSPC SP 3*	*3*	** Piping Center scope*
Supports for cable trays	95-091,092	SSPC-SP 3	1a	
Pressure vessel for DL Water level gauge	97-195	SSPC-SP 3	9	
Hoist - Grey, Hook - Black	99-XXX	SSPC SP 3	1a	
Erection materials	XX-993	SSPC-SP 3	3	If RPF is available one coat is sufficient.

NOTES:

1. Rust Preventive Coating to be applied on HSFG Bolt threads and other threaded portions.
2. Machined surfaces are to be applied with a coating of Rust Preventive Oil .
3. All shade numbers are as per IS 5. Unless otherwise specified Color/Shade shall be Smoke gray Shade No. 692 of IS5.

ANNEXURE - III : PAINTING SCHEME FOR VALVES

COMPONENTS	Painting Scheme	Shade/ Shade**/ Remarks
All API Valves	10	Aluminum
Cast carbon steel Valves(Conventional)	10	Aluminum
Cast alloy steel Valves (Conventional)	10	Aluminum
Stainless Steel Valves	NO PAINTING IS REQUIRED	
Forged Valves	7	Phosphating
QC NRV	10	Aluminum
HP/LP System	10	Aluminum
Soot Blower Components	1a	Verdigris Green, Shade 280
SV & SRV	10	Aluminum
Silencers	10	Aluminum
Water Level Gauge	10	Aluminum
On Shore OFE Items	1b	French Blue Shade 166
Off Shore OFE Components	13	French Blue Shade 166
Arrow	*	Post Office Red Shade 538 Painting Spec - Pa2
Hand Wheels	*	Aluminum Painting Spec - Pa17

* - As per Valve Scheme
** - All shade numbers are as per IS 5.

NOTES

i. Machined surfaces and threads are to be applied with a coating of Rust Preventive Oil .
ii. All shade numbers are as per IS 5. Unless otherwise specified Color/Shade shall be Smoke gray Shade No. 692 of IS5.

ANNEXURE IV –
PAINTING REQUIREMENTS FOR FBC & HRSG

PG Description	PGMA(s)	Surface preparation	Painting Scheme	Shade/Shade (See Note 3) / Remarks
Drum & suspension rods	04-XXX (Except internals)	SSPC SP 3	1a	International Orange Shade 592
Drum internals	04-XXX	SSPC SP 3	5	
Loose components in drum & drum transport structure *	04-1XX, 04-196 *	SSPC SP 3	3	* Finish coat : Yellow enamel
Drum saddle bearing plate	04-156	SSPC SP 3	1a	
Headers & Loose tubes	05-XXX	SSPC SP 3	3	
WW , SH Panels	06-XXX, 11-XXX	SSPC SP 3	3	
DC, Riser, Suction Manifold	07-1XX, 07-201,206,207,208	SSPC SP 3	3	For raisers having RPF one coat of primer is sufficient.
Loose Tubes, Pr. Part Seals	07-2XX , 07-501,601	SSPC SP 3	2 /3*	*07-216, 217
WW, Hanger, Headers, DC, Raiser Supports	07-4XX	SSPC-SP3	1a	
Module supports	07-504, 505, 506 &510	SSPC SP 3	1a	
Buck stays and roof supports	08-XXX	SSPC SP 3	1a,	1a=VLH,
Seal Boxes	09-XXX	SSPC SP 3	1a	
SH Headers , Loose tubes	10-XXX	SSPC SP 3	3	
SH Coils, Elements	11-XXX,12 XXX	SSPC SP 3	2	
SH Lines & Links (Including DESH)	12-XXX, 12-903 (Other than hangers and Supports)	SSPC SP 3	3	
Hanger & Supports - SH	12-9XX (Except 12-903)	SSPC SP 6 SSPC SP 10	1a, 15	1a=VLH, 15=CLH
Misc. components	12-903,17-903, 19-903	SSPC SP 3	3	
RH Headers , Loose tubes	15-XXX	SSPC SP 3	3	
RH Coils, Elements	16-XXX	SSPC SP 3	2	
RH Lines and Links (Including DESH)	17-XXX , 17-903 (Other than hangers and Supports)	SSPC SP 3	3	
Hanger & Supports - RH	17-9XX (Except 17-903)	SSPC SP 6	1a,	1a=VLH
Hanger & Supports - Eco	19-9XX (Except 19-903)	SSPC SP 6 SSPC SP 10	1a, 15	1a=VLH, 15=CLH
Hanger & Supports - Others	PGs 21,24,47, 48, 80 *80-8XX* *	SSPC SP 6 SSPC SP 10	1a, 15	1a=VLH, 15=CLH * *Piping Center scope*
Roof Skin casing	18-XXX	SSPC SP 3	3	
Economizer Coils/Elements /Headers	19-XXX , 19-903 (Other than hangers and Supports)	SSPC SP 3	2,3	2=Coils /Elements 3=Headers
Economizer Links	19-7xx,8xx	SSPC SP 3	3	
S.B. Piping	21-600	SSPC SP 3	3	
S.B. Piping supports	21-601,725	SSPC SP 3	1a	
S.B. Valves	21-800	SSPC SP 3	3	
S.B. Safety Valves	21-825, 850	SSPC SP 3	3	
Trim Pipe Supports	24-X01,X25,X40, X75,X95,	SSPC SP 3	1a	
Trim Piping , Fittings & Headers	24-X00,X40,X73, X75, X95	SSPC SP 3	3	

PG Description	PGMA(s)	Surface preparation	Painting Scheme	Colour/Shade (See Note 3) / Remarks
Valves/Trim pipes/SV/DWLG * Silencer/S.V. Escape Pipes Water Washing piping	24-X60,X73,X80 24-X20,X85 & X90 24-466	SSPC SP 3 SSPC SP 6 SSPC SP 3	3 9 1a	 *Refer to Valves scheme
Manhole Doors	28-220	SSPC SP 3	10	
Fixing components (Boiler)	30-XXX	SSPC SP 3 SSPC SP 3	3 5	Threaded portions / Fasteners are to be applied with Rust preventive coating
Boiler Skin casing	31-XXX	SSPC SP 3	3	
Fixing components (Auxiliaries)	32-XXX	SSPC SP 3 SSPC SP 3	3 5	Threaded portions / Fasteners are to be applied with Rust preventive coating. Outer casing sheets of GI/Aluminum should both be painted.
Bunker Structure	34-XXX	SSPC SP 6	1a	
Columns	35-1xx (Except 35-190)	SSPC SP 6	1a	No painting required below "0" level.
Ceiling Girders, cross beams	35-2xx	SSPC SP 6	1a	
Foundation materials	35-010,38-010, 39-01X	--	11	
Boiler Supporting Structures (Other than columns ,ceiling girders, Floor Grills, Step Threads, roof sheetings, hand rails/posts, and foundation materials)	35-XXX , 36-XXX 38-XXX, & 39-XXX	SSPC SP 3	1a	
Boiler Roof Sheeting (Vendor Item) AC Sheets / GI Sheets /Meta Poly sheets	35-611,36-611	--	11	
Transportation structure for modules	35-390,391,392	SSPC SP 3	1a	
Floor grills (Including Guard plates),	36-81X 38-810 & 39-810	SSPC SP 3	1a	Black Shade
Stair and Ladders	35-822 ,823 ,36-820 38-820,39-820	SSPC SP 3	1a	Black Shade (for step threads)
Hand rails and posts	36-85X	SSPC SP 3	1a	Black Shade
Boiler outer casing components	37-010	SSPC SP 3 SSPC SP 3	3 5	Threaded portions / Fasteners are to be applied with Rust preventive coating
Oil & Gas burners and ignitors & scanners	41-XXX	SSPC SP 3	1a	
Oil & Gas System	42-XXX	SSPC SP 3	1a	
Ignitor , Scanner & Seal air system	43-XXX	SSPC SP 3	1a	
Ash Cooler	44-402,403`	SSPC SP 3	1a	
Distributor plate	45-450	SSPC SP 3	3	
Fuel piping	47-XXX	SSPC SP 3	1a	
Expansion Joints	48-XX4	SSPC SP 3	1a	
Duct Supports	48-XX5	SSPC SP 3	1a	

PG Description	PGMA(s)	Surface preparation	Painting Scheme	Colour/Shade (See Note 3) / Remarks
Cold air Ducts/ Dampers/	48-0XX, 44-49X,	SSPC SP 3	1a 3	All Exterior surfaces All Interior surfaces
Gates	48-XX3, 48-XX0	SSPC SP 3	3	
Hot air/Flue Ducts/ Dampers/Gates	48-2XX ,48-3XX, 48-4XX ,48-7XX 44-432,48X 48-1xx	SSPC SP 3	1a 3	Exterior of HRSG casings. FBC (both sides), HRSG (Interior)
Coal Feeders	47-953	SSPC SP 3	1a	
Bunker	66-XXX (except 66-125)	SSPC SP 3	1a	
Coal gate	67-252	SSPC SP 3	1a	
Boiler feed piping	80-085	SSPC SP 3	3	
HPBP, LPBP	*80-7XX*	*SSPC SP 3*	*3*	**Piping Center scope*
CLH	*80-8XX,9XX*	*SSPC SP 10*	*15*	**Piping Center scope*
Feed / Condensate lines	80-4XX,5XX,6XX	SSPC SP 3	3	
Auxiliary Structure	*80-8XX,9XX*	*SSPC-SP6*	*1a*	*** Piping Center scope*
Acid cleaning lube oil	*80-600,601,604,673*	*SSPC SP 3*	*1a*	*** Piping Center scope*
IBD, CBD tanks	*81-XXX*	*SSPC SP 3*	*3*	*** Piping Center scope*
Trim pipe Headers, fittings and Supports	80-,145,273, 274, 421, 600 & 601	SSPC SP 3	1a	
Hoist - Grey, Hook - Black	99-100	SSPC SP 3	1a	
Supports for cable trays	97-457	SSPC-SP 3	1a	
Loose components (PR Parts)	HL- 097	SSPC SP 3	3	
Loose components (Ducts)	HL-098	SSPC SP 3	1a	
Spool Duct	HL-7XX	SSPC SP 3	1a	
Loose components Structures)	HL- 099	SSPC SP 3	1a	
Modules	HV-1XX, HL-1XX	SSPC SP 3	3, 5	3:headers 5:Fined tubes (PWHT area)
Links	HV-2XX, HL-2XX	SSPC SP 3	3	
Module components	HL-3XX, HV-3XX	SSPC SP 3	3	
L Frame and Insulation	HV-4XX	SSPC SP 3	3	
Side Casing for modules	HV-5XX, HL-5XX	SSPC SP 3	1a	
Top and bottom casings	HV-6XX, HL-6XX	SSPC SP 3	1a	
Loose Casings	HL-7XX	SSPC SP 3	1a	

NOTES:

1. Rust Preventive Coating to be applied on HSFG Bolt threads and other threaded components.
2. Machined surfaces are to be applied with a coating of Rust Preventive oil.
3. All shade numbers are as per IS 5. Unless otherwise specified Color/Shade shall be Smoke gray Shade No. 692 of IS5.

PROCEDURE
FOR
MAGNETIC PARTICLE EXAMINATION
OF
FERRITIC MATERIALS AND WELDED COMPONENTS

Prepared by	Reviewed by	Approved by
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ASNT LEVEL III
CERT. No: 159659
UT, RT, MT, PT

Effective Date: 30.08.2016

RECORD OF REVISION

Revision NO	Date of Revision	Reason for Revision
01	28 07 1999	Revision in entirety
02	14 08 2003	Clause modified Clause 8.2 added
03	30 08 2016	Revised in entirety based on latest standards.

1.0 SCOPE

1.1 This procedure describes the method, techniques and acceptance standards for Magnetic particle Examination of all shapes of ferromagnetic product forms in Boiler components Boiler Auxiliaries, pressure vessels, Heat Exchangers and Structural.

1.2 The examination shall include all Gas cut openings, attachment welds with a throat thickness over 6mm and on finished surface of welds as required by referencing code/section. The examination includes base material 13mm on each side of the welds.

2.0 REFERENCE

2.1 ASME Section V (Article 7), I & VIII (Division 1 & 2) - 2015

2.2 ASTM B31.1- 2012

2.3 ANSI / AWS D 1.1 (2010)

3.0 EQUIPMENT

3.1 Equipment generating half-wave rectified alternating current employing prods at the end of magnetizing cables shall be used for examination by circular magnetization method.

3.2 Direct / alternating current electromagnetic yokes shall be used to detect discontinuities that are open to the surface of the part by longitudinal magnetization method and to examine the surface where arcing is not permitted or prod method is not practicable.

4.0 EXAMINATION MEDIUM

4.1 The ferromagnetic particles used as examination medium shall be either wet or dry. Wet Particles shall be non - fluorescent type.

4.2 Dry magnetic particles black, gray or red in color shall be used as examination medium for examination of welds and other product forms to provide adequate contrast with the surface being examined. Particle shall be used within temperature range limitation set by the manufacturer of the particle.

4.3 Non fluorescent wet particles will be black or reddish brown in color that provide adequate contrast with the surface being examined. Wet particles shall be suspended in kerosene for application to the test surface by flowing or spraying. Suitable conditioning agents shall be added to the water to provide proper wetting and corrosion protection for the parts being examined.

4.4 The bath concentration shall be determined by measuring the settling volume through the use of pear-shaped centrifuge tube. The settling volume shall be within 1.2 ml to 2.4

ml for non- fluorescent particles per 100mL bath sample and for 0.1 to 0.4mL for fluorescent particle in 100mL bats sample.

5.0 SURFACE CONDITIONING

5. 1 Preparation

5.1.1 As welded, as rolled, as cast or as forged surface is generally acceptable provided the surface irregularities will not mask the indication due to discontinuities. Otherwise surface preparation by grinding or machining may be necessary. Undercuts, Overlaps or abrupt ridges and valleys in the welds and opening shall be smoothly merged with the parent metal.

5.1.2 Prior to magnetic particle examination, ensure that the surface to be examined and adjacent area within at least 25mm of the area of interest shall be dry and free of any dirt, grease, lint, scale, welding flux, spatter, oil or other extraneous matter that would interfere with the examination.

5.1.3 Cleaning may be accomplished by detergents, organic solvents, descaling solution and paint removers, sand or grit blasting method.

5.1.4 Thin nonconductive coating such as painting will not normally interfere with the formation of indications. If nonmagnetic coatings are left on the part in the area being examined, it shall be demonstrated that indications can be detected through the existing maximum coating thickness applied.

5.2 Surface contrast Enhancement

5.2.1 When coating are applied temporarily to enhance particle contrast or if coating are left on the part being examine, it must be demonstrated that indications can be detected through the enhanced coating thickness on a test plate with machined grooves as in 16.0

5.2.2 If indications of required sensitivity could not be detected, the coating shall be removed.

6.0 METHOD OF EXAMINATION

6.1 Examination shall be made by continuous method.

6.1.1 Dry continuous magnetization method : The magnetizing current remains on while the examination medium (Dry particle) is being applied and while the excess of the examination medium is being removed.

6.1.2 Wet continuous magnetization method: The magnetic particle application involves bathing the surface of the part with examination medium and terminating the bath application immediately prior to cutting off the magnetizing current with two or more shots given to the part. The duration of the magnetizing current is typically on the order of 1/2 seconds.

7.0 TECHNIQUES

7.1 One of the following magnetization techniques shall be used.
a) Prod Technique
b) Yoke Technique
c) Head shot and Coil Technique

8.0 TYPE OF CURRENT FOR MAGNETISATION

8.1 Single phase half -wave rectified current (HWDC) shall be employed for Testing with prod techniques.

8.2 The amperage required with single - phase Half-wave rectified current shall be verified by measuring the average current during the conducting half cycle only.

8.3 For Yokes, the current shall be either AC or DC.

8.4 For Head shot and Coil, the current shall be either HWDC or AC.

9.0 CALIBRATION

9.1 Ammeter of magnetizing equipment shall be calibrated as per NDT work Instruction at least once a year, or after each time it has been subjected to major electrical repair, periodic overhaul or damage. If equipment has not been in use for a year or more, calibration shall be done prior to first use.

9.2 Lifting power of yokes

9.2.1 The magnetizing power of yokes shall be verified prior to use each day the yoke is used. The magnetizing power of yokes shall be verified whenever the yoke has been damaged or repaired.

9.2.2 Each alternating current electromagnetic yoke shall have a lifting power of at least 4.5 kg and direct current / permanent magnetic yoke shall have a lifting power of l8.kg, at the maximum pole spacing that will be used or the pole distance shall be the spacing at which the yoke lifts the stipulated weight.

9.2.3 Each weight shall be weighed with a scale from a reputable manufacturer and stenciled

with the applicable nominal weight prior to first use. A weight need only be verified again if damaged in a manner that could have caused potential loss of material.

10.0 EXAMINATION

10.1 Direction of magnetization

10.1.1 At least two separate examination shall be carried out on each area. During the second examination the prods/poles are spaced so that the lines of flux are approximately perpendicular to those used during the first examination. A different technique for magnetization may also be used for the second examination.

10.2 Examination Coverage: Examination shall be made with sufficient overlap to assure 100% coverage of testing.

11.0 PROD TECHNIQUE: (Fig. 1,2&3)

11.1 Magnetizing procedure: The prod electrodes are pressed firmly against the surface in the area to be examined. In order to avoid arcing a remote control switch shall be built in to the prod handles, to permit the current to be turned on after the prods have been properly positioned and to be turned off before they are removed.

11.2 Magnetizing current

11.2.1 The current shall be 100(minimum) to 125 (maximum) amperes/25mm of prod spacing for sections 19mm thick or greater.

11.2.2 For sections less than 19mm thick, the current shall be 90 to 110 amperes / 25mm of prod spacing.

11.3 Prod spacing: Prod spacing shall not be less than 75mm nor exceed a maximum of 200 mm. The prod tips shall be kept clean and dressed and the contact areas of the test surface shall be free from dirt, scale, oil etc, to minimize electrical arcing. In the open circuit voltage of the magnetizing current is greater than 25 volts, Lead, steel or Aluminum rather than copper tipped prods shall be preferred to avoid copper deposits on the part being examined.

12.0 YOKE TECHNIQUE

12.1 The pole spacing shall be between 100 mm to 150mm. The field indicator will be used to check the direction of the part magnetization.

13.0 Head shot and Coil Technique

Head shot:

13.1 Magnetizing Procedure
For this technique, magnetization is accomplished by passing current through the part to be examined. This produces a circular magnetic field that is approximately perpendicular to the direction of current flow in the part.

13.2 Magnetizing current: The current shall be 12 A/mm to 31 A/mm of outer diameter.

Coil/Longitudinal Technique:

13.3 Magnetizing Procedure
For this technique, magnetization is accomplished by passing current through a multi-turn fixed coil (or cables) that is wrapped around the part or section of the part to be examined. This produces a longitudinal magnetic field parallel to the axis of the coil. If a fixed, prewound coil is used, the part shall be placed near the side of the coil during inspection.

13.4 Magnetizing current

A) Parts with L/D Ratios Equal to or Greater Than 4.

The magnetizing current shall be within 10% of the ampere-turn value determined as follows:

$$\text{Amperes Turn} = \frac{35{,}000}{L/D+2}$$

B) Parts with L/D Ratios Less Than 4 but Not Less Than 2

The magnetizing ampere-turns shall be within 10% of the ampere-turns' value determined as follows:

$$\text{Amperes Turn} = \frac{45{,}000}{L/D}$$

C) Parts with L/D Ratios Less Than 2. Coil magnetization technique cannot be used.

Where, L is Length of the Job to be tested and D is outside Diameter of the job.

14.0 APPLICATION OF DRY PARTICLES

14.1 The dry particles shall be applied in such a manner that a light uniform dust-like coating

Settles on the surface of the area being examined. The application technique shall be such that the particles are suspended in air and reaches the examination surface in a uniform cloud with a minimum force, using a hand powder applicators (Squeeze bulb) or specially designed mechanical blower or by a spray nozzle.

14.1.1 Dry particles shall not be applied to a wet surface nor when there is excessive wind. The particles shall not be applied by pouring, throwing, or spreading with fingers.

14.1.2 Any excess powder shall be removed while the magnetization current is on and shall be with a gentle air stream without removing or disturbing particles attracted by a leakage field that may prove to be a relevant indication.

14.2 APPLICATION OF WET PARTICLES

14.2.1 The application of wet particles involves the bathing of the area to be examined, by Spraying or flowing during the application of magnetizing current.

14.2.2 Two or more shots shall be applied, but the last shot shall be applied while the bath still remains on the area to be examined and after the particles flow has been stopped. Care shall be taken to cut off the bath application before removing the magnetic field, to prevent high-velocity particle flow that wash away or remove fine or weakly held indications.

15.0 MAGNETISING FIELD ADEQUACY AND DIRECTION

15.1 By using the Pie shaped Magnetic Field Indicator, the magnetizing field adequacy and direction may be verified.

16.0 LIGHTING

16.1 Visible Light Intensity

16.2 The examination and evaluation of indications shall be performed under minimum light intensity of 100 fc (1000 lx). The light intensity shall be measured with white light meter prior to evaluation of indications or verified light source shall be used. Verification of light sources is required to be demonstrated only one time, documented, and maintained.

17.0 SYSTEM PERFORMANCE CHECK (Fig. 4)

17.1 For prod magnetization with HWAC, performance sensitivity shall be checked at least once in a shift before start of the examination on a test plate that contains machined grooves to different depths. The indication of a groove at 3mm depth from the surface of the test plate will indicate adequate sensitivity.

17.2 If the part is to be tested with contrast coat, the sensitivity shall be checked with the contrast coat on the surface of the test block.

17.3 For electromagnetic yokes, the adequacy or direction of the magnetizing force shall be verified by positioning the 'Magnetic Field Indicator' on the surface to be examined. The pattern in the indicator should be clearly developed on the surface of the block.

17.4 For Head shot and coil, The Ketos (Betz) ring specimen shall be used in evaluating and comparing the overall performance and sensitivity of both dry and wet, fluorescent and nonfluorescent magnetic particle techniques using a central conductor magnetization technique.

18.0 DEMAGNETISATION

18.1 The job to be tested using Head shot and coil technique demagnetization to be carried out.

18.2 The job to be tested using Yoke/Prod no demagnetization is required.

19.0 EVALUATION OF INDICATION

19.1 Mechanical discontinuity at the surface would be indicated by the retention of the powder or medium.

19.1.1 All the indication are not necessarily discontinuity indications since certain metallurgical discontinuities and magnetic permeability variation may produce similar unacceptable discontinuity indication. These non-relevant indications shall be reexamined by any other suitable NDT methods such as Liquid penetrant or macro etching.

19.2 Relevant indications are those which result from unacceptable mechanical discontinuities.

19.2.1 Linear indications are those indications in which length is greater than three times the width.

19.2.2 Rounded indications are circular or elliptical with the length equal to or less than three times the width.

20.0 ACCEPTANCE STANDARDS AS PER ASME (SEC I,VIII Div 1&2 and B 31.1) AND OTHERS

20.1 Welds and Materials

20.2 An indication of an imperfection may be larger than the imperfection that causes it: however, the size of the indication is the basis for acceptance for evaluation.

20.3 Only indications with major dimension greater than 1.5mm shall be considered relevant.

20.4 All surface to be examined, except as mentioned in 19.5, 19.6 and 19.7 shall be free of

20.4.1 Relevant linear indications

20.4.2 Relevant rounded indication greater than 5 mm

20.4.3 Four or more relevant rounded indications in a line separated by 1.5mm or less edge to Edge.

20.4.4 Ten or more rounded indications in any 3870 mm2 (6 inch2)of surface with the major Dimension of this area not to exceed 15omm with the area taken in the most unfavorable location relative to the indication being evaluated.

20.5 Cut edges and openings:

20.5.1 All surface to be examined shall be free of

(a) Cracks
(b) Laminations exceeding 25mm in length.

20.6 In welds joining nipples to drums, spheres or headers, all slag or porosity indications Shall be investigated to assure that no leak - path exists.

20.7 In attachment welds of non-load carrying class, indications from crack or due to material separation are unacceptable.

21.0 ACCEPTANCE STANDARD FOR STRUCTRAL COMPONENTS AS PER AWS D1.1

21.1 The magnetic particle acceptance criteria is based on the size of the actual discontinuity and not the size of the discontinuity as indicated by the magnetic particle inspection medium. Where discontinuity cannot be visually seen (with magnification if required) after removal of the indicating medium, evaluation shall be based on size and nature of the magnetic particle indication.

21.0 Statically loaded Non tubular connections

21.1 Cracks, Lack of Fusion, and Incomplete penetration are not acceptable.

21.2 Undercut-for material with thickness less than 25mm undercut shall not exceed 1.0 mm, except that a maximum 2.0 mm is permitted for a accumulated length of 5omm in any 300mm. For material equal to or greater than 25.0 mm thick, undercut shall not exceed 2.0 mm for any length of weld.

21.3 Porosity - a complete joints penetration groove welds in butt joints transverse to the direction of computed tensile stress shall have no visible piping porosity. For all other groove welds and for fillet welds, the sum of the visible piping porosity 1 mm or greater in diameter shall not exceed 1omm in any linear 25mm of weld and shall not exceed 20mm in any 300mm length of weld.

22.0 Cyclically Loaded Non tubular Connections

22.1 Undercut - In primary members, undercut shall be no more than O.25mm deep when the weld is transverse to tensile stress under any design loading condition. Undercut shall not be more than 1.0mm deep for all other cases.

22.2 Porosity - The frequency of piping porosity in fillet welds shall not exceed one in each 100 mm of weld length and the maximum diameter shall not exceed 2.5mm. Exception for fillet connecting stiffeners to web, the sum of the diameter of the piping porosity shall not exceed 10mm in any linear 25mm of weld and shall not exceed 2omm in any 300 mm length of weld.

22.3 Complete joint penetration groove welds in butt joints transverse to the direction of computed tensile stress shall have no piping porosity.

22.4 PIPING POROSITY - (General) is elongated porosity whose major dimension lies in a direction approximately normal to the weld surface. Frequently referred to as pin holes when the porosity extends to the weld surface.

23.0 EDGE DISCONTINUITIES IN CUT MATERIALS

23.1.1 No crack is acceptable.

23.1.2 Mill induced discontinuity

23.1.3 Length 25mm and less- Acceptable

23.1.4 Length over 25mm and depth up to 3mm- Acceptable

23.1.5 Length over 25mm and depth between 3mm and 25mm ~ indications to be removed.

23.1.6 Length over 25mm and depth greater than 25mm - indications to be removed to a depth up to 25mm.

24.0 REPAIR AND RE-EXAMINATION

24.1 Whenever an imperfection is repaired by chipping or grinding or and subsequent repair

by welding is not required, the excavated area shall be blended into the surrounding surface so as to avoid sharp notches, crevices, or corners.

24.2 After a defect is thought to have been removed and prior to making weld repairs, the area will be examined by suitable method to ensure that the defect has been removed or reduced to an acceptable size of an imperfection.

24.3 where welding is required after repair of an imperfection the area shall be cleaned and repair carried out. After repairs have been made the repaired area shall be blended into the surrounding surface so as to avoid sharp notches, crevices or comers.

24.4 After repairs have been made, the repaired area shall be re-examined by methods of examination that weld originally required for the affected area.

25.0 PERSONNEL QUALIFICATION

25.1 All personnel carrying out the examination and evaluation shall be qualified to minimum Level - II as per ASNT:SNT - TC -1A Edition 2006.

26.0 FINAL CLEANING

26.1 When the inspection is concluded, the magnetic particles shall be removed by any suitable means, leaving the product in a dry and clean condition.

27.0 REPORT

27.1 Copies of the report in a standard format R 49-719-B or equivalent duly signed by a Minimum Level - II personnel shall be issued after the test.

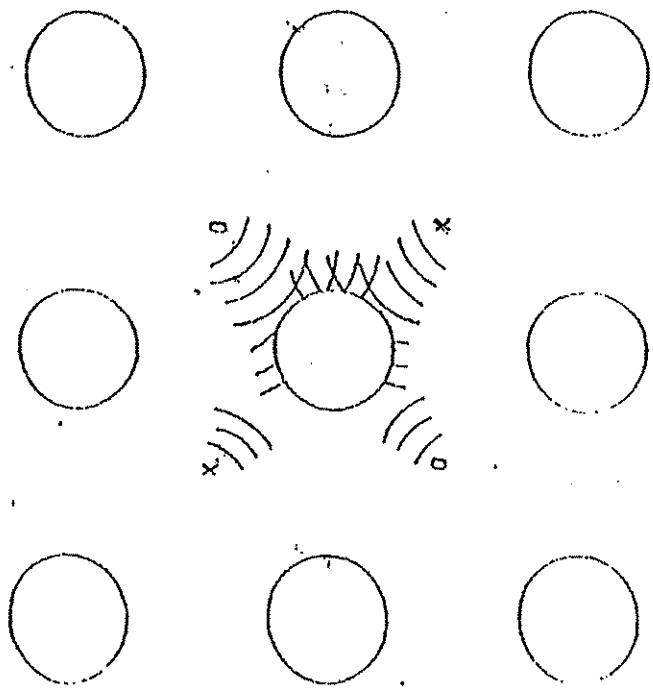


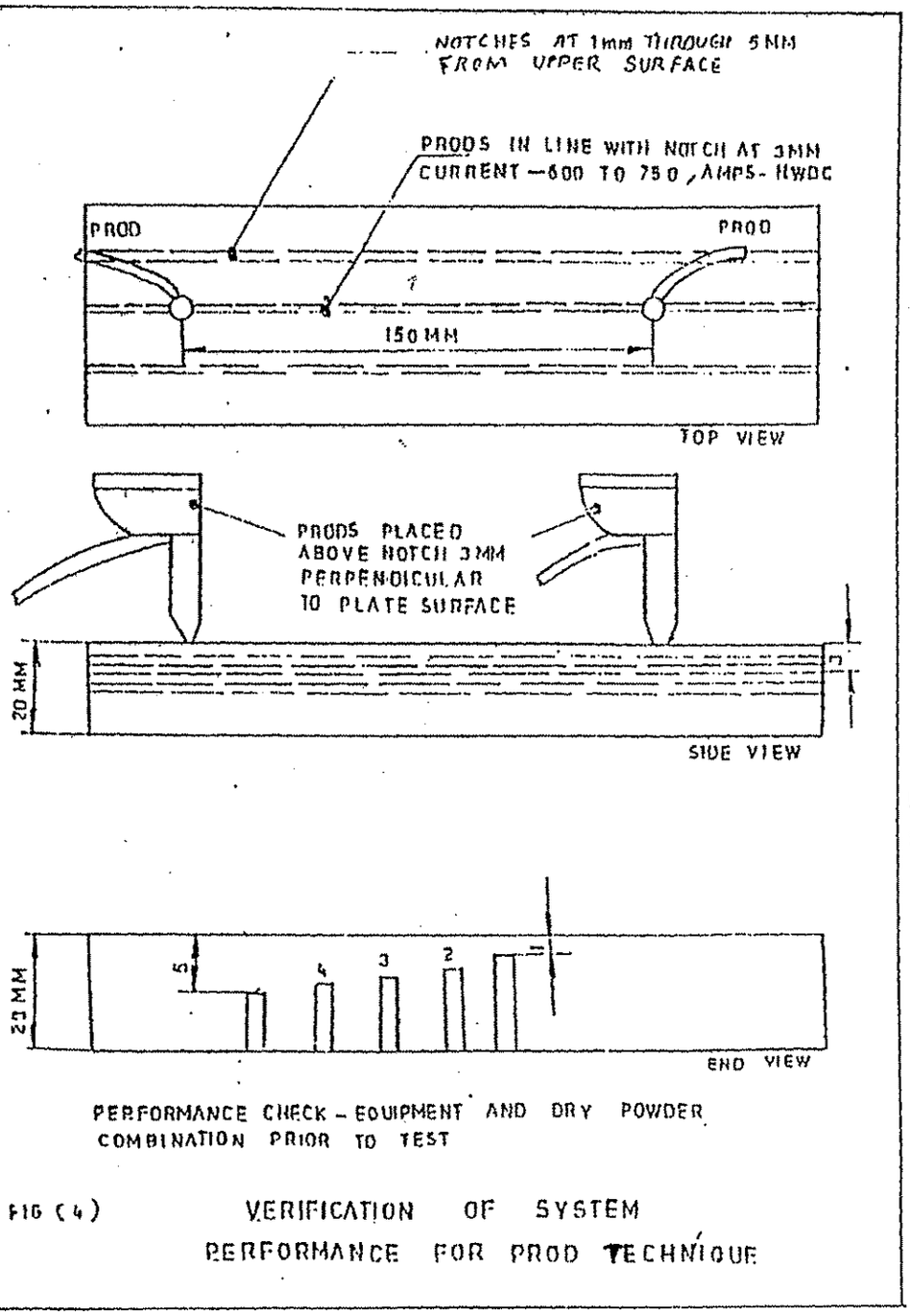
FIG (3) TECHNIQUES FOR EXAMINATION OF FILLET WELDS

0 – POSITION - 1 X – POSITION - 2 ARC BREAK LOCATION

NOTE :

1) PRODS must be placed on drum / header perpendicular to plate surface.

2) Inspection will be 100% of weld for each shot.



PERFORMANCE CHECK – EQUIPMENT AND DRY POWDER COMBINATION PRIOR TO TEST

FIG (4) VERIFICATION OF SYSTEM PERFORMANCE FOR PROD TECHNIQUE

BHARAT HEAVY ELECTRICALS LIMITED

BAP / RANIPET - 632 406

R49-719/B

NON - DESTRUCTIVE TESTING

MAGNETIC PARTICLE EXAMINATION

REPORT NO :

REQ DT : 02-NOV-16

REF NUMBER :

BAY :

WORK ORDER :

DU :

CUSTOMER :

PART NAME :

PART NUM :

QTY :

DRAWING NO. :

REV :

STAGE OF TEST :

MATL SPECIFICATION :

THICKNESS :

WELDER NAME :

SURFACE PREPARATION :

QP NUMBER :

CHP:

INSPECTOR NAME :

REMARKS :

DATE OF TEST :

PROCEDURE REFERENCE :

METHOD :

MAGNETISING CURRENT :

PROD SPACING :

TYPE OF MAGNETISATION

AMPERAGE :

DEMAGNETISATION :

REMARKS :

(LEVEL-II)

OPERATOR NAME & LEVEL

ASNT LEVEL-II PT,MT,UT,RT

APPROVED BY EXTERNAL INS

BHEL/BAP - RANIPET

APPROVED BY NDT

SAMPLE

QUALITY DEPARTMENT
Amendment to Quality Work Instructions (HT Schedule)
QWI NO: BAP:HT:001 REV:05 DT. 11 07 96
Amendment no: A 3 DT. 27 01 07
Description : Heat Treatment schedule

Details of Amendment		
Note Sl.no.	**Amended As**	**Basis For Amendment**
3.1.2(c) and 3.2.1 (B)&(D) **3.2.1(C)** **Table-1 (C.1-I,J)** **4.3.1(b)**	• Rate of heating : Maximum 5600 divided by the maximum metal thickness in millimeters, subject to the minimum of 55 °C /hr and maximum of 220 °C /hr • Rate of cooling maximum 260°C /hr divided by maximum metal thickness in inches subject to minimum 55°C /hr and maximum of 260°C /hr • Soaking Temperature: : 600 °C - 650 °C • IS 2062,ASTM A36 -Soaking temperature 600 °C - 650 °C Soaking temperature: For bearing housing(A216)-600 °C-650°C &Hub disc requirements are deleted.	Revised based on the revision of AWS.D1.1

Prepared by	Reviewed By	Approved By
	B. Srinivasa Rao 27/1/07	

Controlled Copy No	
Issued to Shri	

QUALITY DEPARTMENT
Amendment to Quality Work Instructions (HT Schedule)
QWI NO: BAP:HT:001 REV:**05** DT. 11 **07 96**
Amendment no: A 2 DT. 11 03 2005
Description : Heat Treatment schedule

Details of Amendment		
Note Sl.no.	**Amended As**	**Basis For Amendment**
4.1.5	Following is added: Lug plates for APH module assembly made of Corten / Naxtra 70 material shall be stress relieved as per following cycle. • Soaking temperature - 530 to 580 degree centigrade • Soaking time - 30 minutes minimum • Rate of heating and rate of cooling – shall be as per clause 3.2.1	

Prepared by	**Reviewed By**	**Approved By**

Controlled Copy No	
Issued to Shri	

QUALITY DEPARTMENT		
Amendment to Quality Work Instructions (HT)		
QWI NO: **BAP: HT:001**	REV:05	DT. 11 07 96
Amendment no: A 1		**DT. 06 07 2003**
Description : **Heat treatment schedule**		

Details of Amendment

Note Sl.no.	Amended As	Basis For Amendment
Table-1		
B.3	**Component: AN Fan : Shaft +Flange:** **Material** — **soaking temp** i) SA 335 P12 /13Cr M044 + SA 387Gr 12 — 650-700 °C ii) SA 335 P22/13CrMo44 +SA 387Gr22 /Gr12 — 680-720°C iii) SA 335 P12/13CrMo44 +SA 387Gr22 — 680-720°C Note: Other requirements shall be as per cl 3.1	Clause added to take of care of New material
C.3(a)	b) i) SA 335 P12 /13Cr M044 + SA 387Gr 12 — 650-700 °C ii) SA 335 P22/13CrMo44 +SA 387Gr22 /Gr12 — 680-720°C iii) SA 335 P12/13CrMo44 +SA 387Gr22 — 680-720°C	Clause modified to take of care of New material
4.4	Hardening heattreatment of wear plates: Rate of Heating : 500 °C/Hr Max. Soaking temp : 900-940 °C Soaking time : 10 minutes min. Quenching : in water	New clause added
4.2.4.1	Bearing pedestals & base frames up to Impeller size 31 need not be stress relieved .	New clause added

Prepared by	Reviewed By	Approved By
	B. Srinivasa Rao	

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Issued to Shri	

BHARAT HEAVY ELECTRICALS LIMITED
RANIPET-632 406
QUALITY ASSURANCE

BAP:HT:001

HEATTREATMENT SCHEDULE

EFFECTIVE DATE :: 11 07 96

PREPARED BY : DY.MGR/QA B. Srinivasa Rao

REVIEWED : MANAGER/WTC

AND : DGM /QA

APPROVED BY : DGM/OP&C

REVISION NO :: 05

ISSUED BY :: QUALITY ASSURANCE

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1.0 GENERAL NOTES

1.1 This Schedule is prepared with the guide lines of KKK Work Standards, ASME SEC.VIII, AWS D1.1 and Material Standards for FAN components and of AWS D1.1 for AIRPREHEATER components, ELECTROSTATIC PRECIPITATOR components, STRUCTURES, WIND ELECTRIC GENERATOR components and DEFENCE JOBS.

1.2 Whenever the specified hot working temperature range is exceeded, the components shall be normalised/normalised and tempered/hardened and tempered at the appropriate cycles as that of the receipt condition of the material.

1.3 Whenever not specified, the soaking time shall be as follows:

Hot working, normalising & Annealing .... 1 mt/mm (15 mts.min)

Tempering and Stress relieving ..... 2.4 mts/mm (30 mts.min)

1.4 The following rules shall apply to establish the thickness to be used in determining the soaking time for stress relieving.

1.4.1 For butt welds the thickness shall be the least of the following :

a) Thickness of material
b) Thinner of sections being joined
c) Thickness of weld

1.4.2 For fillet welds, the thickness shall be the throat thickness.

1.4.3 For partial penetration branch welds, the thickness shall be the depth of the groove prior to welding.

1.4.4 For repairs, the thickness shall be the depth of the groove as prepared for repair welding.

1.4.5 For combination of different welds in a component, the maximum thickness shall govern.

1.4.6 In case of groove welds, thickness shell be depth of groove.

1.4.7 If fillet weld is used in conjunction with groove weld, weld thickeness shall be depth of groove or throat of fillet whichever is greater.

1.4.8 For determining the soaking time for hot forming, the thickness shall be thickness of material for pipes, plates and dished ends. For bar stock, the same shall be diameter.

1.5 All materials to be heat treated shall be placed in the furnace in such a manner that they shall not be subjected to flame impingement. They shall be preferably loaded on raised platforms so that no material is in the plane of the burners.

1.6 Autographic recorders shall be provided to record the temperature.

1.7 Soaking time shall be reckoned from the time the temperature of the load crosses the minimum of the recommended cycle to the time it leaves the minimum of the recommended cycle.

1.8 Tolerance band should lie within the temperature range indi - cated for any heat treatment.

1.9 The recorders shall be calibrated periodically.

1.10 The heat treatment charts shall be serially numbered and identified with components. These shall be filed in serial numberwise for easy retrieval and reference.

1.11 When it is impractical to stress relieve at the cycles indicated, the operation may be carried out at a lower temperature as given below:

Decrease in Temperature below minimum specified temperature Deg.C	Minimum holding time at decreased temperature Mts./mm	Remarks
28	5	--
56	10	--
84	25	)Only)for)carbon steels (P1 Gr 1 & 2)
112	50	

1.12 For inter-BHEL unit products and customer supplied products, heattreatment procedures issued by the respective agencies shall be followed.

1.13 In case of power failure during heat treatment, PR:QA:502/latest shall be referred.

1.14 Incase of mixed loads the rate of heating and rate of cooling shall be the least of the rates of heating or cooling of various components .
e.g. If a heattreatment consists of ROH/ROC of impeller as 100 °C/hr Maximum, rotor post as 55°C/hr maximum and guide bearing housing as 120°C/hr maximum, ROH&ROC to be followed is 55°C/hr maximum.(That of rotor post)

1.15 If components of different soaking temperatrure and soaking times are to be combined in a single heattreatment, cl. 1.11 along with appropriate clauses of this schedule shall be reffered .In case of doubt consult QA .

2.0 FURNACE DETAILS

DETAILS	F1 BAY	A3 BAY
Work Centre No.	1522	1543
Location No.	0108	0065
Capacity (MT)	10	30
Make	Vulcan	Vulcan
Furnace Size (mm)		
L	4050	7800
B	3800	5300
H	2075	2900
Max. charge Temp. Deg.C	800	800

3.0 STRESS RELIEF CYCLES

3.1 FAN ROTATING PARTS

3.1.1 Temperature of furnace at the time of loading of jobs shall not exceed 315°C and at the time of discharging temperature shall not be more than 200°C.

3.1.2

a) Rate of heating in the furnace above 315°C and rate of cooling in the furnace upto 200°C shall not be more than 100°C/hour for WStE355 materials and its combination with other materials.

b) Rate of heating in the furnace above 315°C shall not be more than 100°C /hour and rate of cooling in the furnace up to 200°C shall be minimum 200°C/hour incase of NAXTRA70 or equivalent materials.

c) Rate of heating above 315°C and rate of cooling up to 200°C for materials other than above shall be as follows.

RATE OF HEATING: Maximum 200°C/hr divided by thickness of thickest part in inch subject to minimum of 55°C/hr and maximum of 200°C/hr.

RATE OF COOLING: Maximum 260°C/hr divided by thickness ofthickest part in inch subject to minimum of 55°C/hr and maximum of 260°C/hr.

3.1.3 Soaking time shall be 2.4 minutes per mm upto 50 mm.Above 50mm Soaking time is 120 minutes plus 15 minutes for each additional 25 mm over 50 mm.

3.2 FAN STATIC PARTS AND COMPONENTS OTHER THAN FANS

3.2.1 A) Temperature of furnace at the time of loading :: 315°C Max

B) Rate of heating above 315°C :: Maximum 200°C/hr/thickness of thickest part in inch. Subject to Minimum 55°C/hr. and maximum 200°C/hour

C) Soaking Temperature :: 595 - 650°C

D) Rate of cooling upto 315°C :: Maximum 260°C/hr/thickness of thickest part in inches. Subject to Minimum 55°C/ hour and maximum 260°C./hour

E) Cooling below 315°C :: In still air

3.2.2 Soaking time shall be 2.4 minutes per mm upto 50mm. Above 50mm, soaking time is 120 minutes plus 15 minutes for each additional 25mm over 50mm.

3.2.3 Thickness for soaking time shall be computed as per clause 1.4 unless otherwise specified.

3.2.4 *In case of mixed loads, soaking time selected for the cycle shall not exceed the limits given below .

SL.NO.	Weld / Matl.thickness in mm	Max. soaking time in minutes
1	Up to 25	125
2	26 to 50	200
3	51 to 80	250
4	81 to 150	375

* NOT APPLICABLE FOR FAN ROTATING PARTS

4.0 FAN COMPONENTS
4.1 Rotating Parts

4.1.1 Heat treatment cycle for rotating parts such as shafts, impellers shall be as per clause 3.1.Soaking temperature shall be as per Table 1. Thickness for soaking time shall be computed as per clause 1.4.

4.1.1.1 Minimum soaking time for shaft +flange [hub+flange weldment] shall be 120 minutes.

4.1.2 Total soaking time for materials of DIN17102such as WStE 355 ,WStE 460 ,StE 500 shall not exceed 150 mts.When soaking time exceeds 90 minutes,soaking temperature shall be aimed at 530 °C.However,in nocase temperature shall go below 530°C.

4.1.3 Soaking time for RQT 701& DILLIMAX 690E shall not exceed 120 minutes.

4.1.4 Soaking temperature shall never exceed the limit specified in table 1.

4.1.5 Stress relief temperatures for various components shall be as per Table 1 as shown below:

TABLE - 1

S.No	Component	Material	Soaking Temp.°C	Basis
A.0	AP Fans			
A.1	Impeller hub	WStE 355	530-580	Material Standard
A.2	Piston Assembly	SA 105 + WStE 355	530-580	-do-
A.3	Shaft Assembly	StE500 + WStE 355	530-580	-do-
B.0	AN FANS			
B.1	Impeller Assembly	a) WStE 355	530-580	-do-
		b) WStE 460	530-580	-do-
B.2	Shaft Pin + flange	CK 35 + WStE 355	530-580	-do-

S.No	Component	Material	Soaking Temp.°C	Basis
C.0	RADIAL FANS			
C.1	Impeller Assembly	A) WStE 355	530-580	Material Standard
		B) NAXTRA 70	-do-	-do-
		C) RQT701	550-580	-do-
		D) WELDOX 700E	550-580	-do-
		E) DILLIMAX 690E	-do-	-do-
		F) WELTEN 780A	-do-	-do-
		G) SA517 Gr..F	-do-	ASME SEC VIII
		H) SA 592Gr.F	-do-	-do-
		I) IS2062	595-650	-do-
		J) ASTM A36	595-650	-do-
C.2	Damper Shaft	X20Cr 13 V80 + BMC 16	650 -700	Material standard
C.3	a)Shaft tube assy.	a)ST 37/SA 106Gr.B + WStE 355	530-580	-do-
		b)SA 335 P12/ 13 CrMo44 + SA 387 Gr.12	680-720	-do-
		c)15Mo3+WStE 355	530-580	-do-
	b)Shaft tube with buttering layer	13 Cr Mo44/SA 335 P12 + E7018-A1 weld overlay	600-700	Material Standard and ASME Sec.VIII
	c)Shaft tube assy	13 CrMo44/SA 335 P12 with buttering layer + WStE 355	530-580	Material Standard

4.2 STATIC PARTS

4.2.1 Heat treatment cycle for static parts such as Fan housings, OGVs etc. shall be as per clause 3.2.

4.2.2 Clause 4.1.2 shall referred for Soaking time restriction for materials on DIN 17102.

4.2.3 When stress relief is for dimensional stability e.g.stress relief of Fan housings, suction moth with hub, OGV, soaking time shall be computed based on thickness of thickest part.

4.2.4 When stress relief is for relaxation of stresses e.g. stress relief of bearing pedestals, base frame and T-bolts, soaking time shall be computed based on weld thickness as explained under 1.4.

4.3 ARTIFICIAL AGEING

4.3.1 Artificial ageing of bearing housings and hub discs shall be carried out as per the cycles given below:

	Bearing Housing	Hub Discs
a) Material	ASTM A 216	GS17CrMoV511/DIN17245
b) Soaking temperature	595-650°C	660-700°C

Rate of heating, cooling and soaking time shall be as per Clause 3.1. Thickness for computing soaking time shall be maximum thickness of the part.

5.0 AIRPREHEATER COMPONENTS

5.1 (a) Part Name : Support bearing housing cover,Guide brg spool assembly, Guide bearing housing, Support bearing housing, Conventional rotor post, Sector Plate, Cold end and hot end stationary spool assemblies, Rotor post and Centre section for R-type heaters

(b) Stress Relief Cycle: As per clausc 3.2

6.0 ELECTROSTATIC PRECIPITATOR COMPONENTS

6.1 Part Name : Shock bar (old type - plate type)

6.2 Stress relief cycle : As per clause 3.2.

7.0 STRUCTURES

7.1 Above 50mm thickness, stress relief shall be done as per clause 3.2.

8.0 WIND ELECTRIC GENERATOR COMPONENTS

8.1 Part Name : Nacelle Structure, Bearing Housing

8.2 Stress relief cycle : As per clause 3.2.

9.0 DEFENCE JOBS

9.1 Part Name : Launcher Post, Pedestal

9.2 Stress relief cycle : As per clause 3.2

10.0 LOCAL STRESS RELIEF

10.1 To conduct local stress ,weldment and adjacent areas shall be throughly cleaned.

10.2 Refer fig -1 for thermocouple location.

10.3 Heating elements shall be wound around the weld, heat affected zone and the parent metal. Heating band shall extend beyond the weld atleast two times the thickness of thicker plate.(see fig-1)

10.4 Sufficient insulation shall be provided to ensure that temperature of weld and heat affected zone is not less than specified temperature.

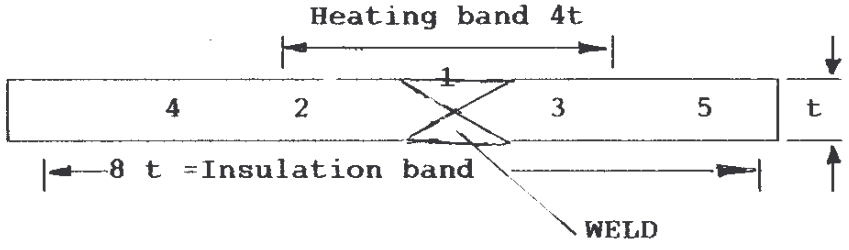
10.5 In addition adjacent portion of material outside the heated zone shall be protected by thermal insulation . Minimum width of such a insulation shall be 8 times the thickness of thicker member on the both sides of weld (see fig .1)

10.6 Ref. 3.0. for stress relief cycle.

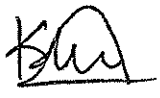
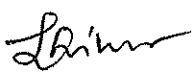
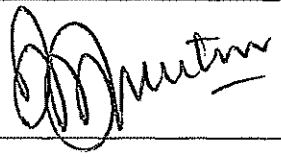
10.7 Heattreatment chart shall be maintained sl no wise. cycle.

FIG -1

1,2,3,4,5 are thermocouple location



PROCEDURE FOR LIQUID PENETRANT EXAMINATION
(Visible Method)

Prepared by	Reviewed by	Approved by
Kaushal Kumar Engineer Level II	**M S Ravikumar** Sr. Manager Level II	**Level III**
		



Effective Date 30 08 2016

1. RECORD OF REVISION

Revision No.	Date of Revision	Reason for Revision
01	28 07 1999	Revision in entirety
02	14 08 2003	Clause 2.1,2.2,2.3,12.1.2.2,12.1.3.1,12.13.2 and 13.1.2.1 modified Clause 8.2 added
03	30 08 2016	Revised in entirety based on latest standards.

1.0 SCOPE

1.1 This procedure defines the method, techniques and acceptance standards for liquid penetrant Examination of all shapes of ferrous and Non-ferrous product forms in Boilers, Boiler Auxiliaries, pressure vessels, Heat Exchangers and structural.

1.2 In pressure vessels the Examination shall include all welds around openings; attachment welds with a throat thickness over 6mm and on finished surfaces of welds as required by referencing code. The examination includes base material 13mm on each side of the weld.

2.0 REFERENCE

2.1 ASME Section VI Article 6, I & VIII (Division 1 &2) -2015

2.2 ASME B 31.1 /2015

2.3 AWS D 1.1 /DI.IM: 2015

3.0 EQUIPMENT

3.1 The term 'penetrant materials' as used in the procedure is intended to include all liquid penetrants, solvents (penetrant removers) or cleaning agents, developers etc used for 'Liquid penetrant Examination'.

3.2 Penetrant used shall be of solvent removable type and have a color contrast, which can be seen, readily in daylight or under normal interior illumination.

3.3 The cleaner used for the surface cleaning shall be an organic chemical such as Acetone or Trichloro Ethylene.

3.4 Developer shall be of non-aqueous suspendible type. When the developer dries, it shall form a white coating of fine powder on the part.

3.5 The Chemicals used for the examination of austenitic stainless steel or nickel base alloys shall be analysed for sulphur and total halogens. The residual amount of total sulphur and chlorine content shall not exceed 1% by weight.

4.0 SURFACE PREPARATION

4.1 In general satisfactory results may be obtained when the surface is as welded, as rolled, as forged or as cast condition. When the surface irregularities might mask the indications of unacceptable discontinuities, the surface shall be prepared by grinding or machining or any other suitable method.

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

4.3 Shot blasting may close discontinuities at the surface and should not be used before conducting penetrant examination. If the component is shot blasted, the surface is to be etched before conducting penetrant examination.

4.4 Prior to the application of the penetrant, the surface is recleaned with typical industrial cleaning agents such as Acetone.

5.0 DRYING AFTER PREPARATION

After cleaning, drying of the surface shall be accomplished by normal evaporation and ensure that the cleaning solution has evaporated. The minimum time required for the cleaner to dry from the surface 60 seconds and maximum time shall be 10 minutes depending on the position.

6.0 TECHNIQUES

6.1 Color contrast (visible) penetrant shall be used with solvent removable penetrant process.

6.2 The temperature of the penetrant and the surface of the part shall not be below 5°C and not above 52°C throughout the examination period. Local heating or cooling is permitted provided the part temperature remains in the range of 5°C to 52°C during the examination.

7.0 TECHNIQUE RESTRICTIONS

7.1 Intermixing of penetrant materials from different families or different manufacturers is not permitted.

7.2 Fluorescent penetrant examination shall not follow a color contrast penetrant examination.

8.0 EXAMINATION

8.1 Penetrant Application

8.1.1 The penetrant shall be applied by brushing, spraying or dipping after the surface is dried. For spraying a handpump or an aerosol spray cans will be used.

8.2 Penetration time

The penetrant shall be remaining wet on the minimum and maximum period (dwell time) as given in Table 2 or as qualified by demonstration for specific application.

Table 2

MATERIAL	FORM	MINIMUM DWELL TIME	MAXIMUM DWELL TIME

Alumimium, Magnesium, steel, Brass, Bronze, Titanium		TEMPERATURE RANGE	TEMPERATURE RANGE
		10 TO 52°C	10 TO 52°C
	Casting and Welds	10 Minutes	20 Minutes
	Wrought materials- Extrusions, Forging and Plates.	10 Minutes	20 Minutes

8.2.1 If the penetrant has completely dried up during the dwell time, then the surface shall be recleaned and reexamined.

8.3 REMOVAL OF EXCESS PENETRANT

8.3.1 After the required dwell time has elapsed, the excess penetrant remaining on the surface shall be removed by wiping with a lint free cloth, repeating the operation until most traces of penetrant have been removed. Final left out penetrant shall be remove by wiping with a clean cloth moistened with the solvent. Excessive application of the cleaner shall be avoided to prevent the possibility of removing the penetrant from discontinuities causing a decrease in the sensitivity of the test. **FLUSHING THE MATERIAL SURFACE WITH THE SOLVENT FOLLOWING THE APPLICATION OF PENETRANT AND PRIOR TO DEVELOPING IS PROHIBITED.**

8.3.2 Drying after excess penetrant removal.

8.3.2.1 After the removal of excess penetrant the surface shall be dried by normal evaporation. The minimum time required for the surface to get dried by normal evaporation is 60 seconds and maximum shall be 10 minutes.Drying of developer shall be by normal evaporation.

8.4 DEVELOPING

8.4.1 The developer shall be applied by spraying to provide uniform coating as soon as possible to the dry surface after the removal of excess penetrant. Insufficient coating thickness may not draw penetrant out of discontinuities. Excessive coating thickness may mask indications.

8.5 WET DEVELOPER APPLICATION

8.5.1 Prior to applying suspension type wet developer to the surface the developer must be thoroughly agitated too ensure adequate dispersion of suspended particles. The developer shall be applied by spraying using spray pump or aerosol spray can. The developer shall be applied over the surface in such a manner to assure complete

coverage of the part with a thin, uniform film of developer. Drying of developer shall be by normal evaporation.

8.6 DEVELOPMENT TIME

8.6.1 The surface shall be closely observed during the application of the developer to monitor the behavior of the indication, which tends to bleed-out. Developing time for final interpretation begins as soon as a wet developer coating is dry. The minimum developing time shall be 10 minutes and maximum shall be 60 minutes.

9.0 INTERPRETATION

9.1 Final interpretation shall be made with in 10 to 60 minutes after the wet developer coating is dry. If the bleed - out does not alter the examination results longer periods are permitted.

9.2 The surface shall be examined in increments if the surface to be examined is large enough to complete the inspection within the prescribed time.

A minimum light intensity of 100 foot candle (1000 lux) is required to ensure adequate sensitivity during the examination and evaluation of indications, which can be achieved by a hand lamp or torch light positioning at a distance of 300mm. The light intensity shall be measured with white light meter prior to evaluation of indications or verified light source shall be used. Verification of light sources is required to be demonstrated only one time, documented, and maintained.

10.0 EVALUATION

10.1 Flaws at the surface will be indicated by bleed out of the penetrant. However localize surface irregularities such as machining marks or other surface conditions may produce false indications. Broad areas of pigmentation which would mask indications are not acceptable and such areas shall be cleaned and reexamined.

10.2 The surface shall be examined in increments if the surface to be examined is large enough to complete the inspection within prescribed time.

10.3 An indication of an imperfection may be large than the imperfection that causes it however, the size of the indication is the basis for acceptance evaluation.

10.4 Relevant indications area are those which result from mechanical discontinuities (imperfection).

10.5 Only indications with major dimension greater than 1.5mm shall be considered relevant.

10.6 Any indication which is believed to be non-relevant shall be regarded as a defect until the indication is either eliminated by surface conditioning or it is evaluated by other non- destructive testing and proved to be non - relevant.

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

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

10.9 Any questionable or doubtful indications shall be reexamined to determine whether they are relevant, or not.

11.0 ACCEPTANCE STANDARD

11.1 Welds and Materials (as per ASME Sec 1 and VIII Div 1&2)

11.1.1 All surface to be examined shall be free of

11.1.2 A)Relevant linear indications.

B) Relevant rounded indications greater than 5mm.

C) All relevant indications shall be investigated to assure that no leak-path exists in welds joining nipples to drums, dished - ends and headers.

11.1.3 Four or more relevant rounded indications in a line separated by 1.5mm or less edge to edge.

11.1.4 In attachment welds of non-load carrying class, indications from crack or due to material separation are unacceptable

11.2 For Power Piping(as per ASME B31.1)

11.2.1 Indications whose major dimensions greater than 2.0mm shall be considered relevant.

11.2.2 The following relevant indication are unacceptable:

a. Any crack or linear indications.

b. Rounded indication whose dimensions greater than 5.0mm.

c. Four or more rounded indication in a line separated by 2.0mm or less edge to edge.

d. Ten or more rounded indication in any 3870mm2 of surface with the major dimensions of this area not to exceed 150mm with the area taken in the most unfavorable location relative to the indications being evaluated.

12.0 WELDS MADE TO STRUCTURAL WELDING CODE AWS D 1.1

12.1 For statically and cyclically loaded non-tubular connections made to AWS code the acceptance of any discontinuity shall be based upon a visual examination of the discontinuity after the removal of developer medium and evaluated for its nature and size. Where the discontinuity cannot be seen after removal of the developer medium either directly or using magnifying glass evaluation shall be based on the size and nature of liquid penetrant indication.

13.0 ACCEPTANCE STANDARD (AS PER AWS)

13.1 Statically loaded non-tubular connections.

13.1.1 Indications from cracks, lack of penetration and lack of fusion are not acceptable.

13.2 Porosity.

13.2.1 Complete joint penetration groove welds in butt joints transverse to the computed tensile stress shall have no visible piping porosity.

13.2.2 For all other groove welds and for fillet welds, the sum of the visible piping porosity of 1.0 mm or greater in diameter shall not exceed 10 mm in any linear 25 mm of weld and shall not exceed 20 mm in any 300 mm length of weld.

13.3 Undercut

13.3.1 For material less than 25 mm thick, undercut shall not exceed 1.0 mm except that a maximum 2.0 mm is permitted for an accumulated length of 50 mm in any 300 mm

13.2 For material equal to or greater than 25 mm thick undercut shall not exceed 2.0 mm for any length of weld.

14.0 Cyclically loaded non-tubular connections.

14.1 Indications from Cracks, Lack of penetration and lack of fusion are not acceptable in any welds.

14.2 Porosity

14.2.1 Complete joint penetration groove welds in butt joints transverse to the direction of computed tensile stress shall have no piping porosity. For all other groove welds, the frequency of piping porosity shall not exceed one in 10omm of length and the maximum diameter shall not exceed 2.5 mm.

14.2.2 The Frequency of piping porosity in fillet welds shall not exceed one in each 10omm of weld length and the maximum diameter shall not exceed 2.5mm. EXCEPTION for fillet welds connecting stiffeners to web, the sum of the diameter of piping porosity

shall not exceed 1omm in any linear 25mm of weld and shall not exceed 20mm in any 300mm length of weld.

14.3 Undercut.

14.3.1 In primary members, undercut shall not be more than 0.25mm deep when the weld is transverse to tensile stress under any design loading condition. Undercut shall not be more than 1mm deep for all other cases.

15.0 REPAIR AND RE-EXAMINATION

15.1 Whenever an imperfection is repaired by chipping or grinding the excavated area shall be blended into the surrounding surface so as to avoid sharp notches, crevices or corners.

15.2 After a defect is thought to have been removed and where welding is required after repair, the area shall be examined for removal of defects, area cleaned and repair carried out. The repaired area shall be blended into the surrounding surface as in 14.1 and re-examined by the liquid penetrant or any other NDT methods originally required for the affected area.

16.0 PERSONNEL QUALIFICATION

16.1 Wherever penetrant examination is required by the referencing code, the same shall be conducted by Level I and evaluated by a personnel qualified to minimum Level II as per ASNT SNT-TC-1A Edition 2006.

17.0 POST CLEANING

17.1 After the examination and evaluation is completed all penetrant testing material shall be removed from the surface, so that it will not interfere with the subsequent processing or service requirements.

18.0 REPORTING

18.1 Where penetrant test is mandatory, a copy of the report signed by personnel certified to minimum Level-II will be issued in format R49-720B or equivalent, after completion the examination.

BHARAT HEAVY ELECTRICALS LIMITED

BAP / RANIPET 632 406

R49-720/B

NON-DESTRUCTIVE TESTING

LIQUID PENETRATION TEST

REPORT NO : REQ DT :

REF NO : BAY :

WORK ORDER : DU :

CUSTOMER :

PART NAME

PART NUM : QTY :

DRAWING NO. : REV :

STAGE OF TEST

MATERIAL SPECIFICATION : CHP :

SURFACE CONDITION : -

QP REFERENCE

REMARKS :

QC-INSPECTOR NAME

DATE OF TEST

PROCEDURE REFERENCE

TYPE OF PENETRANT :)

PENETRANT REMOVER

TYPE OF DEVELOPER

TEMPERATURE

DEWELL TIME

REMARKS

(LEVEL-II)

OPERATOR NAME & LEVEL APPROVED BY NDT APPROVED BY EXTERNAL I

SAMPLE

PROCEDURE FOR RADIOGRAPHIC EXAMINATION OF BUTT WELDS IN STRUCTURES OF BOILER COMPONENTS

Prepared by	Reviewed by	Approved by
K Velladurai Dy. Engineer Level II	Kaushal Kumar Engineer Level II	Level III

L. MARIMUTHU
ASNT LEVEL III
CERT. No: 159659
UT, RT, MT, PT

Effective from 21.09.2016

RECORD OF REVISION

Revision No	Date of Revision	Reason for Revision
01	11-02-2005	Revision in entirety
02	21-09-2016	Revision in entirety based on latest standard

1.0 SCOPE

1.1 This procedure describes the testing method and acceptance standards for the radiographic examination of butt welds in structures having thickness up to 75mm of boiler components, rotating parts and is applicable wherever specified in the concerned quality control procedures.

2.0 REFERENCE

2.1 ASME Section V 2015 (Article 2)

2.2 AWS D.1.1. Structural welding code - Steel 2015

2.3 ASTM E 94

2.4 ASME SECTION VIII DIV 02

3.0 SURFACE PREPARATION

3.1 The finished surface of the weld may be flush with the plate or have a reasonably uniform reinforcement, not to exceed 3.0 mm. Both surfaces of the test assembly in the area of the weld shall be smooth enough such that the resulting radiographic contrast due to any remaining irregularities cannot mask or be confused with that of any objectionable defect or the contract documents require the removal of weld reinforcement.

4.0 EQUIPMENTS AND MATERIALS

4.1 Radiation Sources

4.1.1 Iridium-192 Source may be used for radiography.

4.2 Film

4.2. The film used for radiography shall be generally the following brands of film.

- Kodak - Industrex AA 400 /T 200/ M
- Agfa Gevaert – Agfa D7 / D5 / D4
- Laser D7 / D5 / D4

4.2.2 Other brands of films shall be used subjected to approval as per procedure No: NDT: WI: 010.

4.3.1 Lead Intensifying Screens shall be used to improve the quality of the radiograph. Screen shall be of thickness not less than 0.13mm. Suitable lead backing shall be used to avoid back scatter wherever required. Fluorescent screens shall not be used.

4.3.2 All intensifying screens shall be handled carefully to avoid dents, scratches, dirt or grease on the active surfaces and shall not cause any false indications due to the defective screens. Screens shall be in direct contact with the film. Screens showing evidence of physical damage should be discarded.

5.0 TECHNIQUES OF RADIOGRAPHY

5.1 Radiographs shall be made with single source of radiation and the source is positioned so that the center of the cone of the radiation beam falls normal to the axis of the weld and centered with respect to the length and width of the weld being examined.

5.2 A single-wall exposure technique shall be used for radiography. In single-wall technique, the radiation passes through only one wall of the weld (material) which is reviewed for acceptance of the radiograph. The film being exposed shall be close to the surface of the weld, opposite to the radiation source and parallel to the front surface of the work to avoid enlargement and distortion of image. As Gamma radiations are divergent in nature the radiographic image or the structure within the weld will be larger than the object or structure itself.

5.3 The width of the film shall be sufficient to depict all portions of the weld joint including the heat affected zones and shall provide sufficient additional space for required IQI and film identification without infringing upon the area of interest in the radiograph.

5.4 The source object distance, the perpendicular distance from the radiation source to the object, shall be as large as possible as the degree of enlargement will decrease with the increase in distance.

5.5 The source to object distance shall neither be less than seven times the maximum thickness of the weld plus reinforcement and backing if any, under examination nor the length of the film being exposed in a single plane.

5.6 Films shall have sufficient length and shall be placed to produce at least 12.5 mm of film exposed to direct radiation from the source beyond each free edge where the weld is terminated.

6.0 IDENTIFICATION OF RADIOGRAPHS

6.1 Each butt weld will have an identification number to identify the weld and segments. These number and location marker will appear as a permanent image on the radiographs.

6.2 Location markers shall be placed on the source side of part. Outer edges of the weld shall be identified by keeping segment numbers or alphabetic letters on one edge and the arrows on the other edge beneath the segment number or letter, but clear from the edges, using lead markers.

6.3 The weld shall be divided into suitable segments in such a way that the density at the extremities of the radiographs shall not be less than 15% of the density at the middle.

6.4 Radiographs shall be taken with sufficient overlap, such that no area will be left untested.

6.5 Information required to show on the radiograph shall include the contract identification, initials of the radiographic inspection co., initials of the fabricator, the radiography identification marks, date of radiography and weld repair number, if applicable. These identification numbers shall be placed 19 mm away from the weld edge.

6.6 To identify repairs, letters R1,R2,R3 etc. shall be placed in addition to the original system of identification. Suffix RT will represent retake without repair and GRE or MRT for grind and retake.

7.0 DENSITY OF RADIOGRAPHS

7.1 The transmitted radiographic film density through the body of appropriate hole type IQI and the area of interest shall be 2.0 minimum and 4.0 maximum for single wall viewing. A step wedge comparison film or a densitometer will be used for judging film density. A tolerance of 0.05 in density is allowed for variation between densitometer readings

7.2 If the ratios of thicker weld section to thinner weld section is 3 or greater radiographs shall be exposed to produce a density of 3.0 to 4.0 in thinner section. When this is done densities less than 1.8 will be accepted in the thicker section.

7.3 If the density of radiograph anywhere through the area of interest varies by more than minus 15 % or plus 30% rounded to the nearest 0.1 from the density through the body of the IQI within the minimum/ maximum allowable density ranges specified in the para 7.1, then an additional IQI shall be used for each exceptional area, one shall represent the lightest area and the other the darkest area of interest.

8.0 STEP WEDGE FILM

8.1 The density of step wedge comparison films calibration shall be verified by calibrated densitometer.

9.0 SCATTERED RADIATION

9.1 Back scattered radiation shall be checked by attaching lead letter 'B' of 13mm in height and 1.5 mm in thickness on the back of each film holder during exposure. If the lighter image of 'B' appears on the radiograph as an image on darker background, the radiograph shall be considered unacceptable . A dark image of 'B' on a lighter background is not a cause of rejection.

10.0 IMAGE QUALITY INDICATORS (IQI) as per AWS D1.1

10.1 IQI shall be of plate and hole type. The Designated hole type IQI with essential hole shall be as given in Table-1, below:

TABLE-1

Material thickness, IQI Designations and Essential Holes.				
Nominal Single Wall Thickness range mm	IQI			
	Source side		Film side	
	Design.	Essn. Hole	Design.	Essn. Hole
Upto 6 inclu.	10	4T	7	4T
Over 6 thru 10	12	4T	10	4T
Over 10 thru 16	15	4T	12	4T
Over 16 thru 20	17	4T	15	4T
Over 20 thru 25	20	4T	17	4T
Over 25 thru 32	25	4T	20	4T
Over 32 thru 38	30	2T	25	2T
Over 38 thru 50	35	2T	30	2T
Over 50 thru 65	40	2T	35	2T
Over 65 thru 75	45	2T	40	2T

10.2 IQI shall confirm to fig 6.9 of AWS D1.1 and shall be made of carbon steel or type 304 stainless steel. For welds, the thickness on which the IQI is selected shall be the nominal single wall thickness plus the reinforcement.

10.3 The hole type IQI shall be placed adjacent to the weld except for instances where the weld material or the geometrical configuration makes it impracticable to place the IQI, in which case the IQI shall be placed on the weld metal itself.

10.4 Number of IQI

10.4.1 For welds joining nominal equal thickness:

10.4.2 Where a radiograph represent 255 mm or greater of weld length, IQI shall be placed at the ends of the segment, one on either side of the weld. Where a radiograph represents less than 255 mm of weld, one IQI shall be placed at the center away from the weld edge.

10.4.3 For welds at a transition in thickness:

10.4.4 Where a radiograph represent 255mm or greater of weld length, two IQI on either end of the weld on thinner side and one IQI on thicker side at the center of the weld shall be placed 10mm away from the weld. The IQI on the transition thickness shall be based on the maximum thickness under the IQI. Similarly for weld length less than 255mm one IQI shall be placed on thinner side and one on transition side.

10.5 A shim of material radiographically similar to the weld metal shall be placed under the IQI, if needed, so that the radiographic density throughout the area of interest is not more than minus 15 % from the radiographic density through the designated IQI adjacent to the essential hole. The dimension of the shim shall be 3mm more than the IQI at least in 3 sides.

11.0 GEOMETRIC UNSHARPNESS (Ug)

11.1 The maximum value for geometric unsharpness will be

0.51 mm for thickness up to 50 mm
0.76 mm for thickness from 50mm to 75mm

11.2 Final acceptance of the radiographs shall be based on the ability to see the prescribed IQI image and the specified hole or a designated wire.

12.0 QUALITY OF RADIOGRAPHS

12.1 All radiographs shall be free from mechanical, chemical or other blemishes to the extent that they do not mask and are not confused with image of any discontinuity in the area of interest of the being radiographed. Such blemishes include, but are not limited to
(a) fogging
(b) Processing defects such as streaks, watermarks or chemical stains.
(c) Scratches, finger marks, crimps, dirtiness, static marks, smudges or tears
(d) False indications due to defective screens.

13.0 ACCEPTANCE STANDARD

13.1 For welds subject to cyclically loaded non-tubular tension member

13.1.1 The following type of discontinuities shall not be acceptable.

a. Any type of crack.

b. The greatest type of any porosity or fusion type discontinuity (such as slag, lack of fusion and incomplete penetration) that is 2mm or larger, in greatest dimension shall not exceed the size 'B' indicated in figure1 for the effective throat or weld size involved. The maximum size limitations 13 mm shall apply to all weld effective throat of greater than 38mm also.

c. The distance from any porosity or fusion type discontinuity described above to another such discontinuity, to an edge, or to the toe or root of any interacting flange to web weld shall not be less than the maximum clearance allowed 'C' indicated in fig I for the size of discontinuity under examination.

d. Discontinuities having a greatest dimension of less than 2mm shall be unacceptable if the sum of their greatest dimension exceeds 10 mm in any 25mm length of weld.

e. Adjacent discontinuities spaced less than the minimum spacing required by fig I shall be measured as equal to the sum of total length of discontinuities plus the length of the space between them and evaluated as a single discontinuity.

13.2 For welds subject to cyclically loaded non-tubular compression member:

13.2.1 The following type of discontinuities shall not be acceptable.

a. Any type of crack.

b. The greatest dimension of any porosity or a fusion type discontinuity that is 3mm or larger, in greatest dimension shall not exceed the size 'B' nor shall the space between adjacent discontinuities be less than the minimum clearance allowed 'C' indicated by figure II, for the size of discontinuity under examination. The maximum size limitation 19 mm applicable to weld thickness 38mm as shown in fig II shall apply to all weld sizes greater than 38 mm.

c. Discontinuities having a greatest dimension of less than 2mm shall be unacceptable, if the sum of their greatest dimension exceeds 10mm in any 25mm length of weld.

d. Adjacent discontinuities not separated by two times the length of the largest discontinuity shall be measured as one length equal to the total length of discontinuity inclusive of the space in between and evaluated as a single discontinuity.

13.3 Welds in different parts of Impeller Assembly and other Rotating Machineries.

13.3.1 a. Any indication which is interpreted to be a crack or lack of fusion or lack of penetration is not acceptable regardless of their length.

b. Indications of slag inclusions are not acceptable if the length is more than 5mm.

c. Successive indication of slag inclusions less than 5mm in length shall be separated by at least 5 times the length of the longer of the two indications.

d. The aggregate length of successive slag inclusions shall not exceed 't' in a length of 12't' ('t' is the thickness of the thinner of the section joined)

e. Rounded indications whose major dimension is greater than 0.8 mm are considered to be relevant.

f. Rounded indications whose major dimension is greater than 3.2 mm are not acceptable.

g. Isolated indication of maximum size of 3.2 mm is permissible provided it is separated from the adjacent indications by at least 25 mm (fig III).

h. Randomly distributed rounded indications are acceptable as per chart in figure III (Figure 4-5 of ASME Section VIII, Appendix 4)

i. No cluster of rounded indication is acceptable.

14.0 PERSONNEL QUALIFICATION

14.1 Personnel performing examination shall be qualified in accordance with NDT:WI:006

1) Operator	Minimum Level I
2) Film Evaluation	Minimum Level II

15.0 REPORT

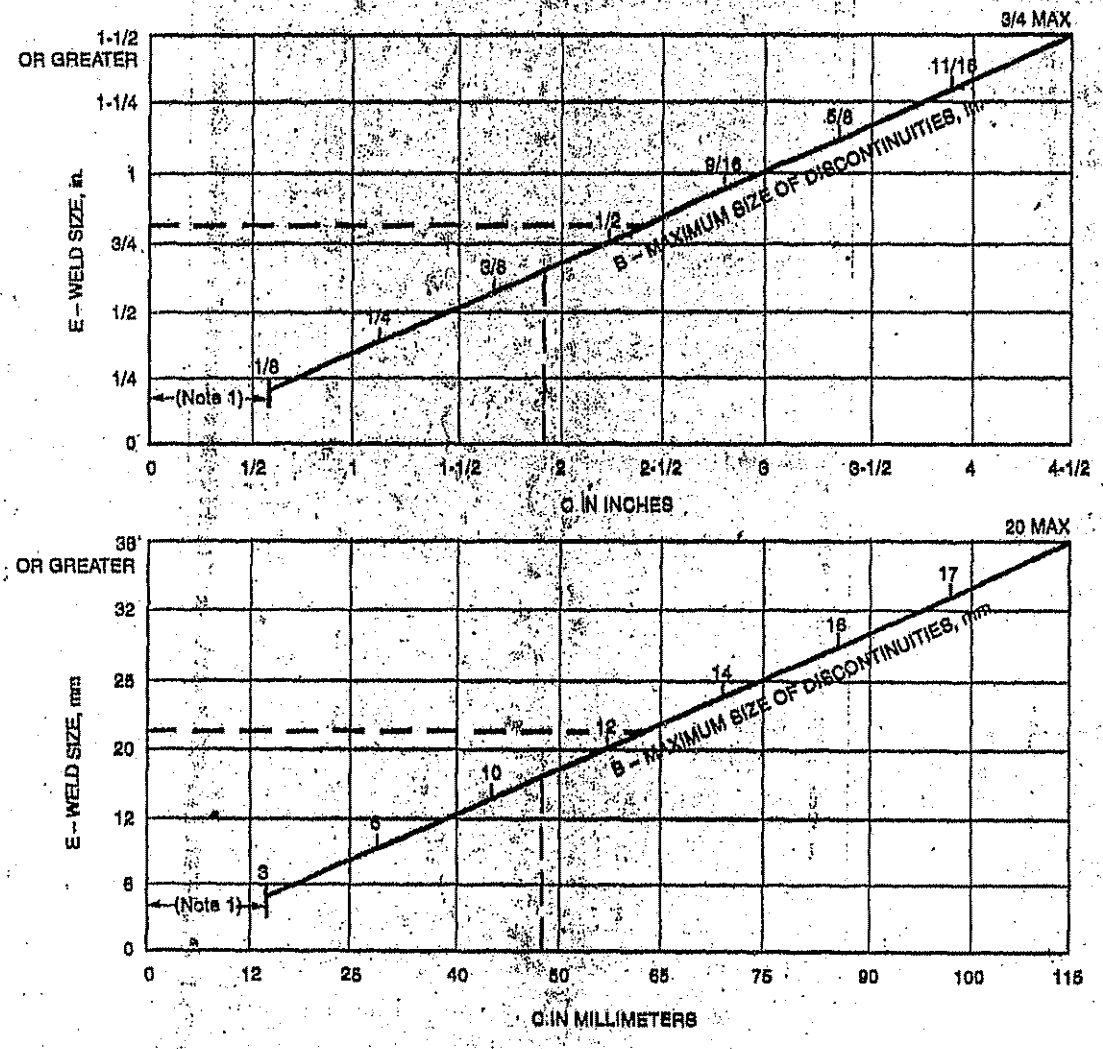
15.1 After the evaluation, report shall be issued in the radiographic examination report form no:R49-718/A or equivalent. Wherever required, approval shall be obtained from the concerned external inspection agency.

15.2 The tests, reports and radiographs will be preserved for five year or till the documents are signed, whichever is earlier.

16.0 SAFETY

16.1 Radiography shall be performed in accordance with all applicable safety requirements as specified in Safety Procedure BHEL: NDT: RP: SAF: 01

FIGURE I

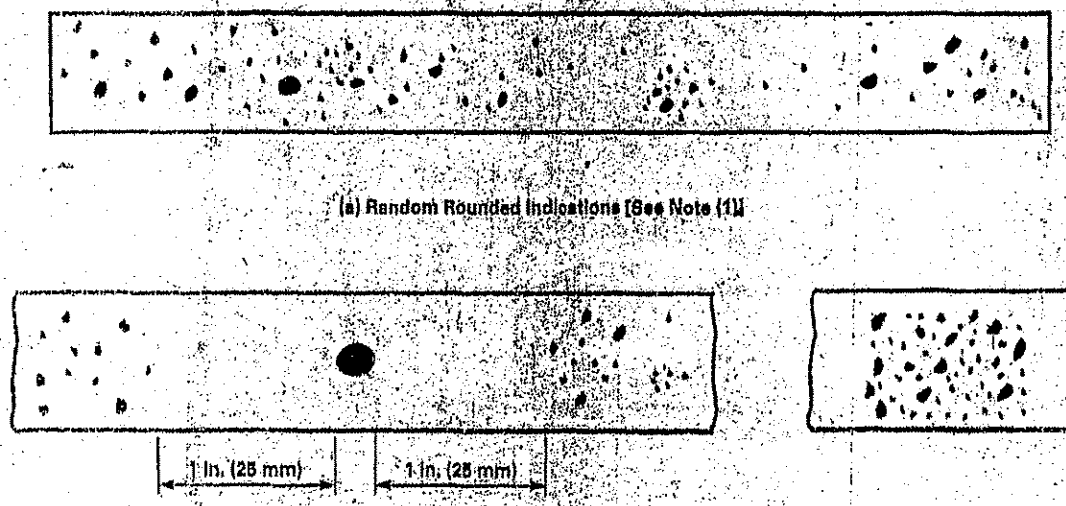


General Notes:
- To determine the maximum size of discontinuity allowed in any joint of weld size, project E horizontally to B.
- To determine the minimum clearance allowed between edges of discontinuities of any size, project B vertically to C.
- See Legend on page 225 for definitions.

Note:
1. The maximum size of a discontinuity located within this distance from an edge of plate shall be 1/8 in. [3 mm], but a 1/8 in. [3 mm] discontinuity shall be 1/4 in. [6 mm] or more away from the edge. The sum of discontinuities less than 1/8 in. [3 mm] in size and located within this distance from the edge shall not exceed 3/16 in. [5 mm]. Discontinuities 1/16 in. [2 mm] to less than 1/8 in. [3 mm] shall not be restricted in other locations unless they are separated by less than 2L (L being the length of the larger discontinuity); in which case, the discontinuities shall be measured as one length equal to the total length of the discontinuities and space and evaluated as shown in Figure 6.6.

Figure 6.5—Weld Quality Requirements for Discontinuities Occurring in Cyclically Loaded Nontubular Compression Welds (Limitations of Porosity or Fusion-Type Discontinuities) (

FIGURE II



(a) Random Rounded Indications [See Note (1)]

(b) Isolated Indication [See Note (2)]

(c) Cluster

NOTES:
(1) Typical concentration and size permitted in any 6 in. (152 mm) length of weld.
(2) Maximum size per Table 4-1.

FIG. 4-5 CHARTS FOR *t* OVER $\frac{3}{8}$ in. TO $\frac{3}{4}$ in., INCLUSIVE

BHARAT HEAVY ELECTRICALS LIMITED

BAP RANIPET - 632 406

NON-DESTRUCTIVE TESTING

RADIOGRAPHIC EXAMINATION

R49-718/A

REPORT NO :
REF NUM
WORK ORDER :
CUSTOMER :
PART NAME :
PART NUM :
DRAWING NUMBER :
MATL SPECIFICATION :
WELD PROCESS :
WELDER NAME :
SURFACE CONDITION :
QP NUMBER :
REMARKS :
QC_INSPECTOR NAME :
DATE OF TEST :
PROCEDURE REFERENCE :
SOURCE & STRENGHT :
TECHNIQUE :
EXP TIME :
LEAD SCREEN (FRONT & BACK) :
FILM DENSITY
IQI / SENSITIVITY

REQ DATE :
BAY :
DU :
QTY :
REV :
THICKNESS :
TYPE OF JOINT :
CHP :
SIZE :
FILM USED :
SFD :
CAMERA NO :
RADIOGRAPH NO :

RT READINGS

SL	LOCATION	FILM SIZE	SEGMENT NO	FINDINGS	REM
1					
2					
3					
4					
5					

TEST STATUS : ☐ ACCEPTED

(LEVEL II)	ASNT LEVEL-II PT,MT,RT,UT BHEL/BAP - RANIPET	
OPERATOR NAME & LEVEL	APPROVED BY NDT	EXTERNAL INS

SAMPLE

PROCEDURE FOR ALLOWABLE DEVIATIONS FOR DIMENSIONS WITHOUT SPECIFIED TOLERANCES.

Prepared by	Reviewed by	Approved by
10/09/2020	10/09/2020	
Renjith K Manager / QA	R. Arunachalam DGM / QA & QC - OLI	K. Saketharaman AGM / Quality

1.0 SCOPE

This procedure describes the allowable deviations for the dimensions without specified tolerance in drawing.

2.0 REFERENCES

ISO 2768-1 (1989) and previous revision of PRQA 500.

3.0 PROCEDURE

a. Table 1 given below indicates the permissible variation in Linear Dimension of fabricated and machined components. The coarse grade is to be followed for fabricated components and medium grade for machined components.
b. Table 2 given below indicates the permissible deviations for Radii & Chamfers for machined components.
c. Table 3 given below indicates the permissible deviations for Angular dimensions for machined components.
d. Table 4 given below indicates the conditions under which the deviations given in this standard are not applicable.
e. Special rulings may be stated for linear dimensions of welded structures consisting of several assemblies.
f. If closer tolerances than those given in this procedure are necessary, the same shall be indicated in the relevant drawings.

TABLE - 1

Degree of accuracy	Permissible deviations for the linear dimensions nominal size range (in mm)											
	0.5* up to 3	Over 3 up to 6	Over 6 up to 30	Over 30 up to 120	Over 120 up to 400	Over 400 up to 1000	Over 1000 up to 2000	Over 2000 up to 4000	Over 4000 up to 8000	Over 8000 up to 12000	Over 12000 up to 16000	Over 16000 up to 20000
f (fine)	± 0.05	± 0.05	± 0.1	± 0.15	± 0.2	± 0.3	± 0.5	± 0.8	-	-	-	-
m (medium)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2	± 2	± 3	± 4	± 5	± 6
g (coarse)	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2	± 2	± 3	± 4	± 5	± 6	± 7	± 8
sg (very coarse)	-	± 0.5	± 1	± 1.5	± 2.5	± 4	± 6	± 8	± 8	± 10	± 12	± 12
*In the case of nominal sizes below 0.5 mm, the deviations must be specified directly by the side of the nominal size.												

TABLE – 2

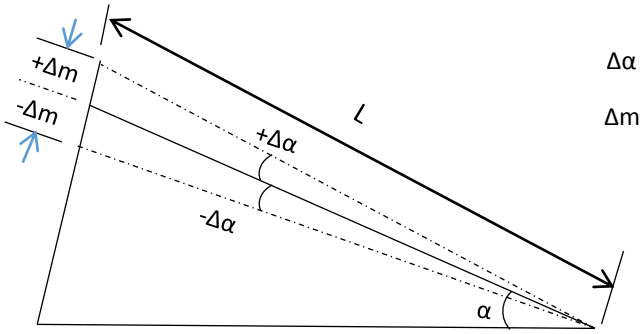
DEVIATIONS FOR RADII & CHAMFERS

All dimensions are in mm

CLASS OF DEVIATION	RANGE OF NOMINAL DIMENSIONS					
	Above	0.5	3	6	30	120
Fine & Medium	Upto and including	3	6	30	120	315
		± 0.2	± 0.5	± 1	± 2	± 4

TABLE – 3

DEVIATIONS FOR ANGULAR DIMENSIONS



Δα = Angle tolerance in angular units.

Δm = Angle tolerance in linear units.

All Dimensions are in mm

	Length (L) of shorter side of angle in mm							
Class of Deviations	Above	-	10	50	120	500	800	1250
	Up to & including	10	50	120	500	800	1250	2000
Fine and Medium	Δm (mm)	± 0.1	± 0.2	± 0.6	± 0.8	± 0.96	± 1.125	± 1.5
	Δα (deg or min)	± 1°	± 30′	± 20′	± 10′	± 4′	± 3′	± 2′ 3″

TABLE – 4

NON APPLICABILITY OF THE STANDARD

Standard Specification	Conditions for Tolerancing	Dimensions	Production Method	Special Agreements.
Where permissible deviations have been specified.	Where higher values than those specified in Table 1 and 2 may be allowed. Where only positive or only negative deviations are desired. Where parts are manufactured separately and are required to be assembled together without any further treatment (selective assembly, spare parts etc)	For dimensions required to give a certain class of it. For dimensions resulting after assembly Where concentricity between parts is required. For angular dimensions of a circular division (for example, angular positioning of teeth of clutches) For angular dimensions in precision taps and in pipe bends. For dimensions of welded assemblies (unless the part is to be machined)	Casting, forging, pressing, rolling, welding, flame cutting.	Where this variations from this standards are agreed upon between the purchaser and the manufacturer.

PROCEDURE FOR	RESTARTING OF FURNACE DURING THE RUNNING OF HEAT TREATMENT CYCLE IN CASE OF POWER FAILURE OR DISRUPTION OF FUEL SUPPLY
EFFECTIVE DATE	21-04-93

PREPARED BY	B. Srinivasa Rao
REVIEWED BY	
APPROVED BY	

ISSUED BY:	REV.NO.:
QA	00

CONTROL NO [ ]

MASTER COPY

PROCEDURE FOR RESTARTING OF FURNACE DURING THE RUNNING OF HEATTREATMENT CYCLE IN CASE OF POWER FAILURE OR DISRUPTION OF FUEL SUPPLY

1.0 **Scope**

This procedure specifies the steps to be followed in case of power failure or disruption of fuel supply herein after called power failure.

2.0 **Procedure**

2.1 **Incase of power failure during heating up:**

2.1.1 Follow the original heat treatment cycle from the temperature at which power returns.

2.2 **Incase of Power failure during soaking:**

2.2.1 Repeat original heat treatment cycle for all materials except for WStE355 material. In case of wstE 355 ensure the following

2.2.2 Determine the time of soaking prior to power failure

2.2.3 Subtract this soaking time from total soaking time. This is balance soaking time.

2.2.4 Follow the original heat treatment cycle from the temperature at which power returns except for soaking where the soaking time shall be balance soaking time.

2.3 **In case of Power Failure during cooling down**

2.3.1 Repeat original heat treatment cycle for all materials except WStE355 material. In case of WStE355, no reheat-treatment shall be done.

BHARAT HEAVY ELECTRICALS LIMITED
RANIPET.

QUALITY DEPARTMENT

PR:QA:504
REV: 00
Date: 27 05 93

Procedure for	Seaworthy packing of Components for Export Contracts.
Effective Date	27 05 93

	NAME	DATE	SIGNATURE
Prepared by	V. JAYARAMAN	27 05 93	V. Jayaraman
Reviewed by	N. BABU	27 05 93	
Approved by	N.MISRA	27 05 93	

ISSUED BY — SR MGR/QUALITY ASSURANCE

V. JAYARAMAN, MANAGER/QA

CONTROLLED COPY No.: ABAD

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PROCEDURE FOR SEAWORTHY PACKING FOR EXPORT CONTRACTS

1.0 SCOPE: This procedure lays down methods to be adopted for SEAWORTHY PACKING OF COMPONENTS FOR EXPORT CONTRACTS.

2.0 WOOD TOBE USED:

2.1 FIR, CHIR, CHEMICALLY TREATED MANGO WOOD may be used for packing wood for the Seaworthy packing. The wood specification SPEC:Packwood:01/DT:080593 SHALL BE USED.

2.2 Mango wood if used shall be chemically treated.

3.0 CONSTRUCTION OF WOODEN BOXES:

3.1 Slides: They are used at the bottom of boxes. They are also called as runners.

3.2 The quantity of slides/runners are selected depending upon the weight and over all dimension of the load, to be carried. Table 1 and 2 details out the number of slides, length & cross section of slides to be provided with their carrying capacity.

3.3 BOTTOM FRAME: The construction of bottom frame is as shown in Fig.2. (Annexure)

3.4 TOP FRAME: The construction of top frame is as shown in Fig.3. (Annexure).

3.5 Thickness of sheathing for top, sides and end. Thickness of the boards used for sheathing for the top, sides and end panels shall be 25 mm.

3.6 The top of box consists of beam supported on top travers bar and sheathing as shown in Fig.3.

3.7 The dimension of items 1,2 of Fig.3 shall be as per table 3. (Annexure)

3.8 The dimensions of the end and lateral panels shall be calculated according to the over-all dimensions of items to be packed.

3.9 Diagonal braces shall be used in packing cases with height exceeding 600 mm as shown in Fig.4.

3.10 The angle between the lower or upper horizontal supports and diagonal braces shall be in the range of 30' to 60' and if possible this angle preferrably be kept at 45°

3.11 If the height of the box exceeds more than 1400 mm, the diagonal braces shall cross each other and when this dimension exceeds 1800 mm additional horizontal support shall be provided as shown in Fig.5 and Fig.6. (Annexure)

3.12 Intermediate supports shall be used in such a way that the diagonal braces when fixed are inclined at 45'. The distance between two intermediate supports shall not be more than 1.7 and less than 0.6 of the height of the box.

3.13 Size of upper and lower horizontal supports and vertical supports shall be as per table 4. Refer Figures 7,8,9 & 10 for the arrangements.

3.14 For compact fitting the diagonal braces be cut according to the shape of the place.

3.15 Selection of bottom boards and traverse bars.

3.16 The bottom of the box consists of slides fixed with traverse bars and bottom boards.

3.17 In case of central loading (when the load is not fixed on slides) carrier traverse bars shall be used to fix the load.

3.18 The cross section of end traverse bar (item 1) and thickness of bottom boards (item 2) shall be as per table 5. (Annexure)

3.19 25mm thickness of bottom board is allowed to be used for concentrated load upto 1000 kgs when the load is fixed on cross bar or slides.

3.20 All boxes measuring more than 600mm height shall be constructed by assembling end, side and top shooks on a bottom forming a complete enclosed box Refer Fig.11. (Annexure)

3.21 All smaller boxes shall be constructed by assembling sides on ends and then the bottom planks are fixed connecting the sides. Then the slides or runners are provided over the bottom clamps by nailing.

3.22 Angle iron cleats shall be used for strengthening the joints as indicated in Fig.12. (Annexure)

4.0 Weather Proof lining:

4.1 Alkathene film of sufficient thickness shall be used wherever weather proof packing is needed.

5.0 Cushioning Material:

Felt shall be used for cushioning and padding wherever cushioning is required.

6.0 Moisture Absorbent:

6.1 Silicagel in 1/2kg cloth bags shall be used for Moisture absorption inside the packing.

7.0 Steel crating:

The boxes shall be crated with 'C' clamps as per Fig.13. (Annexure)

8.0 Nails:

8.1 Nails used shall be made up of wires as per IS:280/1962 with a strength UTS of 550 MPa.

8.2 The Nails shall be procured as per IS:6732 & IS:6733.

9.0 Sling Plates:

These shall be provided as per the packing case drawings.

10.0 Arrangement of small boxes:

For arrangement of small boxes refer Fig.15. (Annexure

11.0 Despatch Details:

11.1 Despatch details such as consignor/consignee address, contract and case details, country of origin, port of delivery, stacking instructions shall be written on one of the sides of the boxes.

11.2 One copy of the packing slip shall be neatly folded inside a polythene bag and nailed near the arrow marking.

11.3 One copy of the packing slip shall be kept inside the box at a prominant place. Refer Fig.17. (Annexure)

WI. & SPEC. FOR
EXPORT PACKING

DESPATCH DETAILS

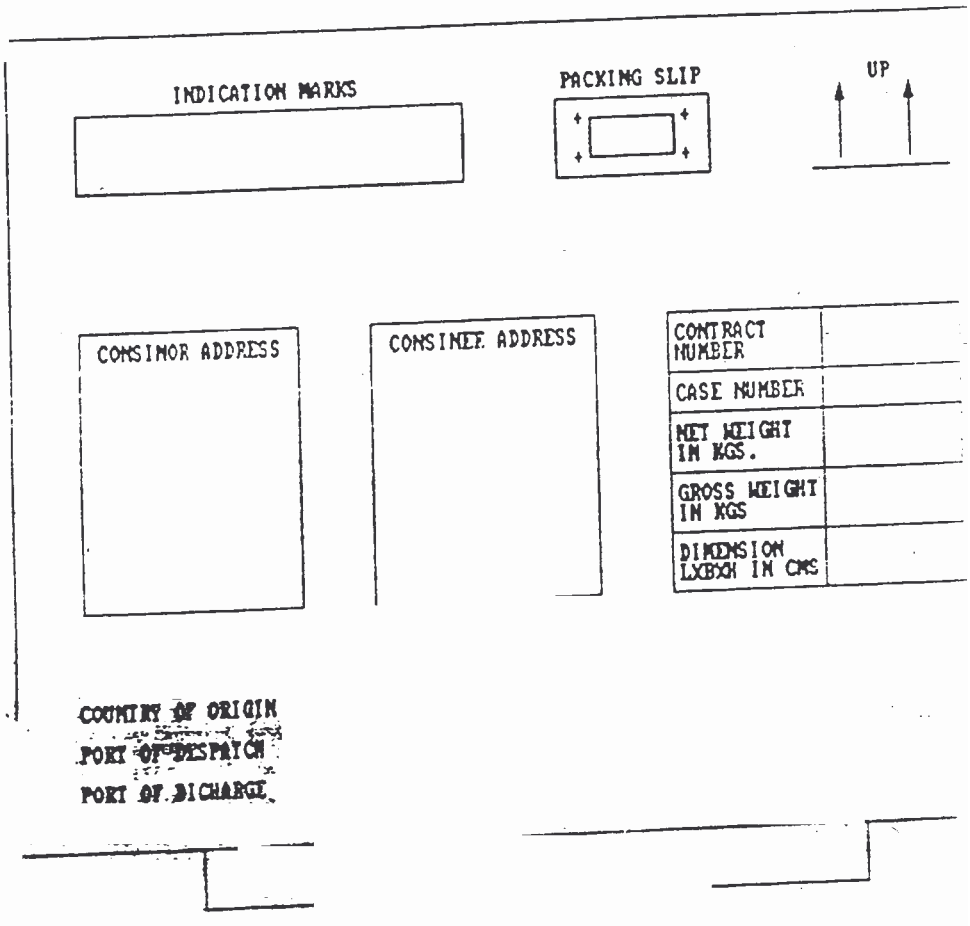


Fig.17

TOP FRAME ARRANGEMENT

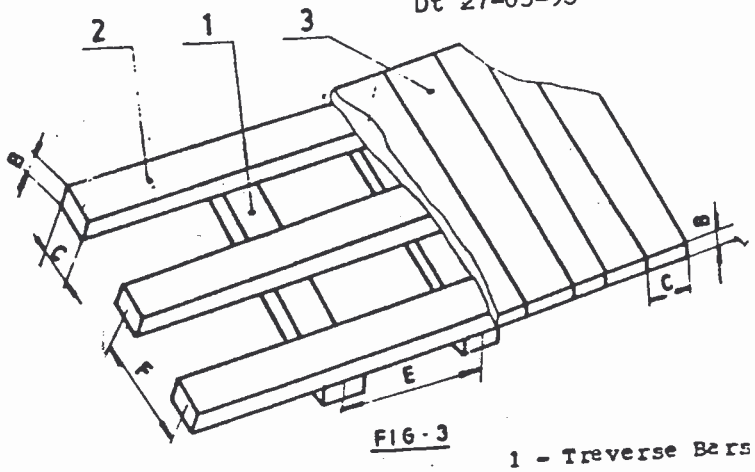


FIG-3

1 - Treverse Bars
2 - Horizontal Scans
3 - Top Board

PROVISION OF DIAGONAL BRACING ARRANGEMENT

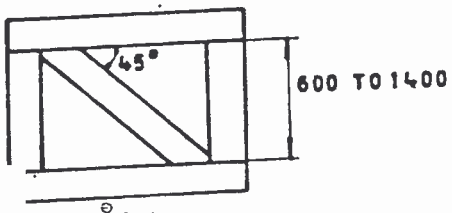


FIG:4

ARRANGEMENT OF DIAGONAL BRACING AND HORIZONTAL SUPPORT

Annexure to PR:QA : 504/Rev 00/
Dt 27-05-93

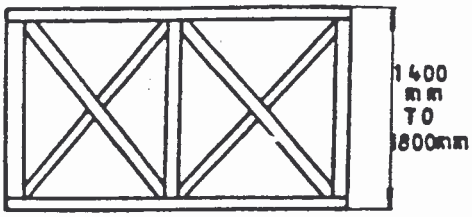


FIG:5

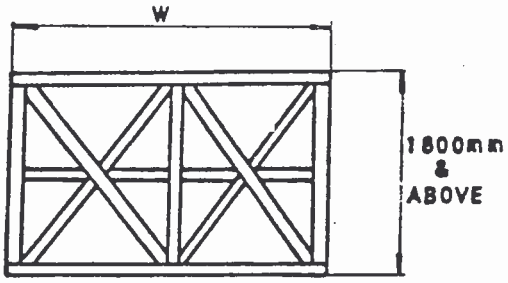


FIG:6

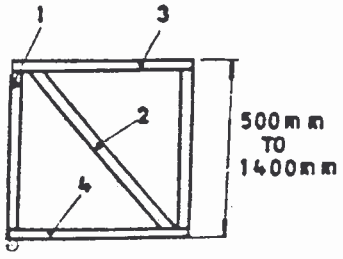


FIG:7

1- Vertical Support
2- Diagonal Bracing
3- Upper Horizontal Support
4- Lower Horizontal Support

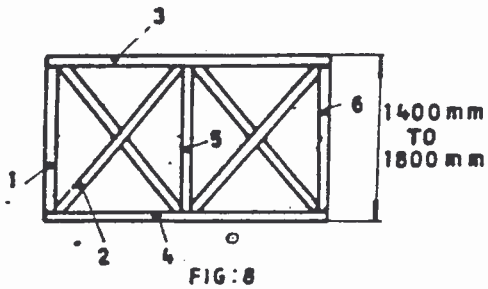


FIG:8

1, 5, 6 - Vertical Support
2 - Diagonal Bracing
3 - Upper Horizontal Support
4 - Lower Horizontal Support

ARRANGEMENT OF DIAGONAL BRACING AND HORIZONTAL SUPPORT

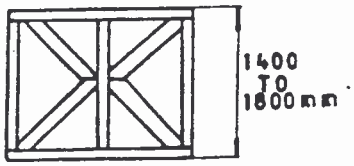


FIG:9

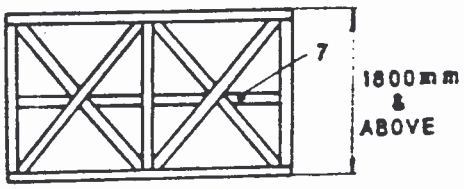
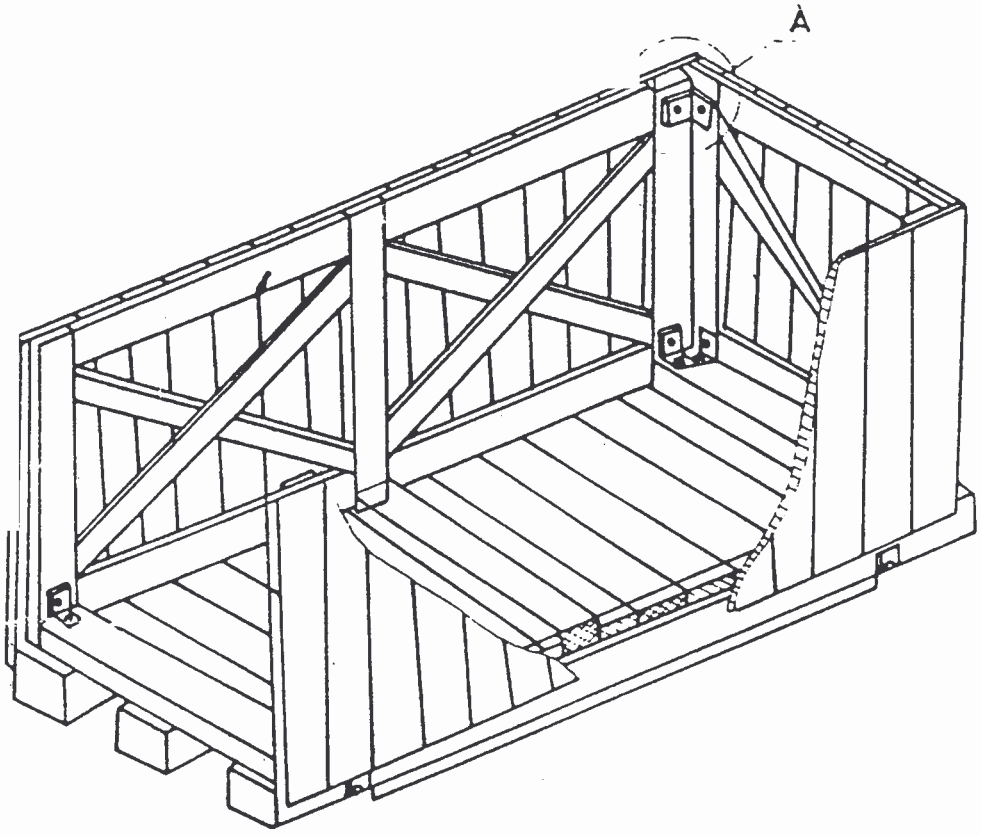
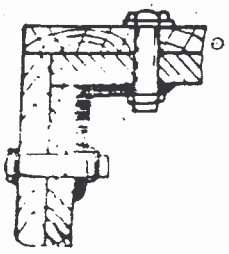


FIG:10

7- Middle Horizontal Support

ARRANGEMENT OF PACKING CASE





DETAIL-A

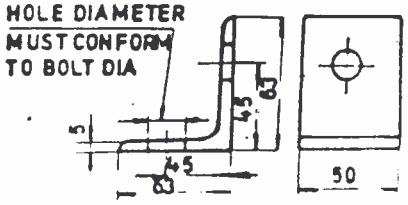


FIG 1

ARRANGEMENT OF ANGLE IRON CLEATS

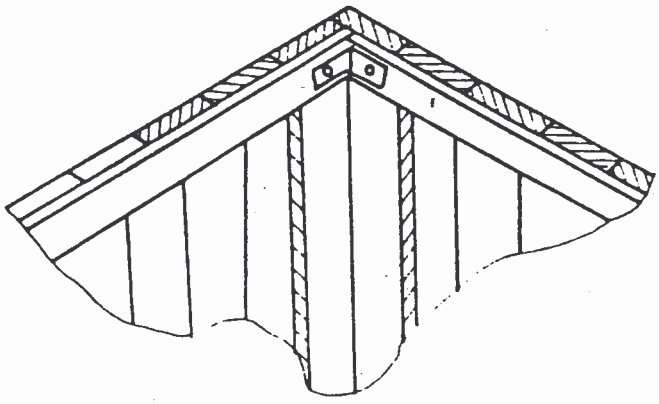


FIG:12

ARRANGEMENT OF C-CLAMPS AROUND CASES

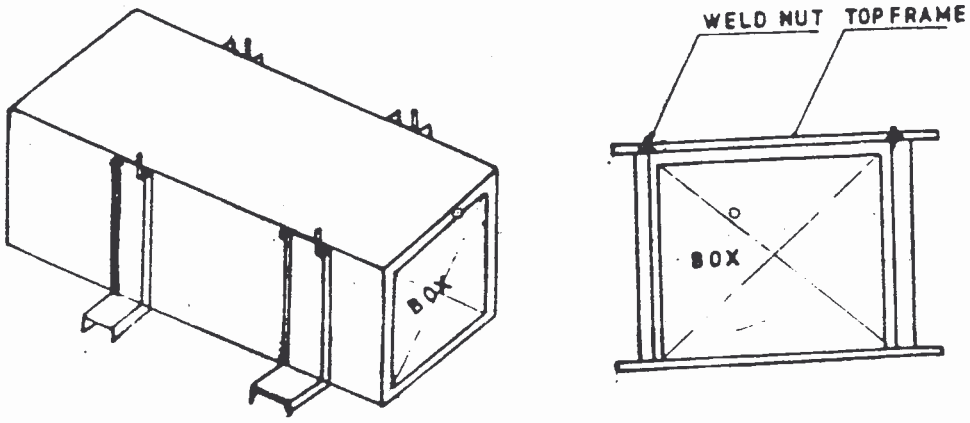


FIG:13

ARRANGEMENT OF SLING - PLATE ON CASES

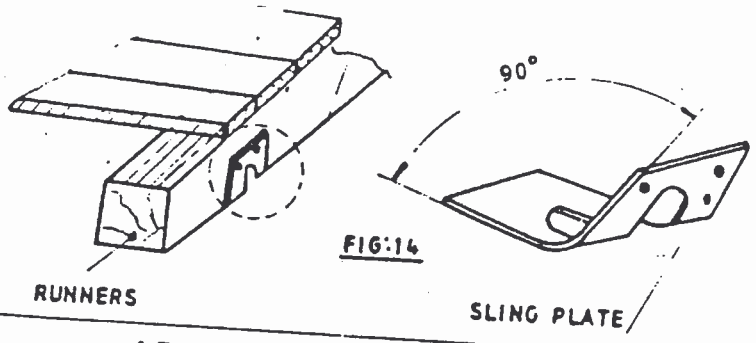
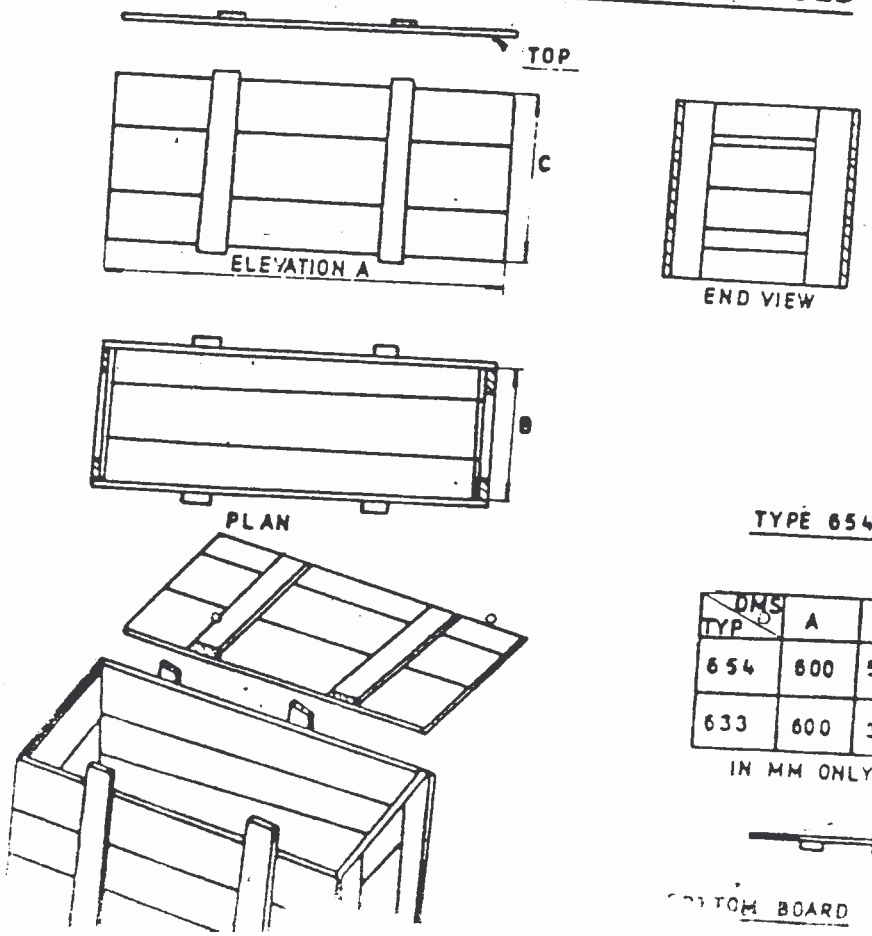


FIG:14

ARRANGEMENT OF SMALL CASES



TYPE 654, 633

TYP \ DMS	A	B	C
654	600	500	400
633	600	300	300

IN MM ONLY

BOTTOM BOARD

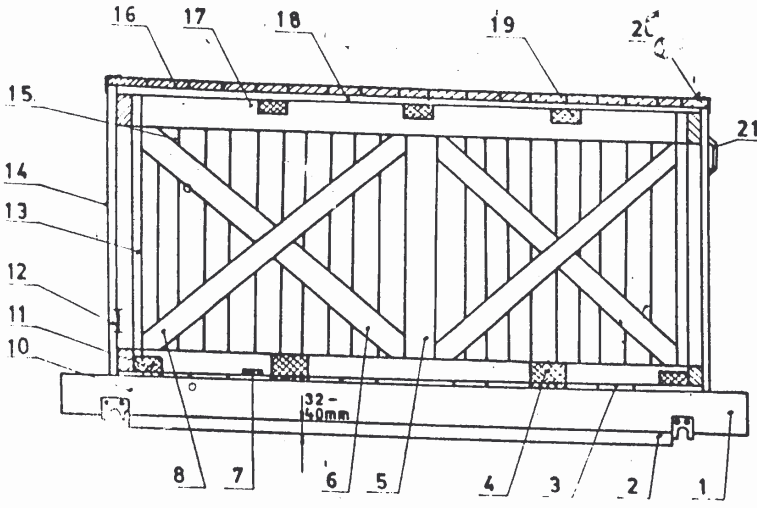


FIG-1

1. SLIDE
2. LONGITUDINAL UNDER SLIDE BOARD
3. BOTTOM BOARD
4. CARRIER TRAVERSE BAR
5. INTERMEDIATE VERTICAL SUPPORT
6. DIAGONAL BRACING
7. DRAINAGE HOLES
8. BATTEN
9. SLING PLATE
10. NUT, BOLT, WASHER
11. END TRAVERSE BAR
12. WATER PROOF LINING OF BITUMANISED PAPER
13. VERTICAL SUPPORTS
14. END SHEATING BOARD
15. SIDE SHEATING BOARD
16. TOP SHEATING BOARD
17. LONGITUDINAL SUPPORT
18. TOP HORIZONTAL BEAM
19. TOP SHEATING BOARD
20. TOP CORNER STRIPS (FOR STRENGTHENING)
21. OUT SIDE DOCUMENTS CONTAINER.

NOMENCLATURE OF PARTS OF PACKING CASES

BOTTOM FRAME ARRANGEMENTS

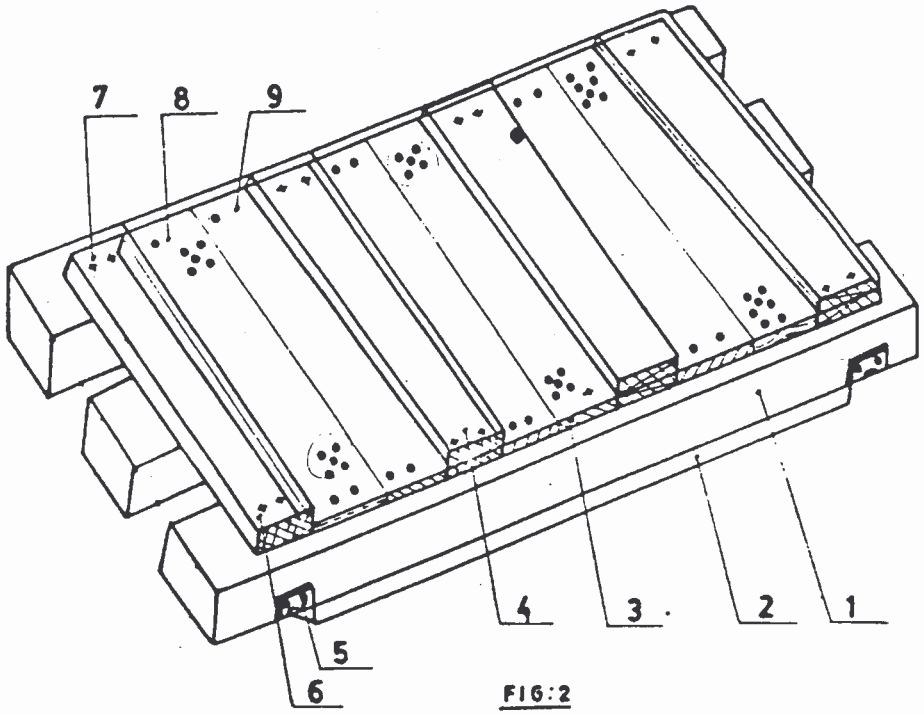


FIG:2

1. SLIDE
2. UNDER SLIDE BOARD
3. BOTTOM BOARD
4. CARRIER TAXERSE BAR
5. SLING PLATE
6. TRAVERSE BAR
7. BOLT, NUT & WASHER
8. DRAINAGE HOLES
9. NAILS .

Table 4

End and side Panels	Width of the panel	Distance between longitudinal support DIM 'D'						
		600	800	1000	1200	1400	1600	1800
		Cross Section (b x c) item 1 to 7						
Fig 7	600 to 1200	30 x 100	30 x 100	30 x 100	30 x 130	30 x 130	30 x 130	30 x 130
Fig 8	1201 to 1600	30 x 130	30 x 130	30 x 130	30 x 130	30 x 130	30 x 130	30 x 130
Fig 9	1601 to 2000	30 x 130	30 x 130	30 x 130	30 x 130	30 x 130	30 x 130	30 x 130
Fig 10	2001 to 3000	30 x 130	30 x 130	30 x 130	30 x 130	30 x 130	30 x 130	40 x 150
	3001 to 4000	30 x 130	30 x 130	40 x 150	40 x 150	40 x 150	40 x 150	40 x 150

TABLE-5

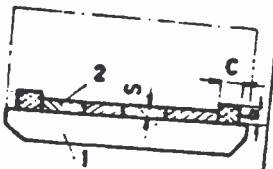
BOTTOM TRAVERSE	CROSS SECTION OF END TRAVERSE BAR ITEM 1 FIG. X AND THICKNESS OF BOTTOM BOARD (ITEM 2)			
	LOAD IN KG	WIDTH OF BOX	CROSS SECTION	S
	UP TO 3000	ABOVE 1000mm	100 X100	25

Table 1

No. of Slides	Length of Slides	Weight in kgs.	Type of Loading
2	600 - 1800mm	0 - 1000	Two slides for central loading near the ends or uniformly distributed load
3	1801 - 2500mm	1001 - 5000	Three slides with load concentrated near the end or uniformly distributed load

Table 2

Distance between top horizontal scans Dim 'F'	Distance between the axes of the traverse bar dimension E in Fig. 3				
	500	600	700	800	900
	Size b x c				
700 - 1000 MM	30x100	30x100	30x100	30x100	30x100

Table 2

Load	Length of Slides 600	800	1000	1200	1300	1500	2000
	Cross Section b x c						
500	50 x 100	50 x 100	50 x 100	50 x 100	75 x 100	75 x 100	100 x 100
800	50 x 100	50 x 100	75 x 100	75 x 100	75 x 100	75 x 100	100 x 100
1000	75 x 100	75 x 100	75 x 100	100 x 100	100 x 100	100 x 110	100 x 150
1500	75 x 100	75 x 100	100 x 100	100 x 100	100 x 100	100 x 150	100 x 150
2000	75 x 100	100 x 100	100 x 100	100 x 150	100 x 150	100 x 150	150 x 150
2500	75 x 100	100 x 100	100 x 150	100 x 150	100 x 150	150 x 150	150 x 150
3000	100 x 100	100 x 150	150 x 150	150 x 150	150 x 150	150 x 150	

BHEL: BAP:RANIPET
QUALITY DEPARTMENT

PR : QA :505
REV . NO . 01
DATE . 14 .07 .93
PAGE 01 OF 05

PROCEDURE FOR STORAGE OF SHELF LIFE ITEMS LIKE RUST PREVENTIVE FLUIDS , PAINTS , RUBBER COMPONENTS , GREASE AND ANTISEIZE COMPOUNDS AND SIMILAR COMPONENTS / ITEMS.

EFFECTIVE DATE : 14 . 07. 93

	Name	Signature with date
Prepared by	V JAYRAMAN	14/7/93
Reviewed by	P H TAMBAKHE	14/7/93
Approved by	R N MISRA	14/7/93

ISSUED BY : SM / QUALITY ASSURANCE

CONTROLLED COPY NO [ ]

INFORMATION COPY [ ]

Record of Revisions

Sl no	Revision carried out	Reason
01	S1 nos 1 , 5 , 7 , 9 & 10 the method of storage revised.	--------

PROCEDURE FOR STORAGE OF LOW SHELF LIFE ITEMS LIKE ANTI SEIZE / THREAD COATING COMPOUNDS , GREASES , PAINTS , RUST PREVENTIVE FLUIDS, RUBBER COMPONENTS

1. 0 SCOPE:

This procedure spells out the method of storage of low shelf life items like antisize/thread coating compounds , greases , paints , rust preventive fluids and rubber compounds .

2 . 0 STORAGE

Please See the table . 1 . The method of storage of low shelf items is given in the table .

TABLE 1

S.No.	Description	Category	Method of storage	Items covered under the category .
01	Anti Seize compound/greases	L	Indoor storage in closed containers well ventilated and dry rooms , away from heat sources sunshine , flames , gas cylinders .	Thread Coating compounds , greases , molysulf lubricants etc.
02	Sealing Compounds	L	Indoor storage closed containers well ventilated and dry rooms , away from heat sources sunshine , flames , gas cylinders / solvents etc. . If containers are damaged, reject the item	All sealing compounds

03	Rust preventive fluids (film forming type)	RPF	Outdoor, undershade Dry condition away from 1)Flame heat 2) Sunshine, 3)Gas cylinders, 4)Petrol Diesel, Kerosene other solvents 5) Near Fire extinguishing equipment .	Collecting Electrode rust preventive fluids, candopeel, strippable Coating.
04	Rust preventive fluids (non film forming type)	RPN	- DO -	APH heating element rust preventive fluids .
05	Natural Rubber	RB	Indoor storage well ventilated dry rooms with paper and chalk powder wrapings, Away from oils, Solvents, alkalis , acids and flames , sunshine , weld heat.	Gaskets ,washers, forms, shapes, tubes pipes , conduits etc. .
06	Synthetic Rubber	RS	- DO -	- DO -
07	Red Oxide Zinc Chrome paints IS 2074	PR	In sealed containers indoors: In dry and well ventilated rooms Away from heat & flame , gas cylinders, flammable materials like Petrol , Diesel ,Kerosene etc .	- DO -
08	IS 2932 Synthetic enamel paints		- DO -	All Colors shades .

09 . Epoxy Paints	PEPX	In sealed containers. Indoor Dry condition . On separate racks ; Away from heat , flammable materials like Petrol , Diesel Kerosene , solvents .	This category includes Inorganic Zinc Rich paints also .
10 . Chlorinated rubber paints .	PCLR	In sealed containers. Cool Dry place . Indoor only. Away from flame , heat, flammable materials like petrol , Diesel kerosene.	

BHARAT HEAVY ELECTRICALS LIMITED	PR:QA:507
BOILER AUXILIARIES PLANT	REV NIL
QUALITY ASSURANCE & CONTROL DEPT	DATE : 5.7.93
	PAGE NO:01/03

PROCEDURE FOR LOCALISED HEAT TREATMENT ON STRUCTURAL WELD JOINTS

EFFECTIVE DATE: 05.07.93

	NAME & DESIGN.	SIGN & DATE
PREPARED BY:	H A KERKETTA DY MANAGER/QC	
CHECKED BY:	V JAYARAMAN DY MANAGER/QA	
APPROVED BY:	P H TAMBAKHE SR MANAGER/QA	

ISSUE DATE: 2-7-93 REV.NO.NIL

ISSUED BY SR MANAGER/QA

INFORMATION COPY NO.

CONTROL COPY NO.

PROCEDURE FOR LOCALISED HEAT TREATMENT ON STRUCTURAL WELD JOINTS

1.0 SCOPE:

1.1 This procedure details the requirements for local heat treatment (stress relieving) on structural weld joints.

1.2 This procedure is applicable for components fabricated at BHEL's sub contractors works

2.0 PROCEDURE:

2.1 The weldments and adjacent areas shall be throughly cleaned and made free from grease, oil chloride and suplhur bearing components

2.2 The heating elements shall be wound around the weld heat affected zone and the parent metal

2.3 The heating band shall extend beyond the weld atleast two times the thickness of the thicker plate.

2.4 Sufficient insulation shall be provided to ensure that the temperature of the weld and the heat affected zone is not less than that specified in the QCP TGH :001 AMEND:02 dated 04:12:92 temperature at the edges of the heated band is not less than half the peak temperature.

2.5 In addition the adjacent portion of the material outside the heated zone shall be protected by means of thermal insulation to avoid sharp temperature gradient. The minimum width of such insulation shall be 8 times the thickness of the thicker member.

2.6 The entire heating operation shall be controlled through electrical controls so that uniform rise in temperature is achieved.

2.7 Above 300 degree centrigrade the rate of heating per hour shall not exceed 220 degree centrigrade divided by maximum metal thickness in inches.

2.8 During the heating period, the differences of temperature as recorded by the thermo couples shall not be more than 150 degree centrigrade within any 4500 mm interval under heating)

2.9 When the portion heated has attained the stress relieving temperature (620 degree centigrade) the temperature shall be held constant for a period of one hour for every one inch thickness. During this holding period there shall not be any significant variation in temperature throughout the heated portion.

2.10 The rate of cooling per hour the holding temperature shall not be more than 260 degrees centigrade divided by maximum metal thickness in inches. Further cooling below 300 degrees centigrade can be done in still air.

3.0 RECORDS:

3.1 The following records shall be furnished alongwith the temperature chart.

a) Time of starting the heating operation

b) Time of reaching the holding temperature

c) Time when cooling started

d) Time when the temperature recorder was cut off.

e) Calibration and validity of thermocouples and temperature recorder.

f) Sketch showing the locations of thermocouples and their representation on the chart.

BHEL : BAP : RANIPET
QUALITY DEPARTMENT

Procedure for Blast cleaning
of Boiler Auxiliaries components.

PR : QA : 508
REV NO. 02
Dt. 31-03-98

	Name & Designation	Signature & Date
Prepared :	V.Jayaraman,MGR/QA	
Reviewed :	DGM/M&S	
	DGM/OP&C	
Approved :	H ANANTHANARAYANAN DGM / QA	

Issued by : DGM / QA

Controlled Copy No. /----------\ | | \----------/

Issued To : /----------\ | | | | \----------/

QUALITY ASSURANCE
BHEL RANIPET
MASTER COPY

RECORD OF REVISIONS

REV NO	CLAUSE REVISED	REASON FOR REVISION
00	FRESH ISSUE	----------
01	CL 3.0,4.0 MODIFIED.C1 4.3.ADDED TABLE UNDER C1 4.4 REVISED. C1 5.0 MODIFIED. ANNEXURE I PARAMETER CARD REVISED. ANNEXURE II MODIFIED. ANNEXURE III MODIFIED.	INCORPORATED SAND BLASTING IN ALL CLAUSES.
02	CL 4.4 TOTALLY REVISED SPLITING INTO CL 4.4.1 & 4.4.2	SURFACE CLEANLINESS & SURFACE ROUGHNESS REQUIREMENTS REFINED.

1.0 Scope

1.1 This procedure details out the nozzle blast cleaning process, its equipment, the controls exercised and qualification and training of the personal using the process.

2.0 Qualification and Training of the blast cleaning personal.

2.1 The personnel shall be trained and qualified to do the blast. Cleaning process. To this effect the blast shop/vendor should have a 'Training / Qualification record' for each blast cleaning personal with identify. (sample form enclosed in Annexure III)

3.0 Equipment

The blast cleaning equipment, viz. the compressed air line, the silo, the valves, the abrasive, jet nozzels shall all be of such material as to give consistently same surface finish for the same set of process parameters viz, nozzle, air pressure, grit/shot/sand particle size distribution and the nozzle distance from the job.

4.0 Quality of shots/grits/sand

4.1 Where shot blasting is called for the shots shall be spherical and near spherical and shall meet. Us Screen Size S330 or S390 made of chilled iron shots. With a cleaning rate of 0. 72/0. 67 sq. ft per minute at 80 psj gauge pressure and 5/16" diameter nozzle.

4.2 where crushed iron grits are used at : 80 psj gauge pressure and 5/16" dia nozzle SAE grit G 50 or a combination of 10% G50 and 90% misccl small grits. The cleaning rate shall be 1.56/1.38 sq. ft per minute.

4.3 where sand blasting is required to be done the sand shall be river sand with not less than 95% silica sand. The sand should have low chloride content (not more than 0.03% by weight). The grain size of sand shall he between 1 mm and 0.7 mm with linear sharp edges and sharp corners.

4.4 Testing the area cleaned

4.4.1 The vendor/blasting shop shall qualify the grit/shot/sand pressure nozzle dia combination by actually doing blast cleaning on a medium rested steel test plate of 1'x1' square. The cleanliness of the surface shall be matching the surface cleanliness standard to be prepared for Sa2, Sa2.5 and Sa3 separately and kept as reference standard. QA shall certify the above surface cleanliness standard.

4.4.2 Where surface roughness measurement is also a requirement of the contract the same shall be checked. The roughness f the surface after blasting shall be compared visually against a standard test coupon. Whose roughness is measured by a surface roughness tester and fixed.

4.4 The vendor shall prepare a 'certificate for Qualification of Blast cleaning process' duly signed by process. (sample form enclosed in Annexure IV)

5.0 Parameter Card:

The vendor/production bay shall maintain a parameter card as given in Annexure I after each qualification and do the blasting as per the parameter card. The inspector in the bay shall do periodic surveillance to verify and record in a register the satisfactory functioning of the sand/shot/grit blasting process as per the parameter card. The parameter card shall be prepared reviewed and approval by competent personal in the prodn. shop/vendor incorporating all the process variables actually used.

6.0 Maintenance of log book of work

The blast shop/vendor shall maintain a log book of all operations duly verified and signed by the inspector in the bay/vendor's works and kept as a record of operations carried out.

7.0 Identification of job

The blast shop/vendor shall attach and identity card duly and firmly attached to the job indicating OPS NO., WO N0./PGMA/DU (in the case of shop) PO No. and who No./OGMA/DU (in the case of vendor)

PARAMETER CARD

Process	:	sand/shot/grit blasting
Nozzle type & size	:	
Pressure of air	:	
Sand/shot/grit size	:	
Certificate reference	:	
Equipment Name	:	

Prepared by	Reviewed by	Approved by

ANNEXURE II
PR : QA : 508/REV 02/ 31-03-98

BLAST CLEANING GRIT NUMBERS AND SCREENING TO TOLERANCES
PERCENT OF TOTAL SAMPLE BY WEIGHT FO EACH PERTINENT SCREEN

SEA NO SYSTEM	HIGH LIMIT GRIT RETAINE % MAX	SCREEN SCREEN NO & APERTURE	NOMINAL GRIT RETAINE % MAX	SCREEN SCREEN ON &APERTURE	LOW LIMIT CRIT RETAINE % MAX	SCREEN SCREEN APERTURE
C-10	0	7 (.111)	80	10 (.0787)	10	12(.0661)
C-12	0	8 (.0937)	80	12 (.0661)	10	14(.0555)
C-14	0	10 (.0787)	80	14 (.0555)	10	16(.0469)
C-16	0	12 (.0661)	75	16 (.0469)	15	18(.0394)
C-18	0	14 (.0555)	75	18 (.0394)	15	25(.0280)
C-25	0	16 (.0469)	70	25 (.0280)	20	40 (.0165)
C-40	0	18 (.0394)	70	40 (.0165)	20	50 (.0117)
C-50	0	25 (.0280)	65	50 (.0117)	25	80 (.0070)
C-80	0	40 (.0165)	65	80 (.0070)	25	120(.0049)
C-120	0	50 (.0117)	60	120(.0049)	30	200(.0029)
C-200	0	80 (.0070)	55	200(.0029)	35	325(.0017)
C-325	0	120(.0049)	20	325(.0017)	-	----------

BLAST CLEANING SHOT NUMBERS AND SCREENING TO TOLERANCES
PERCENT OF TOTAL SAMPLE BY WEIGHT FO EACH PERTINENT SCREEN

SEA NO SYSTEM	HIGH LIMIT SCREEN GRIT RETAINE % MAX	SCREEN NO & APERTURE	NOMINAL CRIT RETAINE % MAX	SCREEN SCREEN ON &APERTUNE % MAX	LOW LIMIT CRIT RETAINE	SCREEN SCREEN APERTURE
S-1320	0	4 (.187)	85	6 (.132)	5	7 (.111)
S-1110	0	5 (.157)	85	7 (.111)	5	8 (.0937)
S-930	0	6 (.132)	85	8 (.0937)	5	10(.0787)
S-780	0	7 (.111)	80	10 (.0787)	10	12(.0661)
S-660	0	10(.0787)	80	12 (.0661)	10	14(.0555)
S-550	0	12 (.0661)	80	14 (.0555)	10	16(.0469)
S-460	0	14 (.0555)	75	16 (.0469)	15	18(.0394)
S-390	0	16 (.0469)	75	18 (.0394)	15	20(.0331)
S-330	0	18 (.0394)	75	20 (.0331)	15	30(.0232)
S-230	0	20 (.0331)	70	30 (.0232)	20	40(.0165)
S-170	0	30 (.0232)	70	40 (.0165)	20	50(.0117)
S-110	0	40 (.0165)	65	50 (.0117)	25	80(.0070
S-70	0	50 (.0117)	65	80 (.0070)	25	120(.0049)

ANNEXURE -II
(PR : QA : 508/REV 02/31-03-98)

CERTIFICATE OF QUALIFICATION / EXPERIENCE
FOR BLAST CLEANING PERSONAL

Name : Blasting }

Technique }

Used }

Id No. :

Experience in sand } Blast cleaning }

blasting } Equipment used }

Experience in grit / } Nozzles used }

Shot blasting }

This is top certify that ..... Id. No.....

has worked on blast cleaning using .....

for .....years and can satisfactorily perform

blast cleaning on the equipment mentioned above. He is

qualified to do blast cleaning.

SINGNATURE & RUBBER STAMP/SEAL

OF CONTRACTOR / SHOP -IN -CHARGE

Annexure - IV

CERTIFICATE FOR QUALIFICATION OF BLAST CLEANING PROCESS

(P 1 refer C 1. 4. 4. of PRQA : QA : 508 : REV .02/ 31-03-98)

Certificate No.

Process : Shot/grit/Sand blasting

Pressure :

Nozzle size / type :

Hose size / classification :

Sand / grit / shot / particle size :

Test coupon size :

Time required for cleaning}

Test coupon }

Area cleaned per hour }

surface finish achieved : Sa2 / Sa2 1/2 / Sa3

(compare against standard
referance coupon)

Certified that the sand / shot / grit blasting process is qualified
for the parameter combination specified above.

OP & C / MSA / M & S QA

BHEL
RANIPET
QUALITY DEPARTMENT

PR :QA:509 PAGE 01 OF 02

GUIDELINES FOR NDT REQUIREMENTS ON GAS CUT EDGES

EFFECTIVE DATE 04-08-93

PREPARED BY B SRINIVASA RAO

REVIEWED BY P.H.TAMBAKHE

APPROVED BY R N MISTRA

ISSUED BY: QUALITY ASSURANCE REV. NO.:00

CONTROL NO ----------

1.0 SCOPE :

The procedure specifies the items for which for which Magnetic Particle Testing shall be conducted on gas cut edges.

2.0 PREFERENCE:

Sheet 7 of 12 of CE spec .M&P spec No.: 5.11.1.1.(s) dated 05-11-84 and review with SM/QA

3.0 GENERAL :

All gas cut edges which are machined later need not be examined by MT (Magnetic Particle Testing)

3.1 Plates above 38.1 mm for the items specified below shall only be tested. Stiffeners need not be non-destructively tested.

3.1 A FANS: Center plate , AP fan impeller hub flanges. Flanges for Conical cover plate, Flange for AP fan cover plate ,Impeller rings made of plate ,Conical cover plate seating rings.

3.1 A APH: Lug plates of lug assembly ,Rotor post header plates.

3.1 C ESP/Structural items: plates used as flanges for floor beams and those structural items for which NDT requirements are specified in other transmittals like QPS, Letters etc.

4.0 Reference standard and acceptance norm for MT shall be as per BHE :NDT:RP:MT:01/ latest revision.

****

BHEL RANIPET	**QUALITY ASSURANCE** **PRQA**	**PR:QA: 510** **DATE: 10 06 02** **PAGE 01 OF 03**

PROCEDURE FOR	MEASUREMNT OF INTERNAL AND EXTERNAL KEY WAY DIMENSIONS

	Dept	**SIGNATURE**
PREPARED BY	QC-Met	
REVIEWED BY	**QA** **QC**	
APPROVED BY	Head QA	

REVISION NO:	**00**
ISSUED BY	**QUALITY ASSURANCE**

Control copy No:	
Issued to Shri:	

MASTER COPY

1.0 SCOPE

This procedure details out the methods of measuring the internal and external key way dimensions .

2.0 REFERENCE DOCUMENT:

DRAWING

3.0 CHECKING PROCEDURE:

3.1 PREREQUISITE FOR KEY WAY OPERATIONS:

3.1.1 The shaft diameter/bore on which the key way is to be taken shall be finished to the drawing dimension. If allowance is provided for further machining, that has to be taken into account for key way machining.

3.1.2 Orientation of key way is to be ensured wherever applicable.

3.1.3 Diameter of cutter and its uniformity is to be ensured.

3.1.4 Shaft OD or bore ID shall be taken as reference.

3.1.5 Refer annexure for detailed sketches (page 1 to 5 of annexure.

3.2 EXTERNAL KEY WAY:

3.2.1 SETTING:

3.2.2 Dial the pre-machined diameter in two axes to get uniform depth and parallel key way (Refer Fig-1)

3.2.3 Permissible variation shall be 0.4 mm for 100 mm length.

3.3 MACHINING:

3.3.1 Take OD as reference, bring the cutter to the center line and machine.

3.3.2 When more than one pass is required to finish the size with smaller size cutter, check key way offset before achieving the final size.

3.3.3 Keep gauge blocks (shaft dia – key way size ÷ 2) over the gauge block dial reading will be the key way offset (Fig.2)

3.3.4 Ensure key way depth.

3.4 INTERNAL KEY WAY:

3.4.1 **SETTING:**

3.4.2 Dial the bore in two axes to get uniform depth and parallel key way (Fig.3).

3.4.3 If the bore size is too small to accommodate dial, insert one 1:200 taper mandrel and dial. Consider the taper of mandrel (0.5 : 200) during dialing (Fig.4)

3.4.4 Permissible variation shall be 0.04 mm for 100 mm length.

3.5 MACHINING:

3.5.1 Taking ID as reference, bring the tool to the bore center and machine.

3.5.2 If the tool size is less than the key way size and requires two or more passes, check for offset before achieving the final size.

3.7 CHECKING:

3.7.1 Check the key way size using gauge block. Push fit is recommended.
3.7.2 Check the parallelism of key way bearing surfaces using gauge blocks.
3.7.3 Keeping the gauge blocks in the key way, check the key way offset using vernie caliper or bore dial gauge or ID mic. Half of the variation will be the offset (Fig.5).
3.7.4 For bigger size bore, fit one parallel block in the key way to extend beyond the center line of the bore and check the offset.

3.8 PERMISSIBLEL KEY WAY OFFSET:

Key way size	Diameter	Permissible value
Upto 6	10 – 22	0.10
8 – 10	> 22 – 30	0.16
12 – 18	> 38 – 65	0.20
20 – 28	> 65 – 110	0.30
32 - 36	> 110	0.40

Rev no	Clause revised	Revision made	Effective date
00	--	--	10 06 2002

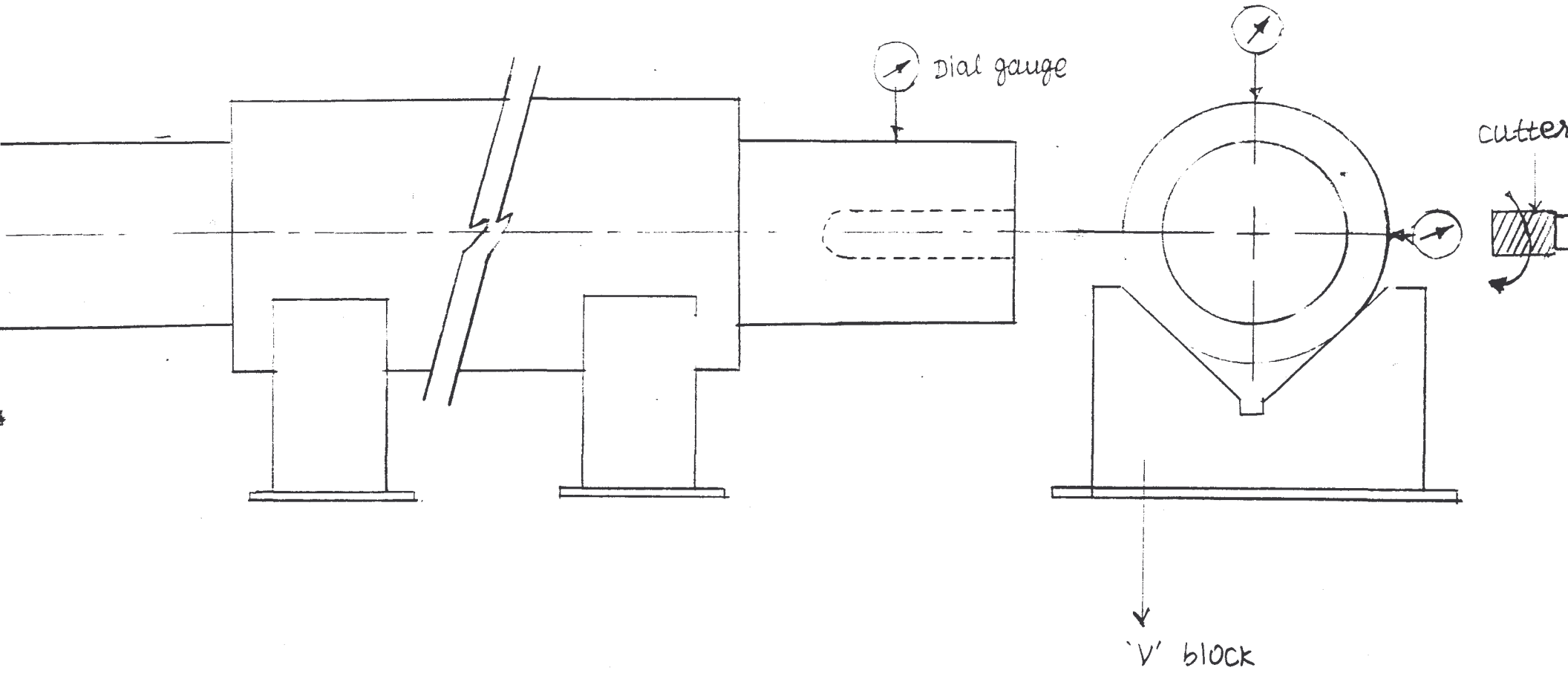
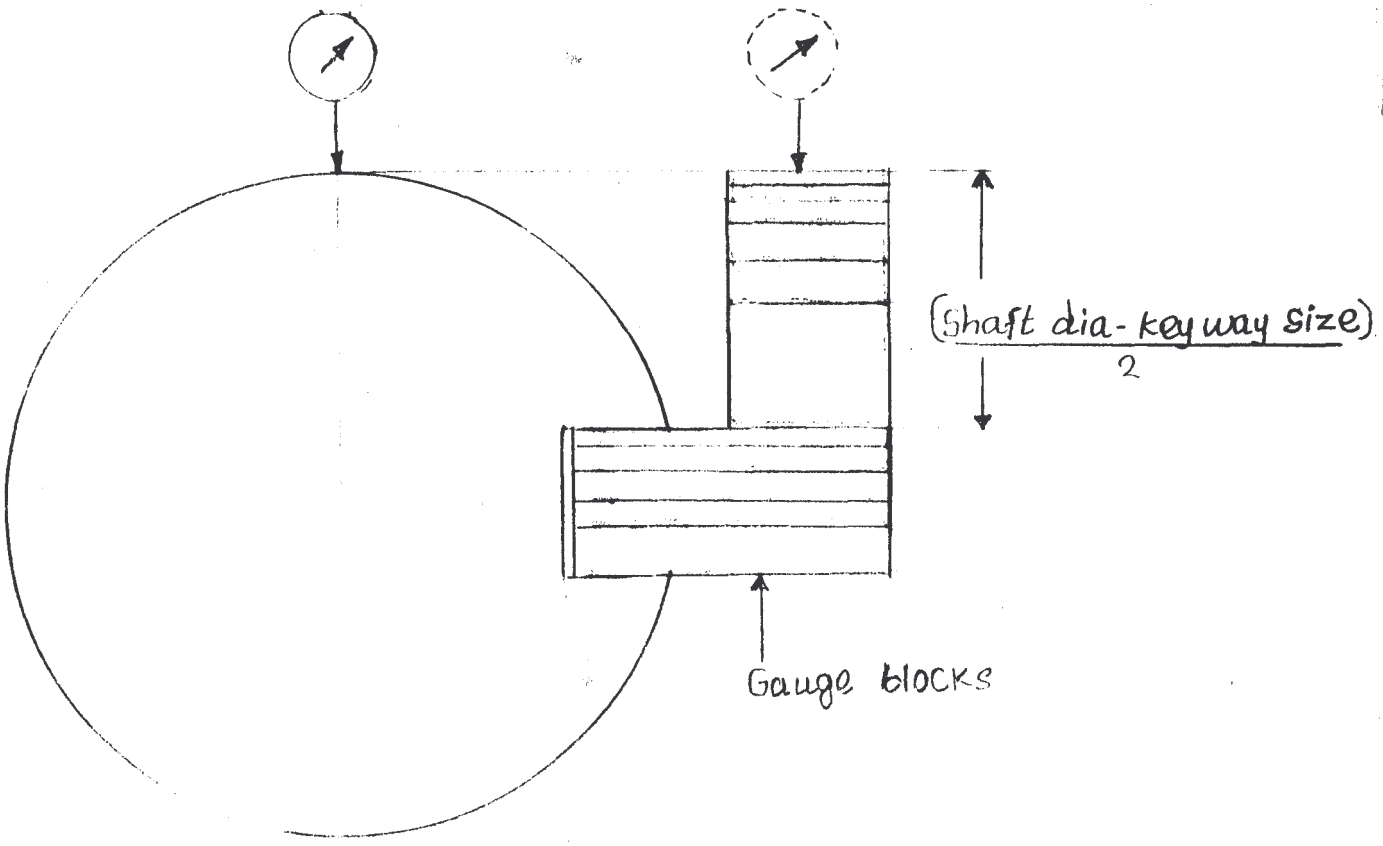


Fig 1.



KEY WAY OFFSET = DIFF IN DIAL READINGS.

Fig 2

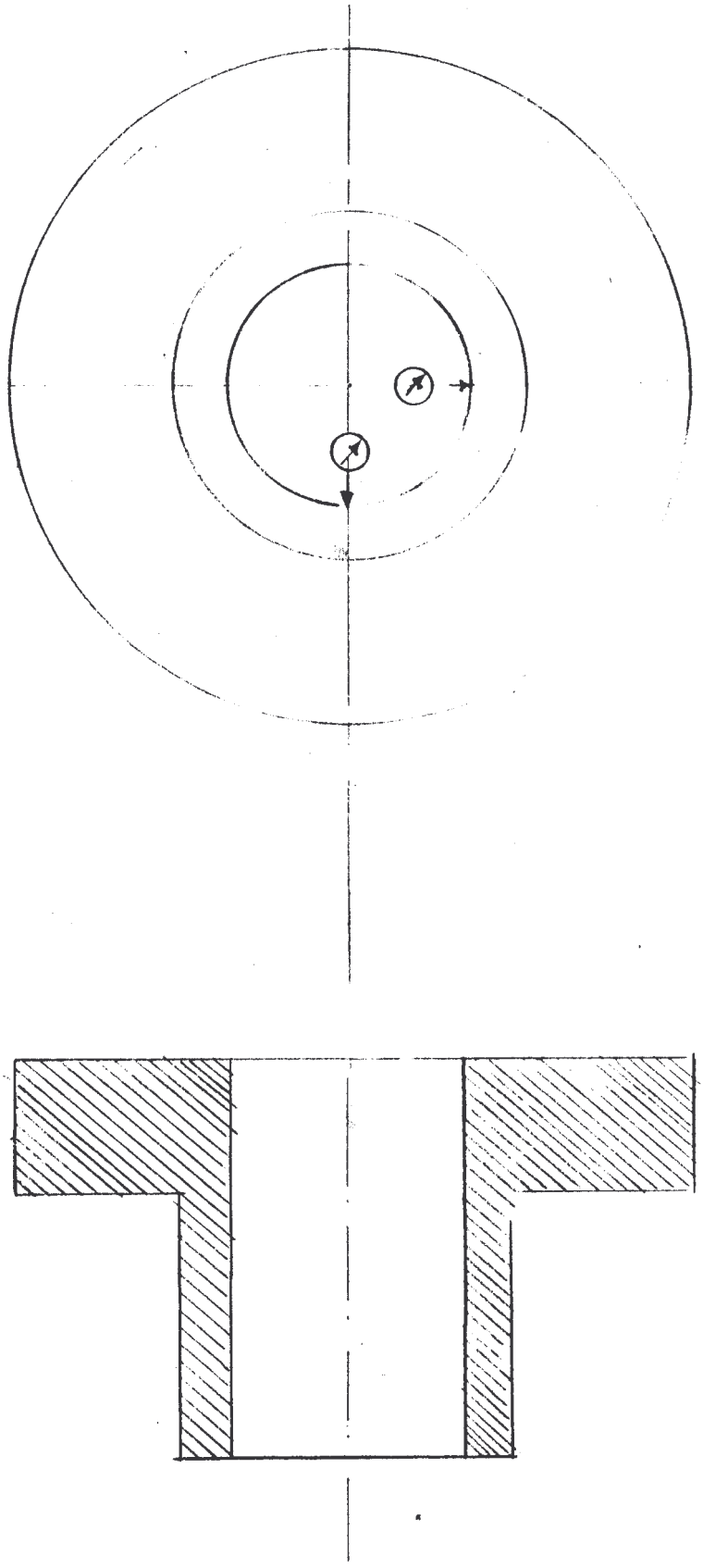
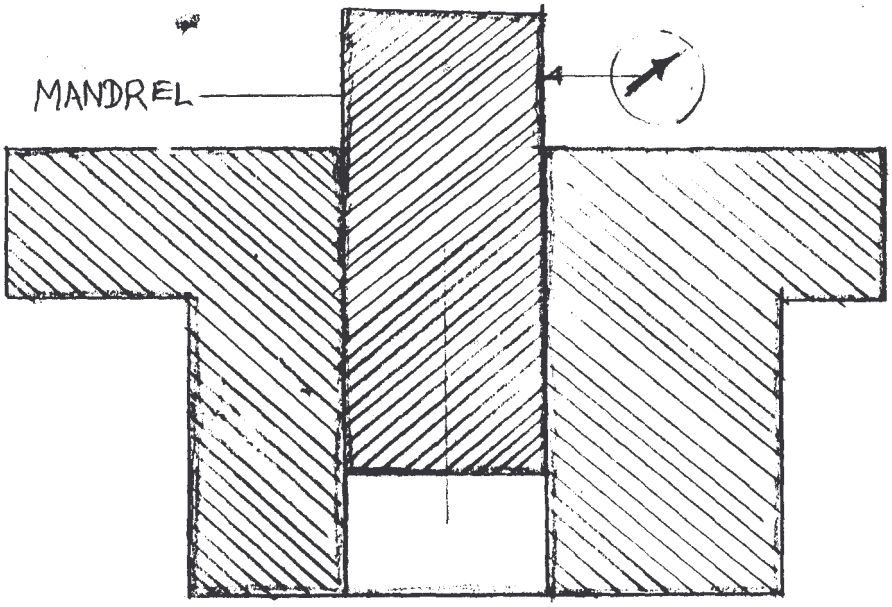
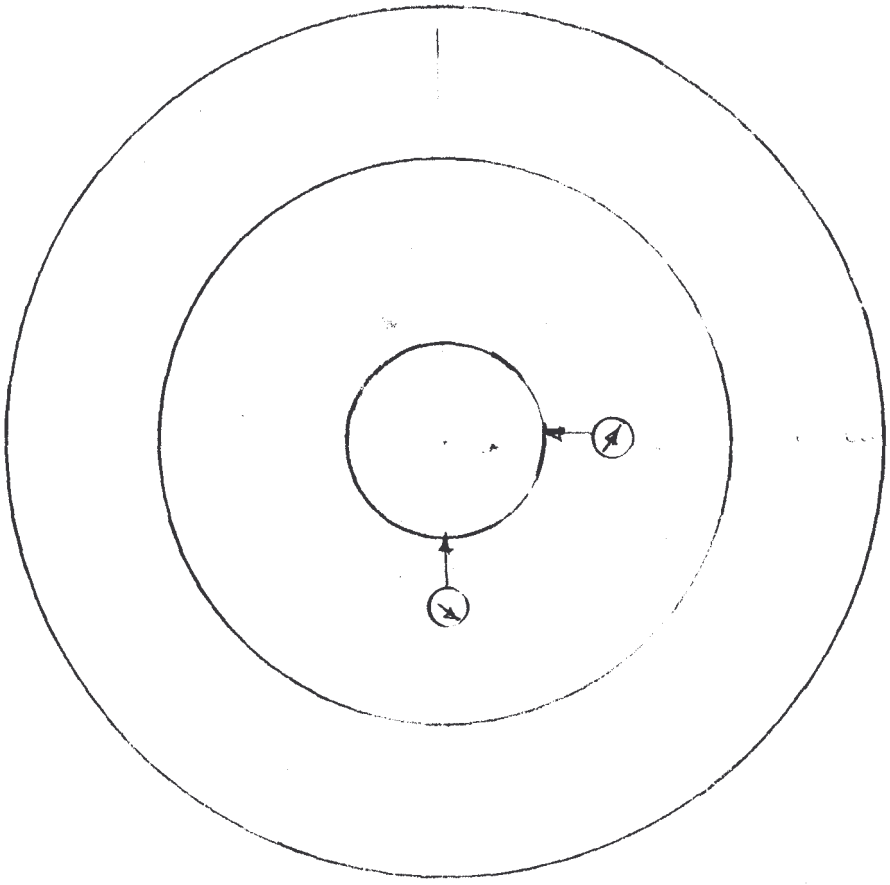
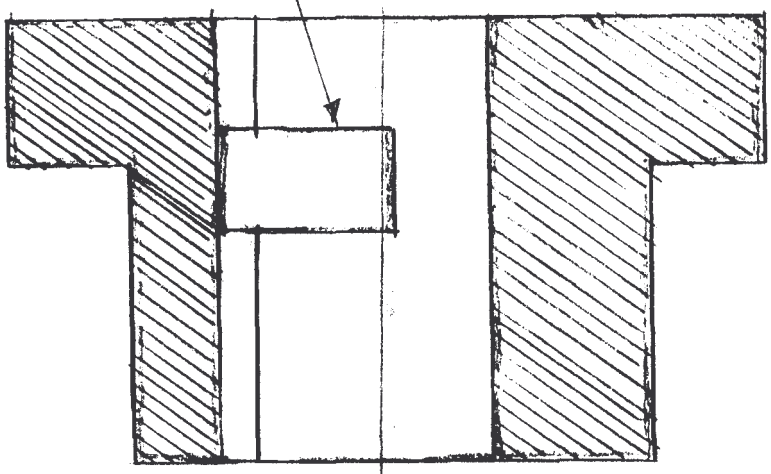
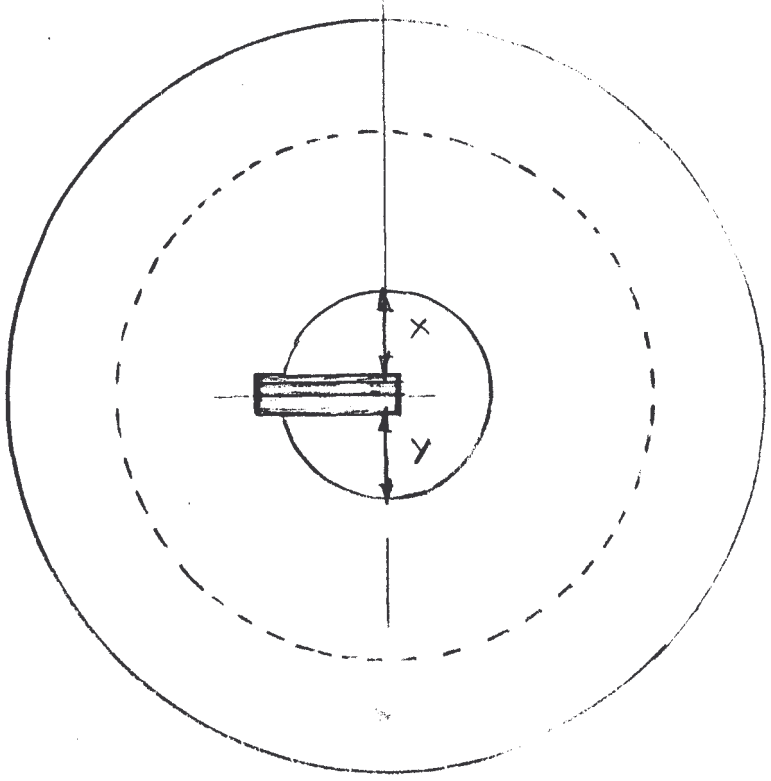


Fig 3.


MANDREL







KEY WAY OFFSET = $\frac{(X-Y)}{2}$

BHEL RANIPET-6	***ANNEXURE TO PRQA 510*** ***REV:00*** DT 10 06 02

BHEL::BAP::RANIPET
QUALITY DEPARTMENT

PROCEDURE FOR	CONTROL OF SURFACE PREPARATION AND PAINTING OF FABRICATED COMPONENTS AT SUB-CONTRACTORS WORKS.
EFFECTIVE DATE	31.1.94

	NAME	SIGNATURE &DATE
PREPARED BY	V JAYARAMAN	
REVIEWED BY	H ANANTHANARAYAN	
APPROVED BY	R V MISRA	

ISSUED BY	QUALITY ASSURANCE

CONTROL COPY NUMBER [ ]

MASTER COPY

PROCEDURE FOR CONTROL OF SURFACE PREPARATION AND PAINTING OF FABRICATED COMPONENTS AT SUB-CONTRACTORS WORKS.

1.0 SCOPE:

1.1 This procedure details out the requirement for surface preparation and painting of all fabricated components at sub-contractors works.

1.1.1 Surface preparation equipment:

The sub-contractor should have the minimum surface preparation equipment as mentioned below:

a) Wire brush
b) Emery sheets of rough type
c) Power wire brush to be used with pneumatic or electrical motors
d) Brush for cleaning the dust removed by wire brushing power tool cleaning

1.2 Whenever any special requirement for surface preparation and painting are required, the same shall be indicated in the drawing or shall be informed separately to sub-contractors.

1.3 This PRQA is in line with the requirement of Painting Schedule RP 0674199.

2.0 SURFACE PREPARATION:

2.1 CLEANING OF OIL, GREASE ETC

2.1.1 The entire outer surface of the fabricated components shall be thoroughly cleaned using mineral turpentine, wire wheel, grinding wheel to make it free from OIL, GREASE, RUST MILL SCALES and weld spatters.

2.2 METHOD OF RUST REMOVAL

2.2.1 Wire brush, emery sheets of rough type, Power /rotary wire wheel may be used for removing the dust, rust and mill scales from the surface.

2.2.2 The "Rustkil" (rust remover/converter) shall be applied whenever the rust cannot be removed by using power tool cleaning.

2.2.3 Only after clearance of surface preparation by BHEL Inspection/BHEL Authorised Inspection Agencies the sub-contractor can proceed with painting.

.0 PAINTING

.1 Only paints from BHEL approved suppliers shall be applied.

.2 After visual inspection and clearance by QC BHEL/Authorised Inspection Agency one coat of red oxide Zinc chrome primer as per IS 2074 shall be applied by brushing to a dry film thickness of approx 25 microns.

.3 The paint shall be allowed to hard dry and thoroughly before applying the second coat.Second coat shall be applied only after 18 hours.

.4 A second coat of IS 2932 Synthetic Enamel smoke grey paint shall be applied over the primer to a coating thickness of 20 microns approximately.

.5 The small items shall be dipped in the paint tank.

The final inspection of the component shall be offered to QC BHEL/Authorised Inspection Agency.only after hard drying of the enamel paint and stencilling of work order No,D.U.No,details.

All edge prepared areas for welding at shop/site at later stage shall be applied with one coat of weldable primer.

Any scratches and soil sticking on the surfaces during handling shall be rectified before despatch to BHEL/Shipping.

RECORDS:

The firm shall record the make/brand name and batch number of the approved paint used in the dimension report.

.1. The sub-contractors shall maintain records of the primer paints procured, the source of the primer paints namely dealer, the manufacturer of the primer paints, the batch number of the primer paints and the delivery chalan reference for the paint procured along with the quantity and also copy of the test certificates certifying the quality of the paint. These records shall be verified by BHEL inspector immediately on procurement of the paint by sub-contractor and shall be countersigned by BHEL inspector. This record is subject to audit by Quality Assurance.

4.2 The firm shall show the details/evidence for procurement of approved paints to QC personnel(BHEL)/Authorised Inspection Agency whenever required during surveillence checks/audits. The sub-contractor before use of primer paints shall verify the correctness of specification of the primer paints before openiong the drums. The drum shall be rolled roughly 20 times before opening the seal and stirring the contents. the contents shall be thoroughly stirred using a steel rod and shall be checked for any settling of pigment. If any pigment settlement is observed the process of resealing, rolling, stirring thereby redispersal of the paint pigment into the medium is to be ensured.Now a small quantity can be transered to painting cans and applied by neat brushes of width atleast 3 inches.

4.3 The sub contractor shall ensure that the required number of primer coats are given on the components as per the painting schedule RP 0674199. Visual inspection shall be done for checking damages, poor paints, improper finish. After the paint films dry the inspector will randomly check the coating thickness with coating thickness gauge for the correctness of the thickness of the paint in case of any doubt.

5.0 TESTING OF PAINT SAMPLES

5.1 QC BHEL personnel shall collect random samples of paint (approx 1 litre) and submit the same to Quality Assurance for testing. Such random samples may be collected whenever any doubt arises about the quality of paint while carrying out visual inspection. Alternately QC/OLI may scrape dried paint film from painted surfaces for testing at paint test lab.

5.2 In case any batch of paint is found not conforming to requirement,the concerned brand of paint shall be removed from the approved list of paint suppliers of BAP, Ranipet.

QUALITY ASSURANCE

Amendment to Quality Work Instruction (QWI): PRQA

Amendment No: A2 **Date: 24.03.2018**

PR:QA 514 **Rev: 03** **Dated: 24/07/1999**

Title: Procedure for Colour coding for Raw materials

Clause no	Details of amendment	Basis for Amendment
Refer page 4 of 4 Clause III	Clause III Rounds & Rods: Colour code for Rounds and Rods of ASTM A479 UNS no: S32205 shall be Brown Br.	Colour code for ASTM A479 UNS no: S32205 was not included and hence added now.

Prepared by	Reviewed by	Approved by
Rajamanickam.M Sr.Engr/ QA	R. Arunachalam DGM/ QA& QC-OLI	C. Srinivasan DGM/ QA& QC- Proc

QUALITY DEPARTMENT		
Amendment to Quality Work Instructions (PR:QA)		
QWI NO: PR:QA 514	**REV:03**	**DT. 24 07 99**
Amendment no: A 1		**DT. 21 01 04**
Description:	**Colour Coding for Raw materials**	

Details of Amendment		
CLAUSE NO	AMENDED AS	BASIS FOR AMENDMENT
(I)4	Colour code for Plates and Sheets of Corten A Corten B and ASTM A 588 A/B shall be yellow.	Colour code for ASTM A588 was not included and hence added now

Prepared by	**Reviewed by**	**Approved by**
	B. Srinivasarao	

Control copy No	
Issued to Shri	

BHARAT HEAVY ELECTRICALS LTD
BOILER AUXILIARIES PLANT
QUALITY DEPARTMENT

PR:QA: 514/03
Date: 24/07/99
Page: 01 of 04

PROCEDURE FOR	COLOUR CODING FOR RAW MATERIALS
EFFECTIVE DATE	24 07 99

	NAME	SIGNATURE	DATE
PREPARED BY:	V.JAYARAMAN, M/QA	V. Jayaraman	24/7/99
REVIEWED & APPROVED BY:	H.ANATHANARAYANAN, DGM/QA	H Anathanarayanan	

ISSUED BY: QUALITY ASSURANCE

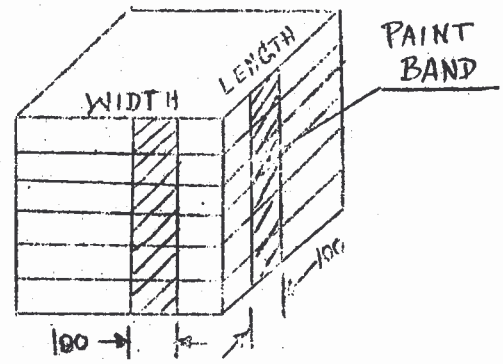
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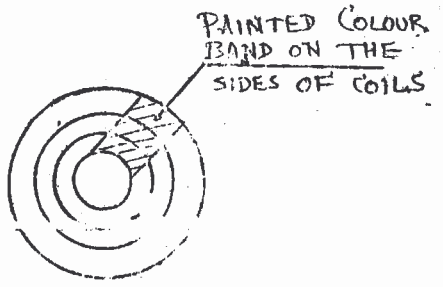
MATERIAL TYPE	COLOUR	COLOUR PAINTING LOCATION & MODE ON THE RAW MATERIAL

RECORD OF REVISIONS

REV.NO	EFFECTIVE DATE	CLAUSE REVISED
00	10.08.94	FRESH ISSUE
01	31.01.96	(a) THE IN IS 226/IS 2062 IS TRANSFERRED TO SA 105. (b) COLOR CODES ASTM Gr12, ASTM Gr 22,AISI 450, AISI 304 ARE ADDED
02	15.04.96	COLOR CODES AISI 316 L & ASTM A 564 - X M25 ARE ADDED.ASTM GR12&GR 22 DELETED.
03	24.07.99	NEW MATERIALS AND COLOR CODES ADDED.

MATERIAL TYPE	COLOUR	COLOUR PAINTING LOCATION & MODE ON THE RAW MATERIAL
I PLATE & SHEETS		
1. P 355 NH	BLACK	
2. NAX TRA 70 OR EQUI	WHITE	
3. XAR-400	ORANGE	
4. COR-TEN A} COR-TEN B}	YELLOW	
5. IS 2062/EQUI	GREY	
II COILS A (APH)		
1. CORTEN A	YELLOW	
2. IS 513 Gr DD/(CR)} OR EQUI }	WHITE	
3. IS 513 Gr D (CR)	RED OXIDE	
4. IS 513 Gr 'O' (CR)	BLACK	
7. IS 1079 Gr DD (HR)	BLUE	





LEGEND : CR - Cold Rolled
HR - Hot Rolled

MATERIAL TYPE	COLOUR	COLOUR PAINTING LOCATION & MODE ON THE RAW MATERIAL
III ROUNDS & RODS		
1. X20 Cr 13	WHITE & BLACK	W/BK → Gr
2. IS 2062	GREY	
3. SA 105	BLACK	Bk → W
4. SA 105 BRIGHT BAR	WHITE	
5. SA 193 B7	RED	R → Y/BK
6. BMCQ 45	YELLOW & BLACK	
7. CORTEN A	YELLOW	Y → Gr/R
8. En 36B	GREEN	
9. En 36C	GREEN&BLUE	GR/BL → Y/BL
10. 2C 357 N	YELLOW & BLUE	
11.STE 500	GREEN & RED	G/R → R/BK
12.AISI 450	RED & BLACK	
13.AISI 420	BLACK & WHITE	Bk/W → R/BL
14.ASTM A 564-XM25	RED & VIOLET	
GENERAL		
15. AISI 304 AISI 304L	RED&WHITE RED & WHITE &BLACK DOT	→ R/W
16. AISI 316 AISI 316L	RED & YELLOW RED & YELLOW& BLAACK DOT	→ R/Y
17. ASTM- GR 12/P12/T12/F12	ALUMINIUM PAINT	→ Al
18. ASTM- GR 22/P22/T22/F2	BLUE	→ BL

PCFILENAME:PRQA514.03

BHEL:BAP:RANIPET
QUALITY DEPARTMENT

PRODUCT NCR CAUSE CODES

PR:QA:516
REV NO 00
DT: 24-04-95
PAGE 01 OF 06

EFFECTIVE DATE	24-04-95

PREPARED BY	V JAYARAMAN	V. Jayaraman
REVIEWED BY	H ANANTHANARAYANAN	H Ananth
APPROVED BY	H ANANTHANARAYANAN	H Ananth

ISSUED BY :	QUALITY ASSURANCE

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CONTROLLED COPY NO: [X]

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QUALITY DEPARTMENT
PRODUCT NCR CAUSE CODES

This procedure gives guide lines for filling PRODUCT NCR CAUSE CODES on PRODUCT NCRs while filling them.

SL NO	OPERATOR FAULTS (100 SERIES)	CAUSE CODE	REMARKS
01	NOT UNDERSTOOD DRAWING REQUIREMENT	101	
02	WRONGLY OPERATED THE MACHINE	102	
03	DO NOT UNDERSTAND OPS REQUIREMENT	103	
04	USE OF DEFECTIVE TOOLS	104	
05	USE OF WRONG TOOLS	105	
06	LACK OF TRAINING	106	
07	STAGES IN THE PROCESS BYPASSED	107	
08	DRILLING SET UP ERRORS	108	
09	USAGE OF WRONG / INACCURATE INSTRUMENTS	109	
10	WRONG MEASUREMENTS	110	
11	UNQUALIFIED OPERATOR	111	
12	USE OF WRONG CONSUMABLES	112	
13	INPROPER CLEANING OF JOB	113	
14	DEFECTS DUE TO LACK OF APPLICATION OF TECHNIQUE	114	
15	WORK INSTRUCTIONS NOT FOLLOWED	115	
16	WRONG INTERPRETATION OF WORK INSTRUCTIONS	116	
17	UNCLASSIFIED	117	

PRODUCT NCR CAUSE CODES

SL NO	MACHINE FAULTS (200 SERIES)	CAUSE CODE	REMARKS
01	MACHINE DOES NOT HAVE ADEQUATE PROCESS CAPABILITY	201	
02	TOOL BREAKDOWN	202	
03	SUDDEN BREAKDOWN	203	
04	BACK LASH ERROR	204	
05	ERROR CAUSED BY INEXPLICABLE MACHINE COMPONANT MOTION	205	
06	UNCLASSIFIED	206	

PRODUCT NCR CAUSE CODES

SL NO	MATERIAL FAULT (300 SERIES)	CAUSE CODE	REMARKS
01	MATERIAL HARDNESS HIGH / LOW	301	
02	CHANGE OF MATERIAL DUE TO DCN	302	
03	USE OF WRONG MATERIAL	303	
04	MATERIAL WAS CHANGED BUT WORK INSTRUCTION WAS NOT CHANGED	304	
05	UNCLASSIFIED	305	
06	MATERIAL WITH DEVIATION USED	306	

PRODUCT NCR CAUSE CODES

SL NO	PROCESS FAULT (400 SERIES)	CAUSE CODE	REMARKS
01	NO STOCK OF MATERIAL AVAILABLE	401	
02	PROCESS INADEQUATE	402	
03	UNCLASSIFIED	403	

PRODUCT NCR CAUSE CODES

SL NO	SUB DELY ITEMS (500 SERIES)	CAUSE CODE	REMARKS
01	MECHANICAL PROPERTIES NOT MEETING REQUIREMENT	501	
02	CHEMISTRY NOT MEETING REQMT.	502	
03	PLATING / COATING NOT OK	503	
04	P.O AMENDMENT NOT GIVEN BUT MATERIAL WAS AVAILABLE AT STORES.	504	
05	WRONG MATL CODE USED BY STORES	505	
06	WRONG DRAWING REFERRED IN P.O	506	
07	STANDARDS REFERRED IN P.O WERE WRONG	507	
08	PAINTING DEFECTS NOTICED ON RECEIPT QF MATL AT STORES	508	
09	NDT DEFICIENCIES NOTICES.	509	
10	H T DEFICIENCIES NOTICED.	510	
11	WELDING DEFECTS NOTICED.	511	
12	TESTS NOT GIVEN CLEARLY ON P.O	512	
13	TESTS AS PER P.O NOT CARRIED OUT	513	
14	DESIGN TECH SPECS DID NOT SPE CIFY ALL REQUIREMENTS AS PER STDS.	514	
15	CALIBRATION OF TEST/MEASURING EQUIPMENT NOT EVIDENT.	515	
16	DIMENSIONAL DEVIATION	516	
17	UNCLASSIFIED	517	
18	PART NO & TYPE VARIATION	518	
19	DEVIATION IN ROUTINE REST RESULTS	519	
20	DEVIATION IN TYPE TEST RESULTS	520	

PROCEDURE FOR CODIFICATION OF SAR FOR ANALYSIS

Prepared by	Reviewed by	Reviewed by	Approved by
Abdul Ghani Senior Engineer / QA	Renjith K Manager / QA(Mech)	R. Arunachalam DGM / QA & QC - OLI	K. Saketharaman AGM / Quality

1.0 SCOPE

This procedure gives guidelines for codifying the causes of non conformances reported through Site Action Requests (SARs). The Corporate single sign on system have codified defect type and defect sub type for SARs. This defect type and defect sub type for SARs will be used for SARs to facilitate SAR analysis to take corrective/preventive action.

2.0 PROCEDURE

2.1 SARs will be received in Corporate Single sign on system.

2.2 QA will forward the SARs to concerned departments after review for their review and comments.

2.3 QA will dispose the SARs after review of department comments.

2.4 Site may accept unit disposition or return the SAR in case of non acceptance.

2.5 The online disposed copy of SARs will be used by department for analysis and corrective/preventive action. Copy can be provided to departments after disposition on request.

2.6 QA while disposing the SAR, shall review site given data for Defect type, Defect Sub-Type and severity rating and suitably select them in the online disposition of SAR as per reply comments from departments.

2.7 These Cause codes(Defect type, Defect Sub-Type and severity rating) can be used for identification of issues for RCA analysis in RCA committee meeting.

2.8 List of SARs will be sent to RCA committees every quarter. Concerned departments and RCA committee will analyse the causes and take corrective action to eliminate the potential root cause of nonconformances. RCA details will be updated in online system. Corrective action reports will be reviewed by concerned departments. QA may monitor Corrective and preventive action reports. These reports will be discussed by Business Excellence in the Plant Quality Council Meetings.

RECORD OF REVISIONS

Rev No	Date	Revision details
00	31.08.1995	Original Issue
01	24.11.2020	Procedure revisited and revised based on Corporate Online SAR system.

Annexure I(Defect Type & Defect Sub Type)

Defect Type	Material	Logistics	Design/Drawing
Defect Sub type	1. Wrong Supply(dimensional mismatch, variation in quantity,part missing,etc) 2. Defective supply(extra processing required at site, product received in damaged conditions 3. Material not suitable for site condition 4. Theft of material from site 5. Deficiencies in Purchase orders 6. Others	1. Transportation Damage 2. Damage due to improper handling(loading/unloading) 3. Damage due to improper packing 4. Damage due to poor storage or preservation at site 5. Others	1. Design document/drawing error; 2. vendor design fault; 3. Use of obsolete or unauthorized drawing/technological process/document; 4. Drawing interference issue with existing structure; 5. Additional requirement by customer; 6. Other

Defect Type	Testing/Inspection	Process	Manufacturing defects/welding
Defect Sub type	1. Inadequate test plan/procedure; 2. Use of wrong/ defective/ uncalibrated testing instrument/equipment; 3. Non compliance of testing procedure; 4. Skipping of inspection stages; 5. Inadequate inspection; 6. Other	1. Inadequate / non compliance of process; 2. Use of defective/uncalibrated machine or tool; 3. Deviation from design/drawing/specification; 4. CNC Program error, 5. Technology document error; 6. Other	1. Improper profile; 2. Incorrect dimension; 3. Incorrect weight; 4. Surface defects; 5. Mismatch in assembly; 6. Aesthetics issues(painting); 7. Others

Defect Type	Welding defects	Workmanship	BOI's
Defect Sub type	1. Cracks,Porosity,solid/slag inclusion; 2. Lack of fusion/inadquate penetration; 3. Lack of fusion-incomplete penetration; 4. Imperfect shape; 5. Miscellaneous defects; 6. Undercut; 7. Spatter; 8. Overlap; 9. Crater; 10. Necklace cracking; 11. Other	1. Deployment of unskilled workers; 2. Selection of wrong tool; 3. Other	1. Deficiency in vendor supplied items; 2. Inadequate test report; 3. Deviation from design/drawing/specification; 4. Other

Annexure II(Severity Rating)

Severity Rating	
Rating	**Description**
0.1	Minor NC-Concurrence of Unit required for use
0.2	NC observed-Activity not stopped-Rework possible at site with minor cost debit
0.3	NC observed-Activity not stopped-Rework possible with local purchase
0.4	Activity stopped- Rework possible at site with local purchase
0.5	Activity stopped- Rework possible at site with resources(man,materials,etc) to be arranged from unit/vendor
0.6	Activity stopped-Replacement of rejected item with new one
0.7	Activity stopped-Replacement of rejected item with change in layout/material/process
0.8	Activity stopped-Item to be sent to unit/vendor works for repair/rework;
0.9	Product failures during erection&commissioning causing major delay in final commissioning &COD of project.
1.0	Product failureshaving consequential losses of facilities, human, image, future business, generation loss due to shutdown, etc

PROCEDURE FOR SURFACE PREPARATION AND PAINTING

PREPARED BY

DEPARTMENT	NAME & DESIGNATION S/Shri	SIGNATURE
QA	Rajamanickam. M Sr.Engr/ QA	

REVIEWED BY

DEPARTMENT	NAME & DESIGNATION S/Shri	SIGNATURE
ENGINEERING	S.S. Mani AGM/ Engg	
QUALITY ASSURANCE	R. Aruchachalam DGM/ QA& QC-OLI	24/11/18

APPROVED AND ISSUED BY

DEPARTMENT	NAME & DESIGNATION S/Shri	SIGNATURE
QUALITY	B. Srinivasa Rao AGM/ Quality	9/12/18

Record of Revision

Rev. No	Effective Date	Details of Revision
00	10.10.2002	RP0674199 Rev 05 requirements and PRQA rev 12 requirements were fully reviewed and this document is released as Rev 00 taking care of painting requirements of BAP projects. For project specific painting schemes respective CIS or contract specific painting schemes to be referred
01	22.05.2007	Painting requirement are fully reviewed. Red oxide Zinc chromate for primer application (IS 2074) is corrected as Red oxide Zinc phosphate primer (IS 12744) and also number of coats & DFT corrected
02	24.01.2018	Painting requirement are fully reviewed and totally revamped. Specific painting scheme for different environments are envisaged and other details added for overall painting document.

1.0 SCOPE

1.1 This procedure specifies the requirements for surface preparation, application of primer, intermediate and finish paints, personnel qualification, testing, inspection of manufactured and sub contracted components of APH, Fans, ESP, Gates and Dampers and Chimney. (For desalination, please refer PRQA:526/ Latest respectively)

1.2 As these standard painting schemes have evolved well over the years, and the performance of these paint systems have been satisfactory in many sites, these schemes will be offered to the customers during the tender stage. The use of standard painting scheme has several advantages including the avoidance of certain time consuming surface preparations and also the use of the proven techno-economic options for painting of the products.

1.3 In case of special contract requirements, wherein the customer is specific about having a painting scheme different from the above, then those special contractual requirements will be addressed through a Contract Specific Document with customer approval, when required. The linkage will be provided in the CQR issued by QA.

1.4 Good preservation/ transportation enhances the life of painted products. Suitable lasing method (use of rubber, nylon, rope/bel) shall be used while transporting and avoid metal slings to tie up the product with the load carrier.

2.0 GENERAL

2.1 This procedure specifies the painting requirements to

a) Provide adequate surface protection of components under prescribed storage conditions at Shop/ Site.
b) Temporary protection for components coming under the flue gas path till they are erected and
c) Protection for a reasonable time till completion of erection for components continuously exposed to atmospheric environment.

2.2 The scheme is based on the site practice of need based touch-up/ re-preservation program based on the duration of storage and the condition.

2.3 No painting shall be applied on the stainless steel, galvanized and any plated surfaces. For estimation of requirements of painting, the approximate area of coverage on non-absorbing surface is as given below,

SL NO	Generic nature of paint	Theoretical covering area (Sq.m/ litre)	DFT/ Coat (Min)	Shade
01	Red oxide zinc phosphate primer to IS 12744	10	30	Red oxide
02	Synthetic enamel paint to IS 2932	10	20	Smoke grey
03	Heat resistant aluminum paint to IS 13183	10	20	Aluminum

2.4 For bought-out items, the painting scheme shall be specified in Engineering Drawing/ purchase Specification. Wherever it is not specified, the following is the minimum requirement,

a) Primer: Two coats of red oxide Zinc phosphate primer to IS 12744- DFT 30 microns
b) Finish: Two coats of synthetic enamel to IS 2932 smoke grey shade no:692 of IS: 5. DFT 20 microns per coat

Manufactured items for bough-out items shall be as per the painting scheme of the applicable PGMA in this document.

2.5 All currently active PGMA's are covered. Requirements for Missing/ new PGMA's can be obtained from Engineering and Quality Assurance department.

3.0 PAINTING SCHEME & REFERENCE ANNEXURES

3.1 The surface preparation, primer coat, intermediate coat and finish coat requirements for various painting schemes are given as part of this document.

3.2 Section I deals with the surface preparation schedule and section II deals with painting and coating.

3.3 Standard painting scheme for normal environment/ coastal (or) refinery (or) chemical environment/ export projects can be referred in Part- I/ II / III in Section II available with this document.

3.4 Annexure I shall be referred for notes on painting scheme furnished in this document. Necessary instructions given for protective coating of various components.

3.5 Inspection and testing plan on surface preparation and painting is given under Annexure II. Description given for various grade of surface cleanliness and inspection techniques.

3.6 Procedure for painter qualification given under Annexure III.

3.7 The paints envisaged as per this document are indicated in this document under the Annexure IV- Painting scheme details for procurement and application purposes.

3.8 Good painting practices, which will be of assistance to task performer, have been detailed in Annexure VI.

SECTION - I

4.0 SURFACE PREPARATION REQUIREMENTS FOR PAINTING AND COATING

4.1 The effectiveness and duration of the protection provided by organic, Inorganic and metallic coatings for corrosion protection depends among other things decisively on proper surface preparation. This section deals with the methods of surface preparation, their effectiveness and fields of application.

4.2 This section is largely based on ISO 8501-1; 1988 that in turn is based on the Swedish standard SS 05 59 00.

4.3 SURFACE PREPARATION METHODS

4.3.1 Surface preparation depends on the initial condition of uncoated surfaces. The details of rust level, rust removal methods and characteristics surfaces are given in Table 1.0.

4.4 DEFINITIONS AND METHODS OF CLEANING

4.5 CLEANLINES OF SURFACES

4.5.1 Cleaning requirement and levels of cleanliness, contaminants such as dirt, oil that will interfere with the adhesion or effectiveness of the proposed coating must be removed. Coats of materials related to the metal (scale, rust) and coats of different materials (e.g existing coating) should be removed until the agreed level of cleanliness is attained.

4.5.2 Contaminants/ coats, both of related material and of materials different from the metal may be removed in one operation if the nature, level and thickness permits this. The required level of cleanliness depends on

- The corrosion protection system selected
- The type of corrosion exposure expected
- The initial condition of the surface being prepared
- The possible rust removal method
- Economic considerations

4.5.3 Generally, the standard levels of cleanliness as in table 1.0 should be used as basis. This does not cover the removal of weld spatter, weld or flame cutting slag or chips, repair grinding of rolling defects (laminations) deburring and similar operations.

4.6 MECHANICAL METHODS OF REMOVING DUST

4.6.1 Manual rust removal:

4.6.1.1 This applies to standard levels of cleanliness St 2, St 3 as per table 1.0 manual cleaning uses wire brush, stripping knife, Swedish scraper, rust removing hammer etc., the method must not damage the metal being derusted. Subsequent cleaning by sweeping or brushing off or by blowing off with dry air.

4.6.2 Mechanical rust removal:

4.6.2.1 This applies to standard levels of cleanliness St2, St3 as per table 1.0 cleaning can be done by mechanically driven rust removing tools viz. rotating wire brush, impact piston devices or rotary descalers, sanding discs etc. The surface areas where the power driven tool cannot enter, manual cleaning should be done. The method must not damage the metal being derusted. Subsequent cleaning by sweeping or brushing off or blowing off with dry air.

4.6.3 Blast cleaning

4.6.3.1 This applies to standard levels of cleanliness Sa 1, Sa 2½, Sa 3 as per table 1.0. Chemically contaminated surfaces must be pre-washed. Surfaces having coarse rust must be pre-cleaned with impact tools prior to blast cleaning.

4.6.3.2 Compressed air blasting is generally recommended for our operations. It is freely directed air blasting in blasting cubicles, Rooms or sheds with re-circulation of blasting abrasives.

4.6.4 Removal of contaminants/ coat of material different from the metal

4.6.4.1 Surface of metal contaminated with cutting fluid (machine coolant) oil or grease shall be wiped with mineral turpentine/ tri-chloroethylene prior to applying any methods of mechanical surface preparation.

4.6.4.2 If any old paint film or rust preventive films are present they may be removed with paint removing jelly.

4.6.4.3 As far as possible the cleaning method should be so chosen that all the scale is removed from the metallic surface to be coated. For heavily scaled metallic surfaces either blasting or picking may be adopted over and above the requirements called for in the table 1.0

4.6.5 Notes to Table 1.0

4.6.5.1 Initial condition of uncoated surfaces (rust grade as per SS 05 59 00)

a) Steel surface largely covered with adhering mill scale but little, if any rust.

b) Steel surface, which begun to rust and from which the mill scale has begun to flake.

c) Steel surface on which the mill scale has rusted away or from which it can be scrapped, but with slight pitting visible under normal vision.

d) Steel surface on which the mill scale has rusted away and on which general pitting is visible under normal vision.

4.6.5.2 Standard levels of cleanliness equivalent to steel structures painting council of US (SSPC) also given in brackets in table 1.0.

Table 1.0

Standard levels of cleanliness	Rust removal method	Initial conditions of steel surfaces (Uncoated ref. 4.5)	Essential characteristics of the prepared steel surface
St 2 (SSPC- SP 2)	Thorough hand and power tool cleaning	B, C, D	When viewed without magnification, the surface shall be free from visible oil, grease and dirt and from poorly adhering mill scale, rust coatings and foreign matter.
St 3 (SSPC SP 3)	Very thorough hand and power tool cleaning	B, C, D	As for St 2, but the surface shall be treated much more thoroughly to give a metallic sheen arising from the metallic substrate.
Sa 1 (SSPC SP 7)	Light blast cleaning	B, C, D	When viewed without magnification, the surface shall be free from visible oil, grease and dirt and from poorly adhering mill scale, rust coatings and foreign matter.
Sa 2 (SSPC SP 6)	Thorough blast cleaning	B, C, D	When viewed without magnification, the surface shall be free from visible oil, grease and dirt and from most of the mill scale, rust, paint coatings and foreign matter. Any residual contamination shall be firmly adhering.

Standard levels of cleanliness	Rust removal method	Initial conditions of steel surfaces (Uncoated ref. 4.5)	Essential characteristics of the prepared steel surface
Sa 2½ (SSPC SP 10)	Very thorough blast cleaning	B, C, D	When viewed without magnification, the surface shall be free from visible oil, grease and dirt and from the mill scale, rust, paint coatings and foreign matter. Any remaining traces of contaminations shall show only as slight stains in the form of spots or stripes.
Sa 3 (SSPC SP 5)	Blast cleaning to visually clean steel	A, B, C, D	When viewed without magnification, the surface shall be free from visible oil, grease and dirt and from the mill scale, rust, paint coatings and foreign matter. It shall have a uniform metallic colour.

SECTION –II

PART- I

STANDARD PAINTING SCHEME FOR NORMAL ENVIRONMENT

Sl no	PGMA/Description	Surface preparation & surface profile	Primer coat		Intermediate coat		Finish coat			Total DFT µ (min)
			Paint	No of coats/ DFT	Paint	No of coats	Paint	No of coats	Shade	
A	**REGENERATIVE AIR PRE- HEATERS**									
01	Heating element baskets (without elements) 52010, 024, 025	Power tool cleaning to ST- 3 (SSPC SP3)	Red oxide zinc phosphate primer (Alkyd base) to IS 12744	02/ DFT=30µ/ coat	--	--	--	--	--	60
02	Heating element baskets (with elements) 52010, 024, 025	--	Temporary rust preventive oil non dry type (*) (Dipping)	--	--	--	--	--	--	--
03	Rotor post assembly machined items of (52011), Pin rack assembly (52012), Seals (52013, 52054, 52055), sector plates (52041, 52042) and machined components of APH	--	Temporary rust preventive oil dry type (**)	40	--	--	--	--	--	40
04	**Components in flue gas path and insulated** Rotor post assy (52011), T bars (52013), Rotor housing assy (52030), Hot and cold connecting plate assy (52041,52042)	Commercial blast cleaning (Sa 2) (SSPC SP6)	Red oxide zinc phosphate primer (Alkyd base) to IS 12744	02/ DFT=30µ/ coat	--	--	--	--	--	60

(*) Specification as per PRQA 522/ Rev 00

(**) Specification as per PRQA 523/ Rev 00; For CE coil- TEP/AQCS/RP (Latest)

Part- I contd….

Sl no	PGMA/Description	Surface preparation & surface profile	Primer coat		Intermediate coat		Finish coat			Total DFT µ (min)
			Paint	No of coats/ DFT	Paint	No of coats	Paint	No of coats	Shade	
05	**Components exposed to atmosphere** Rotor drive assy (52100), Access door (52220), Air seal piping (52211), observation port other than glass part (52220), Rotor stoppage alarm other than aluminium (52220), Loose items of air receiver (52220), Guide bearing assy (52261), Support bearing assy (52262), Oil piping GB, SB (52271, 52272), Oil circulation unit (52274), Deluge and wash pipe assy (52301, 52302), Cleaning device assy (52339, 52340), Thermocouple pipe assy other than SS	Commercial blast cleaning (Sa 2) (SSPC SP6)	Red oxide zinc phosphate primer (Alkyd base) to IS 12744	01/ DFT=30µ/ coat	--	--	Synthetic Enamel paint to IS 2932	02/ DFT= 20 µ/ coat; Total 40µ	Smoke grey Shade 692 of IS 5	70
B	**TUBULAR AIR PRE-HEATER**									
01	Side walls (external surfaces and internal surfaces)	Commercial blast cleaning (Sa 2) (SSPC SP6)	Red oxide zinc phosphate primer (Alkyd base) to IS 12744	02/ DFT=30µ/ coat	--	--	--	--	--	60

Part- I contd….

Sl no	PGMA/Description	Surface preparation & surface profile	Primer coat		Intermediate coat		Finish coat			Total DFT µ (min)
			Paint	No of coats/ DFT	Paint	No of coats	Paint	No of coats	Shade	
02	Machined surfaces, tubes of TAPH, tube plates and intermediate plates	--	Temporary rust preventive oil dry type (**)	40	--	--	--	--	--	40
C	**FANS**									
01	Foundation materials 550XX, 560XX (Threaded portion)	Power tool cleaning to St-3 (SSPC SP3)	Temporary rust preventive oil	40	--	--	--	--	--	--
			Other areas except threaded portion- Red oxide Zinc phosphate primer to IS 12744, DFT- 30 µ							
02	**Components exposed to atmosphere**									
02.a	Bearing pedestals, Base frame, servomotor assy, shaft with bearing assy, OGV, IGV (55-1XX, 55-2XX, 55-3XX, 55-5XX, 55-6XX, 56-4XX) Bearing pedestals, Base frame, shaft with bearing assy, RVC, IGV, Support for seal, shaft protecting tube, Spiral casing (if no insulation is applicable), Damper (56-1XX, 56-2XX, 56-3XX, 56-4XX) Coupling guard (56-8XX, 55-8XX), Tools (56-000, 55-000)	Commercial blast cleaning (Sa 2) (SSPC SP6)	Red oxide zinc phosphate primer (Alkyd base) to IS 12744	01/ DFT=30µ/ coat	--	--	Synthetic Enamel paint to IS 2932	02/ DFT= 20 µ/ coat; Total 40µ	Smoke grey Shade 692 of IS 5	70
			General notes for Sl no: 02.a & 02.b for C. Fans 1) As a assy, no blasting to be done for servomotor assy& shaft with bearing assy. 2) Before assy, all external un-machined surfaces of bearing housing/ cylinder to be painted. 3) AP impeller painting to be done before assembly except oil chamber area & mating component contact area. 4) After SR/ Before machining, blasting and primer painting to be done.							
02.b	AP fan components like Servomotor assy, Shaft with bearing assy	Power tool cleaning to St-3 (SSPC SP3)	Epoxy based zinc phosphate primer to IS 13238	02/ DFT=30µ/ coat	--	--	--	--	--	60

Part- I contd….

Sl no	PGMA/Description	Surface preparation & surface profile	Primer coat		Intermediate coat		Finish coat			Total DFT µ (min)
			Paint	No of coats/ DFT	Paint	No of coats	Paint	No of coats	Shade	
03	**Components in Air/ Gas and under insulation**									
03.a	Suction chamber, diffuser, housing, OGV, Spiral casing, damper, IGV, RVC, impeller, shaft (56-1XX,56-2XX, 56-3XX, 56-4XX) Silencer (55-9XX, 56-9XX)	Commercial blast cleaning (Sa 2) (SSPC SP6)	Red oxide zinc phosphate primer (Alkyd base) to IS 12744	02/ DFT=30µ/ coat	--	--	--	--	--	60
03.b	AP fan impeller (55-2XX, 55-3XX)	Power tool cleaning to St-3 (SSPC SP3)	Epoxy based zinc phosphate primer to IS 13238	02/ DFT=30µ/ coat	--	--	--	--	--	60
04	Journal area of shaft (55-1XX, 56-1XX, 55-2XX, 56-2XX, 55-3XX, 56-3XX, 56-4XX)- Refer PRQA 341/ Latest									
05	All machined surfaces shall be applied with rust preventive.									
D	**ELECTROSTATIC PRECIPITATOR**									
01	GD drive arrangement (7X X10), Drive arrangement for emitting system (7X X17), Inspection doors (7X X23), Drive arrangement for CE rapping (7XX26), Outer roof (7X X42), ESP Penthouse other items (7XX55), ESP test equipment (7XX61), Water washing system (7X X66), Tools & Tackles (7X 996), Lifting beam (7X X20)	Commercial blast cleaning (Sa 2) (SSPC SP6)	Red oxide zinc phosphate primer (Alkyd base) to IS 12744	01/ DFT=30µ/ coat	--	--	Synthetic Enamel paint to IS 2932	02/ DFT= 20 µ/ coat; Total 40µ	Smoke grey Shade 692 of IS 5	70

Part- I contd….

Sl no	PGMA/Description	Surface preparation & surface profile	Primer coat		Intermediate coat		Finish coat			Total DFT µ (min)
			Paint	No of coats/ DFT	Paint	No of coats	Paint	No of coats	Shade	
02	ESP Penthouse columns & Trusses (7X-X55), ESP columns (7X X81), Hopper approach platform (7X X65)	Blast cleaning to near white metal Sa 2½ (SSPC SP10) Surface profile of 35-50µm	Epoxy based Zinc phosphate primer to IS 13238 (Latest)	01/ DFT= 30µm	Epoxy based MIO pigmented intermediate coat	01/ DFT= 75µm	Epoxy based polyamide cured finish paint to IS 14209 (Latest) + Aliphatic acrylic polyurethane paint to IS 13213 (Latest)	01/ DFT= 30µm 01/ DFT= 30µm	Smoke grey Shade 692 of IS 5	165
		Columns below 0.0 level- Chlorinated rubber based zinc phosphate primer to 50µm (min) to be applied.								
03	Stringer and guard plates (8X 610), Hand rails, post, step treads, Floor grills (8X 611,612,613)	Hot dip galvanizing to a coating weight of 610gm per sq. m (minimum) and to a coating thickness of 85 microns (minimum)								

Sl no	PGMA/Description	Surface preparation & surface profile	Primer coat		Intermediate coat		Finish coat			Total DFT µ (min)
			Paint	No of coats/ DFT	Paint	No of coats	Paint	No of coats	Shade	
04	Insulator housing assy (7X X06), Gas distribution assy (7X X08), GD rapping mechanism (7X X09), Gas screening (7X X11), Emitting system suspension (7X X13), Emitting Electrode rapping (7X X16), Suspension arrangement for CE (7X X19), Frame of Emitting system Top, middle& bottom (7X	Commercial blast cleaning (Sa 2) (SSPC SP6)	Red oxide zinc phosphate primer (Alkyd base) to IS 12744	02/ DFT= 30µ/ coat	--	--	--	--	--	60

	X21, X22, X32), shock bars(7X X24), CE rapping mechanism (7X X25), contd… Contd… Ridges (7X X43), Hopper upper, lower &middle part (7X X44, X45), Insulator support panel (7X X46), Roof panel assy (7X X47) Casing structure (7X X28, X48), Casing shell (7X X49, ESP funnel (7X X50), Splitter & Guide vane (7X X57)									

Sl no	PGMA/Description	Surface preparation & surface profile	Primer coat		Intermediate coat		Finish coat			Total DFT µ (min)
			Paint	No of coats/ DFT	Paint	No of coats	Paint	No of coats	Shade	
05	EE (7X X15) (EE hook), EE suspension hook (7X X13), CE (7X X20), CE suspension hook (7X X19), Foundation material for ESP structures & ducts (7X X80)	--	Temporary rust preventive oil dry type (**)	40	--	--	--	--	--	40
E	**GATES AND DAMPERS**									
01	Gates and Damper Temperature ≤ 95°C (57-0XX, 57-1XX)	Commercial blast cleaning (Sa 2) (SSPC SP6)	Red oxide zinc phosphate primer (Alkyd base) to IS 12744	01/ DFT= 30µ/ coat	--	--	Synthetic Enamel paint to IS 2932	02/ DFT= 20 µ/ coat; Total 40µ	Smoke grey Shade 692 of IS 5	70
02	Gates and Damper Temperature ≥ 95°C (57-2XX, 57-3XX, 57-4XX, 57-6XX)	Commercial blast cleaning (Sa 2) (SSPC SP6)	Red oxide zinc phosphate primer (Alkyd base) to IS 12744	02/ DFT= 30µ/ coat	--	--	--	--	--	60

03	Gates blades, Machined components of G&D	--	Temporary rust preventive oil dry type (**)	40	--	--	--	--	--	40

Sl no	PGMA/Description	Surface preparation & surface profile	Primer coat		Intermediate coat		Finish coat			Total DFT µ (min)
			Paint	No of coats/ DFT	Paint	No of coats	Paint	No of coats	Shade	
F	**CHIMNEY**									
01	Foundation bolt (87010)	Power tool cleaning to St-3 (SSPC SP3)	Temporary rust preventive oil dry type (**)	40	--	--	--	--	--	40
02	Shells- Inside and Uninsulated side, base plate (87 100)	Blast cleaning to near white metal Sa 2½ (SSPC SP10) Surface profile of 35-50µm	Heat resistant aluminium paint as per IS 13183 (Gr I- Upto 600°C, Gr II- 200°C to 400°c Gr. III- Upto 200°C)	02/ DFT= 20µ/ coat	--	--	--	--	--	40
03	Ducts uninsulated, Strakes, (87150), Painter trolley (87200)	Power tool cleaning to St-3 (SSPC SP3)	Heat resistant aluminium paint as per IS 13183 (Gr I- Upto 600°C, Gr II- 200°C to 400°c Gr. III- Upto 200°C)	02/ DFT= 20µ/ Coat	--	--	--	--	--	40
04	Shells- Outside insulated (87100), Ducts- Insulated (87150)	Blast cleaning to near white metal Sa 2½ (SSPC SP10) Surface profile of 35-50µm	Red oxide zinc phosphate primer (Alkyd base) to IS 12744	02/ DFT= 30µ/ coat	--	--	--	--	--	60
05	Ladders, Hand rails, Floor grills. Platforms (87300)	Commercial blast cleaning (Sa 2) (SSPC SP6)	Red oxide zinc phosphate primer (Alkyd base) to IS 12744	01/ DFT= 30µ/ coat	--	--	Synthetic Enamel paint to IS 2932	02/ DFT= 20 µ/ coat; Total 40µ	Smoke grey Shade 692 of IS 5	70

SECTION –II

PART- II

STANDARD PAINTING SCHEME FOR COASTEL/ REFINERY ENVIRONMENT

Sl no	PGMA/Description	Surface preparation & surface profile	Primer coat		Intermediate coat		Finish coat			Total DFT µ (min)
			Paint	No of coats/ DFT	Paint	No of coats	Paint	No of coats	Shade	
A	**REGENERATIVE AIR PRE- HEATERS**									
01	Heating element baskets (without elements) 52010, 024, 025	Power tool cleaning to ST- 3 (SSPC SP3)	Red oxide zinc phosphate primer (Alkyd base) to IS 12744	02/ DFT=30µ/ coat	--	--	--	--	--	60
02	Heating element baskets (with elements) 52010, 024, 025	--	Temporary rust preventive oil non dry type (*) (Dipping)	--	--	--	--	--	--	--
03	Rotor post assembly machined items of (52011), Pin rack assembly (52012), Seals (52013, 52054, 52055), sector plates (52041, 52042) and machined components of APH	--	Temporary rust preventive oil dry type (**)	40	--	--	--	--	--	40
04	**Components in flue gas path and insulated** Rotor post assy (52011), T bars (52013), Rotor housing assy (52030), Hot and cold connecting plate assy (52041,52042)	Commercial blast cleaning (Sa 2) (SSPC SP6)	Red oxide zinc phosphate primer (Alkyd base) to IS 12744	02/ DFT=30µ/ coat	--	--	--	--	--	60

(*) Specification as per PRQA 522/ Rev 00

(**) Specification as per PRQA 523/ Rev 00; For CE coil- TEP/AQCS/RP (Latest)

Sl no	PGMA/Description	Surface preparation & surface profile	Primer coat		Intermediate coat		Finish coat			Total DFT µ (min)
			Paint	No of coats/ DFT	Paint	No of coats	Paint	No of coats	Shade	
05	**Components exposed to atmosphere** Rotor drive assy (52100), Access door (52220), Air seal piping (52211), observation port other than glass part (52220), Rotor stoppage alarm other than aluminium (52220), Loose items of air receiver (52220), Guide bearing assy (52261), Support bearing assy (52262), Oil piping GB, SB (52271, 52272), Oil circulation unit (52274), Deluge and wash pipe assy (52301, 52302), Cleaning device assy (52339, 52340), Thermocouple pipe assy other than SS	Blast cleaning to near white metal Sa 2½ (SSPC SP10) Surface profile of 35-50µm	Inorganic Ethyl zinc silicate primer to IS 14946 (Latest)	01/ DFT= 75µm/ coat	Epoxy based MIO/TiO_2 pigmented intermediate coat	01/ DFT= 75µm/ coat	Epoxy based polyamide cured finish paint to IS 14209 (Latest)	01/ DFT= 75µm/ coat	Smoke grey Shade 692 of IS 5	225
B	**TUBULAR AIR PRE-HEATER**									
01	Side walls (external surfaces and internal surfaces)	Commercial blast cleaning (Sa 2) (SSPC SP6)	Red oxide zinc phosphate primer (Alkyd base) to IS 12744	02/ DFT=30µ/ coat	--	--	--	--	--	60

Part- II contd….

Sl no	PGMA/Description	Surface preparation & surface profile	Primer coat		Intermediate coat		Finish coat			Total DFT µ (min)
			Paint	No of coats/ DFT	Paint	No of coats	Paint	No of coats	Shade	
02	Machined surfaces, tubes of TAPH, tube plates and intermediate plates	--	Temporary rust preventive oil dry type (**)	40	--	--	--	--	--	40
C	**FANS**									
01	Foundation materials 550XX, 560XX (Threaded portion)	Power tool cleaning to St-3 (SSPC SP3)	Temporary rust preventive oil	40	--	--	--	--	--	--
			Other areas except threaded portion- Red oxide Zinc phosphate primer to IS 12744, DFT- 30 µ							
02	**Components exposed to atmosphere**									
02.a	Bearing pedestals, Base frame, servomotor assy, shaft with bearing assy, OGV, IGV (55-1XX, 55-2XX, 55-3XX, 55-5XX, 55-6XX, 56-4XX) Bearing pedestals, Base frame, shaft with bearing assy, RVC, IGV, Support for seal, shaft protecting tube, Spiral casing (if no insulation is applicable), Damper (56-1XX, 56-2XX, 56-3XX, 56-4XX) Coupling guard (56-8XX, 55-8XX), Tools (56-000, 55-000)	Commercial blast cleaning (Sa 2) (SSPC SP6)	Red oxide zinc phosphate primer (Alkyd base) to IS 12744	01/ DFT=30µ/ coat	--	--	Synthetic Enamel paint to IS 2932	02/ DFT= 20 µ/ coat; Total 40µ	Smoke grey Shade 692 of IS 5	70
			General notes for Sl no: 02.a & 02.b for C. Fans 1) As a assy, no blasting to be done for servomotor assy& shaft with bearing assy. 2) Before assy, all external un-machined surfaces of bearing housing/ cylinder to be painted. 3) AP impeller painting to be done before assembly except oil chamber area & mating component contact area. 4) After SR/ Before machining, blasting and primer painting to be done.							
02.b	AP fan components like Servomotor assy, Shaft with bearing assy	Power tool cleaning to St-3 (SSPC SP3)	Epoxy based zinc phosphate primer to IS 13238	02/ DFT=30µ/ coat	--	--	--	--	--	60

Part- II contd….

Sl no	PGMA/Description	Surface preparation & surface profile	Primer coat		Intermediate coat		Finish coat			Total DFT µ (min)
			Paint	No of coats/ DFT	Paint	No of coats	Paint	No of coats	Shade	
03	**Components in Air/ Gas and under insulation**									
03.a	Suction chamber, diffuser, housing, OGV, Spiral casing, damper, IGV, RVC, impeller, shaft (56-1XX,56-2XX, 56-3XX, 56-4XX)	Commercial blast cleaning (Sa 2) (SSPC SP6)	Red oxide zinc phosphate primer (Alkyd base) to IS 12744	02/ DFT= 30µ/ coat	--	--	--	--	--	60
03.b	Silencer (55-9XX, 56-9XX)	Blast cleaning to near white metal Sa 2½ (SSPC SP10) Surface profile of 35-50µm	Inorganic Ethyl zinc silicate primer to IS 14946 (Latest)	01/ DFT= 75µm/ coat	Epoxy based MIO/TiO_2 pigmented intermediate coat	01/ DFT = 75µ m/ coat	Epoxy based polyamide cured finish paint to IS 14209 (Latest)	01/ DFT= 75µm / coat	Smoke grey Shade 692 of IS 5	225
03.c	AP fan impeller (55-2XX, 55-3XX)	Power tool cleaning to St-3 (SSPC SP3)	Epoxy based zinc phosphate primer to IS 13238	02/ DFT= 30µ/ coat	--	--	--	--	--	60
04	Journal area of shaft (55-1XX, 56-1XX, 55-2XX, 56-2XX, 55-3XX, 56-3XX, 56-4XX)- Refer PRQA 341/ Latest									
05	All machined surfaces shall be applied with rust preventive.									
D	**ELECTROSTATIC PRECIPITATOR**									
01	ESP Penthouse other items (7XX55), Water washing system (7X X66), Tools & Tackles (7X 996), Lifting beam (7X X20) Ridges (7X X43), Hopper upper, lower &middle part (7X X44, X45)	Commercial blast cleaning (Sa 2) (SSPC SP6)	Red oxide zinc phosphate primer (Alkyd base) to IS 12744	01/ DFT= 30µ/ coat	--	--	Synthetic Enamel paint to IS 2932	02/ DFT= 20 µ/ coat; Total 40µ	Smoke grey Shade 692 of IS 5	70

	Insulator support panel (7X X46), Roof panel assy (7X X47) contd… Contd… Casing structure (7X X28, X48), Casing shell (7X X49, ESP funnel (7X X50), Splitter & Guide vane (7X X57)									

Sl no	PGMA/Description	Surface preparation & surface profile	Primer coat		Intermediate coat		Finish coat			Total DFT µ (min)
			Paint	No of coats/ DFT	Paint	No of coats	Paint	No of coats	Shade	
02	GD drive arrangement (7X X10), Drive arrangement for emitting system (7X X17), Inspection doors (7X X23), Drive arrangement for CE rapping (7XX26), Outer roof (7X X42)ESP Penthouse columns & Trusses (7X-X55), ESP columns (7X X81), ESP test equipment (7XX61), Hopper approach platform (7X X65),	Blast cleaning to near white metal Sa 2½ (SSPC SP10) Surface profile of 35-50µm	Inorganic Ethyl zinc silicate primer to IS 14946 (Latest)	01/ DFT= 30µm/ coat	Epoxy based MIO/TiO_2 pigmented intermediate coat	01/ DFT= 75µm/ coat	Epoxy based polyamide cured finish paint to IS 14209 (Latest) + Aliphatic acrylic polyurethane paint to IS 13213 (Latest)	01/ DFT= 30µm/ coat 01/ DFT= 30µm/ coat	Smoke grey Shade 692 of IS 5	165
		ESP columns- Below 0.0 level- Two coats of primer as mentioned above shall be applied since this item will be embedded inside the concrete pedestal.								
03	Stringer and guard plates (8X 610), Hand rails, post, step treads, Floor grills (8X 611,612,613),	Hot dip galvanizing to a coating weight of 610gm per sq. m (minimum) and to a coating thickness of 85 microns (minimum)								

Part- II contd….

Sl no	PGMA/Description	Surface preparation & surface profile	Primer coat		Intermediate coat		Finish coat			Total DFT µ (min)
			Paint	No of coats/ DFT	Paint	No of coats	Paint	No of coats	Shade	
04	Insulator housing assy (7X X06), Gas distribution assy (7X X08), GD rapping mechanism (7X X09), Gas screening (7X X11), Emitting system suspension (7X X13), Emitting Electrode rapping (7X X16), Suspension arrangement for CE (7X X19), Frame of Emitting system Top, middle& bottom (7X X21, X22, X32), shock bars(7X X24), CE rapping mechanism (7X X25)	Commercial blast cleaning (Sa 2) (SSPC SP6)	Red oxide zinc phosphate primer (Alkyd base) to IS 12744	02/ DFT= 30µ/ coat	--	--	--	--	--	60

Sl no	PGMA/Description	Surface preparation & surface profile	Primer coat		Intermediate coat		Finish coat			Total DFT µ (min)
			Paint	No of coats/ DFT	Paint	No of coats	Paint	No of coats	Shade	
05	EE (7X X15) (EE hook), EE suspension hook (7X X13), CE (7X X20), CE suspension hook (7X X19), Foundation material for ESP structures & ducts (7X X80)	--	Temporary rust preventive oil dry type (**)	40	--	--	--	--	--	40
E	**GATES AND DAMPERS**									
01	Gates and Damper Temperature ≤ 95°C	Blast cleaning to	Inorganic Ethyl zinc	01/	--	--	Epoxy based	01/	Smoke grey	160

	(57-0XX, 57-1XX)	near white metal Sa 2½ (SSPC SP10) Surface profile of 35-50µm	silicate primer to IS 14946 (Latest)	DFT= 80µm/ coat			polyamide cured finish paint to IS 14209 (Latest)	DFT= 80µm/ coat	Shade 692 of IS 5	

Sl no	PGMA/Description	Surface preparation & surface profile	Primer coat		Intermediate coat		Finish coat			Total DFT µ (min)
			Paint	No of coats/ DFT	Paint	No of coats	Paint	No of coats	Shade	
02	Gates and Damper Temperature > 95°C (57-2XX, 57-3XX, 57-4XX, 57-6XX)	Blast cleaning to near white metal Sa 2½ (SSPC SP10) Surface profile of 35-50µm	Inorganic Ethyl zinc silicate primer to IS 14946 (Latest)	01/ DFT= 80µm/ coat	--	--	Heat resistant aluminium paint as per IS 13183 (Gr I- Upto 600°C	02/ DFT= 20µ/ coat	Alumi nium	120
03	Gates blades, Machined components of G&D	--	Temporary rust preventive oil dry type (**)	40	--	--	--	--	--	40
F	**CHIMNEY**									
01	Foundation bolt (87010)	Power tool cleaning to St-3 (SSPC SP3)	Temporary rust preventive oil dry type (**)	40	--	--	--	--	--	40
02	Shells- Inside and Uninsulated side, base plate (87 100)	Blast cleaning to near white metal Sa 2½ (SSPC SP10) Surface profile of 35-50µm	Heat resistant aluminium paint as per IS 13183 (Gr I- Upto 600°C, Gr II- 200°C to 400°c Gr. III- Upto 200°C)	02/ DFT= 20µ/ coat	--	--	--	--	--	40
03	Ducts uninsulated, Strakes, (87150), Painter trolley (87200)	Blast cleaning to near white metal Sa 2½	Heat resistant aluminium paint as per IS 13183	02/ DFT= 20µ/ Coat	--	--	--	--	--	40

		(SSPC SP10) Surface profile of 35-50µm	(Gr I- Upto 600°C, Gr II- 200°C to 400°c Gr. III- Upto 200°C)							
Sl no	**PGMA/Description**	**Surface preparation & surface profile**	**Primer coat**		**Intermediate coat**		**Finish coat**			**Total DFT µ (min)**
			Paint	**No of coats/ DFT**	**Paint**	**No of coats**	**Paint**	**No of coats**	**Shade**	
04	Shells- Outside insulated (87100), Ducts- Insulated (87150)	Blast cleaning to near white metal Sa 2½ (SSPC SP10) Surface profile of 35-50µm	Red oxide zinc phosphate primer (Alkyd base) to IS 12744	02/ DFT= 30µ/ coat	--	--	--	--	--	60
05	Ladders, Hand rails, Floor grills. Platforms (87300)	Hot dip galvanizing to a coating weight of 610gm per sq. m (minimum) and to a coating thickness of 85 microns (minimum)								

SECTION –II

PART- III

STANDARD PAINTING SCHEME FOR EXPORT CONTRACTS

Sl no	PGMA/Description	Surface preparation & surface profile	Primer coat		Intermediate coat		Finish coat			Total DFT µ (min)
			Paint	No of coats/ DFT	Paint	No of coats	Paint	No of coats	Shade	
A	**REGENERATIVE AIR PRE- HEATERS**									
01	Heating element baskets (without elements) 52010, 024, 025	Power tool cleaning to ST- 3 (SSPC SP3)	Red oxide zinc phosphate primer (Alkyd base) to IS 12744	02/ DFT=30µ/ coat	--	--	--	--	--	60
02	Heating element baskets (with elements) 52010, 024, 025	--	Temporary rust preventive oil non dry type (*) (Dipping)	--	--	--	--	--	--	--
03	Rotor post assembly machined items of (52011), Pin rack assembly (52012), Seals (52013, 52054, 52055), sector plates (52041, 52042) and machined components of APH	--	Temporary rust preventive oil dry type (**)	40	--	--	--	--	--	40
04	**Components in flue gas path and insulated** Rotor post assy (52011), T bars (52013), Rotor housing assy (52030), Hot and cold connecting plate assy (52041,52042)	Commercial blast cleaning (Sa 2) (SSPC SP6)	Red oxide zinc phosphate primer (Alkyd base) to IS 12744	02/ DFT=30µ/ coat	--	--	--	--	--	60

(*) Specification as per PRQA 522/ Rev 00 (**) Specification as per PRQA 524/ Rev 00 (Sea worthy rust preventive oil); CE coil- TEP/AQCS/RP (Latest)

Sl no	PGMA/Description	Surface preparation & surface profile	Primer coat		Intermediate coat		Finish coat			Total DFT µ (min)
			Paint	No of coats/ DFT	Paint	No of coats	Paint	No of coats	Shade	
05	**Components exposed to atmosphere** Rotor drive assy (52100), Access door (52220), Air seal piping (52211), observation port other than glass part (52220), Rotor stoppage alarm other than aluminium (52220), Loose items of air receiver (52220), Guide bearing assy (52261), Support bearing assy (52262), Oil piping GB, SB (52271, 52272), Oil circulation unit (52274), Deluge and wash pipe assy (52301, 52302), Cleaning device assy (52339, 52340), Thermocouple pipe assy other than SS	Blast cleaning to near white metal Sa 2½ (SSPC SP10) Surface profile of 35-50µm	Inorganic Ethyl zinc silicate primer to IS 14946 (Latest)	01/ DFT= 75µm/ coat	Epoxy based MIO/TiO_2 pigmented intermediate coat	01/ DFT= 75µm/ coat	Epoxy based polyamide cured finish paint to IS 14209 (Latest)	01/ DFT= 75µm/ coat	Smoke grey Shade 692 of IS 5	225
B	**TUBULAR AIR PRE-HEATER**									
01	Side walls (external surfaces and internal surfaces)	Commercial blast cleaning (Sa 2) (SSPC SP6)	Red oxide zinc phosphate primer (Alkyd base) to IS 12744	02/ DFT=30µ/ coat	--	--	--	--	--	60

Part- III contd….

Sl no	PGMA/Description	Surface preparation & surface profile	Primer coat		Intermediate coat		Finish coat			Total DFT µ (min)
			Paint	No of coats/ DFT	Paint	No of coats	Paint	No of coats	Shade	
02	Machined surfaces, tubes of TAPH, tube plates and intermediate plates	--	Temporary rust preventive oil dry type (**)	40	--	--	--	--	--	40
C	**FANS**									
01	Foundation materials 550XX, 560XX (Threaded portion)	Power tool cleaning to St-3 (SSPC SP3)	Temporary rust preventive oil	40	--	--	--	--	--	--
			Other areas except threaded portion- Red oxide Zinc phosphate primer to IS 12744, DFT- 30 µ							
02	**Components exposed to atmosphere**									
02.a	Bearing pedestals, Base frame, servomotor assy, shaft with bearing assy, OGV, IGV (55-1XX, 55-2XX, 55-3XX, 55-5XX, 55-6XX, 56-4XX) Bearing pedestals, Base frame, shaft with bearing assy, RVC, IGV, Support for seal, shaft protecting tube, Spiral casing (if no insulation is applicable), Damper (56-1XX, 56-2XX, 56-3XX, 56-4XX) Coupling guard (56-8XX, 55-8XX), Tools (56-000, 55-000)	Blast cleaning to near white metal Sa 2½ (SSPC SP10) Surface profile of 35-50µm	Inorganic Ethyl zinc silicate primer to IS 14946 (Latest)	01/ DFT=80µ/ coat	--	--	Epoxy based polyamide cured finish paint to IS 14209 (Latest)	01/ DFT= 80µm/ coat	Smoke grey Shade 692 of IS 5	160
		General notes for Sl no: 02.a & 02.b for C. Fans 5) As a assy, no blasting to be done for servomotor assy& shaft with bearing assy. 6) Before assy, all external un-machined surfaces of bearing housing/ cylinder to be painted. 7) AP impeller painting to be done before assembly except oil chamber area & mating component contact area. 8) After SR/ Before machining, blasting and primer painting to be done.								
02.b	AP fan components like Servomotor assy, Shaft with bearing assy	Power tool cleaning to St-3 (SSPC SP3)	Epoxy based zinc phosphate primer to IS 13238	02/ DFT=30µ/ coat	--	--	--	--	--	60

Part- III contd….

Sl no	PGMA/Description	Surface preparation & surface profile	Primer coat		Intermediate coat		Finish coat			Total DFT µ (min)
			Paint	No of coats/ DFT	Paint	No of coats	Paint	No of coats	Shade	
03	**Components in Air/ Gas and under insulation**									
03.a	Suction chamber, diffuser, housing, OGV, Spiral casing, damper, IGV, RVC, impeller, shaft (56-1XX,56-2XX, 56-3XX, 56-4XX)	Commercial blast cleaning (Sa 2) (SSPC SP6)	Red oxide zinc phosphate primer (Alkyd base) to IS 12744	02/ DFT= 30µ/ coat	--	--	--	--	--	60
03.b	Silencer (55-9XX, 56-9XX)	Blast cleaning to near white metal Sa 2½ (SSPC SP10) Surface profile of 35-50µm	Inorganic Ethyl zinc silicate primer to IS 14946 (Latest)	01/ DFT= 75µm/ coat	Epoxy based MIO/TiO_2 pigmented intermediate coat	01/ DFT = 75µ m/ coat	Epoxy based polyamide cured finish paint to IS 14209 (Latest)	01/ DFT= 75µm / coat	Smoke grey Shade 692 of IS 5	225
03.c	AP fan impeller (55-2XX, 55-3XX)	Power tool cleaning to St-3 (SSPC SP3)	Epoxy based zinc phosphate primer to IS 13238	02/ DFT= 30µ/ coat	--	--	--	--	--	60
04	Journal area of shaft (55-1XX, 56-1XX, 55-2XX, 56-2XX, 55-3XX, 56-3XX, 56-4XX)- Refer PRQA 341/ Latest									
05	All machined surfaces shall be applied with rust preventive.									
D	**ELECTROSTATIC PRECIPITATOR**									
01	ESP Penthouse other items (7XX55), Water washing system (7X X66), Tools & Tackles (7X 996), Lifting beam (7X X20) Ridges (7X X43), Hopper upper, lower &middle part (7X X44, X45) Insulator support panel (7X X46),	Blast cleaning to near white metal Sa 2½ (SSPC SP10) Surface profile of 35-50µm	Red oxide zinc phosphate primer (Alkyd base) to IS 12744	02/ DFT= 30µ/ coat	--	--	Synthetic Enamel paint to IS 2932	02/ DFT= 20 µ/ coat; Total 40µ	Smoke grey Shade 692 of IS 5	100

	Roof panel assy (7X X47) contd… Contd… Casing structure (7X X28, X48), Casing shell (7X X49, ESP funnel (7X X50), Splitter & Guide vane (7X X57)									

Sl no	PGMA/Description	Surface preparation & surface profile	Primer coat		Intermediate coat		Finish coat			Total DFT µ (min)
			Paint	No of coats/ DFT	Paint	No of coats	Paint	No of coats	Shade	
02	GD drive arrangement (7X X10), Drive arrangement for emitting system (7X X17), Inspection doors (7X X23), Drive arrangement for CE rapping (7XX26), Outer roof (7X X42)ESP Penthouse columns & Trusses (7X-X55), ESP columns (7X X81), ESP test equipment (7XX61), Hopper approach platform (7X X65),	Blast cleaning to near white metal Sa 2½ (SSPC SP10) Surface profile of 35-50µm	Inorganic Ethyl zinc silicate primer to IS 14946 (Latest)	01/ DFT= 75µm/ coat	Epoxy based MIO/TiO_2 pigmented intermediate coat	01/ DFT= 75µm/ coat	Epoxy based polyamide cured finish paint to IS 14209 (Latest) + Aliphatic acrylic polyurethane paint to IS 13213 (Latest)	02/ DFT= 35µm/ coat 01/ DFT= 30µm/ coat	Smoke grey Shade 692 of IS 5	250
		ESP columns- Below 0.0 level- Two coats of primer as mentioned above shall be applied since this item will be embedded inside the concrete pedestal.								
03	Stringer and guard plates (8X 610), Hand rails, post, step treads, Floor grills (8X 611,612,613),	Hot dip galvanizing to a coating weight of 610gm per sq. m (minimum) and to a coating thickness of 85 microns (minimum)								

Part- III contd….

Sl no	PGMA/Description	Surface preparation & surface profile	Primer coat		Intermediate coat		Finish coat			Total DFT µ (min)
			Paint	No of coats/ DFT	Paint	No of coats	Paint	No of coats	Shade	
04	Insulator housing assy (7X X06), Gas distribution assy (7X X08), GD rapping mechanism (7X X09), Gas screening (7X X11), Emitting system suspension (7X X13), Emitting Electrode rapping (7X X16), Suspension arrangement for CE (7X X19), Frame of Emitting system Top, middle& bottom (7X X21, X22, X32), shock bars(7X X24), CE rapping mechanism (7X X25)	Blast cleaning to near white metal Sa 2½ (SSPC SP10) Surface profile of 35-50µm	Red oxide zinc phosphate primer (Alkyd base) to IS 12744	02/ DFT= 30µ/ coat	--	--	--	--	--	60

Sl no	PGMA/Description	Surface preparation & surface profile	Primer coat		Intermediate coat		Finish coat			Total DFT µ (min)
			Paint	No of coats/ DFT	Paint	No of coats	Paint	No of coats	Shade	
05	EE (7X X15) (EE hook), EE suspension hook (7X X13), CE (7X X20), CE suspension hook (7X X19), Foundation material for ESP structures & ducts (7X X80)	--	Temporary rust preventive oil dry type (**)	40	--	--	--	--	--	40
E	**GATES AND DAMPERS**									
01	Gates and Damper Temperature ≤ 95°C (57-0XX, 57-1XX)	Blast cleaning to near white metal Sa 2½	Inorganic Ethyl zinc silicate	01/ DFT= 80µm/ coat	--	--	Epoxy based polyamide cured	01/ DFT= 80µm/ coat	Smoke grey	160

		(SSPC SP10) Surface profile of 35-50µm	primer to IS 14946 (Latest)				finish paint to IS 14209 (Latest)		Shade 692 of IS 5	

Sl no	PGMA/Description	Surface preparation & surface profile	Primer coat		Intermediate coat		Finish coat			Total DFT µ (min)
			Paint	No of coats/ DFT	Paint	No of coats	Paint	No of coats	Shade	
02	Gates and Damper Temperature > 95°C (57-2XX, 57-3XX, 57-4XX, 57-6XX)	Blast cleaning to near white metal Sa 2½ (SSPC SP10) Surface profile of 35-50µm	Inorganic Ethyl zinc silicate primer to IS 14946 (Latest)	01/ DFT= 80µm/ coat	--	--	Heat resistant aluminium paint as per IS 13183 (Gr I- Upto 600°C	02/ DFT= 20µ/ coat	Aluminium	120
03	Gates blades, Machined components of G&D	--	Temporary rust preventive oil dry type (**)	40	--	--	--	--	--	40

Sl no	PGMA/Description	Surface preparation & surface profile	Primer coat		Intermediate coat		Finish coat			Total DFT µ (min)
			Paint	No of coats/ DFT	Paint	No of coats	Paint	No of coats	Shade	
F	CHIMNEY									
01	Foundation bolt (87010)	Power tool cleaning to St-3 (SSPC SP3)	Temporary rust preventive oil dry type (**)	40	--	--	--	--	--	40
02	Shells- Inside and Uninsulated side, base plate (87 100)	Blast cleaning to near white metal Sa 2½ (SSPC SP10) Surface profile of 35-50µm	Inorganic Ethyl zinc silicate primer to IS 14946 (Latest)	01/ DFT= 80µm/ coat	--	--	Heat resistant aluminium paint as per IS 13183 (Gr I- Upto 600°C, Gr II- 200°C to 400°c Gr. III- Upto 200°C)	02/ DFT= 20µ/ coat	Alumi nium	120
03	Ducts uninsulated, Strakes, (87150), Painter trolley (87200)	Blast cleaning to near white metal Sa 2½ (SSPC SP10) Surface profile of 35-50µm	Inorganic Ethyl zinc silicate primer to IS 14946 (Latest)	01/ DFT= 80µm/ coat	--	--	Heat resistant aluminium paint as per IS 13183 (Gr I- Upto 600°C, Gr II- 200°C to 400°c Gr. III- Upto 200°C)	02/ DFT= 20µ/ coat	Alumi nium	120

Part- III contd….

Sl no	PGMA/Description	Surface preparation & surface profile	Primer coat		Intermediate coat		Finish coat			Total DFT µ (min)
			Paint	No of coats/ DFT	Paint	No of coats	Paint	No of coats	Shade	
04	Shells- Outside insulated (87100), Ducts- Insulated (87150)	Blast cleaning to near white metal Sa 2½ (SSPC SP10) Surface profile of 35-50µm	Inorganic Ethyl zinc silicate primer to IS 14946 (Latest)	01/ DFT= 80µm/ coat	--	--	Heat resistant aluminium paint as per IS 13183 (Gr I- Upto 600°C, Gr II- 200°C to 400°c Gr. III- Upto 200°C)	02/ DFT= 20µ/ coat	Aluminium	120
05	Ladders, Hand rails, Floor grills. Platforms (87300)	Hot dip galvanizing to a coating weight of 610gm per sq. m (minimum) and to a coating thickness of 85 microns (minimum)								

ANNEXURE I

NOTES FOR PAINTING SCHEME PART I, II& III

1. This painting scheme covers a comprehensive list of PGMAs being used in 125 to 800MW in an effort to standardize the painting scheme. Therefore, entire list of PGMAs will not be applicable for any specific project and only those PGMAs applicable for the project may be used, while choosing the painting scheme applicable.
2. Rust preventive coating should be given on HSFG bolt and nut threads and inside surfaces of fabricated structure shall be painted with red oxide primer paint during fitup stage.
3. All threaded & machined surfaces are to be applied with a coating of Temporary Rust preventive oil.
4. All surfaces of foundation materials, insulation pins, Anchor channels, Sleeves Splice/ cover plate/ gusset plate and metal contact area usually bolted at site to enhance the load transfer by friction grip shall be coated with temporary rust preventive fluid and during execution of civil works; the dried film coating shall be removed using organic solvents.
5. PGMAs under sub vendor items are not indicated. Please refer respective Engineering document for all sub-vendor items. Whenever it is not specified, it shall be as per the painting scheme of the applicable PGMA.
6. No painting is required for Aluminium, Stainless steel components and galvanized items. Abrasive blast cleaning to SSPC – SP 6 (Sa 2) grade shall be done on any damaged painting area. This repair is not applicable to inorganic ethyl zinc silicate pained component.
7. The Temporary rust preventive coating that has already been applied on any component, tubes, pipes etc shall be visually inspected for good adherence. If the coating is intact, direct coating of alkyd based red oxide paints over the coating is permitted. In case the coating is peeled off over a large area, then the coating is to be removed by suitable solvents/ heating to 350- 400 deg C for an hour before primer paint application- but in this case, it should be ensured that the minimum surface cleanliness required for primer paint application shall be SSPC – SP2 (equivalent- Hand tool cleaning)
8. All currently active PGMAs are covered. Requirements for Missing / new PGMAs will be included under the relevant section following the appropriate paint logic.
9. Ground shade/ color finish paints & identification tag/ band for equipments, supporting structures and other components shall be followed as per tender.
10. In components, wherever plate/ sheets of thickness less than or equal to 4mm, tubes/ rods are used, power/ hand tool cleaning to SSPC- SP3/ SSPC-SP 2 shall be followed and the painting shall be done as per SL no: D/01 of PRQA:590- Section II A/B/C. For all commissioning components- erection materials two coats of Red oxide Zinc phosphate primer shall be applied to meet the temporary protection till erection, after power tool cleaning.
11. Touch-up painting of damaged areas shall be carried out as per clause applicable painting scheme.
12. Structural members having welded connections at site, relevant area can be painted with primer paint instead of weldable primer.
13. This painting scheme is the final document and it overwrites any other document indicating painting/ coating schemes. The component not covered in approved painting scheme, this is the document to decide the type of paint application.
14. All components covered under different PGMAs are to be painted. In case any component is left out, the same shall be deemed to be included under relevant section.

ANNEXURE II

INSPECTION & TESTING PLAN FOR SURFACE PREPARATION, PAINTING

SL NO	COMPONENT/ OPERATION	CHARACTERISTICS	CL	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOC/ ACCEPTANCE NORM	TYPE OF RECORD	AGENCY			REMARKS
								M	C		
1.0	Surface preparation for plates/ rolled sections/ components										
1.1	Raw material	Rust, pitting	B	Visual	100%	Note 1	R	P	V	-	
1.2	Blasting media	Type of quality of abrasives	B	Random sample test	Abrasive quality for each lo	Note 1a	R	P	V	-	
1.2.1	Blasting/ Power tool cleaning	Surface roughness/ cleanliness	A	Visual, Measure-ment	100% 10 spots/ sq.m	Surface profile as per approved painting scheme, Note 2	R	P	W	-	
		Profile defects	B	Visual	100%	Note 3	R	P	W		
1.2.2	Substrate dust contamination (for blasting)	Adhesive Tape test	B	Measure-ment	Two spots/ component	Note 4	R	P	W	-	Randomly selected 10X magnifier, Transparent adhesive tape 25mm width
1.2.3	Substrate chemical contamination (for blasting)	Surface contamination test	B	Measure-ment	One test/ abrasive lot used	SSPC SP 12 Chloride <15µg/cm² (PPM) Sulphate <20 PPM	R	P	W	-	Any suitable method to identify salt contamination
1.2.4	Substrate-coating conditions	Flash rusting steel temp environmental condition	A	Visual Measure-ment	100% One spot/ Lot	Note 5	R	P	V	-	
2.0	In process Painting										
2.1	Paint	Physical& Chemical	A	Review of documents	100%	Invoice/ data sheet	TC	P	V	-	Physical verification of shade, batch no, date of manufacture, supplier approval status
2.2	Mixing (Two pack system)	Mixing ratio& Durations	B	Documents	100%	Painting data sheet Note 6	R	P	V	-	Electrical/ pneumatic agitator

SL NO	COMPONENT/ OPERATION	CHARACTERISTICS	CL	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOC/ ACCEPTANCE NORM	TYPE OF RECORD	AGENCY			REMARKS
								M	C		
2.2.1	Filtering	Free from foreign particle	B	Documents	100%	Use sieves 80-100 microns	R	P	V	-	Nylon mesh or muslin cloth
2.2.2	Paint testing	Physical & chemical properties	C	Lab test	Random	Suppler TC/ Data sheet/ IS specificaions	R	P	W		Sample collected at each vendor at regular intervals as advised by BHEL shall be sent to BHEL/ NABL accredited lab
2.2.3	Painting	Personnel qualification Inspection personnel	C C	Review of documents	100%	In line with this PRQA- Annexure III Certification by reputed institution or by an Expert. (NACE/SSPC/ Level II)	R R	V V	V V		
2.3	Airless/ Air spray	Spray process pot life	B	Documents	100%	Supplier manual Tip selections, Note 7	R R	V P	V V		
2.4	Coating thickness & coating intervals	Wet film, Dry film thickness	B	Measurement	100%	SSPC- PA 2 Note 8	R	P	V		
		Intervals	B	Documents	100%	Painting data sheet/specification	R	P	V		Min: 24 hrs or as per paint specification / data sheet
3.0	Final Testing										
3.1	Peel off test Cross cu/ X-cut	Adhesive strength between substrate & primer and subsequent over coats	A	Test on each coat: Primer, Intermediate& final coat	3 spots	ASTM D3559-7 Note 9	R	P	W		4x magnifier lens, 25mm width pressure sensitive tape (P99), cutting edges with template

SL NO	COMPONENT/ OPERATION	CHARACTERISTICS	CL	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOC/ ACCEPTANCE NORM	TYPE OF RECORD	AGENCY			REMARKS
								M	C		
3.2	Final Inspection	Dry film thickness	A	Document	15 spots/ sq.m	Approved painting scheme, SSPC PA 2	R	P	W		
		Finish, shade and paint defect	A	Visual	100%	Note 8	R	P	W		Use of shade card

NOTE- 1: Rust Grade

As per ISO 8501-1, rust and painting are graded into four categories as A, B, C & D. Rust and pitting shall be removed by competent process prior to application of primer. Pitted area shall be cleaned by blasting/ power tool cleaning/ grinding provided thickness shall be met to the design requirement. Plates/ components identified under heavy pitted category C or D, acceptance/rejection reserved to QC/ BHEL.

NOTE- 1a: Blasting media

Blasting media shall be copper slag, iron slag, steel shots/ grits & aluminum oxide. The abrasive used for blasting process shall be within chemical contaminations chloride<15ppm and sulphate <20ppm. Mixing ratio of shots/ grits (generally 3:1) shall meet the surface roughness 35-50 microns after blasting. Blasting media shall be suitably sieved to get the required particle size 0.5 to 1.0mm. (Steel shots ASTM G40/G80)

NOTE- 2: Blast cleaning

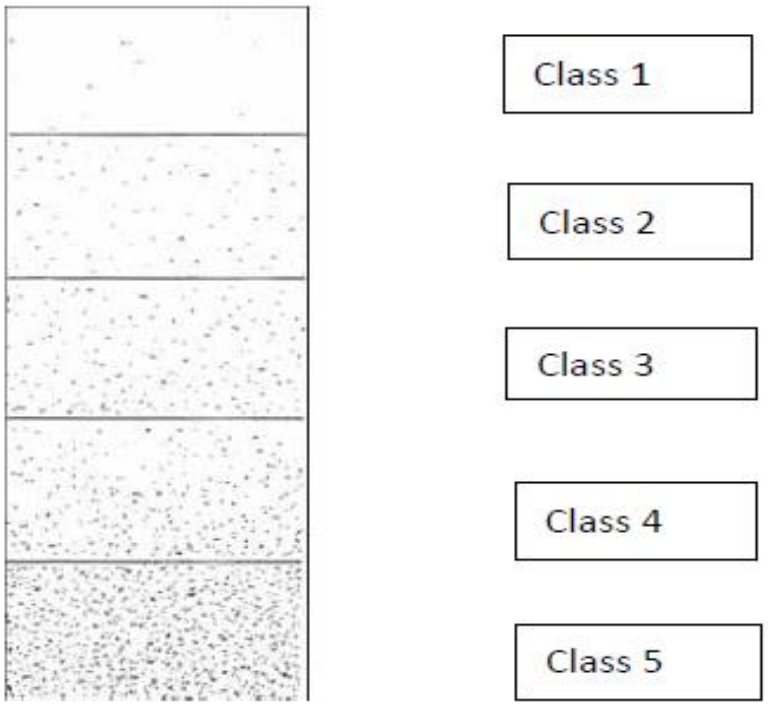
a) Air quality must be checked before start of blasting process by blotter test
b) Surface finish: The blasted surface shall meet the SSPC- SP10 (SA 2.5) finish near white metal. Surface roughness shall be checked in 10 spots/Sq.m. Digital/ Analog instrument duly calibrated shall be used to measure the surface roughness. Power tool cleaned surface shall be met to SSPC- SP3. Blasting/ power tool cleaned surface shall be met as per ISO 8501-1 requirement.
c) Surface roughness: Average value shall be 35-50 microns for blast cleaned surface.
d) Blasting: Shall not be done during rainy/ mist seasons where relative humidity is more than 80%.
e) Optimum blasting pressure and nozzle size (straight bore or venturi type) to get required surface roughness (90-100psi for mineral abrasives and 120-125 psi for metallic abrasives, standing distance 12-18 inches and standing angle 80-90 deg. for full blasting, sweep blast 45-60 deg. with respect to the substrate).

NOTE- 3: Profile defects

a) Surface shall be visually checked and free from defects such as rust, dust, grease, oil, sharp corner/edges, rolling imperfection/ overlap, vein, undulations, mill scales, improper weld beads/ shapes/ undercuts, weld slag, spatters etc.
b) Sharp corner/edges shall be ground off to radius 1.5 to 2mm and blunted. Other profile defects if any shall be ground/chipped out/ repaired by suitable means

NOTE- 4: Dust

A transparent adhesive tape test shall be conducted on substrate to ensure cleanliness of the substrate and same shall meet the class 1 requirement.



NOTE- 5: Coating conditions

a) Abrasive media used for blasting shall be free from moisture and other contaminations.
b) Flash rusting if any shall be removed by sweep blasting

c) Primer paint shall be applied immediately or within 4 hours in case of blast cleaning and within 8 hours in case of power tool cleaning.
d) Painting shall not be done during rainy/ mist seasons when relative humidity is >80%.
e) Painting shall be commenced, when the metal surface temperature is >3°C above the dew point temperature
f) Painting shall not be done, when the steel surface temperature is >45°C.
g) A suitable instrument duly calibrated is required to check the dew point temperature and steel surface temperature.

NOTE- 6: Mixing

a) Paint mixing ratio for two packs painting system shall be done as per the painting data sheet provided by the manufacturer. Individual component shall be mixed thoroughly and then mix the component as per data sheet ratio (by volume or by weight). Blend by boxing is prohibited for inorganic zinc rich primer (ie react with moisture). Off ratio (partial ratio) blends won't cure properly.
b) Mixing of thinner is not required for airless spray, however mixing of thinner<5% is permitted. If required add thinner after mixing of paints and mix it with homogenously.
c) Paint mixing shall be done at least for not less than 20 minutes or as per paint data sheet with electrical/ pneumatic operated tool to achieve mixing chemically matured.
d) Mixed paint particles shall be filtered with sieves of 80-100 microns to avoid clogging of nozzle tip. Once components are blended, pot life begins and use the mixed paint immediately as specified pot life period indicated in the data sheet.
e) Zinc rich primers dispersed slowly in to binder and agitate slowly while mixing process.
f) Primer, Intermediate and final coat shall be the same supplier, if any change, compatibility certificate shall be obtained from the paint supplier.

NOTE- 7: Spray process

a) Painting shall be done at controlled environment only and free from dust& paint soot.
b) When volume of solids of paint s more than 50%, airless spray shall be selected for painting application.
c) Select proper nozzle tip size and pressure to achieve uniform DFT and less wastage.
d) Painting shall be done within pot life period specified in the paint product data sheet, to avoid premature paint failure.
e) Avoid arcing, tilting and maintain constant distance (12-18 inch), tip selection, tip pressure according to paint, triggering at appropriate locations and banding while painting.
f) While painting of inorganic zinc silicate, RH shall be above 65%, if painted below RH 65% water curing is required.
g) Top coat over and above epoxy intermediate coat shall be done within a month and proper roughness shall be created before top coat.

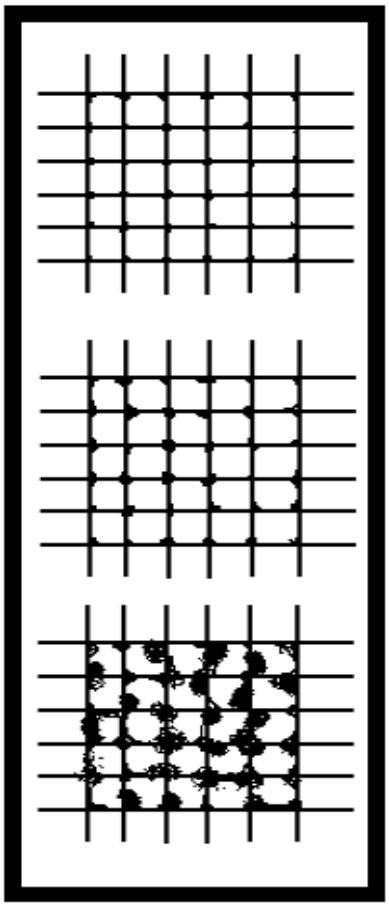
NOTE- 8: Coating Thickness

a) Wet film thickness (WFT) shall be measured immediately after paint applications using Comb gauge/ eccentric wheel.
b) WFT can be calculated as: WFT= (100XDFT)/ VS where, DFT is the dry film thickness and VS= % of volume solid of supplied paint from data sheet.
c) Dry film thickness shall be measured after hard dry condition of each coat.
d) Dry spray/ Dust particles embedded after previous coat shall be cleaned/ removed with fine emery paper prior to application of subsequent coat. Coating thickness shall not be less than the requirement as specified in the painting scheme at any case tolerance on total DFT as specified in the applicable painting scheme shall be within -0/+20 microns or +10% of total DFT, whichever is higher.
e) Coating thickness shall not be less than the requirement as specified in the painting scheme at any case tolerance on total DFT as specified in the applicable painting scheme shall be within -0/+20 microns as specified in the applicable painting scheme.
f) Painted surface shall be free from paint defects namely crack, sagging, dry spray, orange peel etc.
g) Finish and shade as per paint data sheet. A painted panel shall be made available with at works to check/ compare the painted surface.

NOTE- 9: Peel off Test

a) Paint peel off test shall be done after 48 hours of painting operation, on single/ multi coated painted surface of the component for each coat.
b) When total DFT is less than 125 microns- Cross cut method shall be followed.
c) DFT up to 50 microns 1mm spacing with 6 cuts minimum to the length of 20mm.
d) DFT more than 50 microns and less than 125 microns 2mm spacing with 6 cuts minimum to the length of 20mm.
e) When total DFT is more than 125 microns- X cut method shall be followed. The smaller angle of cut shall be between 30 to 45 degrees cut to length of 40mm.
f) For all tests, ensure that coating film has been penetrated and minimum three locations shall be tested.
g) The adhesion test shall be conducted where the substrate temperature is below 35°C for alkyd base paints.

Acceptable norm for Cross cut method:



< 5% Peel- Acceptable-(5A)

5-10% % Peel – Acceptable (4A)

>10% Peel - Not Acceptable (3A)

Acceptable norm for X cut method:

5A- No peeling- Acceptable

4A- Trace peeling along incisions or at their intersection- Acceptable

3A- Jagged removal along incision up to 1.6mm on either side- Not acceptable

PAINTING INSPECTION FORMATS

VENDOR CODE	I ST VENDOR : FABRICATION/ 2 ND VENDOR BLASTING							
	SURFACE PREPARATION (POWER TOOL/BLASTING REPORT							
PAINTING SCHEME			REPORT NO& date					
PROJECT			PO.NO.					
WO.NO.								
PRODUCT DESCRIPTION								
SURFACE PREPARATION (REF STANDARD ISO 8501)								
Sieve size used and size of abrasive								
BLASTING MEDIUM USED			RAW MATERIAL RUST GRADE A B C D					
DU .NO	QTY	TEMPERATURE			RH	DATE	START TIME	END TIME REMARKS
		DRY BULB	WET BULB	DEW POINT				
MOISTURE CONTENT TEST FOR IF COMPRESSED AIR USED (BLOTTING PAPER CHECK)							OK / NOT OK	
SURFACE PROFILE GAUGE READING(IN MICRONS) DATE & TIME SURFACE FINESH TO SA 2.5 (SSPC SP 10)/ SURFACE CLEANLINESS FOR POWER TOOL CLEANING								
SURFACE SALT CONTAMINATION TEST(IF ANY) FOR BLASTED SURFACE					REPORT		OK / NOT OK	
DUST FREE CHECK TEST FOR BLASTED SURFACE	TAPE REPORT							
DUST FREE CHECK RESULT LEVEL FOR BLASTED SURFACE	1 2 3 4 5							
Visual inspection(pitting, weld spatter/slag, rolling defects ,etc.,								
FIRM QC	TPI /BHEL QC							

VENDOR CODE	1'ST VENDOR;FABRICATION, 2'ND VENDOR: PAINTING									
	PAINT REPORT									
PAINTING SCHEME			REPORT NO & date							
PROJECT			PO.NO.							
WO.NO.										
PRODUCT										

PRIMER COAT PAINT

PAINT SPECIFICATION/STD IS No:..... /SHADE	
PAINT MANUFACTURER	
SUPPLIER/TRADER NAME	
MANUFACTURING DATE / BATCH NO. / TC No	
MIXING RATIO / TWO PART SYSTEM IF ANY	
NUMBER OF COAT	
DURATION OF MIXING (use of stirrer) DATE / TIME :	

DU NO	QTY	TEMPERATURE				RH	DATE	START TIME	END TIME	REMARKS
		DRY BULB	WET BULB	METAL SURFACE	DEW POINT					

WET FLIM THICKNESS (in microns)			
SPRAY GUN USED			
HARD DRY TIME (REQURIED)			
DFT REQUIRED			
DFT ACTUAL MEASURED (SSPC PA 2)			
Visual inspection(pitting,weld spatter/slag,rolling defects ,etc.,) / paint defect			
PEAL OFF TEST(AST M- D3359)	CROSS CUT TEST DFT UP TO 50 MICRONS PITCH 1mm , cut Length 20mm	REPORT	OK / NOT OK
	CROSS CUT TEST DFT BETWEEN 50 TO 125 MICRONS PITCH 2mm, cut length 20 mm	REPORT	OK / NOT OK
	X CUT TEST ABOVE 125 MIC(included angle 30 to45 deg, cut length 40mm)	REPORT	OK / NOT OK

FIRM QC	TPI /BHEL QC

VENDOR CODE	1ST VENDOR;FABRICATION 2ND VENDOR: PAINTING
	PAINT REPORT

PAINTING SCHEME	-	REPORT NO& Date	
PROJECT		PO.NO.	
WO.NO.			
PRODUCT			

INTERMEDIATE/FINAL COAT

PAINT SPECIFICATION/ SHADE	
PAINT MANUFACTURER	
SUPPLIER/TRADER NAME	
MANUFACTURING DATE / BATCH NO. / TC No./DC	
MIXING RATIO / TWO PART SYSTEM IF ANY	
NUMBER OF COAT	
DURATION OF MIXING (use of stirrer) DATE / TIME :	

DU NO	QTY	TEMPERATURE				RH	DATE	START TIME	END TIME	REMARKS
		DRY BULB	WET BULB	METAL SURFACE	DEW POINT					

WET FLIM THICKNESS (in microns)	
SPRAY GUN/NOZZLE NO USED	
HARD DRY TIME (REQURIED)	
DFT REQUIRED	
DFT ACTUAL MEASURED (Not less than specified in painting scheme)	
Visual /paint defect (if any)	

Peel of test (ASTM-D3359)	CROSS CUT TEST DFT BETWEEN 50 TO 125 MICRONS PITCH 2mm, cut length 20 mm	REPORT	OK / NOT OK
	X CUT TESTABOVE 125 MIC(cut included angle 30 to45 deg, cut length 40mm)	REPORT	OK / NOT OK

FIRM QC	TPI/BHEL QC

ANNEXURE III

PROCEDURE FOR QUALIFICATION OF PAINTERS

1.0 SCOPE

This standard describes, in general, the procedure and criteria to be followed for qualifying an operator/ painter for carrying painting work at BHEL Shop or at vendor works.

2.0 OBJECTIVE:

To evolve criteria and procedure for qualification of operators/ painters.

3.0 PROCEDURE:

Following procedure shall be adopted for certification of operator/ painter qualification for carrying out painting process.

3.1 Vendor shall initiate the format 'Record of personnel deployed for painting work' as shown in Annexure III A. This annexure is subsequently forwarded to concerned department of the unit.

3.2 Concern department is to forward to the reputed agency/expert having NACE/ SSPC (Level II) shall assess and certify the suitability of an operator / painter to conduct a painting process. In case, a new operator/ painter is inducted shall have experience in the painting field minimum 2 years and qualification not less than VII std, then he shall be assessed by reputed agency/expert. In case, an operator/painter does not carry out painting work for more than two years, then he shall be re-qualified and issued a certificate in line with the annexure.

3.3 An operator/ painter engaged in carrying special process like painting shall be re-qualified once in 3 years.

3.4 Following criteria have been identified and evaluated for each operator/ painter. Each criterion has been allocated 10 marks.

3.4.1 Mainly, there are three types of painting processes which are being followed for carrying out painting, these are

- Brush application
- Air spray painting
- Airless spray painting/ Air assisted airless spray

The operator is expected to know the basics of the above painting processes, technical details of process equipment and their salient features, awareness about Do's and Don'ts in painting work.

3.4.2 Understanding of the documents/ specification

The operator/ painter should have the knowledge about surface cleaning and acceptance norms, paint systems, mixing ratio and pot life of two pack systems, drying and curing behavior, use of proper thinner, control of viscosity and its importance, over-coating interval, precautions to be observed during their use etc.

3.4.3 Awareness about handling of materials/ jobs

The operator/ painter is expected to have knowledge about handling of paint components like base, hardener and thinner, handling and upkeep of painting equipment, cleaning of brush, gun and other parts of equipment. He is also expected to know how to handle cleaned and painted jobs.

3.4.4 Performance evaluation based on job/samples

The operator / painter shall be asked to prepare the test panel/job which shall be evaluated for following parameters:

- Uniformity of coating + 10% DFT required.
- Visual defects like brush marks, wrinkles, pinholes etc.
- Surface finish, gloss
- Presence of dry spots, overflow marks

The operator/ painter shall first clean the test panels thoroughly followed by a coat of primer/ finishing paint etc, using requisite painting process , i.e., brush/ air spray/ airless spray etc. After evaluation of test panels and based on result, the marks shall be allotted. After evaluation of test panels and based on result, the marks shall be allotted.

3.4.5 Knowledge about safety and hygiene

Each operator/ painter is expected to know about the safety of self and surroundings, use of safety appliances, effect of solvent vapors on health etc. He is supposed to know personal hygiene as well as upkeep of painting equipment and painting area.

3.4.6 Classroom training

A class room training by the supplier/ expert (manufacturer like Nerolac, Berger etc) of the paint which we are procuring, must be arranged for the painters to have knowledge about the paints, enamels, coatings etc and their applications. The class room training must be arranged in local languages for understanding of the painters.

4.0 CERTIFICATION FOR QUALIFICATION

Each operator/ painter is evaluated for above criteria and marks are being allotted for each criterion. The operator/ painter must obtain a minimum marks 5 for each criteria and

qualifying marks shall be 25 out of 50. The painter should pass in field/ practical test, even performed well in the written examination. The certification shall be specified in the area of type of application process as a painter is qualified. (example: airless/ spray/ pressure pot/ air spray) etc.

5.0 ISSUE OF CERTIFICATE

The operator/painter who qualifies the test shall be issued a certificate in standard format shown below, which shall be kept in the concerned and certifying department/ vendor works for record. The format can be modified to suit the requirement at vendor works with prior approval from QA. This certificate shall be signed by initiating section in charge and certifying department/ reputed agency/expert

6.0 VALIDITY

The validity of the certificate is for 3 years from the date of issue. The operator/ painter is required to appear for re-test to extend the validity.

Annexure III- A

RECORD OF TRAINING & QUALIFICATION FOR PERSONNEL TO BE DEPLOYED FOR PAINTING PROCESS

Photo

VENDOR NAME AND ADRESS

1. Name :
2. Father's name :
3. Date of birth/ Age :
4. Basic Qualification :
5. Experience in the painting field :

Name of Expert trainer :
Designation :

Date of start of training	Training subject	Faculty	Duration (Hrs.)	Certificate issued Yes/no	Remarks
	1.Painting process and Equipment		2		Issued on
	2.Painting Document/ Data sheet/Batch TC		1		
	3.Knowlege of paint component and mixing		1		Validity up to:
	4.Painting performance Evaluation on sample		2		
	5. Safety and hygiene		1		

Marks obtained: (each section carry 10 marks)

1) Knowledge of painting process and equipment : ----------
2) Understanding of documents / specification : ----------
3) Handling of components : ----------
4) Performance evaluation based on jobs/samples : ----------
5) Knowledge of safety and hygiene : ----------

Qualifying marks are 25/50

Qualified for : Airless spray & air spray
Painting System : Alkyd/ Epoxy/zinc silicate and heat Resistant based paints

Signature of Initiating Official

Signature of Certifying expert

ANNEXURE IV

Painting Scheme- Details for procurement and application process

Sl no	Generic nature of paint	Theoretical covering capacity Sq. m per litre	No of pack	Volume solids % (min)	DFT in microns (min) per coat	Shade	Shade no to IS 5	Mode of appln	Over coating Interval hrs
01	Heat resistant Aluminium paint to IS 13183 Gr. I	10	1	--	--	Aluminium	--	Brush/ Spray	24
02	Heat resistant Aluminium paint to IS 13183 Gr. II	10	1	--	--	Aluminium	--	Brush/ Spray	24
03	Red oxide zinc phosphate primer to IS 12744	10	1	--	--	Red oxide	--	Brush/ Spray	12
04	Epoxy Zinc rich primer to IS 14589 Gr.II	8	2	35	40	Grey	--	Spray	24
05	HB Chlorinated rubber based zinc phosphate primer	10	1	40	50	Grey	--	Brush/ Spray	12
06	Epoxy based zinc phosphate primer to IS 13238	10	2	40	35	Grey	--	Spray	24
07	Inorganic Ethyl Zinc silicate to IS 14946	8	2	60	65	Grey	--	Spray	24
08	Polyamide cured Epoxy based MIO/ TiO_2 pigmented intermediate coat	8	2	50	75	Grey/ Brown	--	Spray	16
09	Long oil alkyd synthetic enamel finish paint to IS 2932	10	1	--	--	Reqd. shade	Corrpdg. Shade no	Brush/ Spray	12
10	Epoxy based polyamide cured finish paint to IS 14209	10	2	40	35	Smoke grey/ Grey white	692 RAL 9002	Spray	24
11	Aliphatic acrylic polyurethane paint to IS 13213	10	2	40	30	--	--	Spray	24

Sl no	Generic nature of paint	Theoretical covering capacity Sq. m per litre	No of pack	Volume solids % (min)	DFT in microns (min) per coat	Shade	Shade no to IS 5	Mode of appln	Over coating Interval hrs
12	Temporary rust preventive fluid (Non- drying type) to PRQA 522 (Latest)- For APH Elements	10	1	--	--	Black	--	Dip	--
13	Temporary rust preventive fluid (Drying type) to TEP:AQCS:RP (Latest)- For CE coils	10	1	--	--	Black	--	Dip	--
14	Temporary rust preventive fluid (Drying type) to PRQA:523 (Latest) for other components	10	1	--	--	Amber	--	Brush/ Spray	12
15	Sea worthy rust preventive fluid to PRQA:524 (Latest) for other components	10	1	--	--	Amber	--	Brush/ Spray	12

ANNEXURE V

GOOD PAINTING PRACTICES (DO's and DON'Ts IN PAINTING):

1.0 Do's:

a) Remember, painting is an important value adding activity. Give it all your care.
b) Store paints in covered places. Avoid direct exposure to sunlight on paints.
c) Ensure the validity of the shelf life of the paint before use.
d) Roll the paint drum several times to ensure thorough mixing of the paint before use.
e) Use proper tools to open lid of the drum.
f) Mix the paints thoroughly to ensure homogeneity.
g) Apply strip coat on edges, corners and weld beads.
h) Follow instructions on the paint can or literature whenever a new scheme/ source of paint is used.
i) Draw only the required quantity of the paint for the job and immediately recap the can.
j) Ensure proper ratio of mixing in case of two pack system, as per norms.
k) Use only the specified thinner prescribed by the supplier or standard.
l) Ensure good quality of compressed air (free from moisture and oil) prior to spray painting.
m) Use only clean/ new brushes of definite size for painting.
n) Clean the bristles well in the thinner before they are used for the painting.
o) Painting shall be done in a well-ventilated area/ identified area
p) Ensure proper surface preparation as per the painting scheme.
q) Ensure that the blasted surface be painted within 4 hours after blasting.
r) Ensure that the surface to be painted is free from oil, grease, stay arcs, dents etc.
s) Adhere to the number of coats shade, dry film thickness and inter-coat curing time interval as specified. Clarify with lab, if needed.
t) Use lint free cloth/ clean wiping rags for cleaning the surfaces prior to the painting.
u) Maintain the right distance between the surface and spray gun (6 inches to 8 inches)
v) Ensure that the mixed paints will be used before the expiry of its pot life in case of two-pack systems.
w) Ensure that the items to be painted are inspected and cleared by the inspection personnel concerned.
x) Preserve the balance thinned paints in a separate closed container for future use, if they don't have any restricted pot life.
y) Clean the brush before and immediately after painting. Keep them clean during interruptions too.

2.0 Don'ts:

a) Do not use the paint, which has crossed its expiry date.
b) Do not draw more paint than necessary from the stores.
c) Do not make holes in the drum to draw the paint.
d) Do not keep the paint drum open for a long time.
e) Do not interchange the thinners for the same generic paint between suppliers.
f) Do not use kerosene as thinner.
g) Do not smoke while painting.
h) DO not leave the brush without cleaning after painting.
i) Do not paint close to a welding area.
j) Do not paint when there is rain or sandstorm or when the relative humidity is about 90%.
k) Do not paint when the metal is chill (temp< (dew point+3°C) or very hot (>48°c)
l) Do not paint when the surface is not cleaned/ prepared for painting requirements.
m) Do not paint the finish coat if the primer coat is not satisfactory.
n) Do not leave the balance paint open after painting.
o) Do not use VCI pellets for stainless steel components and its composite assemblies.

3.0 CLEANING OF PAINTED & RUST PREVENTIVE COATED SURFACES

Wherever required, paints and rust preventive protection can be removed either by using the following commercial solvents or by flame cleaning/ blasting

For rust preventive	Acetone, Methyl Ethyl ketone or Tri-chloro Ethylene
For all paints	Alkaline paint strippers or Solvent based paint strippers

4.0 SURFACE PREPARATION

- Surfaces of components shall be thoroughly cleaned before the application of primer paint and shall be free from grease, oil, rust, weld slag, spatters etc.
- Abrasive blast cleaning to SSPC SP6 (Sa 2) grade shall be done to prepare the surfaces of hot worked pipes prior to application of primer.
- A comparative chart indicating the surface preparation standard equivalents is given below for ready reference.

DESCRIPTION	SSPC SCHEME	SWEDISH STANDARD SIS - 05 - 5900
Solvent cleaning	SSPC- SP 1	-
Hand tool cleaning	SSPC- SP 2	St2
Power tool cleaning	SSPC- SP 3	St3
Flame cleaning	SSPC- SP 4	F1
Blast cleaning to White metal	SSPC- SP 5	Sa3
Commercial blast cleaning	SSPC- SP 6	Sa2
Brush off blast cleaning	SSPC- SP 7	Sa1
Pickling	SSPC- SP 8	-
Blast cleaning to near white metal	SSPC- SP 10	Sa 2½

5.0 APPLICATION OF PAINT

a) Primer paint shall be applied immediately or within 4 hours in the case of shot blast cleaning and within 8 hours for mechanical cleaning.
b) Wherever tubes/ pipes are not either shot blasted or heat treated during manufacture, the rust preventive coating provided by the tube/ pipe mill shall be treated as base for primer coating for subsequent painting of alkyd base paints like one coat of red oxide zinc phosphate (when called for). When special paint is specified in the painting scheme, the existing rust preventive fluid is to be removed by blast cleaning. However, rusted areas are to be cleaned free of oil, grease, rust etc. thoroughly using emery paper/wire brush and making rust preventive coated surfaces coarse.
c) Ready mixed paints shall be used as supplied by the supplier without any addition of thinner unless otherwise specified. Two pack systems are to be used as per supplier's instructions.
d) Wherever second coat of finish coat is to be applied in succession, 24 hours minimum drying time shall be provided between each coat for single pack paints. For two-pack system refer paint supplier's catalogue.
e) No painting is required in case of Stainless Steel, Aluminium and Galvanized components, unless otherwise specified in contracts.
f) For all machined components, rust preventive fluids shall be applied.
g) All weld edge preparations for site welding shall be applied with one coat of weldable primer. For small components having weld ends on both sides, full surface can be painted with weldable primer.
h) Part processed items meant for shop assembly shall be painted at sub-contractors works with primer/ special paints (when called for in the painting scheme) based on the scope

of the indent/ purchase order. Further paint touchup/ Coating shall be given appropriately during assembly.

i) For items meant for Spares and subcontracting where no further processing is involved, the painting scheme selected shall be the same as that of similar product configuration / description and not with respect to PGMA. All running meter items for spares one coat of red oxide primer and two coats of Synthetic enamel paint to IS 2932 (Latest) shall be supplied.

j) Assemblies consisting of machined components and special equipments shall not be shot blasted wherever it may affect the system. In such cases power tool cleaning may be adopted for the localized areas only.

BHARAT HEAVY ELECTRICALS LTD
BOILER AUXILIARIES PLANT
TANIPET-632 406 (INDIA)
QUALITY ASSURANCE DEPT.

STANDARD QUALITY PLAN FOR WELDING

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REV.No.NIL
DATE10-06-93
PAGE 01of02

PREPARED BY: V. Jayaram REVIEWED BY: M Tambekh APPROVED BY: M Tambekh

No.	COMPONENT & OPERATION	CHARACTE-RISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE STANDARD	FORMAT OF REC	AGENCY	REMARKS
	2	3	4	5	6	7	8	9	10	11
1	WELDING ELECTRODE/ FLUXES	CHEMISTRY	M	LAB TEST	EACHBATCH	AWS A5.1,5.7 5.5,5.17OR 5.18	AWSA5.1.5.5 5.7,5.17or 5.18	TC	SUPP-LIER	*T.C's WILL BE MAINTAINED BY WTC
2	STORAGE OF ELECTRODES/ FLUXES IN STORES	METHOD OF STORAGE	MAJOR	VISUAL	100%	AS PER AWS 5.8,5.17	A5.1,5.5, 5.18 etc		STORES WTC	
3	ISSUE CONTROL	METHOD OF ISSUE	MAJOR	WQR	10%	AS PER WTC	DP&DI		WTC	
4	WELDER QUALIFICATION	WQR	MAJOR	LIST OF QUALIFIED WELDERS IN PRODN BAYS TO BE CHECKED	100%	ONLY QUALIFIED WELDERS AS PER WQR SHALL BE USED FOR WELDING THAT PARTICU-LAR WELD.		LIST OF QUAL IFIED WELDER	WTC	VERIFICATION OF RECORD i.e,WQR
5	PROCDURE QUALIFICATION	WPS	MAJOR	WPS TO BE VERIFIED FOR THE PARTICULAR MATL.COMB -INATION MATL COMB INATION	100%	ONLY THE QUALIFIED/PRE-QUALIFIED PROCEDURE FOR PARTICULAR MATERIAL COMBINATION AND POSITION METHOD SHALLL BE USED		LIST OF QUA LIFIED WPS	WTC	VERIFICATION OF RECORDS i.e, WPS
6	BAKING & DRY-ING OF LOW H2 ELECTRODES	DRYNESS OF LOW HYDRO-GEN ELECTRO-DES	MAJOR	VISUAL	RANDOM	WTCI:002/REV 02 DT.15.7.93 AWS D.1.1 (LATEST)		LOG BOOK	WTC	VERIFICATION OF RECORDS AT RANDOM

STANDARD QUALITY PLAN FOR WELDING

Q.P.SQPWO1
REV.NO.NIL
DATE10.06.93
PAGE02OF02

1	2	3	4	5	6	7	8	9	10	11
7	PREHEAT,INTER PASS HEAT POST HEATING	TEMPERATURE OF JOB	MAJOR	BY THERMAL CHALK	RANDOM	PR:QA:/WPS/ OPS AND APPLICABLE	COLOUR CHANGE TO INDICATE CORRECT TEMP	—	PRODN/ QC	WITNESS AT RANDOM
8	ROOT WELDING OTHER WELDING	QUALITY OF WELD, INTER PASS CLEANING WIRE BRUSHING GRINDING	MAJOR	VISUAL	RANDOM	AS PER APPLI CABLE WPS, OPS,QCP,PR:QA	NO CRACKS ALLOWED		PRODN/ QC	WITNESS WELD REINFORCEMENT WELD UNDERCUT STANDARD REF. OF INSTRUMENT USED
9	NDE	QUALITY OF WELD	MAJOR	UT,RT PT,MT	AS PER APPLICABLE WI	AS PER APPLICABLE WORK INSTRUCTIONS		HC	QC	WITNESS
10	FILLET SIZES OF FILLET WELD	SIZE OF WELD	M	FILLET GAUGE CHECK	100%	AS PER DRAWING		HC	QC	WITNESS
11	POST WELD HEAT TREATMENT	CORRECTNESS OF SRT CYCLE	C	VERIFICA-TION OF CYCLE AS PER PRODUCT HT CYCLE FROM HT SCHEDULE HT:001	100%	TEMPERATURE AT WHICH JOB LOADED IN FURNACE HEAT ING RATE SOAKING RATE SOAKING TIME COOLING RATE TEMPERATURE TO WHICH JOB TO BE FURNACE COOLED	AS PER SRT CYCLE IN HT:001 FOR THE PARTICULAR COMPONENT	HC	PRODN/ QC	VERIFICATION HT CYCLE

QUALITY CONTROL PROCEDURE

FOR SPLICING NORMS FOR SHEETS / PLATES / STRUCTURALS APPLICABLE TO ESP COMPONENTS FABRICATION

PREPARED BY :

DEPARTMENT	NAME & Designation S/Shri	SIGNATURE
QA	K. Jothi Arulanandam Dy.Mgr/QA	

REVIEWED BY:

DEPARTMENT	NAME & Designation S/Shri.	SIGNATURE
EDC / AQCS	C. Ganesh Sr.Mgr/AQCS	
OUT SOURCING	N. Nandagopal Sr.Mgr/OS	
QUALITY CONTROL	O. K. Abdulhuq Sr.Mgr/QC-OLI	
QUALITY ASSURANCE	R. Arunachalam Mgr/QA	

APPROVED BY

DEPARTMENT	NAME & Designation S/Shri	SIGNATURE
QA	G. BALASUBRAMANIAN SR.DGM / QA, QC(Proc.) & BE	

REV. NO.	EFFECTIVE DATE	REVISIONS MADE
03	30.05.2013	Amendment A1 merged. Feedback from OS and Engg (AQCS) Splicing Norms with applicable Drawing for carbon steel materials and SS Liner Sheet were added and re-issued.
02	03.03.2000	Feedback from MSA and Engg were included and re-issued.
01	16.06.1999	All amendments were merged, feedback from Engg and MSA were included and re-issued.
00	30.10.1985	Original Issue

HISTORY OF RECORD OF REVISIONS

1.0 SCOPE

1.1 This Quality Control Procedure (QCP) specifies the requirements for splicing of sheets / plates / structural which may warrant joints to make the required length / width in order to achieve the final product as per drawing.

1.2 This QCP is applicable to Sheets / Plates / Structural – Angles, Beams of all types, Sections of Rolled / Built up, Rounds, Pipes and Tubes.

1.3 The splicing norms dealt in this QCP is applicable to following ESP components ;

1.3.1 7X-X42 Outer Roof Assy
1.3.2 7X-X44 Hopper Upper & Middle
1.3.3 7X-X45 Hopper Lower with SS Liner Sheet
1.3.4 7X-X46 Insulator Support Panels
1.3.5 7X-X47 Inner Roof Panel Assy
1.3.6 7X-X49 Casing Shell Panels
1.3.7 7X-X50 Inlet / Outlet Funnel

1.4 This QCP covers both Carbon Steel and SS Liner Sheet materials applicable to ESP Components.

2.0 SPLICING NORMS - GENERAL POLICY

2.1 The fabricator or OS cutting plan section shall categorically try to avoid joints as much as possible with the supplied raw materials.

2.2 Further to explain the point no. 2.1 – the fabricator and OS cutting plan section shall try to make the supplied raw materials without any joints to cover up the loaded quantities – Eg., Out of 10 Nos of casing shell Panels loaded - maximum no. of panels shall be accommodated without any joints by fabricator and only to reduce the material wastage the balance quantity of casing shell panels shall be made with permitted joints as applicable.

2.3 The joints permitted are considered with a following view only

2.3.1 To reduce the material wastage
2.3.2 To make the best use of supplied raw materials sizes without prejudice to appearance and quality of final product as applicable
2.3.3 Aesthetic appearance shall not be sacrificed in accommodating the splicing norms.
2.3.4 Splicing Joints shall be avoided where a cross member is meeting or on bolt hole region. This is to be strictly adhered by fabricator and shall study the drawing fully with all the matching components.

2.4 ESP Components where joints are not permitted

2.4.1 Shock Beam
2.4.2 Rapping Shaft
2.4.3 Vertical Beam
2.4.4 Foundation Bolt
2.4.5 Suspension Rod
2.4.6 Emitting Frame Top, Middle and Bottom
2.4.7 Collecting Suspension Arrangements
2.4.8 Lifting Holder
2.4.9 Vertical Stay
2.4.10 Shock bar

3.0 SPLICING NORMS – SPECIFIC TO RAW MATERIALS

3.1 SHEETS / PLATES (CARBON STEEL)

3.1.1 The preparation of joints shall be staggered one so that formation of (+) plus type joint is avoided. The minimum offset (staggering) to avoid the plus type joint shall be minimum 100mm.

3.1.2 For a surface area including 2 Mtr X 2 Mtr and less - the permitted smallest dimension of any piece shall be minimum 400 mm (either length wise or breadth wise) and the same will be 600mm minimum for more than 2 Mtr X 2 Mtr surface area – Refer sketch - S1

3.1.3 The distance between nearest stiffener and the joint parallel to it shall be minimum 50mm – Refer sketch – S1

3.1.4 The vertical joint is permitted on the taper portion. However the distance between meeting of the vertical joint with the horizontal joint shall be minimum 100mm – Refer sketch – S1

3.1.5 Butt weld reinforcement shall be ground flush wherever stiffeners cross them.

3.1.6 When bending of the plate is done before welding, the parallel joints shall be minimum 100 mm away from the bend line. The weld quality shall be ensured by

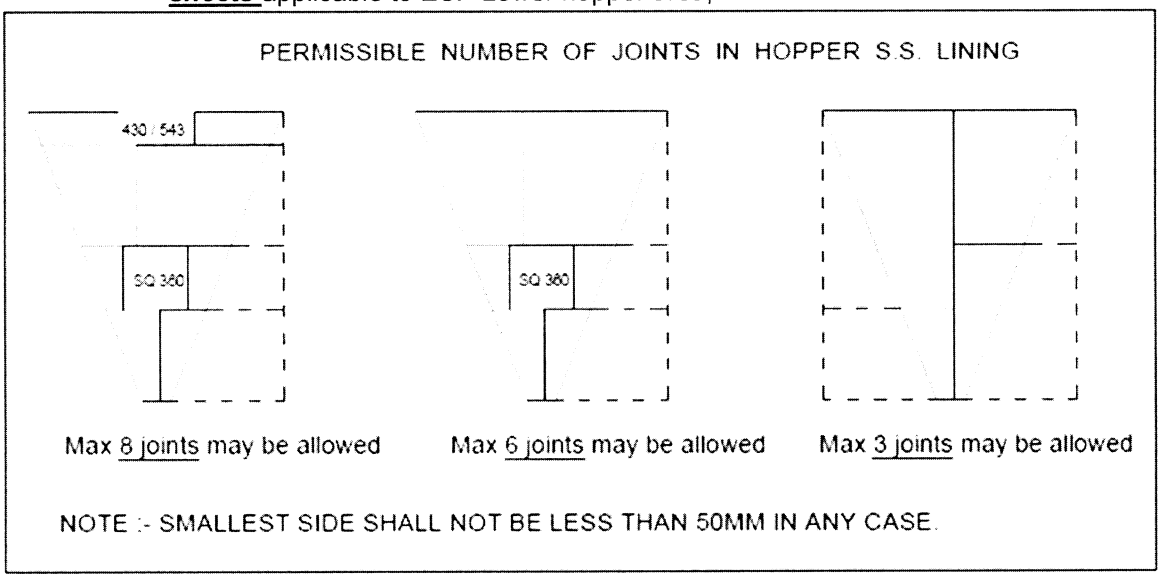
MPI / LPI. If the weld joint is subjected to bend, the weld shall be checked by LPI subsequent to bending.

3.1.7 The maximum number of permitted joints shall be as given below for carbon steel sheets / plates

Sl. No.	Surface Area in Sq. Mtr	Maximum No. Of joints permitted put together both axis (X & Y)
1	Less than & Up to 2	1
2	More than & Up to > 2 < 5	3
3	More than & Up to > 5 < 10	6
4	More than & Up to > 10 < 15	7
5	More than & Up to > 15 < 20	9
6	More than & Up to > 20 < 25	11
7	More than & Up to > 25 < 30	13
8	More than > 30	15

NOTE: The above permitted joints supersedes the maximum no. of joints given in clause no. 4.13 & 4.14 of SQP:ESP:284 Rev.01 Dtd.06.06.2007

3.1.8 The maximum number of permitted joints shall be as given below for ***SS Liner sheets*** applicable to ESP Lower hopper area;



3.2 ANGLES, CHANNELS, BEAMS (BOTH ROLLED / BUILT UP - INCLUDING NPB&UB) APPLICABLE TO ESP ROOF BEAMS & SUPPORTING COLUMNS 7X-X28 and 7X-X81, 82, 83 & 84

3.2.1 The splicing norms for Angles, Channels and Beams (both rolled / built-up) shall be strictly followed as per the drawing no.1-79-081-02331 Rev.00.

3.2.2 Any change other than given in above referred drawing shall be approved by Engg (AQCS) and the request for the same shall be forwarded by cutting plan section of OS Dept.

3.2.3 Only one joint is permitted on the transverse roof beams.

3.3 " H " BEAMS APPLICABLE TO CASING STRUCTURE COLUMNS – 7X-X48 (BOTH ROLLED / BUILT UP)

3.3.1 The splicing norms for "H" Beams shall be strictly followed as per the drawing no. 4-79-000-00763 Rev.00.

3.3.2 Maximum two joints ie., one for shop and another for site / field shall be permitted for a maximum length of 16.5 Mtr of section considering ODC constraints.

3.3.3 Joints on flange shall be staggered by minimum 300 mm avoiding falling of joint on the same side of the built up sections.

3.3.4 The splice plate provided for web joints shall not foul with the gusset plates provided on the "H" beams and a minimum clearance of 50 mm shall be maintained.

3.3.5 The minimum distance permissible between a joint and the nearest gusset / bracket location shall be 200mm.

3.4 RODS, ROUNDS, PIPS AND TUBES

3.4.1 No joint is permitted if the length of rod is 2 M or less.

3.4.2 Minimum length for splicing using sleeve shall be 500mm for tubes

3.4.3 Only one joint is permitted for Tie Rods / Strut

4.0 EDGE PREPARATION, WELDING, WELD NDE DETAILS :

4.1 Check for material specification of plates / sections which are to be joined to avoid mix up of material. TCN to be obtained for change of material.

4.2 Electrode selection shall be as per the respective WPS.

4.3 Welding shall be followed with suitable methods of sequence and controls to minimize the weld distortion.

4.4 Weld over joint shall be avoided and minimum distance between stiffeners parallel to weld joint is 50mm.

4.5 Wherever, back grinding is not feasible due to location of the plate / sheet, root welding to be carried out with 3.15mm electrode and LPI to be carried out after thorough cleaning and repeat LPI after final welding.

4.6 Following are the guidelines for Edge Preparation (EP) if not specified in drawing;

a) **Plates / Sheets up to 5mm :** No EP required. Provide 2 to 3 mm root gap, weld on both sides. MPI to be conducted after final welding.

b) **Plates of 6 mm :** No EP required. Weld shall be with square butt with 2 to 3 mm gap. Weld from first side and turn the plate for back grinding and conduct root LPI. Complete the weld and conduct the final MPI.

c) **Plates of 7 & 8 mm :** Single "V" , 60° EP, Weld from V side and turn the plate, back grind and conduct LPI, complete the Weld. Final MPI.

d) **Plates above 8 mm :** Double "V" , 60° EP, Weld one side, Carryout back grind and conduct LPI to ensure sound metal and weld from other side. Final both side MPI after completion of weld.

e) **For Structural (Angle, Channel, Beam)** : Single "V" , 60° EP, Weld from V side and back grind and conduct LPI. Complete the weld, conduct final LPI before splice plate setting.

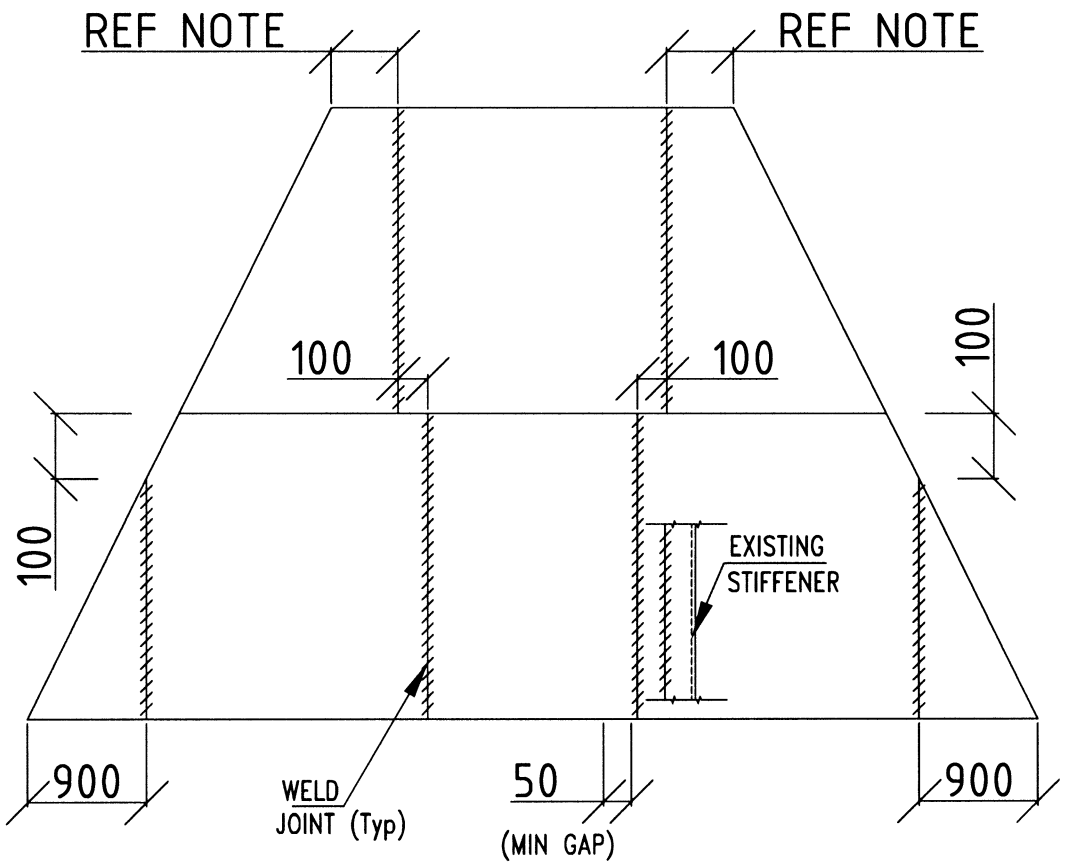
Note:

1. Splice plate details shall be taken from relevant fabrication Engg drawing.
2. Splice Joint shall be avoided where a cross member is meeting.
3. The weld should be ground flush and smooth and the proper splice plate is placed & welded.

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QUALITY CONTROL PROCEDURE FOR SPLICING OF SHEETS, PLATES AND OTHER STRUCTURAL ITEMS

SKETCH FOR CLAUSES 3.1.2 TO 3.1.4



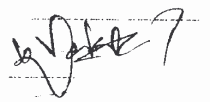
NOTE : MINIMUM DIMENSION OF SPLICED PLATE = 200 MM FOR DUCT WALL OF ANY SIZE

ALL DIMENSIONS ARE IN MM

BHARAT HEAVY ELECTRICALS LIMITED
BOILER AUXILIARIES PLANT
RANIPET 632 406

QUALITY ASSURANCE & CONTROL DEPARTMENT

QUALITY CONTROL PROCEDURE FOR	MANUFACTURING OF PACKING FRAMES AND ANGLE IRONS FOR WIDE COLLECTING ELECTRODE PACKING
EFFECTIVE DATE	05-10-88

ACCEPTED BY	DEPARTMENT	DATE
	AQCS	
	OP&C	
	SC-SA	
	PRODUCTION	
	QUALITY CONTROL	
	QUALITY ASSURANCE	

1.0 SCOPE :

1.1 This Quality Control Procedure details the quality requirements for packing frames and angle irons for packing wide collecting electrodes.

2.0 MATERIALS

2.1 Raw materials used shall conform to the steel grades Specified in the packing drawing.

2.2 No Substitution of material shall be done without the Concurrence of AQCS.

2.3 Raw material used shall be free from harmful defects like Cracks, laminations, laps, serious pittings, etc.

3.0 FABRICATION

3.1 It is the responsibility of the fabricators to impose adequate process control and necessary stage inspection so that the packing frames and angle irons are consistent in Quality and conform to this specification and drawing.

3.2 All components of packing frames and angle irons shall be free from bend and twist. Straightening wherever necessary shall be carried out on individual numbers before assembly / fabrication.

3.3 All Flame cut edges shall be dresses smooth and square by grinding.

3.4 Wherever necessary, welding and drilling fixtures to be used by the fabricators for repeatability and conformance to the requirements.

3.5 E-6013 electrodes of BHEL approved brands only shall be used.

3.6 All Weld profiles shall have workman like finish and sizes of the welds shall be as indicated in the drawing.

4.0 WORKMANSHIP AND TOLERANCES

4.1 Inside dimensions of frames
a) 768 (plus or minus 2mm)
b) 1060 (plus or minus 2mm)

4.2 Bolt hole locations (plus or minus 1.5 mm)

4.3 Wherever holes are envisaged, all the corresponding , items shall be matched properly.

4.4 Framing members to be maintained square/parallell as per the drawing.

5.0 CLEANING AND PAINTING

5.1 All packing frames shall be thoroughly cleaned to remove Weld slag and spatter.

5.2 Cleaned frames and angles shall be coated with one coat of Zinc chromate red oxide primer conforming to IS 2074.

5.3 Painting must not be done over the fasteners.

5.4 Fastening shall be done only after the painting of frames and angles.

5.5 To prevent from rusting, the fasteners should be given rust preventive coating with CHEMTECH -16 or CORROSTOP -SP7 or equivalent to facilitate easy removal of fasteners during assembly at shop.

5.6 All the packing frames and angles must be dry before putting the fasteners at proper places.

6.0 IDENTIFICATION

6.1 All the frames and angles shall be identified by Stencilling the following details :

Sub-contractor's code number :
Work Order Number :
Frame identification No. (1,2,3, or 4) :
Weight :
Drawing Number :

BHEL
RANIPET

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QUALITY DEPARTMENT

AMENDMENT TO QUALITY WORK INSTRUCTIONS (Q.C.P)

Q.W.I.NO:E 018 REV: 00 AMENDMENT SL NO: A 2

DESCRIPTION: Grip Coupling DATE: 28/1/95

DETAILS

CLAUSE NO	AMENDED AS	BASIS FOR AMENDMENT REMARKS
3.4	Defects detected shall be rectified as per QCP 002 (latest).	QCP 2:5:013 withdrawn.

Prepared by Reviewed by Approved by

Distribution: As per standard distribution list.

PC File A:E018.KSU (Floppy 213)

BHARAT HEAVY ELECTRICALS LIMITED
RANIPET 632 406

QUALITY DEPARTMENT

BAP:QA:93:9835
5th jul 93

QCP Ref: E:018 Grip coupling of ESP

Amendment No. 01 Effective date:7/7/93

The following amendments are issued against the referred QCP under the respective clause numbers instead of existing therein.

Clause No	Title	Amended as
2.0	References	1) AWS D1.1 2) AA 041 1401 Corporate standard for welding based on IS 2553. 3) Structural QCP 2:5:013
3.1		Raw-materials used shall conform to the design specifcations. Steel grades generally specified are SA 105,IS 2062.
3.4		Defects detected shall be rectified as per QCP 2:5:013.
5.2		Welders shall be qualified as per AWS D1.1.Welders qualified to any other code may also be permitted at the discretion of Inspection engineers.
5.3.3		PR:QA:020 shall be followed for baking and drying of electrodes.Oven used for baking of electrodes shall be maintained in good working conditions.

Kindly acknowledge receipt of this amendment.

P.T.Tamboli
Sr Manager (QA)

Distribution

As per controlled distribution list

BHEL
RANIPET

BHARAT HEAVY ELECTRICALS LTD.
BOILER AUXILIARIES PLANT
RANIPET 632 406

QCP:E:018

QUALITY DEPARTMENT

QUALITY CONTROL PROCEDURE FOR		GRIP COUPLING OF ESP	
EFFECTIVE DATE			30 04 92
DEPARTMENT	**ACCEPTED BY**	**SIGNATURE**	**DATE**
EDC/AQCS	B BHARATHARAJAN		29/4/92
ANCILLARY DEVELOPMENT	GR VENKATRAMAN		29/4/92
QUALITY CONTROL	HBN MURTHY		29/4/92
QUALITY ASSURANCE	PH TAMBAKHE		29/4/92
QUALITY SURVEILLANCE	G THIRUNAVUKKARASU		29/4/92

ISSUED BY	: QUALITY ASSURANCE
REVISION	: NIL
DATE	: 30 04 92

QUALITY CONTROL PROCEDURE FOR GRIP COUPLING OF ESP ITEM

1.0 SCOPE:

This Quality Control procedure details the quality requirements to be adhered with respect to GRIP COUPLING of ESP.

2.0 References

i) AWS D1.1.
ii) AA041-1401 Corporate standard for welding Based on IS 2553-1984
iii) Structural QCP 2:5:013/08.

3.0 Raw Materials

3.1 Raw material used shall conform to design specifications. Generally SA 105, IS 226 and IS 2062 grades are used.

3.2 In case of material substitution, prior approval from Engineering to be obtained.

3.3 Raw material shall be free from harmful visual defects such as Cracks, seams, laps, laminations, heavy pittings etc.

3.4 Defects detected shall be rectified as per QCP 2/5/013/08.(clause 5.1.4)

3.5 Plates having deviations like bend, out of straight ness, twist, etc., shall be corrected before taking up for fabrication, by cold treatment.

Straightening under hot stage shall be resorted to only under specific permission from quality control

4.0 FABRICATION

4.1 FLAT BAR:

4.1.1 After gascut of flat bar following dimensions are to be ensured.

LENGTH to be maintained within plus or minus 2mm

WIDTH within plus or minus 1mm

FLATNESS within plus or minus 1mm

Ensure centre line marking/punching of the flat bar in longuitudinal direction prior to pressing.No deviation permitted on centerline marking/punching.

4.1.2 PRESSING

Pressing of the flat bar can be carried out either by cold/hot formation. In case of hot formation temperature of the flat shall be maintained within 600-650 degree centigrade during the entire operation. Air cooling only is permitted after pressing.

Pressing shall be carried out across the rolling direction of the plate only.

Following deviations should be avoided.

1. Twist
2. Bend Line Crack
3. Tool marks.

Pressed flat bar shall be checked with TEMPLATE for profile, flatness.

5.0 WELDING

5.1 Pre qualified welding procedure as per section 5 of AWS D1.1. latest shall be used.

5.2 Welders shall be qualified as per AWS D1.1. welders qualified to any other code may also be permitted at the discretion of inspecting engineer.

5.3 ELECTRODE

5.3.1 E 6013 electrode to be used.

5.3.2 Only BHEL(TRICHY/RANIPET) approved brands of electrode shall be used.

5.3.3 PR:QA:020 shall be followed for baking and drying of electrodes. Oven used for baking of electrodes shall be maintained in good working condition.

5.3.4 Size of weld shall be as per drawing.

6.0 TOLERANCES

Length of flat bar	+ or - 2mm.
Height of flat bar	+ or - 2mm.
Bore of the coupling	+ 0.025
Width of the key way	+ 0.021

Offset of keyway centre with respect to flat bar centre shall be maintained within plus or minus 0.5 mm. TWIST NOT PERMITTED

6.0 TOLERANCES

Length of flat bar	+ or - 2mm.
Height of flat bar	+ or - 2mm.
Bore of the coupling	+ 0.025 - 0.000
Width of the key way	+ 0.021 - 0.021

Offset of keyway centre with respect to flat bar centre shall be maintained within plus or minus 0.5mm.

Twist not permitted.

7.0 NDT REQUIREMENTS

7.1 100% LPI on the fillet welds.

8.0 TRIAL ASSEMBLY

Trial assembly of the matching sets shall be carried out as per the following combinations to suit site requirements.

MOTOR SIDE	RAPPING SHAFT SIDE
TYPE 01 DIA 40	DIA 50
TYPE 02 DIA 45	DIA 50
TYPE 03 DIA 50	DIA 50

After fabrication, each piece will be taken and checked in the fixture for straightness and proper alignment. Firm to ensure proper , equal as well as simultaneous contact on both the limbs. This is to ensure equal loading on both the limbs. 100% bearing contacts of the limbs are to be ensured by scrapping/grinding in all the four different contact positions. Subsequently, both the pieces will be punch marked legibly with the same match number alongwith firm code, tied together and despatched to site in pairs. Mix-up between different pairs to be avoided.

9.0 CLEANING AND PAINTING

9.1.1 All items shall be cleaned for loose mill scale, rust and foreign materials before painting. Journal bearing area should be protected with rust preventive oil only.

9.1.2 Following details shall be legibly stenciled and covered with one coat of transparent varnish.

PROJECT NAME :

W.O.NUMBER :

D.U.NUMBER :

VARIANT NO. :

WEIGHT :

SUB.CONT.CODE:

The above details shall be punched and the punched details shall be bordered with white paint.

CHECK LIST

1) RAW MATERIAL

Visual, Verification of MIV for substitution if any and identification of appropriate welding procedures.

2) ELECTRODE

Specification, ISI Mark etc.,

3) PAINT

Specification IS or equivalent Mark etc.,

4) WELD

Size, Visual

5) DIMENSION

Length, height, twist, centreline punching.
Surface finish.

6) PAINTING

Visual for Aesthetic appearance.

7) Calibrated tape, instruments.

****

PC FILE:D:\ESP\QCPE018

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	MANUFACTURER'S NAME& ADDRESS	MANUFACTURING QUALITY PLAN		STANDARD QUALITY PLAN
BHEL	M/S BHEL / BAP / RANIPET TAMIL NADU-632 406	ITEM/SUBSYSTEM: PIN WHEEL ASSY	QP:NO: SQP:EXP:201 REV: NO:00 DATE: 20/ 01/ 2001 PAGE : 01 OF 06	

SL NO 1	COMPONENT & OPERATION 2	CHARACTERISTICS 3	CL 4	TYPE OF CHECK 5	QUANTUM OF CHECK 6	REFERENCE DOCUMENTS 7	ACCEPTANCE NORMS 8	FORMAT OF RECORDS 9	AGENCY M 10	AGENCY C 10	REMARKS 11
1.0	RAW MATERIALS										Raw Matls are taken to stock on verification of TC / Random testing.
1.1	ROUNDS AND PLATES	Chemistry & Mechanical	M	Review of TC*	Each Heat / Lot	As per Matl. Specn		TC	P	V	
1.2	ROUND FOR HUB	Internal Soundness	M	UT	100 %	TDC:RTG:057(latest)		R	P	V	
2.0	IN PROCESS CONTROL										
2.1	FLAME CUTTING	Lamination & Crack	M	Visual	100 %	As per AWS D1.1			P	V	
2.2	WELDING	a) Procedure Qualifn. b) Personnel Qualifn.	M	Review of documents	100 %	..do..		R	P	V	

LEGENDS:
M – MANUFACTURER / SUBCONTRACTOR, C - CONTRACTOR(BHEL) / AUTHORISED INSPN AGENCY
CL - CLASS (M = MAJOR C = CRITICAL) P - PERFORM, V - VERIFICATION, W - WITNESS, R - REPORT TC - TEST CERTIFICATE

PREPARED BY	REVIEWED BY		APPROVED BY
	ENGG (AQCS)		
	QC (OLI)		
	QA		

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	MANUFACTURER'S NAME& ADDRESS M/S BHEL / BAP / RANIPET TAMIL NADU-632 406	MANUFACTURING QUALITY PLAN ITEM : PIN WHEEL ASSY	QP:NO: SQP:ESP:201 REV: NO:00 DATE: 20/01/2001 PAGE : 02 OF 06	STANDARD QUALITY PLAN

SL NO 1	COMPONENT & OPERATION 2	CHARACTERISTICS 3	CL 4	TYPE OF CHECK 5	QUANTUM OF CHECK 6	REFERENCE DOCUMENTS 7	ACCEPTANCE NORMS 8	FORMAT OF RECORDS 9	AGENCY M	AGENCY C	REMARKS 11
									10		
2.3	**PIN: Machining and case hardening**	a) O D (before & after case hardening)	M	Measurement	100 %	Drawing		R	P	V	@ One sample per HT batch of carburisation shall be checkad for case depth.
		b) Depth of case hardening	C	-do-	See @ Remarks	Refer Note & Drg. Case depth shall be 0.8 to 1.0mm		R	P	W	
		c) Surface Hardness	C	-do-	100 %	Hardness HRC 58 to 62		R	P	W	
2.4	**PIN WHEEL - I**										
2.4.1	**Flange drilling** (Flange ring to be drilled in a fixture)	Hole dia	M	Measurement	100 %	Drawing		R	P	V	
2.4.2	**SUB-ASSY OF PIN & FLANGE (Pin Wheel Ring)**	Fillet welding of Pin & Flange	M	Visual & LPI	10 %	AWS D1.1.		R	P	V	
		Note: 1. Sequential Welding to be followed as per drg				Drawing & Notes					
		2. Straighten the ring immediately after welding before it gets cooled.	M	Measurement		Straightness within 1 mm		R	P	V	
		3. Pin Wheel ring to be divided after cooling									

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MANUFACTURER'S NAME & ADDRESS	MANUFACTURING QUALITY PLAN		STANDARD QUALITY PLAN
M/S BHEL / BAP / RANIPET TAMIL NADU-632 406	ITEM/SUBSYSTEM: PIN WHEEL ASSY	QP:NO: SQP:ESP:201 REV: NO:00 DATE: 20/01/2001 PAGE : 03 OF 06	

SL NO 1	COMPONENT & OPERATION 2	CHARACTERISTICS 3	CL 4	TYPE OF CHECK 5	QUANTUM OF CHECK 6	REFERENCE DOCUMENTS 7	ACCEPTANCE NORMS 8	FORMAT OF RECORDS 9	AGENCY 10		REMARKS 11
									M	C	
2.4.3	SUB ASSY OF HUB & FLANGE PLATE	Fillet Welding of Hub & Flange plate with stiffeners Note: After welding of hub, divide it as per drg, but before drilling.	M	LPI	10 %	AWS D1.1		R	P	V	
2.4.4	Drilling, Bore & Key way	Hole dia 100mm & 50mm Note: Use 0.1 mm shims – 3 nos while drilling dia 50.	M	Measurement	100 %	Drawing		R	P	V	
		Bore & Keyway with threaded holes M12	M	Measurement	100 %	..do..		R	P	V	
2.4.5	ASSY OF PIN WHEEL – I	Match Drilling of 8 holes dia 17.5 of Pin Wheel ring sub-assy with sub-assy of Hub & flange plate.	M	-do-	100 %	-do-		R	P	V	

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	MANUFACTURER'S NAME& ADDRESS M/S BHEL / BAP / RANIPET TAMIL NADU-632 406	MANUFACTURING QUALITY PLAN ITEM : PIN WHEEL ASSY	QP:NO: SQP:ESP:201 REV: NO:00 DATE: 20/01/2001 PAGE : 04 OF 06	STANDARD QUALITY PLAN

SL NO 1	COMPONENT & OPERATION 2	CHARACTERISTICS 3	CL 4	TYPE OF CHECK 5	QUANTUM OF CHECK 6	REFERENCE DOCUMENTS 7	ACCEPTANCE NORMS 8	FORMAT OF RECORDS 9	AGENCY 10		REMARKS 11
									M	C	
2.5	PIN WHEEL - II										
2.5.1	Flange Plate drilling (Flange ring to be drilled in a vendor made fixture)	Hole dia	M	Measurement	100 %	Drawing		R	P	V	
2.5.2	Flange Plate and Pin	Fillet welding of Pin & Flange Plate	M	Visual & LPI	100 %	AWS D1.1.		R	P	V	
		Note: 1. Sequential Welding to be followed as per drg	M			Drawing & Notes					
		2. Straighten the ring immediately after welding before it gets cooled.	M	Measurement	100 %	Straightness within 1 mm		R	P	V	

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	MANUFACTURER'S NAME& ADDRESS M/S BHEL / BAP / RANIPET TAMIL NADU-632 406	MANUFACTURING QUALITY PLAN ITEM/SUBSYSTEM: PIN WHEEL ASSY	QP:NO: SQP:ESP:201 REV: NO:00 DATE: 20/01/2001 PAGE : 05 OF 06	STANDARD QUALITY PLAN

SL NO 1	COMPONENT & OPERATION 2	CHARACTERISTICS 3	CL 4	TYPE OF CHECK 5	QUANTUM OF CHECK 6	REFERENCE DOCUMENTS 7	ACCEPTANCE NORMS 8	FORMAT OF RECORDS 9	AGENCY 10		REMARKS 11
									M	C	
2.5.3	HUB & FLANGE PLATE WELDING	Fillet Welding of Hub & Flange plate with stiffeners Note: After welding of hub, divide it as per drg, but before drilling.	M	LPI	10 %	AWS D1.1		R	P	V	
2.5.4	Drilling, Bore & Key way	Drilling of Hole dia 40 & 15mm Note: Use 0.1 mm shims – 3 nos while drilling dia 40.	M	Measurement	100 %	Drawing		R	P	V	
		Bore & Keyway with threaded holes M12	M	Measurement	100 %	..do..		R	P	V	
2.5.5	ASSY OF PIN WHEEL – II	Match Drilling of Dia 6 for Clindrcal Pin after assy of Pin Wheel – II and fillet weld	M	-do-	100 %	-do-		R	P	V	

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	MANUFACTURER'S NAME& ADDRESS M/S BHEL / BAP / RANIPET TAMIL NADU-632 406	MANUFACTURING QUALITY PLAN ITEM/SUBSYSTEM: PIN WHEEL ASSY	QP:NO: SQP:ESP:201 REV: NO:00 DATE: 20/01/2001 PAGE : 05 OF 06	STANDARD QUALITY PLAN

SL NO 1	COMPONENT & OPERATION 2	CHARACTERISTICS 3	CL 4	TYPE OF CHECK 5	QUANTUM OF CHECK 6	REFERENCE DOCUMENTS 7	ACCEPTANCE NORMS 8	FORMAT OF RECORDS 9	AGENCY 10		REMARKS 11
									M	C	
3.0	FINAL INSPECTION FOR PIN WHEEL ASSY – I & II	Pin Wheel Assy - @ completeness and overall dimensions	M	Measurement	100 %	Drawing & Notes		R	P	W	@ The parting line of Position 1 and that of Position 4 to be at 90 degree as per drg for Pin Wheel Assy - I
		Surface Cleaning, Painting & preservation	M	Visual	100 %	BHEL standard painting schedule RP 067 41 99			P	V	

NOTE :

1. Case Depth checking of pin shall be done by destructive testing of one sample per each HT batch at BHEL approved labs.
2. For welding E 7018 electrodes shall be used. These electrodes shall be purchased in hermetically sealed containers. Immediately after opening the hermetically sealed container, electrodes shall be stored in oven held at a temperature of at least 120°C.
3. Electrodes exposed to atmosphere for periods more than four(4) hours shall be baked for at least two(2) hours between 260 to 430°C and held at 120°C until they are used.

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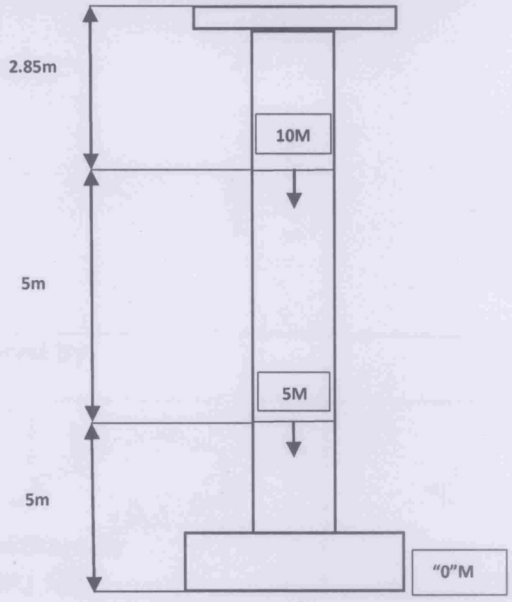
QUALITY ASSURANCE

Amendment to Quality Work Instruction (QWI): PRQA

Amendment No: A1 **Date: 23.06.2018**

ESP: 283 **Rev: 01** **Dated: 30/06/2007**

Title: ESP supporting structures (Columns, bracings, Longitudinal & transverse roof beams)

Clause no	Details of amendment	Basis for Amendment
Refer page 6 of 14 Clause no: 1.7	Clause 1.7 as existing: Before boxing up the columns i.e welding of two channels/beams to make up box section, one coat of red oxide zinc chrome primer, after necessary cleaning shall be applied on inner surface of channel/beam to coating thickness of 25µm (min) Clause 1.7 is amended as follows: Before boxing up the columns i.e welding of two channels/beams to make up box section, one coat of red oxide zinc phosphate primer to IS 12744, after necessary cleaning shall be applied on inner surface of channel/beam to coating thickness of 30µm (min)	Our basic primer paint switched over to Red oxide zinc phosphate primer to IS 12744 as per PRQA 590.
Refer page 9 of 14 Note 5.3.8 Level marking	Note 5.3.8 Level Marking: - Note 5.3.8 Level marking: Sketch added for more clarity: For ex. Height of column: 12.85m, Then  	For more clarity in Level marking.

QUALITY ASSURANCE

Amendment to Quality Work Instruction (QWI): PRQA

Amendment No: A1 **Date: 23.06.2018**

ESP: 283 **Rev: 01** **Dated: 30/06/2007**

Title: ESP supporting structures (Columns, bracings, Longitudinal & transverse roof beams)

Clause no	Details of amendment	Basis for Amendment
	Clause 5.2.7 is added as follows Flatness of Top plate after full welding shall be flat and within 1mm.	Top plate flatness was not available

Prepared by	Reviewed & Approved by
23/06/2018 **Rajamanickam.M** **Sr.Engr/ QA**	**R. Arunachalam** **DGM/ QA& QC-OLI**

Ranipet	MAN UFACTURER'S NAME& ADDRESS	STANDARD QUALITY PLAN		
	BHARAT HEAVY ELECTRICALS LTD BOILER AUXILIARIES PLANT RANIPET-632 406 (INDIA)	ITEM: **ESP** Sub system: ESP supporting Structure (Columns, Bracing & Longitudinal/Transverse roof Beams) (PGMAs: X81, X48, x28, X82, X83, X84, X85, etc.)	QP NO	ESP 283
			REV NO	01
			DATE	30 06 07
			PAGE NO	01 of14

Sl No 1	Component & operation 2	Characteristics 3	Type of Check 4	Quantum of Check 5	Reference Documents 6	Acceptance Norms 7	Format Of Records 8	Agency M.	Agency B.	Remarks 10
								9		
1.0	Raw materials									Raw Materials are taken to stock on verification of TC /Random testing
1.1	Plates, Rolled sections, Hollows.	Chemistry & Mechanical Properties	Chemical & Tensile test	As per TDC	Respective TDC		TC	P	V	
2.0	In process control									
2.1	Flame cutting	Lamination and cracks	Visual	-DO-	As per Aws D1.1		R	P	V	
2.2	Welding	1) Procedure Qualifications	Review of Documents	-DO-	Prequalified welding Procedure as per Aws D1.1		R	P	W	
		2) Personnel Qualifications	-DO-	-DO-	-DO-		R	P	W	

LEGENDS:
M – Manufacturer / Subcontractor,
B - BHEL /BHEL Authorized Inspection Agency,
P - perform, V - Verification of Reports
W -Witness, TC - Test certificate,
DR – Dimensional report,

	PREPARED BY	REVIEWED BY	APPROVED BY
QA		B. Sundarakeo	
QC-OLI			
ENGG		P. Jayakumar	

Rev 00	Dt 20 06 98	Original issue
Rev 01	Dt 30 06 07	Totally Reviewed and updated

Ranipet	MAN UFACTURER'S NAME& ADDRESS	STANDARD QUALITY PLAN		
	BHARAT HEAVY ELECTRICALS LTD BOILER AUXILIARIES PLANT RANIPET-632 406 (INDIA)	ITEM: **ESP** Sub system: ESP supporting Structure (Columns, Bracing & Longitudinal/Transverse roof Beams) X81, X48,X28, X82, X83, X84, X85, etc.	QP NO	ESP 283
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Sl No 1	Component & operation 2	Characteristics 3	Type of Check 4	Quantum of Check 5	Reference Documents 6	Acceptance Norms 7	Format Of Records 8	Agency 9 M	Agency 9 B	Remarks 10
2.3	Weld inspection									
2.3.1		Size and finish	Visual and Measurement	100%	Drawing, Sip: NP:06		R	P	W	** Remarks: 1) Weld fit up 2) 100% LPI for back gouged/chipped area before 2nd side welding (for columns) 3) Random 10%LPI for back gouged/chipped area before 2nd side welding (for bracing).
2.4	Weld NDE columns & bracings									
2.4.1	Fillet: Base plate & top plate welding in columns	Soundness	LPI	100%	AWS D1.1		R	P	W	
	Other fillet weld of column & bracings	-DO-	-DO-	Random 20%	AWS D1.1		R	P	W	
2.4.2	Weld between flange & web by saw (in case of built up beams)	Soundness	MPI	100%	AWS D1.1		R	P	W	

LEGENDS:
M – Manufacturer / Subcontractor, B - BHEL /BHEL Authorized Inspection Agency, P - perform, V - Verification of Reports, W -Witness,TC - Test certificate, DR – Dimensional report.

Ranipet	MAN UFACTURER'S NAME& ADDRESS	STANDARD QUALITY PLAN		
	BHARAT HEAVY ELECTRICALS LTD BOILER AUXILIARIES PLANT RANIPET-632 406 (INDIA)	ITEM: **ESP** Sub system: ESP supporting Structure (Columns, Bracing & Longitudinal/Transverse roof Beams) X81, X48,X28, X82, X83, X84, X85, etc.	QP NO	ESP 283
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			DATE	30 06 07
			PAGE NO	03 of 14

Sl No	Component & operation	Characteristics	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format Of Records	Agency		Remarks
								M	B	
1	2	3	4	5	6	7	8	9		10
2.4.3	1) Welding of Structural for Forming sections 2) Fillet weld of Gusset plates, and plates & Batterns.	Soundness	LPI	20%At Random	AWS D1.1		R	P	W	4) Random10% LPI on finished weld after flush grinding.
2.4.4	Butt welds for structural	Soundness	LPI	**See Remarks	AWS D1.1		R	P	W	
3.0	Dimensional control (Bracings and Columns)	1) Dimensions 2) Twist, sweep camber	Measurement & visual	100%	Drawing		R	P	W	

LEGENDS:
M – Manufacturer / Subcontractor, B - BHEL /BHEL Authorized Inspection Agency, P - perform, V - Verification of Reports -Witness,TC - Test certificate, DR – Dimensional report.

Ranipet	MAN UFACTURER'S NAME& ADDRESS	STANDARD QUALITY PLAN		
	BHARAT HEAVY ELECTRICALS LTD BOILER AUXILIARIES PLANT RANIPET-632 406 (INDIA)	ITEM: **ESP** Sub system: ESP supporting Structure (Columns, Bracing & Longitudinal/Transverse roof Beams) X81, X48,X28, X82, X83, X84, X85, etc.	QP NO	ESP 283
			REV NO	01
			DATE	30 06 07
			PAGE NO	04 of 14

Sl No	Component & operation	Characteristics	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format Of Records	Agency M	Agency B	Remarks
1	2	3	4	5	6	7	8	9		10
LONGITUDINAL & TRANSVERSE ROOF BEAMS										#
3.01	Weld NDE	1) Roof beams a) Butt welds in tension flanges	BG LPI & MPI#	100%	AWS D1.1		R	P	W	1) Weld fit up 1) 100% LPI for back gouged /chipped area. 2) Layer by layer MPI to ensure soundness of welding in between. 3) LPI on finished weld after flush grinding before Welding splice plates.
		b) Other butt Welds	BG LPI & MPI #	100% 10%**	AWS D1.1		R	P	W	
		c) Fillet weld between flanges and web by saw @	MPI	100%	AWS D1.1		R	P	W	
		d) Finish and size	Visual and measurement	100%	Drawing and SIP: NP:06		R	P	W	
3.1	Dimensional control (LR &TRB)	Length, section depth straightness thickness of flange, WEB, hole size, location & pitches, end profile, edge preparation	Visual and measurement	100%	Drawing		R	P	W	

LEGENDS:
M – Manufacturer / Subcontractor, B - BHEL /BHEL Authorized Inspection Agency, P - perform, V - Verification of Reports -Witness,TC - Test certificate, DR – Dimensional report.

	MAN UFACTURER'S NAME& ADDRESS	STANDARD QUALITY PLAN		
Ranipet	BHARAT HEAVY ELECTRICALS LTD BOILER AUXILIARIES PLANT RANIPET-632 406 (INDIA)	ITEM: **ESP** Sub system: ESP supporting Structure (Columns, Bracing & Longitudinal/Transverse roof Beams) X81, X48,X28, X82, X83, X84, X85, etc.	QP NO	ESP 283
			REV NO	01
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Sl No 1	Component & operation 2	Characteristics 3	Type of Check 4	Quantum of Check 5	Reference Documents 6	Acceptance Norms 7	Format Of Records 8	Agency M 9	Agency B 9	Remarks 10
4.0	Trial Assy (Applicable for long roof beam only)	If Longitudinal Roof beams are given in more than three variants, trial assy has to be done first with variant 01 & 02, then variant 02 & 03 only. cumulative location of holes & brackets, twist, sweep, camber, joint location, match marking and vendor identification marking by welding.	Visual and measurement	100%	Drawing		R	P	W	@E7018 electrodes /equivalent in case of SMAW shall be used. **In case of defects % shall be increased.
5.0	Final inspection: Surface cleaning painting, level, center line marking preservation	Welding finish & appearance, match markings, orientation.	Visual	100%	Drawing & painting Schedule PRQA 590/Latest		R	P	W	

LEGENDS:
M – Manufacturer / Subcontractor, B - BHEL /BHEL Authorized Inspection Agency, P - perform, V - Verification of Reports -Witness, TC - Test certificate, DR – Dimensional report.

1.0 NOTE.1.0 GENERAL REQUIREMENTS

1.1 Any additional requirement for a specific contract shall be referred separately

1.2 Raw materials used shall conform to the grades specified in the drawing & GMS.

1.3 Fabricators shall check all the supplied raw material for dimensions, bend etc., Straightening wherever necessary must be carried out before assy and welding.

1.4 Raw material shall be free from harmful visual defects like cracks, seams, laps, laminations, heavy pitting etc.

1.5 Substitution of materials shall be done with the prior approval of EDC/AQCS

1.6 Plates for flanges and web shall be preferably machine gas cut. Cut edges shall be dressed smooth to remove all the undulations. Gas cut notches if any shall be filled up and dressed. The edges shall be straight and square.

1.7 Before boxing up the columns i.e. welding of two channels/beams to make up box section, one coat of red oxide zinc chrome primer, after necessary cleaning shall be applied on inner surface of Channel /Beam to coating thickness of 25 microns(min).

NOTE 2.0 IN PROCESS CONTROL

2.1 The general requirements for process control during fabrication are as detailed in QCP 002 (LATEST) read along with Amendment 1.

2.2 The number of joints shall be as approved by designs on a case-to-case basis. However all joints shall be staggered to a minimum offset of 300mm from web to flange or vice versa.

NOTE 3.0 MARKING, CUTTING AND PREPARATION

3.1 Holes/slots on flanges, end profile, weld access cutting etc to suit roof beam's / column's flanges / webs edge preparation for site joints shall be marked correctly. These profiles, edge preparation shall be gas cut and ground, the holes shall be drilled.

NOTE 4.0 WELDING REQUIREMENTS & WELD INSPECTION

4.1 In the case of columns: Electrodes of E 6013 for thickness upto and inclusive of 20 mm; E 7016 or E 7018 for thickness above 20mm shall be used.

4.1.1 E 6013 electrodes shall be dried in baking oven at 120-130 deg c until they are used, if the packing were found to be damaged or the electrodes were kept exposed to atmosphere for prolonged period.

4.1.2 In the case of roof beams: Electrodes of E7018 shall be used for welding. Before use all the low hydrogen electrodes (Exx16, Exx18) shall be dried in baking oven between 260-427deg C for 2 hours and held at 100 deg C until they are used.

a) In case of Roof beam-E7018 shall be used for welding. These electrodes shall be purchased in hermetically sealed containers. Immediately after opening the hermetically sealed container, electrodes shall be stored in ovens held at a temperature of at least 120 deg c. Electrodes that have been wet shall not be used.

b) Electrodes exposed to atmosphere for periods more than four hours shall be baked for at least two hours between 260 to 430 deg c and held at 120 deg c until they are used.

4.2 Fillet and butt welds shall be done with a minimum of two layers, ensuring complete root fusion.

4.3 Butt joints shall be completed prior to the welding of splice plate.

4.4. Sequence of welding shall be so chosen as to minimize the distortion.

4.4.1 All welds shall be deposited in sequence, that will balance the applied heat of welding as the welding progresses.

4.4.2 In the case of fabricated I or H section, the joints in flange or web shall be completed and straightened. Subsequently H section or I shall be formed.

4.4.3 Distortion in the structural members shall be corrected with carefully supervised application of limited amount of localized heat. Temperature of heated areas as measured by approved methods shall not exceed 650c (a dull red co lour).

4.5 NDT as required shall be carried out on splice joints before cover plate welding.

4.6 Arc strike shall not be done straight on the job. Welder shall have a separate piece for striking the arc.

4.7 Welding procedure specification and welder's qualification are detailed in SIP: NP: 07 (Latest).

4.8 Only BHEL approved brands of electrodes shall be used.

NOTE; 5.0 FABRICATION TOLERANCES:

Following tolerances shall be applicable on different dimensions of: -

COLUMNS

5.1 Length of column shall be maintained during fit-up stages, taking care of shrinkage allowance for PGMAs X48,X81,X82,X83,X84,X85.

a) For length ≤ 10M, shrinkage allowance =5mm.
Length of column (PGMA: 7X-X81) shall be with in ±5mm.
Fit up shall be offered for BHEL/BHEL Authorized inspection agency inspection before full welding.
b) For length > 10m, shrinkage allowance =7mm.

5.1.1 Camber 1 mm per meter length upto a maximum of 5mm of camber only allowed.

5.1.2 Sweep 1 mm per meter length upto a maximum of 5mm of sweep only allowed.

5.1.3 Twist 3 mm maximum.

5.2 All Base / Top plates shall be cut to correct size. Length / Width and shall not vary by more than+/- 2 mm. The axes of the column cross section shall be laid out on the base/top plates. The bolt holes and grout holes shall be correctly located with reference to these axes.

a) Diagonal difference shall not be more than 3mm.

5.2.1 All column Base / Top plates surfaces shall be maintained flat and square to the column axis Within 1mm.

5.2.2 Base and Top plates shall be correctly aligned with respect to column cross section. The axial shift between the central axis of column and the base plate shall be within 2mm.
Rotation of base plate/top plate axis with respect to beam axis shall be measured by dropping a Plumb. The variation from the plumb line with column axis mark shall not exceed 3mm.

5.2.3 Plates shall be in square within 2mm with column and shall be welded.

5.2.4 Base / Top plates shall be square. Bolt holes diagonal difference shall not more than 5mm. Holes pitches difference shall not be more than 3mm.

a) Bolt hole diameter tolerance is +2mm; -0.0mm.

(Wherever drg specifies tolerance for the hole the same shall be followed)

5.2.5 The orientation of the gusset plate welded with column top shall be checked with respect to column base gusset orientation. Location of the gusset plate shall be as per the drawing.

5.2.6 Flatness of the base plate after full welding shall be as follows:

Size	Tolerance
Upto 500 X 500 mm	2mm maximum
Above 500 X 500 mm	3mm maximum

FABRICATED I OR H SECTION:

5.3 The faces of fillet welds may be slightly convex, flat or concave. Except the outside corner joints, the convexity shall not exceed the value of 0.1S + 1.5mm where S is the actual size of the fillet weld in mm.

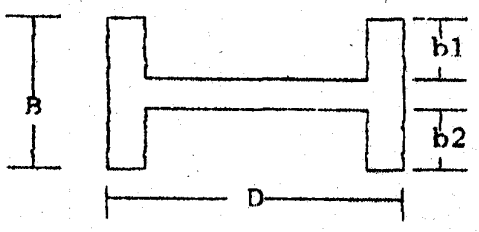
5.3.1 Groove welds shall preferably be made with slight or minimum reinforcement. In the case of butt welds and corner reinforcements shall not exceed 3.2mm in height and shall have gradual transition to the plane of the base metal surface.

5.3.2 The surfaces of butt joints required to be flush shall be finished so as not to reduce the thickness of the thinner base metal or weld metal by more than 0.8mm or 5% of the thickness which ever is smaller nor leave reinforcement that exceeds 0.8 mm. However all reinforcement must be removed where the weld forms part of contact surface.

5.3.3 Undercut shall not be more than 0.33mm deep when its direction is transverse to primary tensile stress in the part that is undercut not more than 0.88mm in all other situations.

5.3.4 Welds shall be free from overlap.

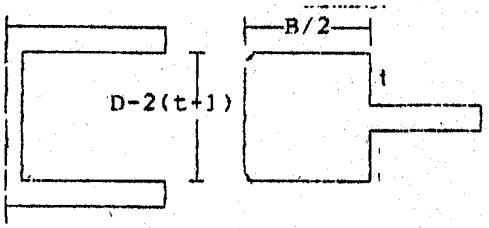
5.3.5 Specified length of section can vary upto +2.0-0.0mm



SECTION SIZE

Flange width = B+3MM to –1 mm
Depth =D +3MM to –1mm
Web Shift (b1 diff b2)/ 2 =2MM
Twist allowed = 2MM ax.
Flange war page = 2MM Max.
Camber & Sweep = 5MM Max.

I or H SECTION



t = Thickness of Flange

PLATE FOR CHECKING WARPAGE

Maximum gap permissible is 1mm.

5.3.6 Abutting parts to be jointed by butt welds shall be carefully aligned. An offset not exceeding 10% of the thickness of the thinner part joined, but in no case not more than 2mm may be permitted as a departure from alignment.

NOTE 5.3.7 CENTRE LINE MARKING OF COLUMNS AND OF FABRICATED COLUMS OUT OF CHANNELS

5.3.7.1 The center line (c1) shall be obtained by joining the center points of web thickness at both ends. This centerline shall be punched for about 100mm length at an interval of every Two meters and also at both ends of the column. Similarly centerline on the web shall be marked taking the mid point of the depth (with web area) at both ends.

5.3.7.2 In the case of columns made of channels; center line should be punched on channel web and bottom plates.

NOTE 5.3.8 LEVEL MARKING

5.3.8.1. Levels in steps of 5 meters shall be punched on the column, taking the top as the reference. The first level from top shall be the nearest. 13.740 meters, the first level shall be punched at 10 meters and the subsequent levels at 5 meters and "0" meter. The levels shall be identified by Punching 10 M, 5M, "0" M and shall be bordered in white paint. There is no tolerance on the level marking and it shall be carefully done.

5.3.8.2 Arrow mark shall be stenciled along with meter mark, arrow pointing downwards.

FABRICATED TYPE BRACINGS FROM CHANNELS

5.4 Size and dimensions shall be maintained as per the design requirement.

5.4.1. A fit up gap of 2mm shall be maintained with tacks between edges of channel flanges prior to welding.

5.4.2. One mm per meter length subject to the maximum of 5mm shall be allowed on Camber and Sweep on the fabricated bracings. Twist shall be controlled within 5mm.

5.5 ROOF BEAMS

Section size:	
Length:	+/- 2mm.
Depth of Beam:	+3mm to –1mm
Flange width:	+3mm to -1mm

5.5.1 Lateral deviation between centerline of weld and canter line of flange at contact surface: 2mm max.

5.5.2 Maximum permissible tilt on individual flanges (warp age) 2mm.

5.5.3 Flatness of web:
Web shall be flat as far as possible. Maximum out of flatness of web shall be as follows:
a) For a length of 3 meters – 3mm(max)
b) For total length of beam - 6mm(max) } Refer X1 of FIG C& D
(Wherever cross members is joining, web flatness shall be within 2mm) (Ref fig enclosed)

5.5.4 Flanges shall be straight at the edges. Maximum permissible waviness on individual flanges (Lengthwise) shall be as follows:
For a length of 3 meter = 3mm (max)
For a total length of Beam = 6mm (max)
(Refer Note Sl no 7.6.6 also)

NOTE 6.0 NON DESTRUCTIVE TESTING

6.1 All weld shall undergo thorough visual examination to detect the weld defects like undercuts, Non -uniform beading, overlaps, excessive concavity or convexity.

6.2 Welds shall be neither undersize nor too much excess than specified.

6.3 Cleaning of the entire columns shall be thoroughly examined before NDE and painting.

NOTE 7.0 TRIAL ASSEMBLIES

All the split columns / longitudinal roof beams shall be trial assembled and match marked in works.

7.1 Edge preparation for site joints of columns / beams shall be carried out before trail assembly.

7.2 During trial assembly, all the pieces of a column / roof beam shall be laid out on a raised level surface. Permanent concrete pedestals or supports out of rolled sections can also be used. These supports below the column / roof beam shall be maintained in one level by water level check. The section of the column / roof beam shall be kept free so that actual out of straightness or twist is reflected. Side support which may tend to neutralise the twist or the out of straightness of the beam shall not be used. For safety purpose, vertical posts may be provided near the column / roof beam. This will avoid toppling of the assembly.
The water level shall be maintained within 2 mm.

7.3 Center lines of individual column/beams shall be punched on both flanges. This center line punching shall be done for lengths of 100mm at interval of about 2 meter.

7.4 The column / beams shall be trial assembled keeping them in 'T' maintaining the bottom flange upwards. Web thickness of the adjacent pieces shall be fully matched.

7.5 The columns / beams may be held in position using bridgeon pieces or cleats during trial assembly.

7.6 The following shall be carefully checked during trial assembly.

7.6.1 Alignment and straightness of total assembled column / beam. Maximum out of straightness Permitted: 5mm (This shall be checked up with respect to the center line already punched).

7.6.2 Proper matching of butt plates with column / roof beam. Root gap for site welding, Bolt hole distances etc shall be checked

7.6.3 MATCHING OF FLANGES AND WEB AT FIELD JOINTS:

Flanges of connecting pieces of roof beams shall be in same level. Maximum off set of 2mm is permitted to accommodate the depth variations. This out of level may be adjusted on the top flange. (Which is kept downwards during trial assembly).

7.6.4 Total length of assembled beam shall be within +/- 5mm

7.6.5 Maximum twists on the section: 0005H (where H is the section depth in mm).
7.6.6 Flatness on the bolt hole joining area shall be maintained within 1 mm.

7.7 All pieces of roof beam shall be match marked during trial assembly.

7.7.1 Match marking should ensure proper identification of matching pieces at site to avoid,
a) Mix up / interchange of pieces between different beam of same EP.

b) Mix up / interchange of pieces between beams of different Eps of same boilers.

c) Any interchange of pieces in same roof beam.

7.7.2. Following scheme of match marking shall be adopted.

a) All roof beams and butt plates of one boiler shall be marked in a continuous serial to identify them separately.
b) For longitudinal roof beams only.
1A: 1A... 1B...1C
2A: 2A... 2B...2C likewise

7.7.3 In addition to the match marks detailed above matching lines shall be punched at each joint. Punched details shall be bordered in white paint for identification.

NOTE 8.0 CLEANING AND PAINTING:

8.1 All columns, bracings, roof beams shall be thoroughly cleaned to remove rust, grease, oil, weld slag, loose mill scales, spatters and other foreign materials.

8.2 Cleaned pieces shall be coated with two coats of paint as indicated below, allowing adequate drying time between each coat.
1) Primary coat of red oxide Zinc chrome primer with 25 microns minimum coating thickness conforming to IS 2074.
2) Finish coat of synthetic enamel long oil alkyd conforming to IS 2932 with minimum thickness of 20 microns (smoke gray shade).
3) Wieldable Primer shall be applied on the edge prepared area and also for a width of 25 mm in the EP adjoining area from EP edge.

NOTE: 9.0 MARKING

1) Following shall be stenciled in white paint and stenciled details covered with one coat of transparent varnish.

Sub contractor's code
W.O.No:
DU No:
Weight:
Project:
Match marks:

2) In addition to the above stenciling, all the above details shall be hard punched with 12mm letter Size in the middle/center of the column/beam on two sides(at 90 degree angle sides) and along with that stencil of those details on the top of the column for easy identification. Further, after punching all the detail, punched area shall be Aluminums painted with a white paint border.

ANNEXURE - I

FABRICATED H/I COLUMN

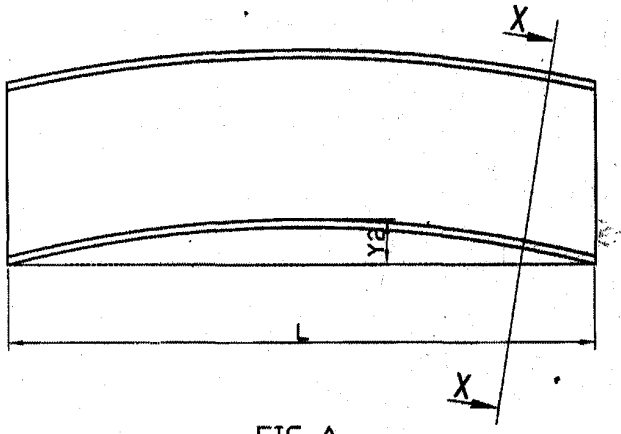
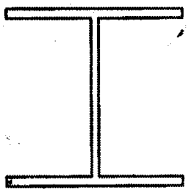


FIG A



SECTION - XX

CAMBER Y2 = 5MM (MAX)

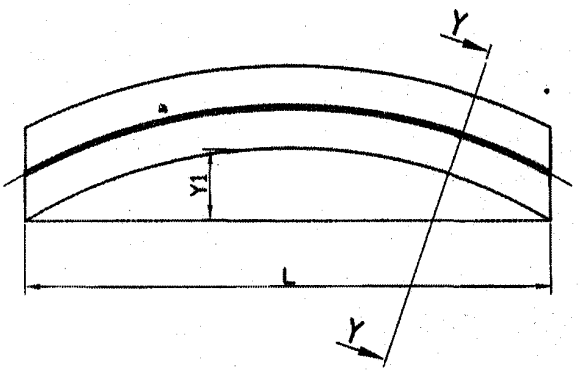
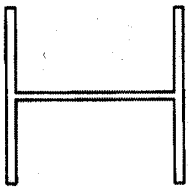


FIG B



SECTION - YY

SWEEP Y1 = 5MM (MAX)

BUCKLING OF WEBS IN H / I COLUMN

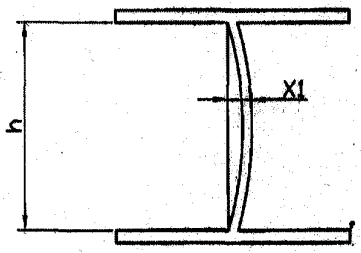


FIG - C

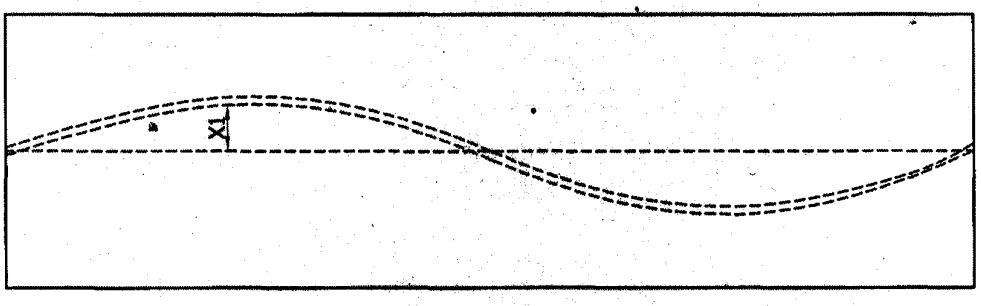


FIG - D

LETTER SIZE 12MM METAL PUNCHING TO BE DONE

AT THE MIDDLE OF THE COLUMN/BEAM

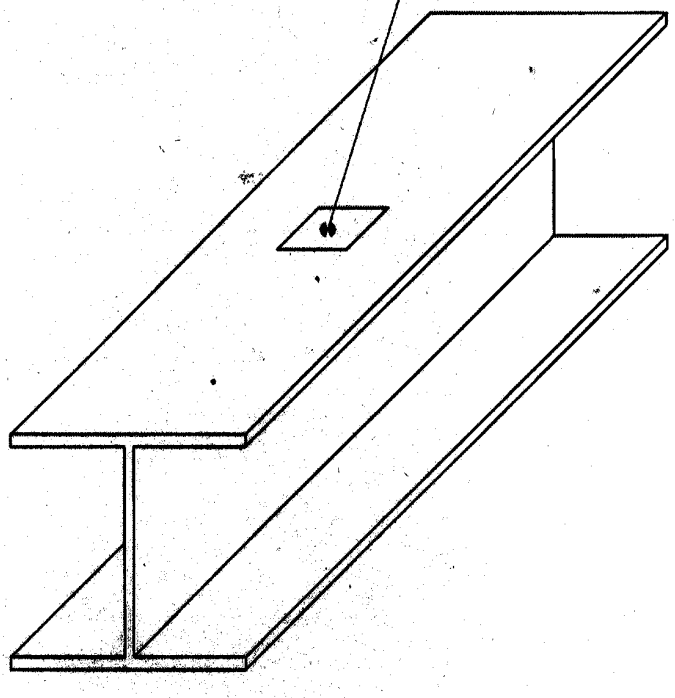


FIG - E

IDENTIFICATION / MARKING

Ranipet	MAN UFACTURER'S NAME& ADDRESS	STANDARD QUALITY PLAN	QP NO	SQP: ESP: 284
	BHARAT HEAVY ELECTRICALS LTD BOILER AUXILIARIES PLANT RANIPET-632 406 (INDIA)	ITEM: ESP Sub system: Sheet/Plate formed Components Shells, Panels & Funnel Assy/Splitters, Hopper walls, GD housing Panels.	REV NO	01
			DATE	06 06 07
			PAGE NO	01 of 09

Sl No	Component & operation	Characteristics	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format Of Records	Agency M	Agency B	Remarks
1	2	3	4	5	6	7	8	9		10
1.0	**Raw Material**									
1.1	Sheets & Plates Rolled section, hollows, Tubes	Chemistry & Mechanical Properties	Chemical & tensile test	As per TDC		Respective TDC	TC	P	V	
2.0	In process control									
2.1	Flame cutting	Lamination and cracks	Visual	100%		As per AWS D1.1	R	P	V	
2.2	Joint 'V' Fit up for plates /Back gouging	Fitup Characteristics "V" Root gap, Land /weld soundness	-DO-	100%		AWS D1.1, Drawing and QCP E002 latest	R	P	V	
2.3	Welding	1) Procedure Qualification	Review of documents	100%		Prequalified welding procedure As per AWS D1.1	R	P	W	
		2) Personal Qualification	-DO-	-DO-		AWS D1.1	R	P	W	

LEGENDS:0
M – Manufacturer / Subcontractor,
B - BHEL /BHEL Authorized Inspection Agency,
P - perform, V - Verification of Reports
W -Witness, TC - Test certificate,
DR – Dimensional report,

	PREPARED BY	REVIEWED BY		APPROVED BY
			QA	B. Sundarakumar 6/6/07
			QC-OLI	
			ENGG	

	MAN UFACTURER'S NAME& ADDRESS	STANDARD QUALITY PLAN	QP NO :	SQP : ESP : 284
	BHARAT HEAVY ELECTRICALS LTD BOILER AUXILIARIES PLANT RANIPET-632 406 (INDIA)	ITEM: **ESP** Sub system: Sheet/Plate formed Components Shells, Panels & Funnel Assy/Splitters, Hopper walls, GD housing Panels.	REV NO:	01
			DATE	06 06 07
			PAGE NO	02 of 09

Sl No 1	Component & operation 2	Characteristics 3	Type of Check 4	Quantum of Check 5	Reference Documents 6	Acceptance Norms 7	Format Of Records 8	Agency M 9	Agency B 9	Remarks 10
2.4	Weld inspn									
2.4.1	Size and finish		VISUAL	-DO-	DRAWING AND SIP; NP;06		R	P	V	
2.5	Weld NDE									REMARKS*; 1) Weld fitup
2.5.1	But welds on soundness Structural joints	SOUNDESS	Visual & LPI	See Remarks*	ASW D 1.1		R	P	V	2) On all Primary stiffeners 100% LPI. On back gouged area 100% LPI.
2.5.2	Fillet weld in structural	-DO-	LPI	10% Random @	-DO-		R	P	V	3)20%Random LPI on other joints
3.0	Dimensional control									
3.1	Hopper walls	Length, width and diagonal straightness waviness, stiffener location and orientation	Measurement and visual	100%	Drawing		R	P	W	@;In case of defects % shall be increased.

LEGENDS:				
M – Manufacturer / Subcontractor, B - BHEL /BHEL Authorized Inspection Agency, P - perform, V - Verification of Reports W -Witness, TC - Test certificate, DR – Dimensional report,	PREPARED BY	REVIEWED BY	QA QC-OLI ENGG	B. Srinivasa Rao P. Lingaiah	APPROVED BY

Ranipet	MAN UFACTURER'S NAME& ADDRESS BHARAT HEAVY ELECTRICALS LTD BOILER AUXILIARIES PLANT RANIPET-632 406 (INDIA)	STANDARD QUALITY PLAN ITEM: **ESP** Sub system: Sheet/Plate formed Components Shells, Panels & Funnel Assy/Splitters, Hopper walls, GD housing Panels.	QP NO : REV NO:	SQP:ESP: 284 01
			DATE	06 06 07
			PAGE NO	03 of 09

Sl No	Component & operation	Characteristics	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format Of Records	Agency M	Agency B	Remarks
1	2	3	4	5	6	7	8	9		10
3.2	Roof panels	Position of support insulator, holes, length width, diagonals & straightness, waviness, stiffener location & orientation.	Measurement & visual	DO	DO		R	P	W	
3.3	Casing Shells	Length, width diagonal, straightness, waveness, stiffener location & orientation	DO	100%	DRAWING		R	P	W	
3.4	Top Panels	Length, width diagonal, straightness, waviness, stiffener location and orientation, hole size & location.	DO	100%	DRAWING		R	P	W	

LEGENDS:
M – Manufacturer / Subcontractor, B - BHEL /BHEL Authorized Inspection Agency,
P - perform, V - Verification of Reports
W Witness, TC - Test certificate,
DR – Dimensional report,

	PREPARED BY	REVIEWED BY		APPROVED BY
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			QC-OLI	
			ENGG	

	MAN UFACTURER'S NAME& ADDRESS	STANDARD QUALITY PLAN	QP NO :	SQP : ESP : 284
			REV NO:	01
	BHARAT HEAVY ELECTRICALS LTD BOILER AUXILIARIES PLANT RANIPET-632 406 (INDIA)	ITEM: **ESP** Sub system: Sheet/Plate formed Components Shells, Panels & Funnel Assy/Splitters, Hopper walls, GD housing Panels.	DATE	06 06 07
			PAGE NO	04 of 09

Sl No	Component & operation	Characteristics	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format Of Records	Agency M	Agency B	Remarks
1	2	3.	4	5	6	7	8	9		10
	Dimensional control contd...									
3.5	Vertical/horizontal splitters; shape	Slope, height location of flat with tacks	Measurement in layout	100%	Drawing		R	P	W	
3.6	Trial assy of hopper lower with heating chamber	Weld gap, overall dimn gap between hopper and heating chamber, matching of poke tube holes.	Measurement and visual	1(one) assy	DO		R	P	W	
3.7	Funnel assy									
3.7.1	Floor assy center line offset if any	Overall dimn length, width diagonal, taper, profile matching holes location ref	Visual measurement template for profile Match marking	100%	Drawing		R	P	W	

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M – Manufacturer / Subcontractor,
B - BHEL /BHEL Authorized Inspection Agency,
P - perform, V - Verification of Reports
W -Witness, TC - Test certificate,
DR – Dimensional report,

	PREPARED BY	REVIEWED BY		APPROVED BY
QA			B. Sundara Rao	
QC-OLI				
ENGG			P. Ranganathan	

Ranipet	MAN UFACTURER'S NAME& ADDRESS	STANDARD QUALITY PLAN	QP NO :	SQP : ESP: 284
			REV NO:	01
	BHARAT HEAVY ELECTRICALS LTD BOILER AUXILIARIES PLANT RANIPET-632 406 (INDIA)	ITEM: **ESP** Sub system: Sheet/Plate formed Components Shells, Panels & Funnel Assy/Splitters, Hopper walls, GD housing Panels.	DATE	06 06 07
			PAGE NO	05 of 09

Sl No 1	Component & operation 2	Characteristics 3	Type of Check 4	Quantum of Check 5	Reference Documents 6	Acceptance Norms 7	Format Of Records 8	Agency 9 M	Agency 9 B	Remarks 10
3.7.2	As a funnel assy flange dimns, level	Over all dimns. bottom/top openings height, diagonals of funnel, and orientation and alignment of corner end plates, verticality.	Visual measurement	100%	DO		R	P	W	
4.0	Final inspn:									
	Surface cleaning, painting & preservation, marking	Welding, finish and appearance.	Visual	100%	Drawing, panting schedule PRQA 590(Latest)		R	P	W	

LEGENDS:
M – Manufacturer / Subcontractor,
B - BHEL /BHEL Authorized Inspection Agency,
P - perform, V - Verification of Reports
W -Witness, TC - Test certificate,
DR – Dimensional report,

PREPARED BY	REVIEWED BY	QA	B. Srinivasa Rao	APPROVED BY
		QC-OLI		
		ENGG		

1.0 Note 1.0 GENERAL REQUIREMENT

1.1 Any additional requirement for a specific contract shall be referred separately.

1.2 Raw materials used shall confirm to the grades specified in the drawing &GMS.

1.3 Raw material shall be free from harmful visual defects like cracks, seams, laps, lamination, heavy pitting etc.

1.4 Fabricators shall check all the supplied raw materials for dimensions ,bend, camber etc. Straightening wherever necessary must be carried out before assy and welding.

1.5 Substitution of materials shall be done with the prior approval of EDC/AQCS.

1.6 Plates for flange shall be preferably machine gas cut. Cut edges shall be dressed smooth to remove all the undulations. Gas cut notches if any shall be filled up and dressed. The edges shall be straight and square.

Note: 2.0 INPROCESS CONTROL

2.1 The general requirements for process control during fabrication in QCP;002[Latest] read along with amendment 1.

Note:3.0 MARKING, CUTTING AND PREPARATION

3.1 Bottom level hopper lower part shall be flat and square and the same shall be assured during assembly.

Note: 4.0 WELDING REQUIREMENT & WELD INSPECTION

4.1 Splice joints shall be completed prior to the welding of cover plate.

4.2 Sequences of welding shall be so chosen as to minimize the distortion.

4.3 NDT as required shall be carried out on splice joints before cover plate welding.

4.3.1 Visual inspection; after fabrication is completed, all welds shall be visually examined for arc strikes, sharp nicks, undercuts and size

4.4 Arc strike shall not be done straight on the job. Welder shall have a Separate piece for striking the arc

4.5 Welding procedure specification and welders qualification are detailed in SIP; NP;07[latest].

4.6 Butt welds in plate to make up the length shall be done carefully with suitable edge preparation. The stiffener angles & channels are to be welded to the casing shell only after completing all the splice joints and correcting weld distortions.

4.7 Splice joints if required, shall be in line with the following clauses.

4.8 Plates of 6 mm can be jointed using one of the following two alternatives;

a) Single v preparation of 60-70 degree with 1-2 mm land and 2-3 mm gap Welding shall be done on the v side. Subsequently, the plates to be turned and backside cleaned by wire brush. Then 2nd side welding to be done. If this method of welding is adopted the inspectors hold point shall be joint fit up stage.

b) The plates can be jointed by keeping straight butt faces with a gap of 2-3 mm. Welding to be done from the first side. Subsequently, the back side to be fully gouged/ground and then welded. In this type, the inspectors hold Point shall be the stage after back gouging. The back gouging shall be checked visually.

4.9 5mm plates shall be joined by straight butt keeping a gap of 2-3mm. Inspectors may have surveillance on joint fit-up but no hold point is required.

4.10 In case of stiffener of small sections, used in casing shell, weld preparation may be single "v". Inspectors shall check the back gouging/grinding after first side welding.

4.11 Weld the "v" from the reversed side by a min of two layers.

4.12 The min strip to be used for weld joint shall be 500mm.

4.13 The distance between the nearest stiffener and the splice joint parallel to it shall be min. 50mm.

NUMBER OF JOINTS

CASING SHELL AREA IN .M. sq	MAX.NO OFVERTICAL JOINTS
Less than 4	-NIL-
Above 4 to 8	2
Above 8 to 12	3
Above 12 to 16	4
Above 16 to 20	5
Above 20 to 24	6
Above 24 to 30	8
Above 30	10

4.14 Wherever the horizontal joints are not in full length then those joints may be counted along with other vertical joints and the same may be allowed as follows.

CASING SHELL AREA in M sq	MAX. NO. OF JOINTS
Less than 2	-NIL-
Above 2-5	3
Above 5-10	5
Above 10-15	6
Above 15-20	8
Above 20-25	10
Above 25- 30	12
Above 30-32	14
Above 32	16

4.15 The joints shall be uniformly distributed throughout the casing shall be inline with above table.

Note: 5.0 FABRICATION TOLERANCES
Following tolerances shall be applicable on different dimensions of casing shells, roof panels, hopper walls.

5.1 Surface of finished casing shell /Hopper wall shall be flat. The manufactures shall take extra care while carrying out the welding and handling/turning the casing shell/hopper wall to avoid out of flatness or waviness. Maximum out of flatness or waviness, as checked by piano wire or straight edge shall not be more than 15mm(i. e. ± 7.5mm).

5.2 Variation in liner dimensions shall not exceed plus or minus 1mm/Metere of nominal dimensions limited to

a) Length 5mm
b) With 3mm
c) Diagonal difference 7mm (Max)
d) Out of straightness of the sides 3mm.
e) Out of squareness of flanges shall not exceed 2mm.

5.3 Hole size and pitch on the flange shall be strictly as per drawing. Hole size Variation shall be limited to +2mm variation in distance between hole centers shall not vary more than ± 2mm.

5.3.1 Stiffener placement shall be with in ± 5mm.

5.3.2 The disposition of dia 500mm hole with respect to the longitudinal center line of the panel shall be with in ± 3mm.

5.3.3 Distance between the rectangular hole (for lifting tool) center of dia 400mm opening is ± 1.5mm.

5.3.4 Diagonal difference of dia 400mm opening in middle roof panel (with two sets of Opening). 3mm max.

Note: 5.3.5 FABRATION & DIMENSIONAL TOLERANCE OF SIDE PANELS AND MIDDLE PANNEL

5.3.5.1 FABRICTION

5.3.5.2 Butt welds in plate to make up the length shall be done carefully. All weld distortions shall be corrected before other stiffeners and Sections are welded to the plates.

5.3.5.3 TOLERENCE

a) Length	± 3mm
b) Width	± 2mm
c) Distance between guide pin	± 2mm
d) Diagonal difference	5mm(Max)

e) Bottom panel walls – position of hole for collecting rapping shall be maintained with in ± 3mm from the bottom edge and the side of the panel. Similarly the position of cut-out for emitting rapping drive shall be with ± 3mm with respect to top and side of the panel.

Note; DIMENSIONAL TOLERANCE OF FUNNEL ASSY

5.3.5.4 Variation in liner dimensions of the funnel wall shall not exceed ± 1mm/meter of nominal dimensions limited to a maximum of 5mm.

5.3.5.5 Difference between diagonals shall not exceed 1mm/metre of approximate nominal diagonals length limited to max.of 7mm.

5.3.5.6 Out of squareness of flanges shall not exceed 1mm.

5.3.5.7 The level of the flanges is to be ensured by water level. The deviations Permitted is 2mm max.

5.3.5.8 The local out flatness allowed in individual panels is 5mm max. Flange holes, pitches of flange holes with in ± 1mm.

Note: 6.0 Marking:

6.1 The following details shall be stenciled with white paint and the stenciled details covered with one coat of transparent varnish at the center of casing shell.

. Sub-Contractor code
. Work Order Number.
. DU Number.
. Weight
. Project

6.2 In addition of above stenciling , following details shall also be welded /punched and bordered in white paint.

. Sub-Contractor code
. Work Order Number.
. DU Number.

***

QUALITY DEPARTMENT		
Amendment to Quality Work Instructions (SQP)		
QWI NO: SQP : ESP:285	REV: 00	DT. 20 06 1998
Amendment no: A 2		DT. 17 02 2005
Description : Collecting & Emitting electrodes suspension frames of ESP		

Details of Amendment		
Clause No.	**Amended As**	**Basis For Amendment**
Note 5.1.2.n	Sharp corners of the weld shall only be dressed smoothly.	E-mail from Engg Dt 25-09-2004

Prepared by	**Reviewed By**		**Approved By**
	1. Quality Assurance		
	2. Quality control		
	3. Engg/AQCS		
	4. MSA		Head/QA

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Issued to Shri	

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QUALITY DEPARTMENT		
Amendment to Quality Work Instructions (SQP)		
QWI NO: SQP:ESP:285	REV:00	DT. 20/06/98
Amendment no: A 1		DT. 25/01/2001
Description: Collecting and Emitting Electrodes Suspension Frames of ESP.		

Details of Amendment

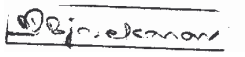
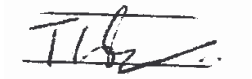
CLAUSE NO	AMENDED AS	BASIS FOR AMENDMENT
Note 3.1.1	E 6013 electrode shall be dried in baking oven at 120-130°C until they are used, if the packings were found to be damaged or the electrodes were kept exposed to atmosphere for prolonged period.	Feed back of CTQ MOM dt:12/10/2000

Prepared by	Reviewd by		Approved by
	Engg/AQCS		
	QC/OLI		
	QA		

MASTER COPY

BHEL RANIPET	STANDARD QUALITY PLAN FOR ESP (MECHANICAL)	
REF.NO.	REVISION NO.	EFFECTIVE DATE
QP: ESP: 285	00	20 06 98

TITLE : COLLECTING AND EMITTING ELECTRODES SUSPENSION FRAMES OF ESP

			SIGNATURE
PREPARED BY	:	A ELANGOVAN/QA	
REVIEWED BY	:	K NITHIANANDAM/QA	
	:	P RAJASEKARAN/QC OLI	
	:	T GNANAPRAKASAM /AQCS	
APPROVED BY	:	H ANANTHANARAYANAN/QA	

ISSUED & CONTROLLED BY : :QUALITY ASSURANCE, BHEL, RANIPET- 632 406

DOCUMENT STATUS ----------
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Mr.

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BHEL RANIPET	STANDARD QUALITY PLAN FOR ESP (MECHANICAL)	
REF.NO.	REVISION NO.	EFFECTIVE DATE
QP:ESP:285	00	20 06 98

TITLE : COLLECTING AND EMITTING ELECTRODES SUSPENSION FRAMES OF ESP

RECORD OF REVISION

REF	DETAILS OF REVISION	DATE AMENDED REVISED
REVISIION 00	TOTALLY REVIEWED. MERGED SQP: ESP 254, 262, QCPE023 & E-024 AND ISSUED AS SQP:ESP:285	20 06 98

MANUFACTURER'S NAME & ADDRESS	MANUFACTURING QUALITY PLAN	QP:ESP:285
BHARAT HEAVY ELECTRICALS LTD BOILER AUXILIARIES PLANT RANIPET - 632 406 (INDIA) QUALITY ASSURANCE DEPARTMENT	ITEM: SUB SYSTEM :--	REV : 00 DATE : 20 06 98 PAGE : 03 OF 12

STANDARD QUALITY PLAN

S.NO.	COMPONENT & OPERATION	CHARACTE-RISTICS	CLASS M C E	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	D*		
1	2	3	4	5	6	7	8	9	D*	10	11
1.0	RAW MATERIALS										
1.1.1	RECTANGULAR HALLOWS, TUBES CHANNELS, ANGLES, HOOKS.	CHEMISTRY & MECHANICAL PROPERTIES TESTING.	MAJOR	REVIEW OF TCs/ RANDOM VERIFICATION OF TCs/RANDOM TESTING	EACH LOT ORD HEAT AS PER MATERIAL SPECIFICATION	MATERIALS SPECIFICATIONS AS PER DRG	TC TAKEN TO STOCK ON	P	V	-	RAW MATERIALS ARE
1.2	RECTANGULAR TUBES/HOLLOWS	CRACKS	MAJOR	VISUAL	100%	CRACKS NOT PERMITTED	R	P	W		
	HOOKS	PROFILE, TOOL MARKS & CRACK	D0	DO	100%	CRACKS AND TOOL MARKS NOT PERMITTED	R	P	W		

LEGEND: RECORDS IDENTIFIED WITH "TICK" SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION.

**M:MANUFACTURER/SUB-CONTRACTOR, C:CONTRACTOR/NOMINATED INSPECTION AGENCY, E:CUSTOMER.
R:REPORT, TR:INSPECTION REPORT, "P" PERFORM, "W" WITNESS AND "V" VERIFICATION AS APPROPRIATE.
TC: TEST CERTIFICATES, "CHP" (CUSTOMER HOLD POINT) : CUSTOMER SHALL IDENTIFY IN COLUMN "E"

MANUFACTURER'S NAME & ADDRESS	MANUFACTURING QUALITY PLAN	QP:ESP:285	
BHARAT HEAVY ELECTRICALS LTD BOILER AUXILIARIES PLANT RANIPET - 632 406 (INDIA) QUALITY ASSURANCE DEPARTMENT	ITEM: SUB SYSTEM :--	REV : 00 DATE : 20 06 98 PAGE : 04 OF 12	STANDARD QUALITY PLAN

S.NO.	COMPONENT & OPERATION	AGENCY M C E	CHARACTE-RISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	REMARKS
1	2		3	4	5	6	7	8	9 D* 10	11
2.0	INPROCESS CONTROL									
2.1	HOOK FIT WITH THE TUBE /HOLLOW/ANGLE/ FRAME PART/	R P W	@VERIFY: HOOKS IN THE FIXTURE WELDED WITH HOOKS		DO MENT AND VISUAL DURING START OF WORK	MEASURE 3 TUBES/ ANGLES	DRAWING	DRAWING	DRAWING	1)REF TO LOCATION OF FIRST HOOK 2)HOOK PITCH 3) HOOK LEVEL FOR CE SUSPENSION
2.2	ASSY OF TUBES /HOLLOWS/ ANGLES AS A DIMENSION]	R P W	FIT UP OF TUBES/HOLLOW S/ANGLES		DO MENT & VISUAL DURING START OF WORK	#MEASURE 2 FRAMES ORIENTATION & LOCATION, 2) DIAGONAL OF HOOKS & HOLES, 3) FRAME 4) OVER ALL	DRAWING	DRAWING	DRAWING	[NOTE:# 1) TUBE/HOLLOW/ANGLE

2.3	STRUCTURE WELDING	AS A FRAME	1)PROCEDURE QUALIFICATION	MAJOR	REVIEW OF DOCUMENTS	100%	PRE QUALIFIED WELDING PROCEDURE AS PER AWSD1.1	R	P W
			2) PERSONAL QUALIFICATION	DO	DO	100%	AWS D 1.1	R	P W

LEGEND: *RECORDS IDENTIFIED WITH "TICK" SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION.

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1	2	3	4	5	6	7	8	9	D* 10	11
2.3.1	WELD INSPN ON HOOK WELDING, AFTER WELDING	SIZE & FINISH	DO	$$ VISUAL	100%	DRAWING & SPIP: NP:06	$$:1) PIN HOLE, BLOW HOLES 2)SHARP CORNER HOOK WELDING 3) EXCESSIVE FILLET SIZE ON HOOK ARE NOT ACCEPTED.	R	P W	
3.0	DIMENSIONAL CONTROL	DIMENSIONS	DO	MEASUREMENT	RANDOM	DRAWING	DRAWING	R	P W	
	1) LENGTH & WIDTH OF FRAMES		DO	DO	DO	DO	R	P W		
	2) LOCATION OF ANGLES MEANT FOR BEAMS W.R.T CENTRE OF FRAMES, SOLES PITCHES									
	3) LOCATION OF HOLES / BACK		MAJOR	MEAURE	RANDOM	DRAWING		R		

	P W										
	MARK IN ANGLE.CHANNEL		MENT								
4) HOOK PITCHES:LONGITUDIANL \	DO	DO	RANDOM		DRAWING		R	P W			
5) HOOK PITCHES:TRANSVERSE	DO	DO	@100%		DRAWING		R	P W			
6) BOW & SIDE BEND ON THE TUBE/HOLLOWS/ANGLES	DO	DO	100%		DRAWING		R	P W			

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3.0 CONTD…

	7)CE HOOK LEVE, HOOK & HOLES DIAGONAL, TWIST, CAMBER & SWEEP OF FRAMES AFTER WELDING AND COMPLETE FABRICATION	CRITICAL	MEASUREMENT	100%	AS PER DRAWING [TWIST, CAMBER & SWEEP NOT PERMITTED]	R	P	W
4.0	FINAL INSPECTION							
	SURFACE CLEANING, PAINTING AND PRESERVATION	PACKING STURDINESS, WELDING SIZE, FINISH & APPEARNCE	DO	VISUAL	100%	AS PER PACKING DRAWING AND PAINTING SHEDULE RP 0674199	R	P	W

LEGEND: * RECORDS IDENTIFIED WITH "TICK" SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION.

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1.0 NOTE.1. 0 GENERAL REQUIREMENTS

1.1 Any additional requirement for a specific contract shall be refereed separately.
1.2 Raw material; used shall conform to the grades specified In the drawing & GMS.
1.3 Raw material shall be free from harmful Visual defects like cracks, seams, laps, laminations, heavy pittings etc.
1.4 Fabricators shall check all the supplied raw materials for Dimensions, bend camber etc. Straightening wherever necessary must be carried out before assy and welding.
1.5 Substitution of materials shall be done with the prior approval of EDC/AQCS.
1.6 Fabricator to impose sufficient process control, necessary Stage inspection so that the components made are consistent On quality and conforms to the drawing and specification. It is the responsibility of the fabricator to adopt sufficient measures to avoid non conformances.
1.7 Tubes/Hollows/Angles shall be gas cut. Cut edges shall Be dressed smooth to remove all the undulations. Gas cut notches if any shall be filled up and dressed. The edges shall be straight and square.
1.8 Tubes /Hollows/Angles shall be cut carefully to the required size and profile and dressed square. No joint on Hollows and Angles shall be permitted.

NOTE 2.0 INPROCSS CONTROL

2.1 The general requirements for process control during fabrication are detailed in QCP:002 (Latest) read along with amendment 1.

NOTE 3.0. WELDING REQUIREMENTS & WELD INSPECTION

3.1 Electrodes :E6013 shall be used for welding.
3.1.1 E6013 electrodes shall be dried in backing ovens at temperature 100 Degree C, until they are used, If the packing were found to be damaged or the electrodes were kept exposed to atmosphere for prolonged period.
3.2 Pre qualified welding procedure as per AWS D1.1 (Latest) Shall be used.
3.3 Welders employed shall be qualified as per AWS D1.1 latest. Welders qualified to other codes may also be permitted to carryout welding at the discretion of Inspection Engineers.
3.4 Fillet and butt welds shall be done with a minimum of Two layers, and 6mm fillet or less can be done in single run ensuring complete root fusion.

3.5 Sequence of welding shall be so chosen to balance Applied heat and to minimise the distortion.
3.6 Arc strike shall be dine straight on the job. Welder Shall have a separate piece for striking the arc.
3.7 weld procedures and welder's qualification are detailed in SIP : NP : 07 (Latest)
3.8 All welds shall undergo thorough visual examination to Detect the weld defects like undercuts, non-uniform Beading, overlaps, excessive concavity or convexity etc.
3.9 Welds shall be neither undersize nor excess than specified.
3.10 Only BHEL approved bands of electrodes shall be used,
3.11 Cleaning of the entire Job shall be thoroughly Examined before painting.
3.12 While welding the Frames adequate care has to be taken to control the distortion.

4.0 WORKMANSHIP AND TOLERANCE

4.1 COLLECTING ELECTRODES

4.1.1 All support angles shall be straight and parallel. Maximum out of straightness shall be within 2 mm.
4.2 All components shall be inspected for dimensions. Permissible tolerance shall be as per the drawing.
4.3 Alignment of hooks across the frame as checked on first set of hooks at edge stiffener end shall be within 2mm.
4.4 Disposition of bolt holes shall be within +/- 1mm.
4.5 Distance between any two support angles are to be maintained as per the drg. This shall be measured at the bottom edge of the support angles.
4.6 Diagonal variation as measured between corner angles / Hooks max. 5mm.

5.0 EMITTING ELECTRODES FRAMES

5.1 Raw material shall be free from bend and twit. Straightening wherever necessary shall be carried put on individual numbers before they are taken up for fabrication.
5.1.1 All Flame cut edges shall be dressed smooth and square by grinding.

5.1.2 The following sequence shall be adopted in fabricating the frame part top and bottom.

a) Straighten the rectangular tubes if necessary. Maximum twist permitted on supplied tube 2mm.
b) Cut to length within +/- 1mm.
c) Remove the rust preventive coat on the rectangular tubes to ensure proper welding.
d) Dress the cut edges by grinding.
e) Weld the electrode holders on the tubes using fixture. All holders shall be on the tube face not having ERW seem.
f) Electrodes holders shall be welded on to the tube with smooth bead avoiding undercuts, weld ripples and spatters.
g) Straighten the tubes.
h) For the tubes meant for frame part bottom weld the end cover sheets.
i) Fix the tubes with the channels/angles on the fixture. The channels/angles shall be cut to the correct size and straightened before they are assembled in the fixture.
j) Check the diagonals.
k) Tack weld the frame.
l) Remove the frame from the fixture: check all the dimensions and full weld.
m)Correct all welding distortions.
n) Dress the sharp corners that may be present at the ends of the electrode holders.
o) Check all the dimensions and alignment of holders.

5.1.3 The following sequence shall be adopted in fabricating the frame part middle.

a) Cut the tube to correct size.

b) Dress the tube to correct size

c) Drill the holes at one end for plug welding the pin.

d) Weld the end cover sheet at the other end

e) Place tube fixture. Fix the pin maintaining overall length and tack weld. Tack weld all electrodes holders on both sides of the tube maintaining them at 180 Degree to reach other.

f) Remove the piece from the fixture and full weld.

g) Dress all the sharp corners that may be present at the edges of the holders.

h) Flush grind the pin plug welding.

i) Straighten the frame.

j) CHECK all the dimensions.

5.1.4 No joint is permitted to make up the length of the Rolled sections.
5.1.5 Fillet welds shall neither be undersize nor too much Oversized than the specified.
5.1.6 No undercuts in the welds shall be permitted.

5.2 FRAME PART TOP AND BOTTOM:

5.2.1 Finished frames shall be free from twist and bend.
5.2.2 All tubes shall be straight.
5.2.3 All electrode holders on a tube shall be in a straight line.
5.2.4 Length of frame +/-1mm.
5.2.5 Diagonal variation between extreme corner holders as well as bolt holes shall be within 5mm max.
5.2.6 Cumulative distance between roes i.e. the dimension 300, 600, 900 mm… +/- 1mm. This shall be measured atleast in three places in each frame i.e. at both ends at the middle of the frame.
5.2.7 all electrode holders shall be perpendicular to the tube face.

5.2.8 First holders at both ends (in all tubes) shall be within:
a) 385 +/- 1mm for frame part top.
b) 285 +/- 1mm for frame part bottom.

5.2.9 Pitch of holders on a tube +/- 3mm.

5.2.10 a) In frame part top, bolt holes shall be in the middle of two end tubes with +/- 1mm.
b) In frame part bottom bolt holes shall be in line With the centre axis of end tubes within +/- 1mm.

5.2.11 The need channel angles shall be square to the tube surface.

5.3 FRAME PART MIDDLE

5.3.1 Finished pieces shall be straight.
5.3.2 All electrode holders shall be in one line.
5.3.3 The electrode holders on both sides of the tube shall be at 180 Degree with each other and diametrically opposite on the tube.
5.3.4 First holder shall be 405 +/- 1mm from pin end & 355 +/-1mm at the other end.
5.3.5 Pitch of electrode holders +/- 3mm.
5.3.6 Overall length of frame part middle +/-1mm.

6.0 CLEANING AND PAINTING

6.1 All frames shall be thoroughly cleaned to remove weld slag, spatter, grease, rust and mill scales.
6.2 Cleaned frames shall be coated with two coats of paint as Indicated below:

a) Primary coat of red oxide zinc chrome prior with 25 Microns minimum coating thickness conforming to IS 2074.
b) Finish coat of synthetic enamel long oil alkyd to IS 2932 with minimum 20 microns thickness of smoke grey shade.

7.0 IDENTIFICATION AND PACKING

7.1.1 In all the frame part top and bottom, the following details shall be stenciled in white paint and stenciled details covered with one coat of transparent varnish.

Sub-Contractor's code
Work order number
D. U. No.
Weight
Sl. No.

7.1.2 For frame part middle :-
The following shall be stenciled on five frame part middle piece in each packing. The stenciled details shall be covered with one coat of transparent varnish and the stenciling shall be clearly visible after packing.

Sub-contractor's code
Work order number
D. U. No.
Weight

The above stenciling shall be done at two places on the packing also.

7.2 In additional to the above stenciling, in all the pieces of frame part top, middle and bottom the sub-contractor's code shall be punched. Punched details shall be bordered in white paint.

7.3 Finished frames shall be packed as per the respective packing drawing and the dispatched. All steel sections used for packing shall be painted yellow.

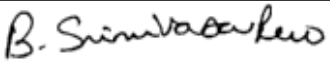
7.4 PACKING

All the frames shall be as per the packing drawing and then dispatched. All steel sections used for packing shall be painted yellow.

****

QUALITY DEPARTMENT	
Amendment to Quality Work Instructions (SQP)	
QWI NO:SQP 286 REV: 00	**DT. 20 06 1998**
Amendment no: A 2	**DT. 04 05 05**
Description : Standard quality Plan for a) Rapping shaft b) Foundation bolt c) Lifting holders	

Details of Amendment		
Note Sl.no.	**Amended As**	**Basis For Amendment**
2.2 2.9	Amendment A1 is deleted. Following are added to the existing clause. • After forming the radius to drawing dimensions, normalizing heat treatment as per following cycle shall be done. ▪ Soaking temperature ; 860 to 900° C ▪ Soaking time : 1 hour minimum ▪ Rate of heating : 200 ° C / hour max ▪ Cooling shall be done by forced air.(by fan)	Revised based on MSA feedback.

Prepared by	Reviewed By	Approved By
		

QUALITY DEPARTMENT
Amendment to Quality Work Instructions (SQP)
QWI NO: **SQP 286** REV:**00** DT. **20 06 98** **Amendment no: A 1** **DT29 09 04**
Description : (a) Rapping **shaft,(b)Foundation bolt,(c) Lifting holders**

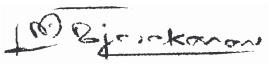
Details of Amendment		
Note Sl.no.	**Amended As**	**Basis For Amendment**
2.2	Clause 2.2 followed by the following content in the remarks column incase of hot working without temperature control, the item shall be Normalized temperature: 860 –900 deg C Soaking time: 2 Hrs. Rate of heating: 150 deg C/Hr. Cooling shall be done at forced still air (By Fan)	Revised based on MSA feed back.

Prepared by	**Reviewed By**	**Approved By**

Controlled Copy No	
Issued to Shri	

BHEL RANIPET	STANDARD QUALITY PLAN FOR ESP (MECHANICAL)	
REF.NO.	REVISION NO.	EFFECTIVE DATE
QP : ESP : 286	00	20 06 98

TITLE : (a) RAPPING SHAFT, (B) FOUNDATION BOLTS &
(c) LIFTING HOLDERS

		SIGNATURE
PREPARED BY	: A ELANGOVAN / QA	
REVIEWED BY	: K NITHIANANDAM / QA	
	: P RAJASEKARAN / QC OLI	
	: T GNANAPRAKASAM/AQCS	
APPROVED BY	: H ANANTHANAYANAN / QA	

ISSUED & CONTROLLED BY : QUALITY ASSURANCE, BHEL, RANIPET-632406

DOCUMENT STATUS ----------
ISSUED TO : ---------- INFORMATION COPY
Mr

DEPARTMENT: ---------- CONTROLLED COPY NP
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RECORD OF REVISION

REF		DETAILS OF REVISION	DATE AMENDED/ REVISED
REVISION	00	TOTALLY REVIEWED AND SQP:ESP 263, 271, 273 AND ISSUED AS SQP : ESP : 286	20 06 98

MANUFACTURER'S NAME & ADDRESS	MANUFACTURING QUALITY PLAN	QP:ESP:286	
BHARAT HEAVY ELECTRICALS LTD	ITEM :	REV : 00	STANDARD QUALITY
BOILER AUXIALIARIES PLANT	(a) RAPPING SHAFTS	DATE : 20 06 98	PLAN
RANIPET - 632 406. (INDIA)	(b) FOUNDATION BOLTS	PAGE : 03 OF 11	
QUALITY ASSURANCE DEPARTMENT	(c) LIFTING HOLDERS		

S.No.	COMPONENT & OPERATION	CHARACTE-RISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	D*	AGENCY **M C E	REMARKS
1	2	3	4	5	6	7	8	9		10	11
1.0	RAWMATERIALS										
	BRIGHT BAR, ROUNDS	CHEMICAL & MECHANICAL PROPERTIES	MAJOR	REVIEW OF TC/RANDOM TESTING	EACH LOT OR HEAT AS PER SPECIFICATION/RANDOM SAMPLE	RESPECTIVE MATERIAL SPECIFICATION AS PER DRAWING		TC	-		RAW MATERIAL TAKES TO STOCK AFTER VERIFICATION OF TC/RANDOM TESTING.
	(s) RAPPING SHAFTS										
2.0	INPROCESS CONTROL :										
	MACHINING OF I)SHAFT ENDS ii)KEY WAY iii)DRILLING OF HOLES	DIMENSIONS AND FINISH	MAJOR	MEASUREM--ENT	100%	DRAWING	DRAWING	R		P W	HOLES ARE TO BE DRILLED IN RELEVANT JIC.
3.0	FINAL INSPECTION:										
		OVERALL DIMENSIONS, FINISH, STRAIGHTNESS	MAJOR	VISUAL & MEASUREMENT	100%	DRAWING	DRAWING	R		P W	

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1	2	3	4	5	6	7	8	9	10			11
	(b) FOUNDATION BOLTS:											
2.0	INPROCESS CONTROL											
2.1	MACHINE	1)MAJOR DIA	CRITICAL	MEASUREMENT	100%	DRAWING / STANDARD		R	P	W		
		2)LENGTH OF MACHINING FOR THREAD CUTTING	MAJOR	MEASUREMENT	100%	DRAWING	DRAWING	R	P	W		
		3)THREAD CUTTING	MAJOR	MEASUREMENT BY GO/NOGO GAUGE	100%	DRAWING / STANDARD		R	P	W		
		4)LENGTH OF FOUNDATION BOLT	MAJOR	MEASUREMENT	100%	DRAWING	DRAWING	R	P	W		
		5)SIDE LUGS	MAJOR	VISUAL	100%	DRAWING	DRAWING	R	P	W		

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1	2	3	4	5	6	7	8	9		10			11
2.2	WELDING	1)PROCEDURE QUALIFICA-TION	MAJOR	REVIEW OF DOCUMENTS	100%	PRE QUALIFIED WELDING PROCEDURE AS PER AWSD1.1		R		P	W		K7018 ELECTRODE SHALL BE USED
		2)PERSONNEL QUALIFICATION	MAJOR	REVIEW OF DOCUMENTS	100%	AS PER AWS D1.1		R		P	W		
2.2.1	WELD INSPN.	WELD QUALITY SIZE & FINISH	MAJOR	VISUAL LPI	100% 10%	DRAWING,SIP:NP:06 AND BHE:NDT:RP:PT:01		R		P	W		10%LPI (LIQUID PENETRANT INSPN.) ON FILLET WELDS OF BOLT WITH PLATES/LUGS
3.0	FINAL INSPN.	COMPLIANCE TO DIMENSION &STRAIGHTNESS	MAJOR	MEASURE MENT & VISUAL	100%	DRAWING	DRAWING	R		P	W		
3.1.1	ASSY OF FOUND ATION BOLTS & NUT	COMPLIANCE	MAJOR	VISUAL GRADE OF NUT	100%	DRAWING	DRAWING	R		P	W		

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3.2.1	SURFACE CLEANING	CLEANING	MAJOR	VISUAL	100%	DRAWING	DRAWING	R		P	W		THREADED AREA TO BE PROTECTED WHILE CLEANING
3.2.2	PRESERVATION	APPLICATION OF RUST PRE-VENTIVE ON THREADED REGION	MAJOR	VISUAL	100%	DRAWING	DRAWING	R		P	W		
3.3	PACKING AND DESPATCH	PROTECTION OF THREADED AREA,IDENTI FICATION OF WORK ORDER, DU NO,ETC...	MAJOR	VISUAL	100%	DRAWING	DRAWING	R		P	W		NOTE:THREADED AREA OF BOLT SHALL BE COATED WITH RUST PREVE-NTIVE FLUID AND COVERED BY TAR IMPREGNATED GUNNY CLOTHS.

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BHARAT HEAVY ELECTRICALS LTD	ITEM :	REV : 00	STANDARD QUALITY
BOILER AUXIALIARIES PLANT	(a) RAPPING SHAFTS	DATE : 20 06 98	PLAN
RANIPET - 632 406. (INDIA)	(b) FOUNDATION BOLTS	PAGE : 07 OF 11	
QUALITY ASSURANCE DEPARTMENT	(c) LIFTING HOLDERS		

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1	2	3	4	5	6	7	8	9		10			11
	(c)LIFFTING HOLDERS												
2.0	INPROCESS CONTROL												
2.1	MACHINING AND THREAD CUTTING	MAJOR DIA, BOOT DIA,, PITCH	MAJOR	MEASUREMENT AND CHECKING WITH GAUGE (CO & NOGO)	100%	DRAWING / STANDARD		R		P	W		
2.2	HIT FORMING IN FIXURE	RADIUS OF REND,FORMING TEMPERATURE	MAJOR	MEASUREMENT	100%	DRAWING	DRAWING	R		P	W		
2.3	NDE	LIQUID PENETRANT INSPN	MAJOR	LPI	100% IN BEND PORTION	AWS D1.1	AWS D1.1	R		P	W		

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MANUFACTURER'S NAME & ADDRESS	MANUFACTURING QUALITY PLAN	QP:ESP:286	
BHARAT HEAVY ELECTRICALS LTD	ITEM :	REV : 00	STANDARD QUALITY
BOILER AUXIALIARIES PLANT	(a) RAPPING SHAFTS	DATE : 20 06 98	PLAN
RANIPET - 632 406. (INDIA)	(b) FOUNDATION BOLTS	PAGE : 08 OF 11	
QUALITY ASSURANCE DEPARTMENT	(c) LIFTING HOLDERS		

S.No.	COMPONENT & OPERATION	CHARACTE-RISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	D*	AGENCY **M	C	E	REMARKS
1	2	3	4	5	6	7	8	9		10			11
3.0	DIMENSION CONTROL	OVERALL DIMENSIONS, THREADED LENGTH, THREADINGS, BOOK RADIUS	MAJOR	CHECK IN LAYOUT & THREAD GAUGE (CO & NO CO).	100%	DRAWING	DRAWING	R		P	W		
4.0	FINAL, INSPN SURFACE CLEANING & PAINTING	MARKING AND PRESERVATION	MAJOR	VISUAL	100%	DRAWING, PAINTING SCHEDULE, PR:QA:590		R		P	W		

LEGEND: * RECORDS IDENTIFIED WITH "TICK" SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION.
** M:MANUFACTURER/SUB-CONTRACTOR,C:CONTRACTOR/NOMINATED INSPECTION AGENCY,B:CUSTOMER.
R:REPORT,IR:INSPECTION REPORT,"P" PERFORM,"W" WITNESS AND "V" VERIFICATION AS APPROPRIATE.
TC:TEST CERTIFICATES,"CHP'(CUSTOMER HOLD POINT):CUSTOMER SHALL IDENTIFY IN COLUMN "E"

NOTE : 1.0 GENERAL REQUIREMENTS :

1.1 Any additional requirement for a specific contract shall be referred separately.

1.2 Raw materials used shall confirm to the grades specified in the drawing and GMS.

1.3 Fabricators shall check all the supplied raw material for dimensions, bend etc.,straightning wherever necessary must be carried out before start of production.

1.4 Raw materials shall be free from harmful visual defects like cracks, seams, laps, laminations, heavy pittings etc.

1.5 Substitution of materials shall be done with the prior approval of EDC/AQCS.

1.6 Fabricator to impose sufficient process control, necessary stage inspection so that the components made are consistant in quality and conforms to the drawings and specifications.

1.7 Plates for foundation bolts shall be preferably machine, gas cut. Cut edges shall be dressed smooth to remove all the undulations. Gas cut notches is any shall be filled up and dressed. The edges shall be straight and square.

1.8 All the low hydrogen electrodes used shall be dried in baking oven between 260 - 427 deg C for two hours and held at 100 deg C until they are used. Welders employed shall be qualified as per AWS D1.1 latest. Welders qualified to other codes may also be permitted to carry out welding at the discretion of inspection Engineers.

1.9 Fillet and butt welds shall be done with a minimum of two layers, ensuring complete root fusion. Sequence of welding shall be so chosen as to minimise the distortion.

1.10 Arc strike shall not be done straight on the job. Welder shall have a separate piece for striking the arc.

1.11 Weld procedures and welder's qualification are detailed out in SIP:NP:07 (Latest) shall be followed.

NOTE 2.0 INPROCESS CONTROL :

2.1 Rapping shafts, Foundation bolts / Lifting holders and the plates shall be made out of single piece. No joint is permitted to make up the length/size.

2.2 Rods for Rapping shafts, Foundation bolts / Lifting holders and plates shall be marked and cut to size by saw cutting or flame cutting. Flame cut edges shall be cleaned to remove slag. Uneven edges shall be dressed by grinding.

2.3 Rapping shaft's holes and key way shall be drilled/made with relevant jigs, the orientation and dimensions shall be maintained as per the drawing.

2.4 Threading of foundation bolt to be carried out prior to welding.

2.5 E 7018 electrode shall be used for welding in case of Foundation bolts. The plate shall be perpendicular to the foundation bolt.

2.6 One face of side lugs shall be machined to give a square face and the same shall be placed upwards while welding with the foundation bolt. Setting and tack welding shall be done on a fixure. The top of the lugs shall be in same level. Any minor error in the length of the side lugs shall be adjusted at the bottom.

2.7 While full welding the side lug to the bolt, welding shall be started 5mm away from the top of the side lugs. All the three rods shall be in the same axis. LPI shall be carried out on welds to ensure soundness of welding of lugs and foundation bolts.

2.8 Foundation bolt shall be straight after welding. If required, straightening to be done. Two mm Maximum out of straightness shall be allowed. Length of side lug shall +/- 1mm and off-set of side lugs and bolt shall be +1.00/-0.0mm. The total length & threaded length of foundation bolt shall be within +/- 5.0mm. Maximum level difference of side lugs at the top should be within +/- 1mm.

2.9 Care shall be taken to avoid OVERHEATING / BLOWING / MELTING during hot forming of adius / bend of Lifting Holders. Heated zone can be visually controlled by maintaining CHERRY RED COLOUR.

Orange or Bright yellow indicates overheating which is to be avoided. Heated area shall be hecked with THERMO CHALK with in 600 deg +50 deg C. Heated area shall be allowed to cool aturally. No sudden cooling with water or any other liquid is allowed.

2.10 Lifting holder shall be straight and the total & threaded length shall be within +/- 5mm.

NOTE 3.0 CLEANING

3.1 All The Rapping shaft, foundation bolts and lifting holders shall be cleaned by wire brush (or) by echanical means to remove burrs, rust, grease, oil and other foreign materials.

3.2 Foundation bolt’s thread portions along with nuts shall be coated with rust preventive component WICOL’ and shall be covered by tar impregnated gunny cloth to prevent transit and handling amages and to be packed in boxes/crates before despatched.

3.3 Lifting holder thread portions shall be coated with rust preventive as per the painting schedule.

3.4 Other portions of Foundation bolts & Lifting holders shall be coated with two coats of paint as ndicated below:

1) A primary coat of red oxide zinc chrome primer conforming to IS 2074 with minimum oating thickness of 25microns shall be applied.

2) A finish coat of synthetic enamel long oil alkyd conforming to IS 2932 (smoke grey shade) ith minimum coating thickness of 20 microns shall be applied.

Adequate drying time is to be allowed between each coat.

3.5 All lifting holder's thread portions shall be covered with gunny cloth to avoid transit/handling amages.

NOTE 4.0 MARKING

4.1 Following shall be stenciled in white paint and stencilled details covered with one coat of ransparent varnish.

Sub contractor's code	:
Work order	:
Du no	:
Weight	:
Project	:
No of pieces in the	:
packing	:

In addition to this, sub contractor's code shall be punched and bordered in white paint.

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QUALITY DEPARTMENT		
Amendment to Quality Work Instructions (SQP)		
QWI NO: SQP:ESP:287	REV:00	DT. 20/06/98
Amendment no: A 2		DT. 25/01/2001
Description: Inner arm & Outer arm, Shock Bars, Vertical Stay, Vertical Beam, Support Beam, Hand Rails, Ridges and Shock Beam.		

Details of Amendment

CLAUSE NO	AMENDED AS	BASIS FOR AMENDMENT
Note 4.1.1	E 6013 electrode shall be dried in baking oven at 120-130°C until they are used, if the packing were found to be damaged or the electrodes were kept exposed to atmosphere for prolonged period.	Feed back of CTQ MOM dt:12/10/2000

Prepared by	Reviewd by		Approved by
	Engg/AQCS		
	QC/OLI		
	QA	B. Srinivasan	

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QUALITY DEPARTMENT

AMENDMENT TO QUALITY WORK INSTRUCTIONS (SQP)

QWI NO: QP:ESP:287 REV 00 DATE : 20 06 98
AMENDMENT NO. A 1 DATE : 18.09.00

DESCRIPTION: INNER ARM & OUTER ARM, SHOCK BARS, VERTICAL STAY, VERTICAL BEAM, SUPPORT BEAM AND HAND RAILS, RIDGES AND SHOCK BEAM.

DETAILS

CLAUSE NO	AMENDED AS	BASIS FOR AMENDMENT/ REMARKS
Note 3.4	This clause note3.4 is Added for Transver ridges: Transverse ridges (7X - X43) - only one joint in each member of the ridges is allowed after obtaining prior approval from engg.	Feed back from engg. (CTQ mom dt:29-4-200)

Prepared by	Reviewed by		Approved by
	Engg/AQCS		
	QC/OLI		
	QA		

BHEL RANIPET	STANDARD QUALITY PLAN FOR ESP(MECHANICAL)	
REF.NO.	REVISION NO.	EFFECTIVE DATE
QP:ESP:287	00	20 06 . 98

TITLE : INNER ARM & OUTER ARM,SHOCK BARS,VERTICAL STAY, VERTICAL BEAM,SUPPORT BEAM AND HAND RAILS,RIDGES AND SHOCK BEAM.

		SIGNATURE
PREPARED BY	:A ELANGOVAN/QA	
REVIEWED BY	:K NITHIANANDAM/QA	
	:P RAJASEKARAN/QC-OLI	
	:T. GNANAPRAKASAM/AQCS	
APPROVED BY	:H ANANTHANAYANAN/QA	

ISSUED & CONTROLLED BY :QUALITY ASSURANCE,BHEL,RANIPET-632406

DOCUMENT STATUS
ISSUED TO:
Mr

☐ INFORMATION COPY

DEPARTMENT: ☐ CONTROLLED COPY NO ☐

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BHEL RANIPET	STANDARD QUALITY PLAN FOR ESP(MECHANICAL)	
REF.NO.	REVISION NO.	EFFECTIVE DATE
QP:ESP:287	00	20 06 98

TITLE : INNER ARM & OUTER ARM,SHOCK BARS,VERTICAL STAY, VERTICAL BEAM,SUPPORT BEAM AND HAND RAILS,RIDGES & SHOCK BEAM

RECORD OF REVISION

REF	DETAILS OF REVISION	DATE AMENDED/ REVISED
REVISION 00	TOTALLY REVIEWED. MERGED SQP:ESP 264, 267,268,270 & 275 ISSUED AS SQP:ESP:287	20 06 98

	MANUFACTURER'S NAME & ADDRESS	MANUFACTURING QUALITY PLAN	QP:ESP:287	STANDARD QUALITY PLAN
	BHARAT HEAVY ELECTRICALS LTD BOILER AUXILIARIES PLANT RANIPET - 632 406. (INDIA) QUALITY ASSURANCE DEPARTMENT	ITEM :INNER ARM & OUTER ARM SHOCK BARS,VERTICAL STAY, VERTICAL BEAM,SUUPORT BEAM, HAND RAILS,RIDGES&SHOCKBEAM	REV : 00 DATE: 20 06 98 PAGE: 03 OF 11	

S.No.	COMPONENT & OPERATION	CHARACTE-RISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	AGENCY M **	AGENCY C	AGENCY E	REMARKS
1	2	3	4	5	6	7	8	9	D*	10		11
1.0	RAWMATERIALS											
	PLATES/ANGLES SQ,HALLOWS/ TUBES/CHANNEL BEAMS.$$	CHEMICAL AND MECHANICAL PROPERTIES	MAJOR	REVIEW OF TC/RANDOM TESTING	EACH HEAT /LOT AS PER SPECI FICATION	RESPECTIVE MATERIAL SPECIFICATION AS PER THE DRAWING.		TC		V		RAW MATERIALS ARE TAKEN TO STOCK ON VERIFICATION OF TCS/RANDOM TESTING
2.0	INPROCESS CONTROL											NOTE:$$(1)IN THE CASE OF SHOCK BARS HOLLOWS OF VERTICAL BEAM NO JOINT IS PERMITTED FOR LENGTH BUILT UP OF ANGLE/FLAT. (2)VERTICALITY OF VERTICAL BEAMS SHALL BE VERIFIED AND CONTROLLED WITHIN THE LIMITS.
2.1	FLAME CUTTING END TRIMMING& FACING	LAMINATION, CRACKS,DIS-CONTINITIES& END SQUARENESS ON CUT EDGES OF RAW MATERIALS	MAJOR	VISUAL	100%	AS PER AWS D1.1,DRAWING NO CRACKS & LAMINATIONS ARE PERMITTED		R		P	V	
2.2	PRESSING/ MARKING/DRILL ING/MACHINING	LENGTH,PROFI LE,RADIUS,HO LES LOCATION, SIZE,ORIENTA ION,PITCHES	MAJOR	MEASURE MENT/VERI FICATION IN FIXTURE VERTFICATI ON OF CHARACTERI CS (HAND RAILS)	100%	DRAWING		R		P	V	

LEGEND: * RECORDS IDENTIFIED WITH "TICK" SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION.
** M:MANUFACTURER/SUB-CONTRACTOR,C:CONTRACTOR/NOMINATED INSPECTION AGENCY,E:CUSTOMER.
R:REPORT,IR:INSPECTION REPORT "P" PREFORM "W" WITNESS AND "V" VERIFICATION AS APPROPRIATE

MANUFACTURER'S NAME & ADDRESS	MANUFACTURING QUALITY PLAN	QP:ESP:287	STANDARD QUALITY PLAN
BHARAT HEAVY ELECTRICALS LTD BOILER AUXIALIARIES PLANT RANIPET - 632 406. (INDIA) QUALITY ASSURANCE DEPARTMENT	ITEM :INNER ARM & OUTER ARM SHOCK BARS,VERTICAL STAY, VERTICAL BEAM,SUPORT BEAM, HAND RAILS,RIDGES&SHOCKBEAM	REV : 00 DATE: 20 06 98 PAGE: 04 OF 11	

S.No.	COMPONENT & OPERATION	CHARACTE-RISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFFRENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	AGENCY M **	C	F	REMARKS
1	2	3	4	5	6	7	8	9	D*	10		11
2.3	WELDING	a)PROCEDURE QUALIFICATION	MAJOR	REVIEW OF DOCUMENTS	100%	PRE QUALIFIED WELDING PROCEDURE AS PER AWS D1.1		R	P	V	V	
		b)PERSONNEL QUALIFICATION	DO	DO	100%	AWS D1.1		R		P	V	V	
2.4	NDT [I]i)	BUTT WELDS ON STRUCTURES SUPPORT BEAM	DO	LPI	#20%RANDOM	AWS D1.1		R		P	V	V	#:IN CASE OF DEFECTS %AGE SHALL BE INCREASED
	@ &ii)	FILLET WELDS BETWEEN TUBES IN CASE OF PLAIN HAND RAILS	DO	LPI	#10%RANDOM	AWS D1.1		R		P	V	V	NOTE:@ BUTT JOINTS ON TUBES TO BE DONE WITH 45oFF ANG
	[II]i)	FILLET WELDS ON STRUCTURES	DO	LPI	#10%RANDOM	AWS D1.1		R		P	V	V	WELDED & THEN TO BE FLUSH
	& II) @	BUTT WELDS ON PLAIN HAND RAILS	DO	LPI	100%	AWS D1.1		R		P	V	V	GROUND

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R:REPORT,IR:INSPECTION REPORT,"P" PERFORM,"W" WITNESS AND "V" VERIFICATION OF DOCUMENTS,
TC:TEST CERTIFICATES,"CHP"(CUSTOMER HOLD POINT):CUSTOMER SHALL IDENTIFY IN COLUMN "F"

MANUFACTURER'S NAME & ADDRESS	MANUFACTURING QUALITY PLAN	QP:ESP:287	STANDARD QUALITY PLAN
BHARAT HEAVY ELECTRICALS LTD BOILER AUXILIARIES PLANT RANIPET -- 632 406. (INDIA) QUALITY ASSURANCE DEPARTMENT	ITEM :INNER ARM & OUTER ARM SHOCK BARS,VERTICAL STAY, VERTICAL BEAM,SUPPORT BEAM, HAND RAILS,RIDGES&SHOCKBEAM	REV : 00 DATE: 20 06 98 PAGE: 05 OF 11	

S.No.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	AGENCY M **	C	E	REMARKS
1	2	3	4	5	6	7	8	9	D*	10		11
2.4	CONTD..	DIMENSION AND SIZE	MAJOR	VISUAL & MEASUREMENT	100%	DRAWING		R		P	V	V	
2.5	HEAT TREATMENT & HARDNESS IN THE CASE OF OUTER ARM												
	HAMMER AND PLATE	HARDNESS	MAJOR	MEASUREMENT	AS PER IS 2500 PART I IL -III,AQL -4%	DRAWING		R		P	V	V	
3.0	DIMENSIONAL CONTROL												
		TUBEØ & THICKNESS,OVERALL DIMENSIONS OF ASSY,HOLES LOCATION, SIZE, ORIENTATION AS PER DRG. TWIST,BEND, STARIGHTNESS ##	CRITICAL	MEASURMENT. VERIFICATION IN FIXURE/ LAYOUT DEPENDING UPON THE CASE	100%	DRAWING		R		P	V	V	##:VERIFY FRAME ANGLE (Ø)(W.R.T FIXING PLATE) IN THE CASE OF HAND RAILS DURING FITUP ASSY

LEGEND: * RECORDS IDENTIFIED WITH "TICK" SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION.
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TC:TEST CERTIFICATES,"CHP"(CUSTOMER HOLD POINT):CUSTOMER SHALL IDENTIFY IN COLUMN "E"

	MANUFACTURER'S NAME & ADDRESS	MANUFACTURING QUALITY PLAN	QP:ESP:287	STANDARD QUALITY PLAN
	BHARAT HEAVY ELECTRICALS LTD BOILER AUXIALIARIES PLANT RANIPET - 632 406. (INDIA) QUALITY ASSURANCE DEPARTMENT	ITEM :INNER ARM & OUTER ARM SHOCK BARS,VERTICAL STAY, VERTICAL BEAM,SUUPORT BEAM, HAND RAILS,RIDGES&SHOCKBEAM	REV : 00 DATE: 20 06 98 PAGE: 06 OF 11	

S.No.	COMPONENT & OPERATION	CHARACTE-RISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	AGENCY M **	C	E	REMARKS
1	2	3	4	5	6	7	8	9	D*	10		11
3.0	CONTD.. IN THE CASE OF INNER ARM:	STRESS RELIEF GAP BET FLATS$	MAJOR	TEMPERATURE CONTROL	100%	DRAWING		R		P	V	IN THE CASE OF SHOCK BARS OF FLAT TYPE $:WITH TEMP PLATE ##:SMALLER & BIGGER HOLES SHALL BE MACHINED KEEPING TWO HALVES TOGETHER AND DRILLING SHALL BE DONE IN FIXURE
	MACHINING/ DRILLING	DIMENSIONS/ FINISH ##	MAJOR	MEASUREMENT	100%	DRAWING		R		P	V	V
	DIMENSION	OVERALL DIMN OF ASSY	MAJOR	DO	AS PER IS 2500 PART I IL-III,AQL 4%	DRAWING		R		P	V	V
4.0	FINAL INSPECTION,SURFACE CLEANING AND PAINTING	MARKING AND PRESERVATION	MAJOR	VISUAL	100%	DRAWING,PAINTING SCHEDULE RP0674199 LATEST,PRQA:590		R		P	V	V
5.0	PACKING	STURDINESS OF PACKING, GROSS WEIGHT,NO OF PIECES INDICATION	MAJOR	VISUAL	100%	AS PER PACKING DRAWING		R		P	V	V

LEGEND: * RECORDS IDENTIFIED WITH "TICK" SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION.
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R:REPORT,IR:INSPECTION REPORT,"P" PERFORM,"W" WITNESS AND "V" VERIFICATION AS APPROPRIATE.
TC:TEST CERTIFICATES,"CHP"(CUSTOMER HOLD POINT):CUSTOMER SHALL IDENTIFY IN COLUMN "E"

1.0 NOTE.1.0 GENERAL REQUIREMENTS

1.1 Any additional requirement for a specific contract shall be referred separately.

1.2 Raw materials used shall conform to the grades specified in the drawing & GMS.

1.3 Raw material shall be free from harmful visual defects like cracks,seams,laps,laminations,heavy pittings etc.

1.4 Fabricators shall check all the supplied raw materials for dimensions, bend , camber etc. , Straightening wherever necessary must be carried out before assy and welding.

1.5 Substitution of materials and Joints (For Support Beam) shall be done with the prior approval of EDC/AQCS.

1.5.1 No joint is permitted on the angle or flat to make up length in the case of shock bar. No joint is permitted to make up the length in the case of vertical beam and stay also.

1.6 Fabricator to impose sufficient process control,necessary stage inspection so that the components made are consistent in quality and conforms to the drawing and specification. It is the responsibility of the fabricator to adopt sufficient measures to avoid Non conformances.

1.7 Plates having deviations like bend, out of flatness etc shall be corrected before taking up for fabrication.

NOTE 2.0INPROCESS CONTROL

2.1 The general requirements for process control during fabrication are as detailed in QCP:002 (Latest) read along with amendment 1.

NOTE 3.0 MARKING,CUTTING AND PREPARATION

3.1 Angles, tubes, sheets,hollows, Channels, Plates and sheets shall be preferably machine or gas cut. Cut edges shall be dressed smooth to remove all the undulations. Gas cut notches if any shall be filled up and dressed. The edges shall be straight and square.

3.2 SHOCK BARS:Holes on angle meant for fixing huck bolt shall be marked correctly.Orientation,location of first hole ref back mark and pitches shall be verified in advance.In the plates holes shall be located at the centre of the plate. Centre of all holes in the angle shall be in one line. Holes can either be punched or drilled.

3.3 Profiles meant for fixing hand rail tubes shall be marked correctly. The profiles of the Ends of the Railings for joints shall be edge prepared with 45o correctly.

NOTE 4.0. WELDING REQUIREMENTS & WELD INSPECTION

4.1 Electrodes : E6013 Electrodes shall be used for Welding.

4.1.1 E6013 electrodes shall be dried in backing ovens at temperature 100o C , until they are used, If the packing were found to be damaged or the electrodes were kept exposed to atmosphere for prolonged period.

4.2 Pre qualified welding procedure as per AWS D 1.1 (Latest) shall be used.

4.3. Welders employed shall be qualified as per AWS D 1.1 latest . Welders qualified to other codes may also be permitted to carryout welding at the discretion of Inspection Engineers.

4.4 Fillet and butt welds shall be done with a minimum of two layers ,and 6mm fillet or less can be done in single run ensuring complete root fusion.

4.5 Sequence of welding shall be so chosen to balance applied heat and to minimise the distortion.

4.6 NDT as required shall be carried out on splice joints before cover plate welding.

4.7 Arc strike shall not be done straight on the job. Welder shall have a separate piece for striking the arc.

4.8 Weld procedures and welder's qualification are detailed in SIP:NP:07 (Latest)

4.9 All welds shall undergo thorough visual examination to detect the weld defects like undercuts, non-uniform beading,overlaps, excessive concavity or convexity etc.

4.10 Welds shall be neither undersize nor excess than specified, shall be as per drg. Smooth contour shall be maintained.

4.11 Only BHEL approved brands of electrodes shall be used.

4.12 Cleaning of the items shall be thoroughly examined before painting.

NOTE 5.0 FABRICATON AND TOLERANCES

1.) VERTICAL BEAM

5.1 The holes in the square tube shall be drilled right through in one setting.

5.2 The welding of angles with the square tube shall be done carefully maintaining perpendicularity. Welds of the angles with the square hollows shall be ground flush.

5.3 In the square hollows of 80x80 for vertical beams, the fabricator shall exercise proper care to ensure that the drilling is done on the sides where there is no weld seam.

5.4 The beam shall be straight throughout the length. Maximum out of straightness permitted 3mm,which is to be checked in the fixture.

.5 Maximum twist permitted in the vertical beam shall be 2mm.

.6 Hole pitches: within ± 1.0mm

2.) SUPPORT BEAM

.1a) All the dimensions like hole pitches and positions of lifting brackets shall be maintained with referance to the centre of the beam. Transverse centre line (Vertical axis) of the beam as well as centrelines of each bracket shall be punched.

.2b) Supporting beam shall be straight throughout the length. Camber or bow permitted 0.5mm/metre length limited to 5mm max.

.3c) The hole dia shall be within ± 0.5mm.

.4d) Position of holes on Web,with referance to flange shall not deviate more than ± 1mm from Specified.

5e) The total length of beam shall be within ± 3mm.

6f) The deviation on hole pitches must not Exceed ± 1mm.

3) SHOCK BARS

Following tolerances shall be applicable on different dimensions of the shock bar (Angle type)

a) Out of alignment of centre of the hole shall be max. 2mm
b) Shock bar angles shall be straight . Out of straightness shall be within 3mm (Max)
c) No twist is permitted.
d) Shock bar slots to be checked with templates for ensuring gap, width and length between flats(Flat type).

4) VERTICAL STAY

Following tolerances shall be applicable on different dimensions of the VERTICAL STAY
a) Length :+0.0/-2.0mm.
b) Both the ends of the vertical stay shall be in the same axis.Maximum out of alignment of the ends shall be within 2.0mm.
c) Out of straightness 1mm/metre limited to 3mm Max.
d) Both the ends shall be square to the tube axis.

pa

5) PLAIN HAND RAILS

Following tolerances shall be applicable on different dimensions of the plain hand rails.
a) Length ±3.0mm, b) Bow 2mm/metre.and c) Notwist is permitted.

NOTE 6.0 CLEANING,PAINTING AND MARKING

6.1 All the finished products shall be thoroughly cleaned to remove burrs, weld slag, spatters,rust,grease and other foriegn materials.

6.2 Cleaned products except plain hand rails shall be coated with two coats of paints as indicated below.

1. A primer coat of red oxide zinc chrome primer confirmng to IS 2074 shall be applied. Minimum coating thickness of 1st coat 25 microns.

2. A finish coat of synthetic eanamel long oil alkyd confirming to IS 2932 (smoke grey shade) shall be applied. Minimum coating thickness of the 2nd coat 20 microns.

6.2.1 Cleaned plain hand rails shall be coated with two coats of paints as indicated below.

1. A primer coat of red oxide zinc chrome primer confirmng to IS 2074 shall be applied. Minimum coating thickness of 1st coat 25 microns.

2. A finish coat of black eanamel over the primer confirming to IS 2932 shall be applied. Minimum coating thickness of the 2nd coat 20 microns.

Adequate drying time is to be allowed between each coat.

6.3 MARKING

6.31 Each piece shall have the following details stenciled: Stenciling shall be covered with one coat of transperant varnish.

1. Sub-Contractors Code
2. W.O.Number
3. DU Number
4. Gross weight of the packing
5. SI. No

NOTE 7.0 PACKING & PRESERVATION

7.1 All the products shall be packed as per the packing drawing mentioned in GMS.

7.2 Adequate support has to be provided during storage to avoid bending/sagging of vertical beams.

7.3 In each packing the following details shall be legibly stenciled at two places.
wo no: project: du no: Qty in packing:
weight of packing: Fabricator's code:

In addition to the above,sub contracter's code shall be welded/punched and bordered in white paint.

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QUALITY DEPARTMENT		
Amendment to Quality Work Instructions (SQP)		
QWI NO: SQP:ESP:288	REV:00	DT. 20/06/98
Amendment no: A 1		DT. 25/01/2001
Description: Insulator Housing		

Details of Amendment

CLAUSE NO	AMENDED AS	BASIS FOR AMENDMENT
Note 3.1.1	E 6013 electrode shall be used for CARBON STEEL Welding. Before use all the electrodes (E XX13) shall be dried in baking oven at 120 - 130°C until they are used, if the packing were found to be damaged or the electrodes were kept exposed to atmosphere for prolonged period.	Feed back of CTQ MOM dt:12/10/2000

Prepared by	Reviewd by		Approved by
	Engg/AQCS		
	QC/OLI		
	QA		

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BHEL RANIPET	STANDARD QUALITY PLAN FOR ESP (MECHANICAL)	
REF. NO	REVISION NO.	EFFECTIVE DATE
QP: ESP :288	00	20 . 06 . 98

TITLE : INSULATOR HOUSING

SIGNATURE

PREPARED BY : A ELANGOVAN / QA

REVIEWED BY : K NITHIANANDAM / QA

: P RAJASEKARAN / QC OLI

: T GNANAPRAKASAM /AQCS

APPROVED BY : H ANANTHANAYANAN / QA

ISSUES & CONTROLLED BY : QUALITY ASSURANCE, BHEL, RANIPET - 632406

DOCUMENT STATUS

ISSUED TO : ----------

INFORMATION COPY

Mr ----------

DEPARTMENT : ---------- CONTROLLED COPY NO ----------

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BHEL RANIPET	STANDARD QUALITY PLAN FOR ESP (MECHANICAL)		
REF.NO.	REVISION NO.	EFFECTIVE DATE	
QP : ESP 288	00	20. 06. 98	
TITLE :	INSULATOR HOUSING		

RECORD OF REVISION

REF	DETAILS OF REVISION	DATE AMENDED/REVISED
REVISION 00	TOTALLY REVIEWED AND QCP E 028 ISSUED AS SQP : ESP : 288.	20 . 06. 98

MANUFACTURER ' S NAME & ADDRESS | MANUFACTURING QUALITY PLAN | QP NO : ESP 288

BHARAT HEAVY ELECTRICALS LTD | ITEM : INSULATOR HOUSING | REV : 00
BOILER AUXIALIARIES PLANT | DATE : 20. 06 98 | STANDARD QUALITY
RANIPET- 632 406 (INDIA) | PAGE : 03 OF 07 | PLAN
QUALITY ASSURANCE DEPARTMENT | SUB SYSTEM : -

S.NO.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	**M	C	E	REMARKS
1	2	3	4	5	6	7	8	9	D*	10		11
1.0	RAW MATERIAL AGENCY	CHEMISTRY & MECHANICAL PROPERTIES	MAJOR	REVIEW	100 % SPECN IN DRG	AS PER MATL SPECN IN DRG	AS PER MATL SPECN IN DRG	MILL TC ON VERIFICATION OF MILL TC.	P	V	-	RAW MATERIALS ARE TAKEN TO STOCK
2.0	INPROCESS CONTROL											
2.1	PRESSING SHEET METAL TO SHAPE	SHAPE	MAJOR	MEASURE MENT & VISUAL	100 %	DRAWING	DRAWING	R	P	V		
2.2	WELDING QUALIFI CATION	1) PROCEDURE QUALIFI CATION	MAJOR	REVIEW OF DOCU MENTS	100 %	PREQUALIFIED WELDING AS PER	PREQUALIFIED WELDING AS PER	R	P	W		

	2) PERSONNEL QUALIFICATION	MAJOR	REVIEW	AWS D1.1 100 %	AWS D1.1	AWS D1.1	AWS D1.1	R	P W

LEGEND: * RECORDS IDENTIFIED WITH “TICK “ SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION.
R: REPORT , TR: INSPECTION REPORT, “P” PERFORM, “W” WITNESS AND “V” VERIFICATION AS APPROPRIATE.
TC: TEST CERTIFICATES, “CHP” (CUSTOMER HOLD POINT) : CUSTOMER SHALL IDENTIFY IN COLUMN “E”

MANUFACTURER ' S NAME & ADDRESS	MANUFACTURING QUALITY PLAN QP NO: ESP 288		
BHARAT HEAVY ELECTRICALS LTD	ITEM : INSULATOR HOUSING	REV : 00	
BOILER AUXIALIARIES PLANT		DATE : 20 06 98	STANDARD QUALITY
RANIPET - 632 406. (INDIA)		PAGE : 04 OF 07	PLAN
QUALITY ASSURANCE DEPARTMENT	SUB SYSTEM :----		

S.NO.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	AGENCY **M | C | E	REMARKS
1	2	3	4	5	6	7	8	9 D*	10	11
		FINISH & SIZE	MAJOR	VISUAL & MEASUREMENT	100 %	DRG & AWS D1.1	R		P V	NOTE: KEROSENE LEAK TEST ON ALL FILLET WELDS SHALL BE WITNESSED WHERE BOTH SIDE WELDING OF JOINT IS NOT CARRIED OUT
2.3	DIMENSION CONTROL	JNSIDE WIDTH/ LENGTH HEIGHT LOCATION OF BUSHING, PCD OF FLANGE CIRCULAR HOLE PIT-CHES ON	MAJOR	MEASUREMENT & VISUAL	100 %	DRAWING	R		P V	

		FLANGE. OUT OF FLATNESS ON COVER TOP									
3.0	FINAL INSPECTION	APPEARANCE & PRESER- VATION	CRJ TICAL	VISUAL	100 %	PAINTING SCHEDULE RPO674199	PAINTING SCHEDULE RPO674199	R	P	W	

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R: REPORT, IR INSPECTION REPORT, “P” PERFORM, “W” WITNESS A”D “V” VERIFICATION AS APPROPRIATE.

NOTE 1.0 GENERAL REQUIREMENTS

1.1 Any additional requirement for a specific contract shall be referred separately.

1.2 Raw materials used shall conform to the grades specified in the drawing & Gms.

1.3 Fabricators shall check all the supplies raw material for dimensions, bend etc. straightening wherever necessary must be carried out before assy and welding.

1.4 Raw materials shall be free from harmful visual defects like cracks, seams, laps, laminations, heavy pittings etc,.

1.5 Substitution of materials shall be done with the prior a approval of EDC/AQCS.

1.6 Fabricator to impose sufficient process control, necessary stage inspection so that the components made are consistant in quality and conforms to the drawings and specification.

1.7 Raw materials shall be preferably machine / gas cut. cut edges shall be dressed smooth to remove all the updulations. . Gas cut notches if any shall be filled up and dressed. The edges shall be straight and square.

1.8 Structurals / Tubes / Plates shall be cut carefully to the required size and profile and dressed square.

NOTE 2.0 IN PROCESS CONTROL

2.1 The general requirements for process control during fabrication are as detailed in QCP 002 (LATEST) read along with amendment 1.

2.2 The number of joints shall be as approved by designs on a case to case basis.

NOTE 3.0 WELDING REQUIREMENTS & WELD INSPECTION

3.1 Electrodes : E6013 for thickness upto & inclusive of 20mm.

3.1.1 E 6013 electrodes shall be used for CARBON STEEL welding . Before use all the electrodes (F XX 13) shall be dried in baking oven at 100 deg c until they are used, if the packings were found to be damaged or the electrodes were kept exposed to atmosphere for prolonged period.

3.1.3 Minimum gauged electrodes shall be used for the welding of sheets in cover sheet casing.

For cover : 2 mm /2.5 mm electrodes

and for sheet casing : 2.5 mm / 3.15 mm electrodes

3 . 2 Welders employed shall be qualified as per AWS D1.1 latest. Welders qualified to other codes may also be permitted to carryout welding at the descretion of inspection Engineers.

3 . 3 Fillet and butt welds shall be done with a minimum of two layers, ensuring complete root fusion.

3 . 4 splice joints shall be completed prior to the welding of cover plate.

3 . 5 Sequence of welding shall be so chosen as to minimise the distortion.

3 . 6 NDT as required shall be carried out on splice joints before cover plate welding.

3 . 7 Arc strike shall not be done straight on the job. Welder shall have a separate piecefor striking the arc

3 . 8 Weld procedure and welder's qualification are detailed in SIP: NP: 07 (Latest)

3 . 9 Only BHEL approved brands of electrodes shall be used.

3 . 10 Size of weld shall be as per drawing.

3.11 Any shall be removed first.

3 . 12 Ensure kerosene leak test if full welding is done in one side only.

4 . 0 WORKMANSHIP AND TOLERANCES

4 . 1 Inside width and length of the insulator housing shall be within plus or minus 5 mm

4 . 2 Height within plus or minus 5 mm.

4 . 3 Location of bush, bushing etc within plus or minus 5 mm.

4 . 4 P C D of flange within plus or minus 1 mm.

4 . 5 Hole pitches (Circular) of flange within +/- 1 mm.

4 . 6 Out of flatness of cover at the top within 5 mm max and also no water shall stagnate when tested by pouring water over it.

4 . 7 Seating of cover on sheet casing (through the packing rope) shall complete. No gap shall be allowed. This shall be checked by placing the insulator housing with the cover in position on a raised level and viewing from inside the sheet casing.

4 . 8 Free movement of cover for opening and closing be ensured.

5 . 0 CLEANING AND PAINTING

5 . 1 All insulator housing shall be thoroughly cleaned to removed weld slag, spatter, oil, grease etc.

5 . 2 Cleaned insulator housings shall be coated with two coats of paint as indicated below.

a) Primary coat of red oxide zinc chrome primer with 25 microns minimum coating thickness conforms to IS 2074.

b) Finish coat of synthetic enamel long oil alkyd to TS 2932 within minimum 20 microns thickness of smoke grey shade.

6 . 0 IDENTIFICATION AND PACKING

6 . 1 In all the insulator housings the following details shall be stencilled in white paint and stencilled details shall be covered with one coat of transparent varnish.

Sub-contractors ‘ s code	:
Work order no	:
D U Number	:
Weight	:
Serial Number	:

6 . 2 In addition to the above stencilling subcontractor’ s code shall also be punched. Punched details shall be bordered in white paint.

BHEL RANIPET	STANDARD QUALITY PLAN FOR ESP (MECHANICAL)		
REF.NO.	REVISION NO	EFFECTIVE DATE	
Q P :ESP:289	00	20 06 98	

TITLE : EXPANSION JOINT (TYPE)

			SIGNATURE
PREPARED BY	:	A ELANGOVAN / QA	
REVIEWED BY	:	K NITHINANDAM	
	:	P RAJASHEKHARAN / QA	
	:	T GNANAPRAKASHAM / QC OLI	
APPROVED BY	:	H ANANTHANARAYAN / QA	

ISSUED & CONTROLLED BY : QUALITY ASSURANCE , BHEL , RANIPET - 632406

DOCUMENT STATUS
ISSUED TO : ---------- INFORMATION

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BHEL RANIPET	STANDARD QUALITY PLAN FOR ESP (MECHANICAL)	
REF. NO.	REVISION NO.	EFFECTIVE DATE
QP : ESP : 289	00	20 06 96

TITLE : EXPANSION JOINTS (BELLOW TYPE)

RECORD OF REVISION

REF	DETAILS OF REVISION	DATE AMENDED/ REVISED
REVISION 00 20 06 98	ESP : 256 REV 01 IS RENUMBERED AS ESP : 289 AND ISSUED .	

MANUFACTURER'S NAME & ADDRESS	MANUFACTURING QUALITY PLAN	QP NO : ESP289
BHARAT HEAVY ELECTRICALS LTD BOILER AUXIALIARIES PLANT RANIPET - 632 406 .(INDIA) QUALITY ASSURANCE DEPARTMENT	ITEM : EXPANSION JOINTS (BELLOW TYPE) SUB SYSTEM : --	REV : 00 DATE : 20 06 98 PAGE : 03 OF 05

STANDARD QUALITY PLAN

S.NO.	COMPONENT OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORDS	AGENCY **M	C	D*	REMARKS
1	2	3	4	5	6	7	8	9				10 11
1.0	MATERIALS : RAW MATERIALS	CHEMISTRY & MECHANICAL PROPERTIES	MAJOR	REVIEW OF TC	EACH LOT OR HEAT	RESPECTIVE MATERIAL SPECIFICATION	MILL TC	P	V		
	BELLOW SHEETS ARE TAKEN TO BELLOWS IN GAS DUCTING				AS PER COLUMN 2 . MATERIAL SPECIFI - CATION .	AS PER	STOCK ON VERIFICATION OF TCs .				
	CORTEN - A OTHER PLATES & SECTION AS PER IS 2062										
2.0	INPROCESS CONTROL										
2.1	FLAME CUTTING	LAMINATIONS & CRACKS	MAJOR	VISUAL	100%	AS PER AWS D1.1	R	P	V		

LEGEND : * RECORDS IDENTIFIED WITH “TICK” ( ) SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION .

**M : MANUFACTURER / SUB - CONTRACTOR , C : CONTRACTOR / NOMINATED INSPECTION AGENCY , E : CUSTOMER .
R : REPORT , IR : INSPECTION REPORT , “P” PERFORM , “W” WITNESS AND “V “ VERIFICATION AS APPROPRIATE .
TC : TEST CERTIFICATES , “CHP’ (CUSTOMER HOLD POINT) : CUSTOMER SHALL IDENTIFY IN COLUMN “ E “.

MANUFACTURER’S NAME & ADDRESS
BHARAT HEAVY ELECTRICALS LTD
BOILER AUXIALIARIES PLANT
RANIPET - 632 406 .(INDIA)
QUALITY ASSURANCE DEPARTMENT

MANUFACTURING QUALITY PLAN QP NO : ESP289
ITEM : EXPANSION JOINTS REV : 00
(BELLOW TYPE) DATE : 20 06 98
STANDARD QUALITY
PAGE : 04 OF 05 PLAN
SUB SYSTEM : --

S.NO.	COMPONENT OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORDS	AGENCY M	AGENCY C	REMARKS
1	2	3	4	5	6	7	8	9 | D*	10	11	
2.2	PRESSING	PROFILE / SHAPE % RADII	MAJOR	MEASURMENT & VISUAL	100%	DRAWING		R	P	V	
2.3	SPLICING	JOINT LOCATION & SOUNDNESS OF WELDING OF SHEET & STRUCTURALS	MAJOR	DO	100%	DRAWING		R	P	V	

2.4	WELDING ELECTRODE E7016/ E7018 FOR CORTEN-A MATERIAL.	1.PROCEDURE QUALIFICATION	MAJOR	REVIEW OF DOCUMENTS	100%	PRE QUALIFIED WELDING PROCEDURE AS PER AWSD1.1		R	P	V		
		2.PERSONNEL QUALIFICATION	MAJOR	DO	100%	AS PER AWS D 1.1		R	P	V		

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MANUFACTURER’S NAME & ADDRESS
BHARAT HEAVY ELECTRICALS LTD
BOILER AUXIALIARIES PLANT
RANIPET - 632 406 .(INDIA)
QUALITY ASSURANCE DEPARTMENT

MANUFACTURING QUALITY PLAN
ITEM : EXPANSION JOINTS
(BELLOW TYPE)
PAGE : 05 OF 05
SUB SYSTEM : --

QP NO : ESP289
REV : 00
DATE : 20 06 98
STANDARD QUALITY PLAN

S.NO.	COMPONENT OPERATION	CHARACTE RISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT RECORDS	AGENCY M | C | E	REMARKS
1	2	3	4	5	6	7	8	9 D*	10	11
2.5	WELD INSPN	SIZE & FINISH	MAJOR	VISUAL	100%	DRAWING & SIP : NP : 06		R	P W	
2.6	WELD NDE	SOUNDNESS	MAJOR	KEROSENE LEAK TEST	100%	PRQA : 076		R	P W	

3.0	DIMENSIONAL CONTROL	OVERALL DIMN LENGTH , WIDTH ETC ..,	MAJOR	MEASUREM - ENT	100%	DRAWING	R	P W
4.0	FINAL INSPN: SURFACE CLEANING AND PAINTING / PRESERVATION	WELDING FINISH AND APPEARANCE	MAJOR	VISUAL	100%	DRAWING PAINTING SCHEDULE RP 0674199 (LATEST)	R	P W

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TC : TEST CERTIFICATES , “CHP’ (CUSTOMER HOLD POINT) : CUSTOMER SHALL IDENTIFY IN COLUMN “ E “.

Ranipet	MAN UFACTURER'S NAME& ADDRESS	STANDARD QUALITY PLAN	QP NO	SQP: ESP 290
	BHARAT HEAVY ELECTRICALS LTD BOILER AUXILIARIES PLANT RANIPET-632 406 (INDIA)	ITEM: ESP Sub system: SCREEN SHEET	REV NO DATE PAGE NO	02 12 07 07 01 of 04

Sl No	Component & operation	Characteristics	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format Of Records	Agency M	Agency B		Remarks
1	2	3	4	5	6	7	8	9			10
1.0	Raw Material:	Chemistry Mechanical properties	Review of TC/ Random testing	100%	Respective Matl Spec as per col 2		MILL TC	P	V		Raw material are taken to stock on verification of TCs /random testing
2.0	In process Control:										
2.1	Punching /drilling of holes	Size, pitch, location	Measure	100%	Drawing		R	P	V		
2.2	Pressing/Rolling of sheets to shape	Shape, profile	Measurement with template	100%	Drawing		R	P	V		
2.3	Dimensional control	Overall length, width section depth, and straightness	Measurement	100%	Drawing		R	P	W		

LEGENDS:
M – Manufacturer / Subcontractor,
B - BHEL /BHEL Authorized Inspection Agency,
C -Customer, P - perform, V - Verification of Reports - W-Witness, TC - Test certificate,
DR – Dimensional report, CHP-Customer Hold point

Prepared by	QA	B. Srinivasa Rao
Reviewed by	QC-OLI	
	ENGG	
Approved by		

	MAN UFACTURER'S NAME& ADDRESS	STANDARD QUALITY PLAN	QP No	SQP:ESP 290
Ranipet	BHARAT HEAVY ELECTRICALS LTD BOILER AUXILIARIES PLANT RANIPET-632 406 (INDIA)	ITEM: ESP Sub system: SCREEN SHEET	Rev No Date Page	02 12 07 07 02 of 04

Sl No	Component & operation	Characteristics	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Form at Of Records	Agency			Remarks
								M	B		
1	2	3	4	5	6	7	8	9			10
2.4	Welding	1.Procedure Qualification	Review of documents	100%	Pre-qualified welding procedure as per AWS D1.3		R	P	V		* Percentage shall be increased in case defects.
		2. Personnel Qualification	-do-	100%	Drawing & AWS D1.3		R	P	V		
2.5	Welding NDE	Butt welds of screen sheets	LPI	10%*	AWS D1.1		R	P	W		
2.6	Final inspection:	Painting & preservation	Visual	100%	Drawing & painting schedule as per PRQA 590		R	P	W		
		Packing	Visual	100%	-do-		R	P	W		

LEGENDS:
M – Manufacturer / Subcontractor, B - BHEL /BHEL Authorized Inspection Agency, C -Customer, P - perform, V - Verification of Reports W - Witness,
TC - Test certificate, DR – Dimensional report, CHP-Customer Hold point

NOTE 1.0 GENERAL REQUIREMENT:

1.1.1 Maximum number of permitted joints in screen sheet is 6.

1.1.2 Minimum length of joint in screen sheet is 1200mm.

1.1.3 For last piece of screen sheet joints, if below 1200mm length ENGG clearance may be obtained through TCN

1.2 Any deviation w.r.t joints/material shall be done with prior approval of EDC/AQCS.

1.3 As far as possible aesthetic appearance shall not be sacrificed in accommodating splicing.

NOTE 2.0 IN PROCESS CONTROL:

2.1 FABRICATION:

2.1.1 MARKING, CUTTING AND PREPARATION:

2.1.2 Raw material shall be marked and cut to size by shearing.

2.1.3 Layout for size and shape shall be marked before cutting (for other than CNC applications) The tolerance for marking shall be maintained with in +2mm unless otherwise specified. The diagonal difference shall be within 3mm.

2.1.4 The marking shall be punched at convenient intervals.

2.1.5 The prepared sheets shall be visually inspected.

2.2 FORMING:

2.2.1 All formed components shall be checked for orientation, angle, and other dimension as per drg. All formed parts shall have smooth finish and shall be free from bends, folds and sudden transitions.

2.2.2 Tolerance for formed components when not specified in DRG. Shall be as follows

a) Straigh length bow bend – 5mm max.
Side bend -- 5mm max.
b) Squareness : 1 mm max

2.3 WELDING CONSUMABLES:

2.3.1 E6013 Electrodes shall be used for welding.

2.3.2 All electrodes shall be dried at 100 deg. C for 1 hour min. and held at 100 deg.C till use.

2.4 FIT UP:

2.4.1 Proper fit up shall be ensured before welding as per Drawing. Tack welding or mechanical clampings shall be used to maintain the fit up requirements before and during welding.

2.4.2 Parts to be joined by butt welds shall be properly aligned. An offset not exceeding 10% of the thickness of the thinner part joined can be permitted, but in no case more than 2 mm, is permitted.

2.5 WELD REPAIRS:

2.5.1.0 Defective welds/base metal shall be repaired by removing or/and rewelding .

2.5.1.1 For weld porosity, slag inclusions & lack of fusion remove defective portions & reweld

NOTE 3.0 NON-DESTRUCTIVE TESTING:

3.1 Visual inspection and LPI shall be performed.

3.2 All NDE shall be carried out by qualified personnel as per BHEL NDT procedures.

NOTE 4.0 MARKING:

4.1 The following details shall be stenciled with white paint and the stenciled details covered with one coat of transparent varnish..

Sub-contractor code
Work order No.
DU No.
Weight
Project

4.2 In addition of the above stenciling, the following details shall also be punched and bordered in white paints.

Sub-contractor's code
Work Order No.
DU No.

NOTE: 5.0 PACKING:

All the screen sheets shall be packed as per the packing drawing referred in GMS. All steel section used for packing shall be painted yellow.

MASTER COPY

QUALITY DEPARTMENT

AMENDMENT TO QUALITY WORK INSTRUCTIONS (SQP)

Q.W.I.NO : QP:ESP:260 **REV :00** **AMENDMENT SL NO : A 2**

DESCRIPTION : GUILLOTINE GATES (ESP) **DATE : 15 02 99**

DETAILS OF AMENDMENT

CLAUSE NO	AMENDED AS	REMARKS
NOTE 1	SEALS MATERIAL SPECIFICATION ASTM B626 UNS 10276 IS DELETED	ENGG HAS REVISED THIS SPECN AS THIS IS MEANT FOR TUBES.

PREPARED BY	REVIEWED BY	APPROVED BY
	B. Srinivasarao	

BHEL
RANIPET

QUALITY DEPARTMENT

AMENDMENT TO QUALITY WORK INSTRUCTIONS (S Q P)

Q.W.I.NO: ESP: 260 REV: 00 AMENDMENT SL NO: A 1

DESCRIPTION: GUILLOTINE GATES (ESP) DATE: 05 11 97

DETAILS

CLAUSE NO	AMENDED AS	BASIS FOR AMENDMENT REMARKS
10.1	Chain, all machined surfaces and Gate plate after testing preventive coating. Painting of all other areas shall be as indicated below. Primer coat: one coat of Red Oxide Zinc Chrome Primer (Alkyd base) to IS 2074. (Coating thickness 25 microns. Finish Ciat: One coat of Synthetic enamel long oil Alkyd to IS 2932 (Coating thickness 20 microns.	





Prepared by Reviewed by Approved by

Distribution: As per standard distribution list.

PC File C: \KNM\ESP\QWIRTE66 . KSU (All same file)

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BHARAT HEAVY ELECTRICALS LIMITED
BOILER AUXILIARIES PLANT
RANIPET - 632 406

ESP: 260/00
PAGE 01 OF 19

STANDARD QUALITY PLAN FOR GUILLOTINE GATES

EFFECTIVE DATE 31 01 94

PREPARED BY : : (K NITHIANANDAM)
QUALITY ASSURANCE

DEPARTMENT	REVIEWED BY	SIGNATURE	DATE
EDC/AQCS	P. JAYKANTH	P. Jayakanth	24/1/94
OPERATION PLANNING & CONTROL	J. MANOHARAN	J Manohar 25.1.94.	
ANCILLARY DEVELOP-MENT	S. JAGANNATHAN	24/1	
QC (PRODN)	S. VISWANATHAN	S. Viswan	
QC (OLI)	H. B. N. MURTHY		

APPROVED BY H. ANANTHANARAYANAN
SR MGR/QA

ISSUED BY : QUALITY ASSURANCE
REV NO : 00
DATE : 31 01 94

DOCUMENT CONTROL NO

RECORD OF REVISIONS

REV NO.	DETAILS OF REVISION	REMARKS
00 11 01 94	This SQP has been prepared by merging the docunents listed in the remarks column.	SQP 13/00 QCP 2: 5: 322/05 QCP 2: 5: 326/02 QCP 2: 5: 349/01 QCP 2: 5: 392/01 QCP 2: 5: 394/01 PR: QE: 022/01 PR: QE: 044/01 PR: QE: 045/01 PR: QE: 054/01

S. NO.	COMPONENT & OPERATION	CHARACTE-RISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE STANDARD	FORMAT OF REC	AGENT	REMARKS
1	2	3	4	5	6	7	8	9	10	11
1.0	MATERIALS									
1.1.	PLATES, SECTIONS FOR FRAME GLAND PLATE-AND LINKAGES ETC.	CHEM. &MECH. PROPERTIES	MAJOR	REVIEW OF TEST CERTIFICATES/ RANDOM TESTING	100%	MATERIAL SPECIFICATION (REF. NOTE: 1)	TC ARE TAKEN TO VERIFICATION OF TC/RANDOM TESTING	QC	RAW MATLS TO STOCK ON	
1.2.	GATE PLATES	-DO-	MAJOR	-DO-		-DO-	TC	QC	-DO-	
1.3.	ROUNDS FOR SHAFTS AND STUDS	CHEM.& MECH. PROPERTIES	MAJOR	-DO-	-DO-	-DO-	TC	QC	-DO-	
1.5.	SEALS	CHEMICAL & MECHANICAL PROPERTIES	MAJOR	-DO-	100%	MATERIAL SPECIFICATION	TC	QC	-DO-	

1	2	3	4	5	6	7	8	9	10	11	
2.3.1		WELD QUALITY		MAJOR	VISUAL	20%	DRAWING, PR QE: 021		R	QC	20% LPI ON
		SIZE AND			LPI		BHE: NDT: RP: PT: 01				FILLET WELDS
		FINISH									OF COLLARS WITH SHAFT
2.4.	GATE PLATE	ROOT GOUGING		MAJOR	NDE/LPI		100% BHE: NDT: RP: PT: 01		R	QC	REF. NOTE 4
	SPLICING	AND FINISH			MPI		BHE: NDT: RP: PT: 01				
2.5.	ASSEMBLY	OVERALL		MAJOR	MEASURE		-DO-	DRAWING		R	QC REF NOTE 5&6
		DIMENSIONS									
2.5.1	SEAL ASSY. PRIOR TO ASSY IN GATE	CRITICAL DIMENSION		MAJOR	-DO-		-DO-	DRAWING		R	QC
2.6.	TRIAL OPERATION OF GATE	FREE OPERATION OF GATE AS PER ORIENTATION AT SITE		MAJOR	OPEN/CLOSE MOVEMENT		-DO-	RELEVANT DRAWINGS AND		R	QC REF NOTE 7
		SEAL TIGHTNESS	-DO-		GAUGE		-DO-	-DO-	R	QC	
3.0.	FINAL INSPECTION										
3.1	COMPLETENESS	COMPLIANCE		MAJOR	MEASUREMENT		-DO-	DRAWING		R	QC REF NOTE 8
3.2.1	SURFACE PREPARATION	SURFACE PREPARATION			-DO-		VISUAL -DO-	PAINTING SCHEDULE RP: 0674199 (Lattest)			
3.2.2	PAINTING	PAINT		MAJOR	VISUAL		-DO-	DRAWING		R	QC REF NOTE 10
		FINISH					PAINTING SCHEDULE				
		COATING THICKNESS	MAJOR	MAJOR	VISUAL MEASUREMENT		-DO- RP 0674199 (Lattest) -DO-	DRAWING	R	QC	

FILE NAME: A: ESP260.3

1	2	3	4	5	6	7	8	9	10	11	
3.3.	PACKING AND DESPATCH	PACKAGING IDENTIFICATION OF W O CAL NUMBER, DU NO MATCH MARKS	CRITI-	VISUAL	100%	DRAWING		R	QC	REF NOTE 11	
3.4.	CERTIFICATION -DO- -DO- CHECKLIST	AS PER			SIGN OFF	-DO-	REFER NOTE 12				

NOTE 1 The materials normally used are given below

Plates	IS 2062 ASTM A36 SA 588 GR A
Rounds	ASTM A 654 ASTM A 108 AISI 304 SA 193 B7 SA 105
Seals	ASTM B575 UNS 10276 ASTM B626 UNS 10276
Castings	IS 210

NOTE 2 In Process Control

The general requirements for process control during fabrication are detailed in QCP 002 (latest)

NOTE 3 Marking, cutting and preparation

3.1 The requirements during marking, cutting and preparation are detailed in QCP 002 (latest)

3.2 Holes on frames for matching with duct flanges and holes for studs shall be marked correctly. These holes may either be punched or drilled. Studs shall be welded on to frame parts as per drawing prior to assembling the sides into frame.

3.3 Whenever the frame channel size is substituted, seal clamping hole dimensions with respect to line of both channels.

NOTE 4	Splicing of gate plate
---	---
4.1	Splicing of gate plate may be either horizontal or vertical.
4.2	No splicing is permitted if plate width is 1.2 meter or less.
4.3	For plates of width upto 2.4 M. one joint is permitted; Above 2.4 M. maximum two joint is permitted. however the spacing between 2 joints shall be minimum 500 mm.
4.4	Any variation for the above norms shall have the approval of Engineering/QA.
4.5	Care shall be taken to avoid waviness during fabrication of gate plate. The waviness of the plates during splicing/ fabrication shall be restricted to 1mm per metre subject to a maximum of 3mm.
NOTE 5	Fabrication
---	---
5.1	Frames shall be made on a leveled surface after ascertaining water level within 5 mm. Frame top and bottom surfaces of the members shall be leveled.
5.1.1	Ensure the assembly of frame maintaining dimensions and distance between studs w. r. t. axis of blade movement on all sides.
5.1.2	Super structure frame shall be made such that the guide angles are placed at correct distance from the centre line of the channel
5.1.3	Ensure that the gap of gate plate movement is in a single plane of correct width. width deviation shall be restricted within 5 mm.
5.1.4	Weld the guide beams as per drg. in port side in level with frame gap. A curved plate shall be welded with guide beam at entry side to avoid struck up of gate plate.
5.1.5	Ensure that the “T” bar shall be welded square to the gate plate through pin plate to accommodate differential expansion. Connecting nut for piston rod shall also be Welded / fastened square to the tee bar. Plate centre line and piston rod centre line nut centre line shall be in one axis. Out of squareness if found, shall be corrected suitably.
5.1.6	Assemble the Isolation valve with transition for seal air fan blower connection.

5.2	Seals shall be manufactured as PR: QE: 063 (latest) and supplied as subassembly. Check for any damage before assembly.
5.3	MACHINING OF SOLID SHAFTS AND HOLLOW SHAFTS
5.3.1	Ensure straightness of the rod/tube before taking up for machining. The round shall be held between centres and machined to size and finish as per respective drawings.
5.3.3	Plain turned drive shafts shall be marked for key way milling and milled suitably to size and finish as per drawing.
5.3.4	The rings shall be machined to diameter, edge prepared and welded with the shaft after a preheat of 150 Degree C with electrode E11018. The shaft shall be post heated at 150 Degree C for 2 hours. This shall be applicable in the case of SA 193 B7 Material only).
5.3.5	Plain turned Idler shaft shall be finished to size and finish as per drawing.
5.3.6	Completely machined shafts shall be checked for size, finish and eccentricity.
5.3.7	Tolerance on bearing and sprocket locating dimensions: outside diameter : + 0.000 - 0.010 Eccentricity : 0.05 mm
5.3.8	Tubes shall be marked and cut to size with ends square and free from burrs.
5.3.9	Set the shaft sub-assembly and tube in assembling fixture as given in the sketch-1
5.3.10	Ensure the co-axiality of the shafts and tube assembly by dial gauge after aligning the key ways if provided.

5.3.11	Plug weld the shaft and tube and complete the welding of shaft sub - assembly with tube on either side maintaining the fillet size.
5.3.12	Completed shaft shall be checked for co-axiality, size, finish, eccentricity, key way orientation, etc as per drawing.
5.3.13	20% LPI/MPI on fillet/plug welds of assembly shall be carried out.
5.3.14	Machined shafts shall be applied with rust preventive oil over machined area.
5.4	AIR TANK
5.4.1	Pipe for all air tank shall be cut to size maintaining the ends square. Where pipes are made of plates, it shall be rolled and welded.
5.4.2	End cover cut to size and edge prepared as per drawing.
5.4.3	The requirements of preheating and welding control are detailed out in QCP 002 (latest)
5.4.4	Butt welds and long seam welds of PEP shall be spot radiographed in addition to LPI/MPI as per approved procedure. If unacceptable defect is noticed during spot radiography , 100% radiography shall be carried out.
5.4.5	Completed air tank shall be hydraulically tested as envisaged in drawing.
5.4.6	Orientation of drain plug shall be ensured. Always it shall be kept downwards.
NOTE 6	Assembly requirements
---	---
6.1	The frame shall be assembled with super structures. Assembly shall be done in horizontal position, ensuring that the whole frame is in a plane. Corner welds of angle frame shall be ground to accommodate the seating of seals.
6.2	Position the mounting plate and assemble the air tank and blower.
6.3	Assemble the cylinder on to the frame and connect the piston rod and ensure the co-axiality of piston rod gate plate.

6.3.1	Check that the piston rod, gate plate and cylinder are in the same plane using spirit level.
6.4	Assemble the pneumatic fittings of correct size and quantity starting from the ports of air cylinder. (4 way solenoid valve, transparent type filter cum lubricator etc.)
6.5	Ensure the connections are air tight using the teflon tapes.
6.6	Assemble the junction box for electrical connections. Assemble the limit switches at the correct locations
6.7	Complete the electrical connections as per relevant wiring diagram and identify the wires.
6.8	Defect free seals shall be assembled in position in correct orientations per drawing.
6.9	connect the air cylinder to pneumatic lines and check for free operation of gate plate and piston.
6.10	Adjust the limit switches ensuring the strike length of blade.
6.11	Sprockets shall be assembled with shaft together with end collars.
6.12	Assemble the drive shaft and idler shaft assemblies in the mounting brackets. Ensure no offset of axis of both drive and idler shafts. Ensure that the bearings are filled with shaft.
6.13	Ensure the correctness of drive chain size, pitch, length etc., and assemble keeping the plate to assembly for modular construction. Defect free seals shall be assembled in position in correct orientation as per drawing.
6.15	Assemble brace angles of super structure in position and complete welding.

6.16 Adjust the chain length and tighten equally on both sides.

6.17 Sagging of chain shall be checked on top side of the chain with bottom side of chain resting on gate plate. This sagging shall be set equal to or less than thickness of chain while gates are in horizontal position.

6.18 A clear gap of 6mm shall be ensured between gates plate and sprocket. While the gate is kept in horizontal position so as to ensure free travel of chain without climbing on the blade during operation.

6.19 Install the actuator mounting brackets on to frame and complete the welding.

6.20 Install the relevant drive in position with all accessories and connections.

6.21 Assemble isolation valve with transition, if required.

6.22 Install the blower assembly with transition if required.

NOTE 7 Testing

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7.1 Testing shall be carried out in the same orientation as envisaged for the system at site/as per customer requirement. The gate shall be positioned in the testing stand maintaining verticality on sides and face of (flow direction). It shall not have any twist.

7.2 Connect the actuator electrically as per wiring diagram

7.3 Adjust the gate in such a way that plate is in the middle of its stroke.

7.4 Set the torque required for ambient operation of the gate or as specified in the actuator data sheet.

7.5 Gate shall be operated with actuator for 5 complete cycles. (with an idle time of 10 minutes in between every two cycles.)

7.6 Record amperage, voltage, time taken for each strike in case of electrical actuator and record air pressure for pneumatic actuator.

7.7	During the test ensure that gate plate is operating freely without rubbing the throat support beam.
7.8	In case the gate is not lifted with minimum setting of the torque switch/torque rating or air pressure shall be slowly increased so as to enable free operation of the gate. In no case this value shall exceed the no load operating condition indicated by Engineering/C&I.
7.9	Normal / running current shall not exceed the permitted value. In case current drawn at no load is more than the acceptable value the same shall be referred to Engineering/ Quality Assurance/C&I for approval.
7.10	The gate shall be visually inspected for any damage to blades, seals etc., Ensure the gate plate is in open position. Provide the lock tab and lock it.
7.11	Set the blade stopper bracket on beam and ensure the stroke length of blade and corner closing.
7.12	Provide chain guards in position. Provide drain holes in frame and dust guard on super structure.
NOTE 8	Final Inspection
-------- --	------ ----------
8.1	The final inspection shall be carried out using the check list and documented.
8.2	Tolerances given in the drawings shall be followed. In addition, the following tolerances also apply.
8.2.1	Pitch holes of matching flanges shall be within plus or minus 1mm individually max plus or minus 3mm cumulative.
8.2.2	Linear tolerance on length/ width plus or minus 1 mm /metre. max 5mm.
8.2.3	Diagonal variation shall be within 1mm/metre with a max of 3mm.
8.3	The gate plates shall be locked using mechanical blade lock assembly.

NOTE 9	NDE requirements
9.1	Mounting bracket welds "T" bar welding of gate plate, collar welding on shaft, blower and air mounting brackets welds shall be checked by MPI. Welding of splice joints of gate plates shall be checked with MPI/LPI. Defects revealed shall be repaired and tested again.
NOTE 10	Preservation & Match marking
10.1	Chain and all machined surfaces shall be applied with Rust Preventive coating. Gate plate shall be applied with one coat of redoxide zinc chrome primer as per IS 2074. Painting of all other areas shall be as indicated in the painting schedule RP 0674199 (Latest).
10.2	Match marking shall be done on all parting lines by stenciling, if envisaged. Match mark shall also be punched on all parting lines and bordered with white paint. Mark the flow direction on the frame.
NOTE 11	Identification and Packing
11.1	Identification marks shall be as per QCP 002 (latest).
11.2	Packing shall be performed at shipping unless otherwise specified in OPS/ Purchase Order/Drg.
11.3	The gate shall be packed in steel crates to avoid damages during handling and transit. Air cylinder in case of hot air gate shall be suitably protected from damages.
11.3.1	The blades shall be arrested from moving during shipping and shall be kept as per drawing.
11.3.2	Components/sub-assemblies like DP switch, actuator, blower etc. , shall be packed separately in polythene sheet and crated in wooden boxes.

TEST REPORT OF GUILLOTINE GATE

TC No :
Date :

1.0 General

Customer :
Work order number : DU NO:
Gate size :
Application :
Type :

2.0 Actuator Name Plate Details:
GMS particulars

3.0 Test results of gate operation:

Cycles	1	2	3	4	5	6	7	8	9	10
Amps During opening										
Amps During closing										
Time taken for full opening/ closing in seconds										

Note: Full load current during operation shall be lesser than that of full load current of motor.

4.0 Gate operation : Satisfactory/Not satisfactory

5.0 Test results : Acceptable/Not acceptable/ rework identified.

Firms inspection
BHEL inspection
Customer inspection

Signature of QC Engr

NOTE 12 Check list

----------	----------	
	PROJECT	:
	UNIT	:
	SIZE	:
	DRG NO.	:
	SL. NO.	: DG/DL/DB: XXX: XXX/HAG: XXX: XXX
A1	FRAME ASSEMBLY:	
	Pitch of holes for seals	
	Distance between top and bottom row holes	
	Alignment of holes	
	Location of the groove from the top of channel flange.	
	Width of the groove	
	Straightness of the groove	
	Chamfering / deburring on the rear edge of the groove	
A2	DIMENSION OF FRAME:	
	1. LENGTH	
	2. WIDTH	
	3. DIAGONALS	
B	DIMENSIONS OF SUPER STRUCTURES:	
	1. WIDTH	
	2. LENGTH	
	3. DIAGONALS	
	The bracket should be ensured for squareness before fitting it on the frame.	
	POSITIONING OF BRACKET:	
	(To be full welded only after final assembly and testing)	
	ASSEMBLY OF TOTAL FRAME:	
	a) Back gauging and LPI from second side	
	b) Dimensions:	
	i) Overall length	
	ii) Diagonals	

D COMPONENTS:
i) shaft dimensions
a) Length of shaft
b) Dia at Bearing location
c) Dia at actuator mounting portion of shaft

ii) Sprocket:
a) Bore
b) Keyway dimensions

E GATE PLATE:
a. Splicing - (If carried out)
i. No. of joints
ii. NDT
b. Overall dimensions:
i. Length
ii. Width
iii. Diagonals
c. Edge beveling with respect to flow direction.
d. Beveling dimensions.

F "T" BAR:
A. DIMENSIONS
1. WIDTH
3. ADJUSTING BOLT HOLE DIMENSIONS
i) PITCH
ii) DIAMETER

B. 'T' BAR AND CONNECTING NUT DIMENSIONS
i) LENGTH
ii) WIDTH
iii) SQUARENESS

G ASSEMBLY OF GATE:
a. Shaft assembly Drive S/Ns. Idler S/Ns.
1. Sprocket assembly

2. Bearing assembly
a) Bearing Type & No.
b) Bearing assembly on shaft.

3. Bearing Housing
4. Lubrication
a. Type of lubrication
b. Brand name

5. Trial Operation

6. Assembly of drive shaft assy with mounting brackets serial numbers.

7. Free rotation check
a. Assembly of seal sub-assembly in position
b. Positioning of gate plate in super structure
c. Positioning of stopper on cross beam
d. Assembly of chain with sprocket and plate
e. Sagging of chain
f. Assembly of actuator / Blower / Air cylinder pneumatic cylinder
g. Aircylinder piston, connecting nut, gate plate all should be in one axis.
h. Positioning of limit switch.

H TRIAL OPERATION:

1. Orientation of Gate:
   a. Theoretical
   b. Test Position
2. Gates Operated -- Manually /with actuator /with pneumatic cylinder
   Name plate details of actuator/Air cylinder
a. No. of cycle operated
b. Condition of the seal after operation
c. Movement of blades:
   Smooth/Difficult/Jerk/Stick-up
d. Current drawn
5. Rectification of defect noticed.
6. Retest results.

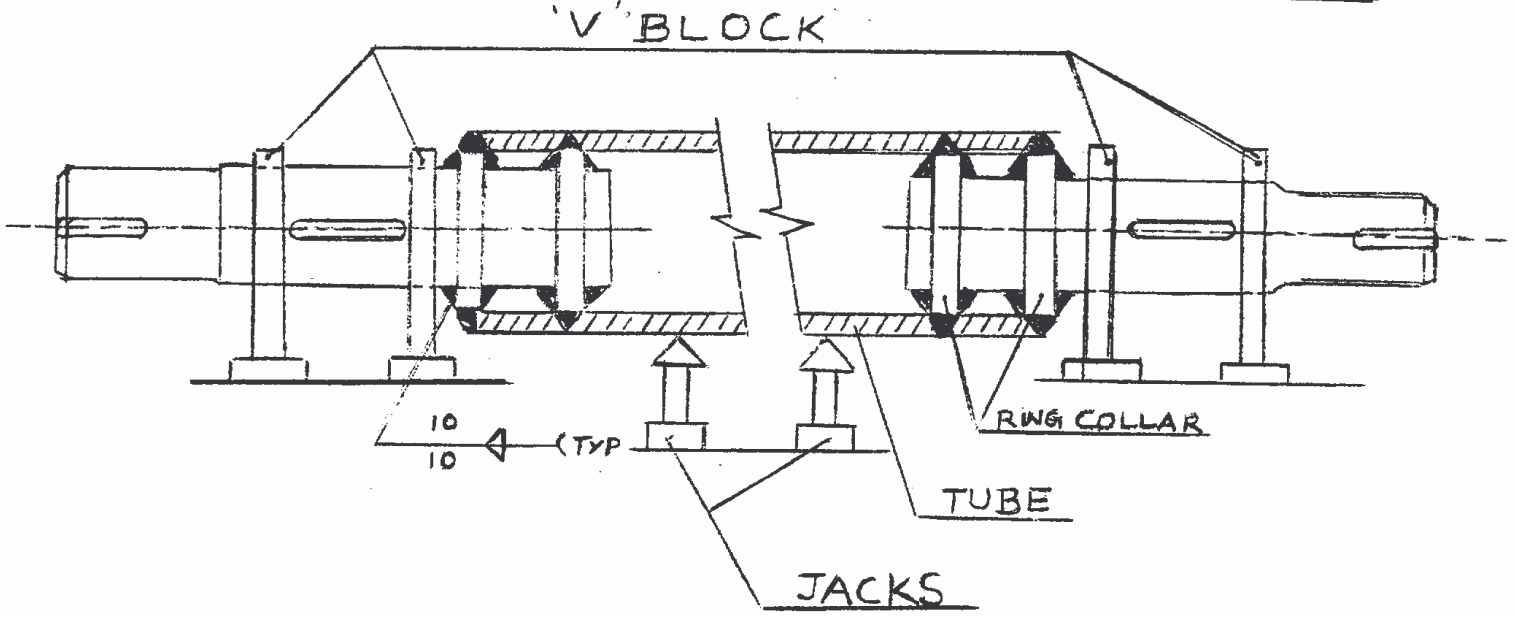
NOTE: Trial operation shall be repeated till satisfactory operation is achieved

I General workmanship

J Mechanical blade lock provided/not provided

K Rust preventive oil applied after testing for gate plate.

ESP 260:00
PAGE 19 OF 19



SKETCH-1

BHEL :: BAP :: RANIPET
QUALITY ASSURANCE

QUALITY CONTROL PROCEDURE FOR	WIND MILL STRUCTURE
EFFECTIVE DATE	20 07 1996

S.NO	NAME	DEPT	SIGNATURE	DATE
01.	L. SUBRAMANIYAM	EDC / WEG		
02.	A.R. RAMAMURTHY	MSA		
03.	H.A. KERKETTA	OC / OLI		
04.	M. VIJAYA KUMAR	OP / C		
05.	V. JAYARAMAN	OA		
06.	N. SOWRIRAJAN	ERN SERVICES		

APPROVED BY DGM / QA

REVISION NO :: 00
ISSUED BY :: QUALITY ASSURANCE

C FILE NAME C: \ WS \ GB \ (FLOPPY X 285)

RECORD OF REVISION

REV NO	DATE	CLAUSE REVISED
00	20 07 96	FRESH ISSUE QCP WM - 01 / 01. QCP WEG - 01/00 AND PR : QA : 703 have been merged and renamed W - 001 / 00 Dtd . 20 07 96

QUALITY CONTROL PROCEDURE FOR WIND MILL STRUCTURE

1.0 SCOPE.

1.1 The QCP WM -01 / 01 , QCP WEG - 02 / 00 and PR : QA :703 /00 have been merged and renamed as w - 001 / Rev . 00

1.2 This Quality Control Procedure lays down Quality Control Criteria for the material , fabrication . checks and trial assembly of the Lattice towers of wind electric generator.

1.3 This procedure is applicable " all sizes of lattice towers"

1.4 MATERIALS

2.1 The materials given in the drawing only shall be used. Whenever there is a change of material. concurrence of the Designs shall be obtained .

3.0 GENERAL

3.1 The Shop planning group / MSA planning group shall arrange for the required quantity and lengths of structural members since no joint is permitted in any member of the tower structure

3.2 The complete windmill structure shall behot dip qalvanised after fabrication and trial assembly with zinc coating weight 900 gm / sq. M and 120 micron average thickness. is 2629 and IS 4759 / 1979 may be used as Governing Standards for general requirements only . IS 2633 may be used for quality control of galvanising process . the bushes connecting the cross members shall be hot dip galvanised to 50 micron thickness .

3.3 Only high strength fastenerssuitably electrogalvanised / cadmium plated shall be used for all bolted connections . the governing standard shall be IS 5358 . the OLI inspection group / External inspection agency / shop inspection group as the case may be , must verify TCs of such fasteners before use in the wind mill structure . All fasteners used for assembly shall be of grade 8.8 or higher Only .

3.4 Wherever welds are required the welds shall be made using qualified welders as per AWS D . 1. 1 and using prequalified welding procedures . for tower top - plates to side plates weld use E7018 electrodes only for side plates to side plate weld use E6013 electrodes .

3.5 The embedded structures the portion (going inside concrete grout) need not be hot dip galvanised as per clause 2. 3 and shall be subsequently cement washed as per the following 'cement wash' composition . Any ungalvanised portion not silicate primer (inorganic zinc rich primer)

3.5.1 The permissible bend and twist on the rolled angles and channels shall be 3mm maximum respectively . If they are having more bend / twist they shall be corrected prior to hole drilling .

3.5.2 CEMENT : Fevicol : Water ratio be 10 kg : 350gm : 650CC .

CAUTION : The job shall be dry while applying the cement wash .The cement wash may be applied by brushing . avoid too much wash .

4.0 DIMENSIONAL INSPECTION

4.1 The lattice tower assembly is joined by bolted connection only . Hence the bolt sizes and pitches shall not differ from the drawing. The inspector shall take extra care to check each hole marking on the angles and members Deviations in the linear dimensions permitted shall be qlmm maximum. Where tolerance is given in the drawing that shall be maintained as per drawing . drilling fixtures duly FOT tested may preferbiy be used .

4.2 For the corner chisels the chamfer 16x 45x shall be precisely maintained for the length specified in the drawing machining / grinding at chamfered end for reference to holes is required .

4.3 For the holes sized the tolerance be +0. 25 / - 0mm.

4.4 the length of corner chisels be Lq 1mm only .

4.5 The length of cross members shall be maintained at L q 1mm only .

4.6 Tower top

4.6.1 The profiled plate shall be checked with a template for the radius R635

4.6.2 SEE ANNEXURE I The horizontal and vertical pitches of the holes on the sides of the tower top shall be drilled using templates and checked for pitches and diameters . The pitch variations shall be limited to tolerance qlmm maximum .

4.6.3 The weld between top plate and side profiled plates shall be LPI tested (100%) . other welds shall be 10% LPI tested . (final weld Only .)

4.6.4 The ends of LPI all chisels and cross members shall be made square by gas cutting and grinding .

4.6.5 The top plate minimum thickness shall be maintained as per drawing . with respect to the central axis of the tower top the top plate shall be exactly perpendicular the planarity of top plate shall be within 0.4mm / Metre checked by Master levels .

4.6.6 100% MPI Shall be done for gas cut edges of plates > 50mm thickness .

5.0 TRIAL ASSEMBLY OF BASE FRAME

5.1 The base frame of the tower Shall be trial assembled in the vertical condition in the Shop / ancillary unit . for every new design / drawing .

5.2 Mark the axis of the tower on the layout in the shop on the floor which Shall be level . The levels of all the four bottom corners Shall be within 1mm .

5.3 Assembly the horizontal bracings and cross members one after another using same size black blots as used for the site assembly .

5.4 Measure the levels of the tops of the four corner chisels at the outside corner . This Shall be within 1mm

5.5 Please refer ANNEXURE IV. Measure the top side dimensions A-B, B-C, C-D AND D-A, they Shall be within qlmm.

5.6 Measure the bottom Side dimensions A-B, B-C, C-D AND D-A, they Shall be within qlmm .

5.7 Measure the diagonals at top from the outside of the corner chisels, A-C And B-D . Shall be within qlmm .

5.8 Measure the cross diagonals at top of a and bottom of C and between top of B and bottom of D . they Shall be within q1 . 5mm

5.9 Measure the opposite cross diagonals between bottom of A And top of C and between bottom of B and top of D . they shall also be within q1 . 5mm .

5.10 Record them in the history card XX annexed (ANNEXURE IV) to this QCP tower wize .

5.11 drop a plumb the tops of A, B, C and D, measure the distance between plumb tip to bottom chisel inside . all the four distances , a-a , b-b , and d-d Shall be equal record the readings

6.0 HORIZONTAL TRIAL ASSEMBLY OF TOWER WITHOUT BASE FRAME

6.1 The lattice tower Shall be horizontally trial assembled without the base frame for its full length . for every new design / drawing .

6.1.1 Bolts nuts and washers Shall be made available for the whole tower for trial assembly .

6.2 Fix the corner chisels and cross members of all the three tiers separately using ordinary bolts (M24) and assemble the lattice tower in the horizontal condition .

6.3 With proper structural supports bring the axis of tower exactly horizontal .

6.4 Match mark each tier at the junction A-A and B-B bolt the tower top also after all the three tiers are joined.

6.5 Drop a plumb at the top plate of tower top to check any deviation from perpendicularly of tower top to the axis of tower .

6.6 Using THEODOLITE/WATER LEVELS find out the axis deviation if any . It Shall not exceed 2mm for the entire height of the tower .

6.7 On the corner chisels ; the cross members and matching areas marked A-A , B-B , the identification Shall be weld marked with 3mm high welds of letter size 50mm . Please See ANNEXURE I I .

6.8 For cross member numbering please see annexure I I I .

6.9 Trial assembly of the top the tower with the tower top Shall be done .

7.0 Machining of tower top :
---------- -- ------ -----

Please Refer Annexure - ZZ

7.1 Level the top tier assy within 2 mm (A-A, B-B)

7.2 Ensure the plumb - out of holes at top and bottom (I . e . D. D and C . C)

7.3 Ensure the faceout of the tower top within 2 mm , If it is more than 2mm , grinding the tower top seating base and reset the flange .

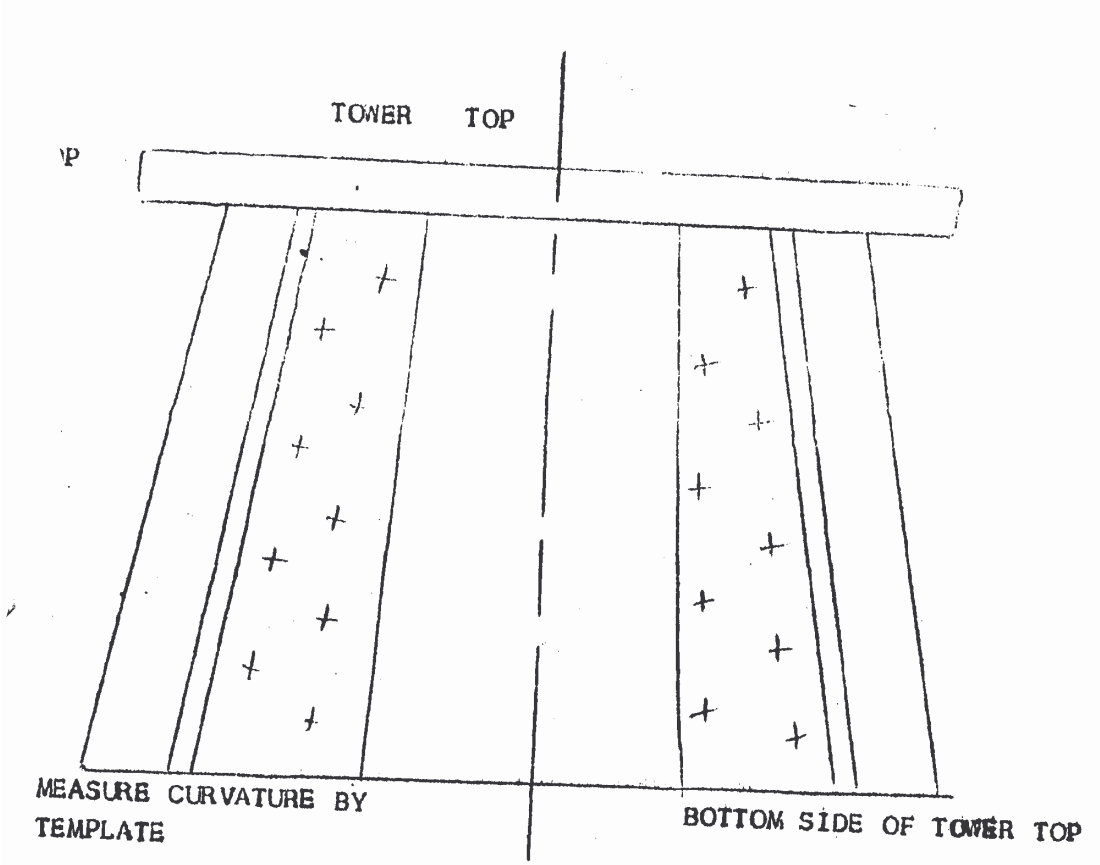
7.4 Mark line 5-5 parallel to C. C on entire periphery of the flange .

7.5 Mark like 1-1 . 2-2 , 3-3 and 4-4 ad Shown in the thickness of the flange .

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PC : GB - 1 (81) FL - 215

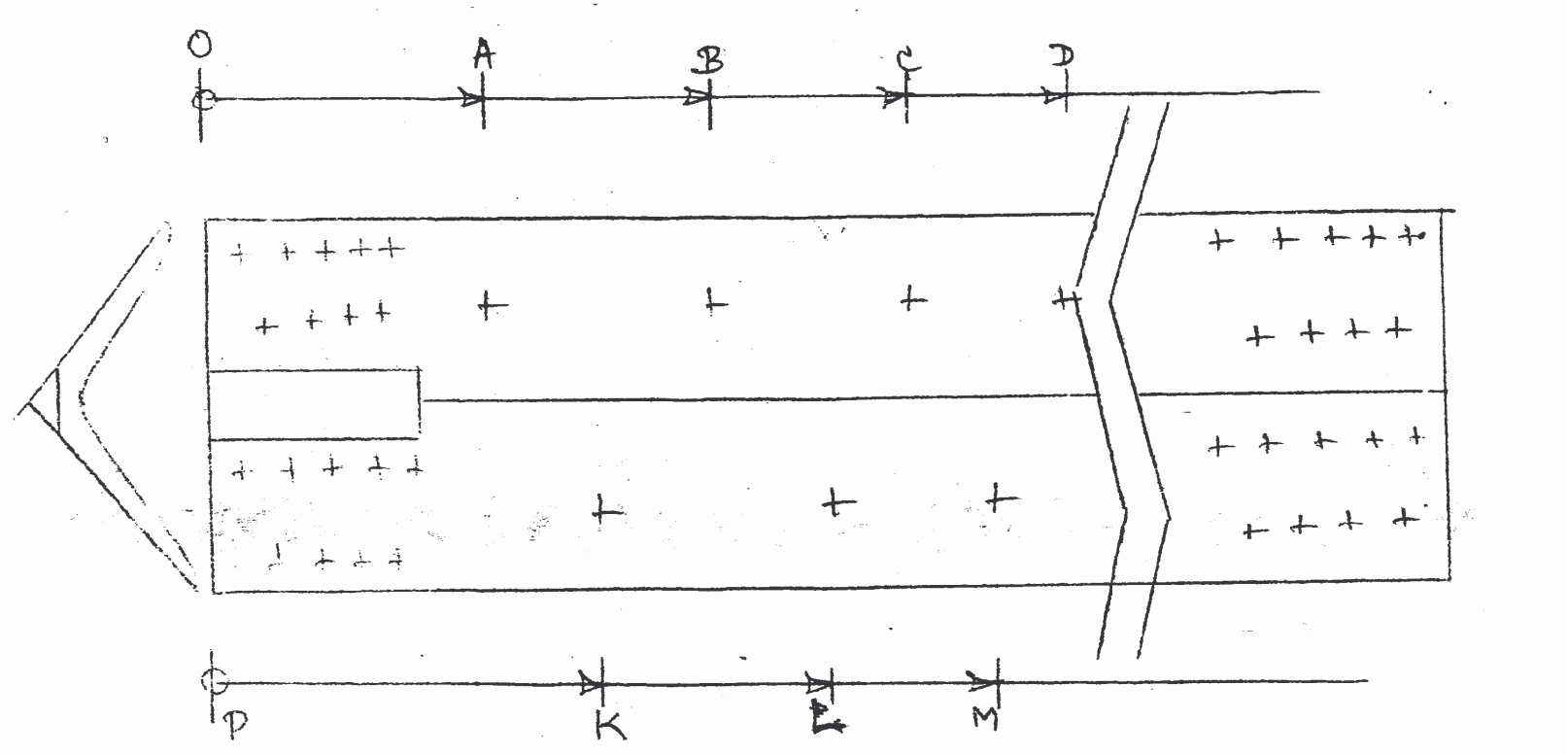
TOWER TOP



01. MARK AND DRILL TOP HOLES .

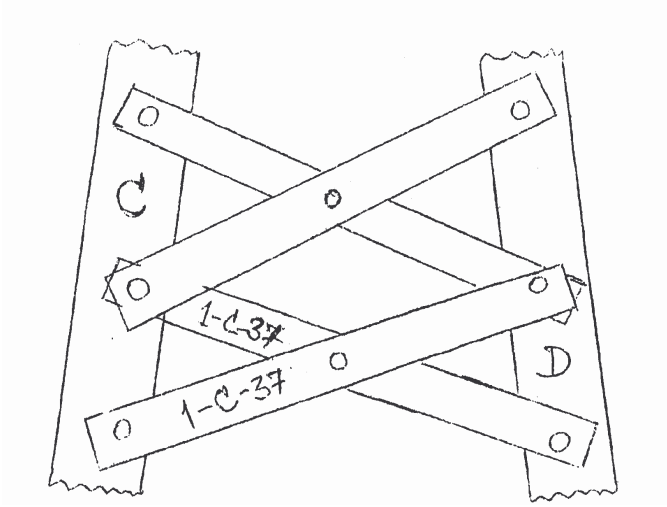
02. DEVIATION FROM PLANARITY OF MACHINED TOP SURFACE OF TOP PLATE SHALL BE 0 . 4MM PER METER .

03. TRIAL ASSEMBLE WITH LATTICE TOWER AND DO IDENTIFICATION MARKING AS GIVEN IN PROCEDURE CL . 5 . 0



1) MACHINE / GRIND FLATEN THIS SURFACE FOR REFERENCE OF CUMULATIVE PITCH OF ALL HOLES .
2) CHAMBER LENGTH SPECIFIED IN DRG . SHALL BE MAINTAINED .
3) CUMULATIVE PITCHES OA, OB, OC, OD ETC SHALL NOT VARY BEYOND = . 1 MM
4) MATCH MARKS SHALL BE MADE BY WELDING 3MM HIGH WELDS OF LETTER SIZE 5
5) LATERAL DEVIATION OF BOLT HOLE LOCATIONS NOT PERMITTED .

CROSS MEMBER NUMBERING DETAIL

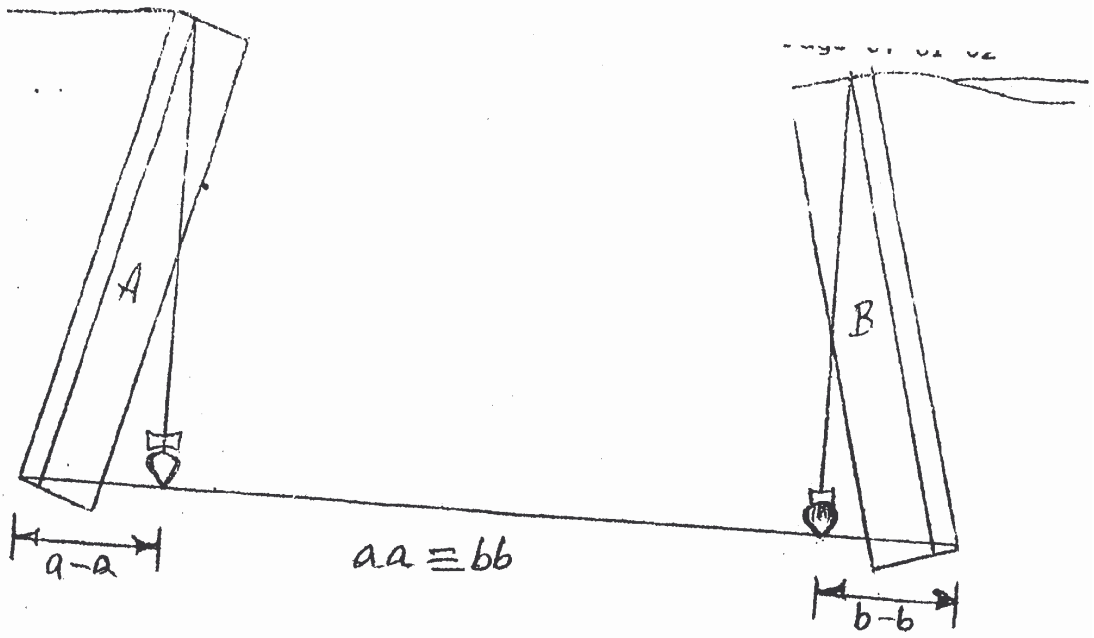


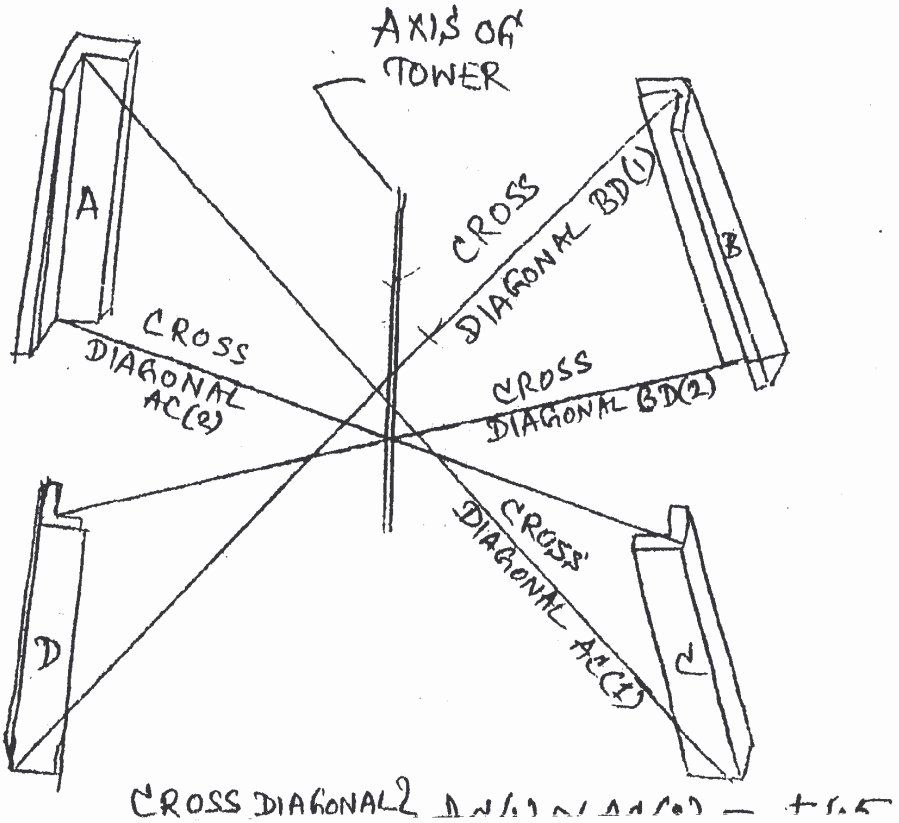
THE CORNER CHISELS ARE NAMED A,B,C & D. THE CROSS MEMBER DESIGNATION WILL BE AS FOLLOWS :

1- C --37

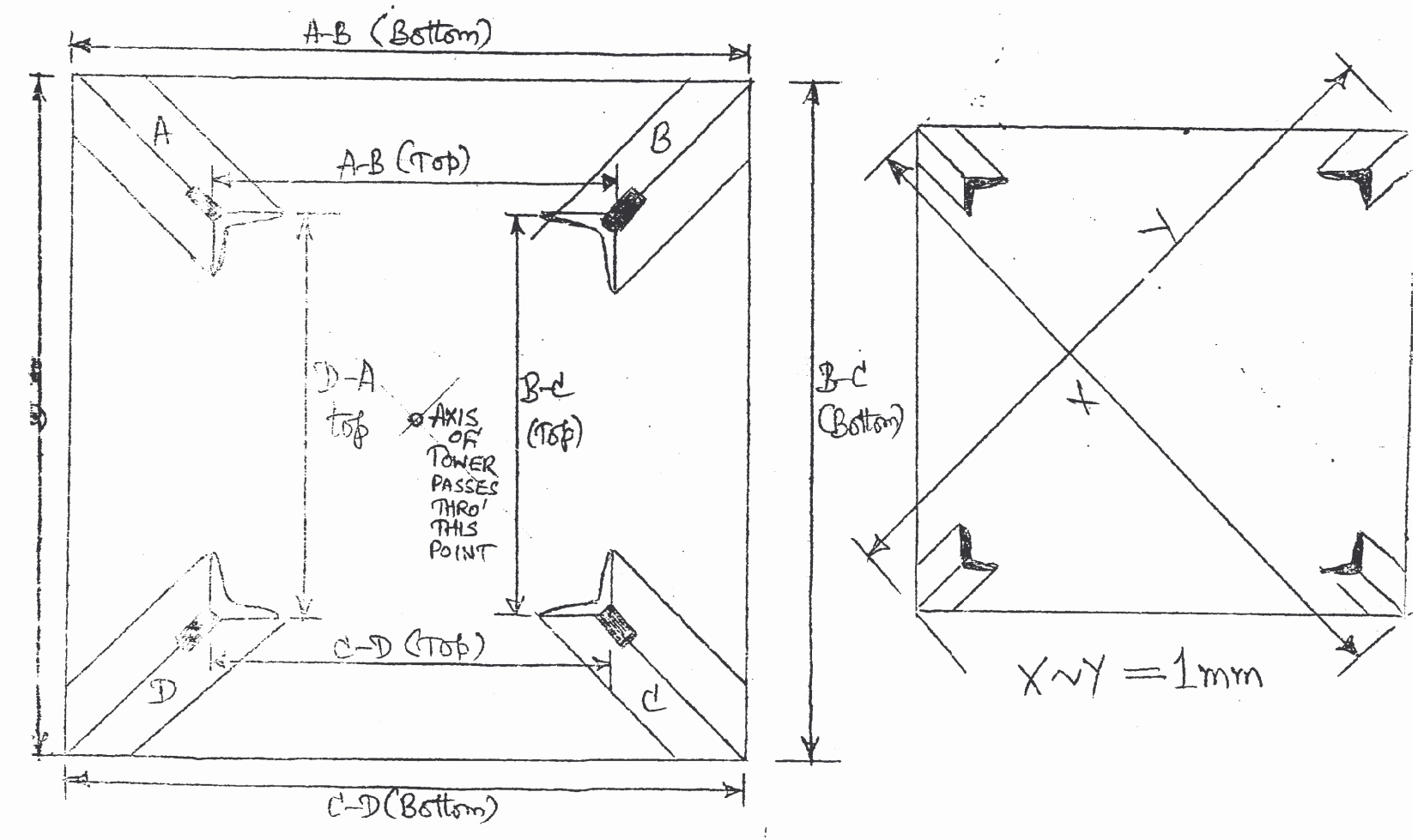
This means tower number	This means the corner chisel from which the cross member will be bolted	Cross member number as given in drawing

There will be two identical cross members bearing same designation as mentioned above . THE same shall be bolted as given in the Sketch above .





CROSS DIAGONAL2


A-B (Bottom)
A
A-B (Top)
B
D-A
Top
AXIS OF POWER PASSES THRO' THIS POINT
B-C
(Top)
C-D (Top)
D
C
C-D (Bottom)
B-C
(Bottom)
X
Y
X~Y = 1mm

ANNEXURE XX

HISTORY CARD FOR FIND ELECTRIC GENERATOR BASE FRAME ASSEMBLY CHECKS

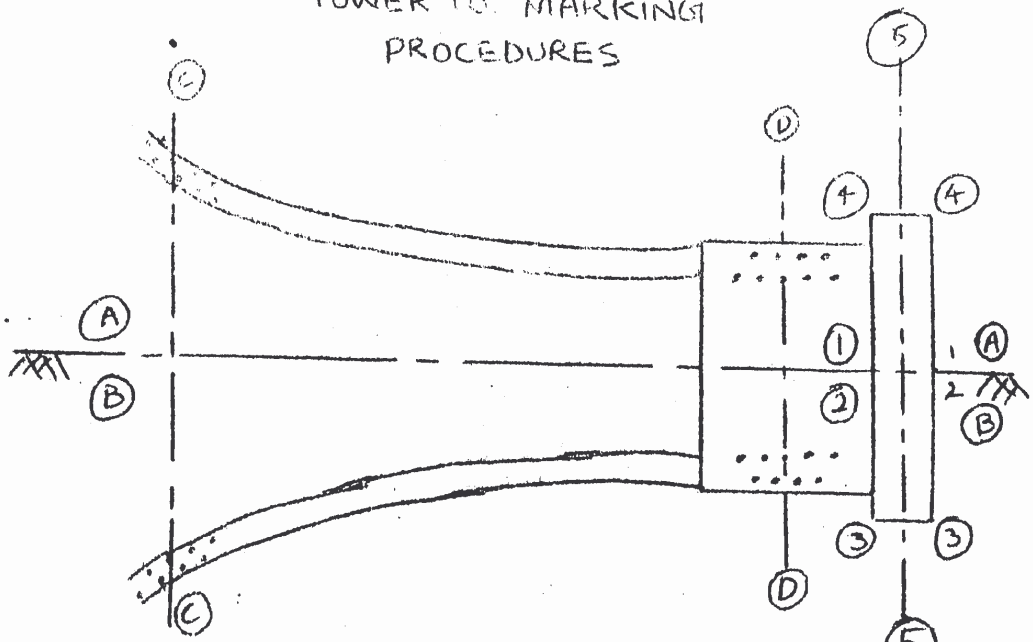
aa	bb	cc	dd	AC1	AC2	BD1	BD2	X	Y

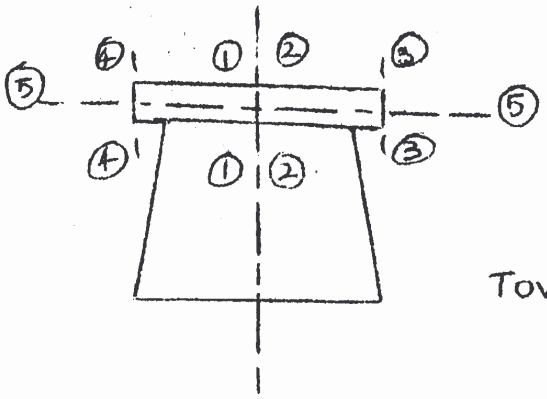
AB Top	AB Bot	BC top	BC Bot	CD top	CD Bot	DA top	DA Bot

ANNEXURE - ZZ

WIND ELECTRIC GENERATOR

TOWER TO MARKING PROCEDURES





TOWER TOP

MARKING DETAILS

A - A, B - B] WATER LEVEL WITH IN 2 MM

C - C, D - D] PLUMB POINT AT HOLES WITH IN 2 MM

1-1, 2-2, 3-3, 4-4] JIG LOCATING MARKS

5-5 - MACHINING REFERENCE LINE

LINES C-C, D-D AND 5-5 SHOULD BE PARALLEL

BHEL
RANIPET

BHARAT HEAVY ELECTRICALS LIMITED
RANIPET 632406

QUALITY DEPARTMENT

QCP : W : 003/ Rev 00
15 /11 /94

QCP for NACELLE COVER ASSEMBLY

Effective Date 18 / 11 / 94

Name	Signature	Deptt	Date
M Ramananda Rao		EDC/WEG	
A R Ramamurthy		MSA	
D G Segar		Prodn	
G Subbaraju		QC	
M Velandi		Prodn	
V Jayaraman		QA	
M Vijayakumar		OP&C	
APPROVED BY	SM/QA	Mr. V. Jayaraman m/Qa.	

Mr. V. Jayaraman m/Qa.
CONTROLLED COPY
CONTROL NO: ABIO.

Issued By : QUALITY ASSURANCE

QCP FOR NACELLE COVER ASSEMBLY

1.0 SCOPE :

The Quality Control Procedure is covering in process quality checks that have to be carried out during manufacture of Nacelle Cover Assembly of Wind Electric Generators of Nordex Design .

2.0 GENERAL :

2.1 Any change of materials covered shall have the approval of WEG designs .

2.2 Welds shall be carried out by qualified welders and inspected by calibrated measuring instruments.

2.3 Any untoleranced dimension not covered either by this QCP or the standard QP WEG 01 or relevant drawings shall be controlled by the procedure PR : QA : 500 dt 16/1/93.

2.4 Welds shall be free from spatter , lack of fusion undercuts , slag inclusion and any other weld defects that will be detrimental to the strength of the weld. All welds shall be smoothly dressed by grinding and smoothly merged with adjacent metal.

2.5 Thickness less than 3 mm shall be welded by welders qualified as per AWS D. 1. 3 and appropriate WPS.Alternately Co2 welding duly prequalified can be used by using fcaw or suitable welding electrode.

3.0 PROCEDURE

3.1 Before pressing in a press the sheet metal shapes shall be checked according to the cutting plan dimensions and PR :QA : 500

3.2 Before final welding the pressed shapes shall be tacked in position and gaps should be exactly as per drawing fit up dimensions then only final welding clearance can be given

3.3 As the top half and bottom half of the nacelle cover assembly are made of sheet steel of 2 mm and 4 mm respectively all care shall be taken to avoid weld distortion. Especially selection and use of electrode sizes . are length and welding current shall be particularly checked and controlled as per WPS .

3.4 The fit up of hinges , door closers , door locks shall be particularly given attention as the Nacelle assembly cannot be brought down from 40 M height from service and repaired as often and easily . Their fit up may be preferable done after sand / shot blasting and painting.

3.5 SAND / SHOT BLASTING :

3.5.1 The finished and dimensionally cleared Nacelle cover top and bottom shall be shot/sand blasted as per PR : QA : 508/Rev 00 dt 7/7/93 to Sa 2 1/2 finish as per SIS 055900 (Near white metal blast cleaning) and checked for profile against a reference (blasted) surface

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roughness specimen.

4.0 Acid cleaning of nacelle cover assembly :

4.1 The Nacelle cover assembly shall be acid cleaned if the following operations are not carried out. Shot blast the tank side walls before they are welded to the nacelle cover bottom. Weld them carefully with fillet welds care- this case acid cleaning is not required.

4.2 If the conditions of cl 4.1 cannot be fulfilled then do acid cleaning. Circulate 10 % v/v hydrochloric acid inhibited with antimony trichloride until the return liquid from the tank is free from any scale. debris. etc. Then circulate pure demineralised water using a pump until a blue lite paper shows no acidic reaction to the return liquid from the tank . Then circulate 2% solution of sodium carbonate through the tank. Then pass compressed air through the tank for 15 to 20 minutes and then close the tank inside with rubber caps.

5.0 PAINTING :

5.1 If there is a specific customer requirements for painting for a project then that shall be followed. otherwise C1 5.2 shall prevail.

5.2 The applicable painting schedule is given below. painting of (interior surface shall be with two pack Epoxy Zinc Rich Primer two coats of the paint shall be used to a total dry film thickness of 60 microns mini mum. This shall be followed by minimum two coats of two pack Epoxy White Enamel paint after 6 hours to a total dry film thickness shall be 230 microns minimum.

5.3 The primer paint thickness shall be checked using an elcometer before applying the final epoxy white paint coating. After he finish coat dries the final coating thickness shall be checked and recorded on history card.

6.0 All vital dimensions of the Nacelle cover assembly shall be recorded in a history card which must incorporate dimensions , WPS No , blast cleaning clearance and paint film thickness.

NPC File C: \ TEMPOR \ QCPW003 . KSU

BHEL : BAP : RANIPET

QUALITY DEPARTMENT

QCP:W:004
DT: 17-07-96
REV: 01

QUALITY CONTROL PROCEDURE FOR	ASSEMBLY OF NACELLES OF WIND ELECTRIC GENERATORS (NORDEX DESIGN) 250 KW/N29 AND 200 KW/N27
EFFECTIVE DATE :	17-07-96

NAME	DEPARTMENT	SIGNATURE	DATE
M. RAMANANDHA RAO	EDC/WEG		15/07/96
M. VIJAYAKUMAR	QP & C		11/0796
A. KARNAN	PRODUCTION		15/07/96
S. KRITHIVASAN			15/07/96
K. LAKSHMIAH	QUALITY CONTROL		12/07/96
V. SUBRAMANIAN			12/07/96
V. JAYARAMAN	QUALITY ASSURANCE		10/07/96
APPROVED BY	DGM/QA		

ISSUED BY : QUALITY ASSURANCE

RECORD OF REVISIONS

REV NO	DATE	CLAUSE REVISED
00	07-12-94	FRESH ISSUE
01	17-07-96	1) CL.2.2.Deleted.other clauses Renumbered. 2) CL.2.4.8,2.4.9 modified & renumbered as 2.3.8 & 2.3.9 respectively. 3) CL.2.4.3,2.6.4 modified & renumbered as 2.3.3. & 2.5.4 respectively 4) CL 3 modified. 5) CL 2.7.1 to 2.7.4 modified & renumbered as 2.6.1 to 2.6.4 6) CL 2.8.1 modified & renumbered as 2.7.1 7) CL 2.8.2 modified & renumbered as 2.7.2

QUALITY CONTROL PROCEDURE FOR ASSEMBLY OF NACELLES OF WIND ELECTRIC GENERATORS (NORDEX DESIGN)

1.0 SCOPE

1.1 This Quality Control Procedure specifies Quality Checks to be carried out during the assembly of components in the Nacelle Assembly of Wind Electric Generators.

1.2 REFERENCE:

Largely the Quality Checks have been derived from M/S NORDEX'S Quality Control Procedures and checklists

1.3 A History Card maintained by QC/shop shall be filled up in full for every Wind Electric Generator Nacelle Assembly of Nordex design manufactured.

2.0 GENERAL:

2.1 Any change of material shall have the approval of Designs/WEG.

2.2 WELDING:

2.2.1 Only Qualified welders shall be used on all welds as per WPS using qualified procedures.

2.2.2. All welds shall be free from slag inclusions, blow holes and other deleterious defects. Fillets shall be checked with fillet gauges to ensure correct profile and throat as per drawing. Butt welds >6mm wide shall be MPI tested.

2.3 ASSEMBLY OF COUPLING ON GENERATOR:

2.3.1. Ensure that the inductive sensor is mounted on left bottom side when we look in front of the generator facing the shaft. Ensure use of loctite 648 and tightening of the bolt to 48 Nm (M10 bolts of bearing cover)

2.3.2. Ensure mounting of disk of conductive sensor on the coupling using bolts (MB X 20) using loctite 648 and tightened to torque 24Nm.

2.3.3. Ensure that the coupling half and distance bushing make full contact with the recess on the shaft. Coupling must make full contact with distance bushing.

2.3.4 The distance from outer edge of coupling to flange on the generator shall be maintained at 199 + or - 1MM.

2.3.5 Ensure tightening of bolts crosswise (Follow the mounting procedure for tightening elements viz I 201 -2 Torque tighten the blots progressively from 40Nm, 80Nm, 110Nm & ultimately to final torque value of 125Nm.

2.3.6 Apply Hydraulic oil to tightening element and shaft to prevent rusting.

2.3.7 Ensure cl.11 of Nordexz Instructions procedure I 201-2 is fully followed for mounting shield & rubber pads.

2.3.8 Ensure fitting of the blower (fan) in the right direction (blades towards the generator) if not already fitted.

2.3.9 Ensure mounting of junction box in the shield & tighten with allen screws if not already mounted.

2.3.10 Ensure placement of cable anchors on generator and plate for sensor cables shall be mounted with rubber packing on the terminal box.

2.4 ASSEMBLY OF HUB ON MAIN SHAFT:

2.4.1 Uniformity in thickness of tightening elements shall be verified before mounting.

2.4.2 Ensure cleaning of the shaft and hub where tightening elements will be placed and application of hydraulic oil to the pressure surfaces of tightening elements.

2.4.3 Check for the careful mounting of hub on the main shaft and placement of tightening element in the recesses. Ensure that hub and tightening elements make full contact with recess on main shaft and hub respectively. Tightening of bolts shall be crosswise (opposite bolts shall be tightened) in sequence.

2.4.4. Torque tightening to 230 Nm shall be ensured and recorded for the small tightening element.

2.4.5 Torque tightening to 325Nm shall be ensured and recorded for big tightening element using special extension for a final torque of 485Nm.

2.4.6 Mounting of distributor block at the end of mainshaft shall be ensured

2.4.7 Make sure that the cover with beading and eyebolts are mounted in the front of the hub.

2.4.8 All threaded holes shall be smeared with antiseize thread lubricant before fixing bolts.

2.4.9 Verify application of rust preventive on mainshaft and tightening elements and all machined surfaces.

2.5 MOUNTING OF GENERATOR OF GEARBOX:

2.5.1 Check the Name Plate details of the generator and ensure that appropriate generator only is mounted on the gearbox.

2.5.2 Ensure cleaning flange on gearbox and flange on generator with a scraper and solvent.

2.5.3 Generator bolt sizes and use of bushings as per Nordex Instruction I 201-4 shall be ensured.

2.5.4 Generator mounting on gearbox with care shall be witnessed if not already mounted. The bolt used for mounting generator in front of Terminal box will be shorter.

2.5.5. CHECK THE FOLLOWING: (if not fitted already to M/8 Nordex)

1) Mounting box of cable inductive sensor shall be mounted on terminal box of generator.

2) Inductive sensor shall be mounted on generator inlet. The Rubber packing between inductive sensor and terminal box shall be ensured.

3) Cables 11,13,14,15,25 & 43 and UVW shall be led on along the pipes to the terminal box on generator.

4) Cables 13,14,15,25, cable 11 and their routing shall be as per Instruction of Nordex I 201-4.

5) Ensure the location of holes & pitches for correctness of mounting of vibration sensor.

2.6 ASSEMBLY OF NACELLE BOTTOM:

2.6.1 The Nacelle bottom shall be mounted in position without damaging the paint coatings if not already mounted by M/S Nordex to avoid scratches. Rugs are used with fork lifts to avoid damage/scratch.

2.6.2 Mounting of Trap door shall be ensured at entrance hole if not already mounted by M/S Nordex.

2.6.3 Hoses and fittings connected to the tank shall be checked for use of loctite and check mounting of 'T' piece with hoses (if not already done by M/S Nordex).

2.6.4 Mounting of holder for brake lever shall be checked and ensured (if not already done by M/S Nordex. The holder is screwed on after smearing in loctite 648 (or equivalent).

2.7 ASSEMBLY OF NACELLE TOP:

2.7.1 After mounting the gear box, generator, coupling and hub on main shaft and properly fastening the Nacelle bottom, the Nacelle top is to be prepared for mounting on the Nacelle bottom (if not already done by M/S Nordex).

2.7.2 Check placement of the Nacelle along with all interiors on pedestals, if not done by M/S NORDEX already

2.7.3 Ensure that for fitting the Nacelle top on Nacelle the lifting eyes provided are only used.

2.7.4 Check mounting of top over Nacelle using M12 X 50 bolts check for the mounting of the gas springs. Ensure use of appropriately rated gas springs 800Nm front and 2000Nm rear and also ensure that gas spring 90Nm is already mounted on top cover.

2.7.5 Check for the mounting of Locks on the front and rear side of Nacelle top.

2.7.6 Close the Nacelle top to see if it makes full contact all the way on the Nacelle edge.

2.7.7 Check the painting of the BHEL emblem with "Manufactured under license from Nordex A/S Denmark" with 'phiroza blue' Nitro cellulose laquer paint.

2.8 MOUNTING OF AIRLOCK:

2.8.1 Ensure that the following/are sent inside the nacelle
---

assy:
---

(1) Fitting of Air lock (Brackett for wind vanes and Anemometer)

(2) Mount pipe for Windvane & anemometer

(3) Mount the fitting for Windvane and anemometer on the pipe.

(4) Ensure the proper typing up of the assembly of anemometer and Windvane on the airlock pipe.

3.0 CHECK LIST - CUM - HISTORY CARD:

The history card R 49-522/A "History Card for Wind Electric Generator Nacelle assembly" shall be used.

3.1.1 Despatch of loose items inside Nacelle: as per GMS.

3.1.2 Despatch of loose items fitter in Nacelle: as per GMB.

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

BHEL : BAP : RANIPET

QUALITY DEPARTMENT

AMENDMENT TO QUALITY CONTROL PROCEDURE (QCP)

QCP: I 001 / REV : 03

AMENDMENT : SL NO : A2
DT: 27.12.2000

DESCRIPTION : QUALITY CONTROL PROCEDURE FOR IPP CHIMNEY

DETAILS PAGE 01 OF 01

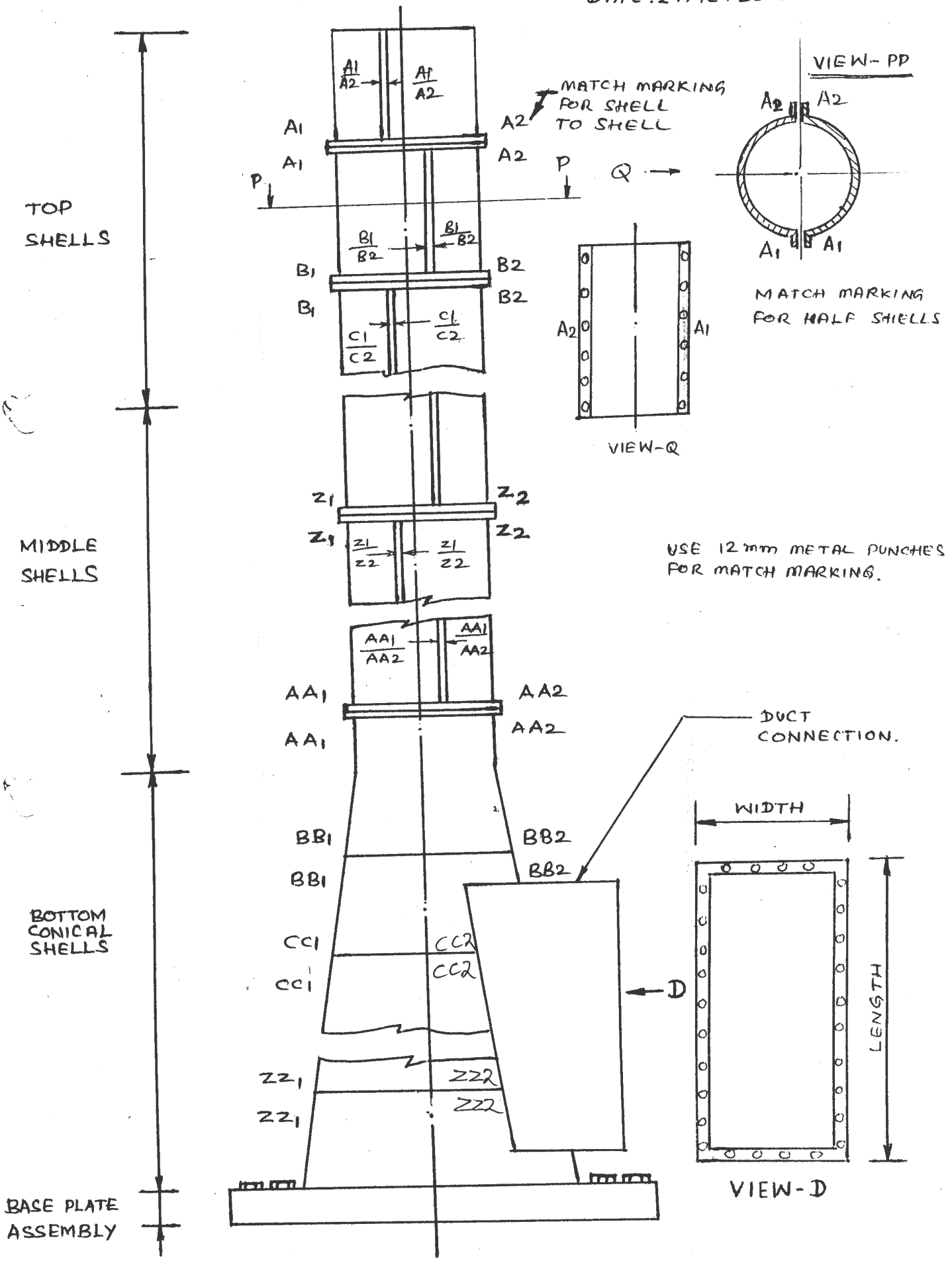
CLAUSE : NO	EXISTING	AMENDED AS
ANNEXURE TO QCP PAGE 3 OF 3 (SKETCH)	MATCH MARKS FOR SHELL TO SHELL INDICATED AS Z1 AND Z2 ON BOTH ENDS	Z̄1 , Z1 AT ONE END AND Z2 , Z2 ON THE OTHER END AS SHOWN IN THE REVISED SKETCH.

NOTE : THE ABOVE MENTIONED CHANGES WILL BE INCORPORATED IN THE RELEVANT W.I. DURING THE NEXT REVISION OF THE DOCUMENT.

PREPARED BY	REVIEWED BY	APPROVED BY

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FIGURE-4


TOP SHELLS
MIDDLE SHELLS
BOTTOM CONICAL SHELLS
BASE PLATE ASSEMBLY
A1/A2
A1
A2
MATCH MARKING FOR SHELL TO SHELL
P
Q
B1/B2
B1
B2
C1/C2
C1
C2
VIEW-PP
A2
A1
MATCH MARKING FOR HALF SHELLS
VIEW-Q
Z1/Z2
Z1
Z2
USE 12 mm METAL PUNCHES FOR MATCH MARKING.
AA1/AA2
AA1
AA2
DUCT CONNECTION.
WIDTH
BB1
BB2
CC1
CC2
D
ZZ1
ZZ2
LENGTH
VIEW-D

BHEL:BAP:RANIPET

QUALITY ASSURANCE

AMENDMENT TO QUALITY CONTROL PROCEDURE (QCP)

Q.W.I.NO:QCP:I:001 REV:03 AMENDMENT SL:NO : A1

DESCRIPTION :QUALITY CONTROL PROCEDURE FOR IPP CHIMNEY DATE:28.11.2000

DETAILS PAGE 1 OF 1

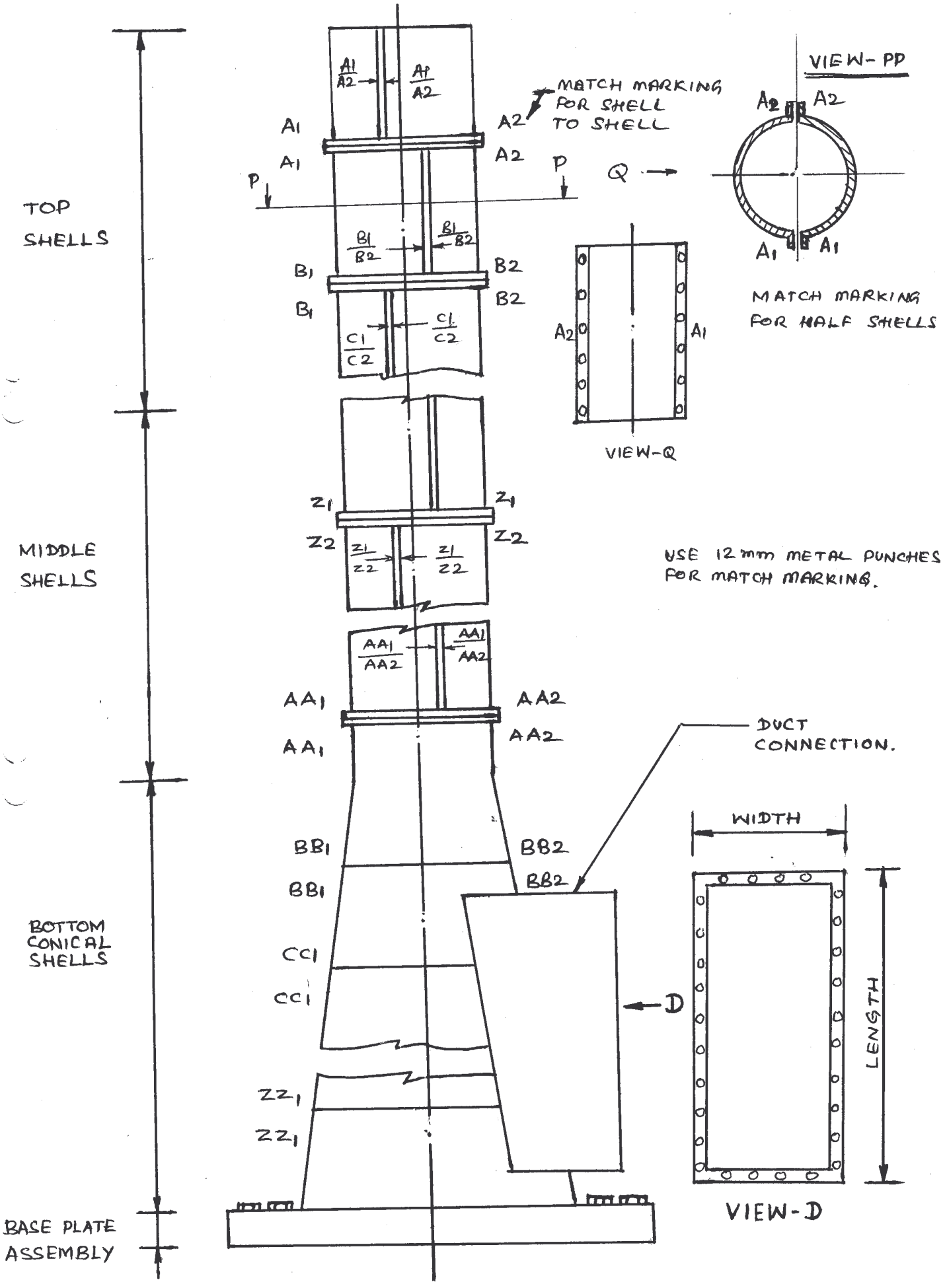
Clause No:	Amended as	Basis for amendment/Remark
Annexure to QCP page 3 of 3	Figure changed to include more number of match marks on shells. (refer fig:4)	To facilitate identification of match marks if more shells are involved.

Note : The above mentioned changes will be incorporated in the relevant W.I. during the next revision of the document.

Prepared by:	Reviewed by :	Approved by:
	B. Srinivasa Rao	

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FIGURE-4


TOP SHELLS
MIDDLE SHELLS
BOTTOM CONICAL SHELLS
BASE PLATE ASSEMBLY
A1/A2
A1
A2
MATCH MARKING FOR SHELL TO SHELL
P
Q
B1/B2
B1
B2
C1/C2
C1
C2
VIEW-Q
VIEW-PP
MATCH MARKING FOR HALF SHELLS
Z1/Z2
Z1
Z2
USE 12 mm METAL PUNCHES FOR MATCH MARKING.
AA1/AA2
AA1
AA2
DUCT CONNECTION.
BB1
BB2
CC1
D
ZZ1
WIDTH
LENGTH
VIEW-D

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BHEL : BAP : RANIPET
QUALITY ASSURANCE

QCP:I:001
REV.03

QUALITY CONTROL PROCEDURE FOR IPP CHIMNEYS

EFFECTIVE DATE 29/6/94

Department	Name & Desgn.	Signature & Date
PRODUCTION	A KARNAN Manager	
OP & C	P S NARASIMHAN Dy.Manager	
ENGINEERING	V HARIHARAN SR MANAGER	
QUALITY CONTROL	M RAVINDRA MANAGER	
QUALITY ASSURANCE	V JAYARAMAN DY MANAGER	

ISSUED BY : QUALITY ASSURANCE

CONTROL COPY NO

PC File: QCPI001.3 in Floppy No.QA/244

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RECORD OF REVISIONS

Rev.No.	Clause(s) Revised	Reason
01	1.0; 4.0; 5:8.1; 5:8:3, 5:9.1; 5:9.3; 5:9.5, 5:9.7; 6:2.6; 6:7, 8:4	To incorporate the requirements of newer chimney designs
02	Amendment 01: Cl.5:9.1 and 5:9.2	Amendment-1 comments incorporated.
03	Cl.3.5; 4.0; 4.1;4.2, 5:9.1; 5:9.2; 5:9.4 5:9.6; 5:9.7; 5:9.11; 7.1; 7.1.1; 7.1.2, 9:2; 9:3	To incorporate requirements of M/s.Reliance Inds., & ACC, Kymore requirements.

1.0 SCOPE

This quality control procedure giver the quality checks, stages and details or inspection that should be done en IPPD Chimneys Projects.

2.0 MATERIALS

2.1 The materials used in the manufacture shall be as per the drawing. Any change of material shall have the prior approval of Engineering.

3.0 WELDING

3.1 All welds shall be done by welders qualified for welding using the relevant procedure and in the relevant positions using relevant consumables and processes only with correct edge preparation and fit up.

3.2 Only E 7018 electrodes shall be used for all carbon steel welds. Where stainless steel welds are involved, E 309 type welding electrodes shall be used using prequalified welding procedures only. When carbon steel to stainless steel welding, WPS shall be the guiding procedure.

3.3 Welds shall be cleaned free of slags and spatter and shall be free from any defects. Permissible defect level shall be as per AWS D1.1. Fillets shall conform to the drawing requirements and shall be checked by fillet gauges by inspector at random.

4.0 NDT

4.1 All butt welds of thickness more than 6mm shall be double 'V' with back gouging/grinding and root LPI and final MPI.

4.2 Butt joint of base plates of thickness more than 50mm shall be UT/RT tested.

4.3 All Butt joints of shell welds shall be MPI/LPI tested.

5.0 **CHECK OF LAYOUT OF STIFFENER PLATES BASE PLATES AND HALF SHELL PLATES** (For conical portion of chimney)

5.1 Refer Figure 1. Check the radius of cut, and diagonals SL1 and SL2, A1, A2, A3, A4 and A5. SL1 SHOULD BE equal to SL2. A1 should be equal to A2=A3=A4=A5.

5.2 Refer Figure 2. Check the radius of cut AND diagonals SLA and SLB and lengths AA, AB, AC, AD and AE. SLA must be equal to SLB. AA must be equal to AB=AC=AD=AE. No deviations are permitted in the lay out.

5.4 Where joints on the plates are to be made, make the joints by butt joints with appropriate edge preparation and checks by NDT as per Clause 4.0. Check the diagonals and slant heights A1, A2, A3, A4 & A5 or AA, AB, AC, AD and AE as the case may be, tolerance are as per PRQA 500.

5.5 Inspect and clear if satisfactory (use only approved templates). Check the curved profile at narrow and braod ends. Trim the cut edges to profile and then edge prepare all four sides by gas cutting and grinding with correct angles and land. The workmanship shall be as per AWS D1.1.

5.6 Mark the ends of the slant line on the narrow and broad ends of the cut shell plate at equal intervals as shown in Figure-3 prior to rolling to ensure squareness of the rolled edges after rolling and to avoid twist of the conical half after rolling. Inspect and clear for rolling. Check for out of squareness of the vertical edges by waterlevels and plumbline after rolling the half conical shells. Check the cut out for inspection door for length, width correctness of location and diagonals and then clear.

5.7 Check stiffener segments positions for stitch welding as per drawing after proper fit up without gap.

5.8 BASE PLATE ASSEMBLY

5.8.1 Check the bottom and top plates of base plate assy for dimensions. Mark and check the pitch circle dia after tacking the two halves and top and bottom plates together. Match drill the plates. Enlarge bottom plate holes.

5.8.2 Check dimensions and profile of the gusset plate (stiffner plate) as per drawing.

5.8.3 Check the pitches of holes. check the position of stiffeners, weld size and root fusion. Check the concentricity of top plate and bottom plate holes.

5.9 TRIAL ASSEMBLY AND MATCH MARKING

5.9.1 CONICAL SHELLS

All flanged shells will be trial assembled with its adjacent tier and despatched.

5.9.2 All unflanged shells shall be inspected for dimensions 100% and despatched. They shall not be trial assembled.

5.9.3 Permissible shell ovality is maximum 1.0% of diameter. Max. diameter difference should be within a difference of 10mm. However in the flange area, the adjacent pieces shall be matched perfectly during trial assembly.

5.9.4 Permissible deviation in gap between two half shells is 3mm. (where conical shell half matching is required).

5.9.5 Permissible deviation in verticality between axis of individual shell top circle and that of bottom circle is to be within 3mm subject to a maximum of 5mm for the two shell assembly.

5.9.6 Water level variations between various diameters of the top of the shell when the bottom of the shells is levelled. Maximum shall be 3mm.

5.9.7 After the matching of the two halves of the shell, fit up and weld of the transport stiffeners inside the shell. Radius deviation shall be within ±2mm at any place.

5.9.8 Clearly punch the match marks and border with white paint.

5.9.9 While retaining the matched halves of the bottom shells in the matched condition using special roller type supports place the half shells of the next level and then check the squareness, ovality, levels and out of verticality.

5.9.10 Match mark them by punching as per Figure 4 and border the match marks by white paint.

6.0 MIDDLE AND TOP CHIMNEY SHELLS

6.1 Check the shell plates for dimensions and diagonal variations and edge preparation prior to rolling. After rolling check the shell for squareness and twist by water levels and plumbing.

6.2 Join the shell and check the fit up for even weld root gap and ovality and deviation from verticality of the axis. Correct if not satisfactoryu. Clear for welding. Permissible off-set from shell to shell is max.4mm.

6.3 Roll the angle stiffeners segments and check for squareness and twist and ovality prior to welding. Clear for welding if found satisfactory. Shell OD should be undersize to angle stiffener rings inside diameter by 3mm on diameter.

6.4 Follow the clause 6.3 for rolling of end flanges of the shell also. Tack the end flanges of the two adjacent shells and match drill the joining holes after marking the PCD and checking.

6.5 Clear for joining each shell to its adjacent shell after checking the water level, fit up, concentricity and out of verticality. Clear for welding.

6.6 Tack weld the match drilled flanges of the shell to the shell with the plate gussets positioned and tack welded. Check the stiffener location prior to welding.

6.7 Match adjacent shells and ensure that the match drilled flanges become matching flanges of the adjacent shells. In the matched condition check for out of squareness, concentricity and out of verticality of the matched shells. Correct prior to match marking.

6.8 Check for proper welding of transport stiffeners inside at 100mm from ends and then dismantle.

7.0 **PAINTERS TROLLEY AND STAINLESS STEEL LINING(where applicable)**

7.1 Use prequalified SS welding procedure as per Clause 3.2.

7.1.1 Guide for Trolley wheel :: Check ovality, concentricity with chimney axis, pitches of holes and curved profil at top and bottom.

7.1.2 Trolley Track:: Check for parallelism of the vertical limb of the trolley track with the axis of trolley track. CHECK for OVALITY of the TRACK. No ovality is permitted. Check pitches of holes for correct size and location. Check stiffener location and stiffener to track weld size.

8.0 **DUCT CONNECTION (Where specified in the drawing)**

8.1 Check the layout of the duct connection plates for dimensions and edge preparation for fit up. Clear for welding if satisfactory.

8.2 Check the duct flange plate for dimensions, diagonal deviations and hole pitches and hole sizes.

8.3 Weld flange plate with correct fit up to the duct connection.

8.4 Check the duct opening whether this is in site's scope. Inspect in the welded condition of this duct connection. Clear if satisfactory.

9.0 **PAINTING**

9.1 Unless otherwise specified, the chimney components shall be given one coat of red oxide zinc chrome primer paint to IS 2074 and two coats of heat resistant black bituminous paint.

9.2 Where specified in the contract, the painting scheme shall be specified in a separate procedure.

9.3 For the Reliance Industries stacks, Patalganga and Hazira Projects, the procedure PR:QA:406 dt.07.06.94 shall be followed.

****

CHECKS

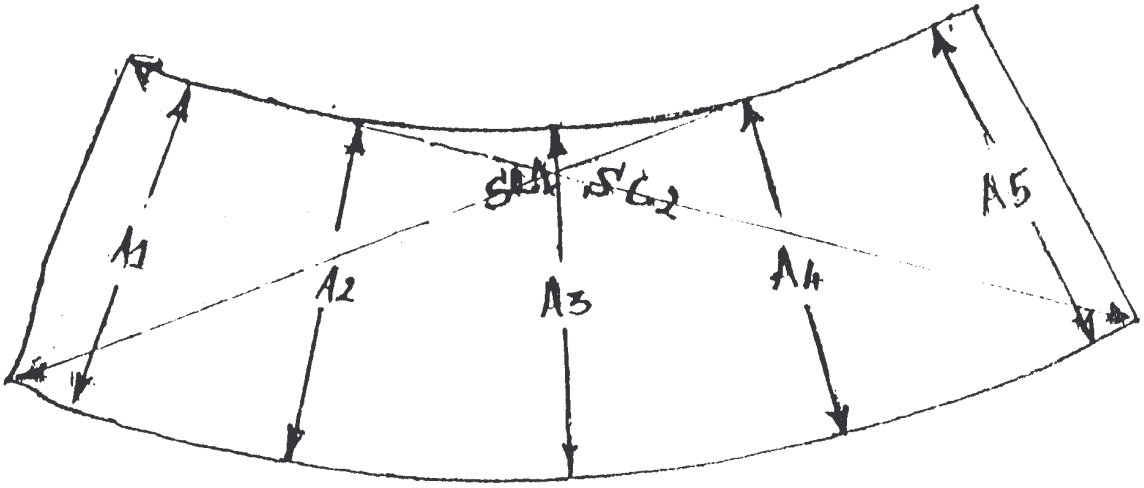


FIG-1

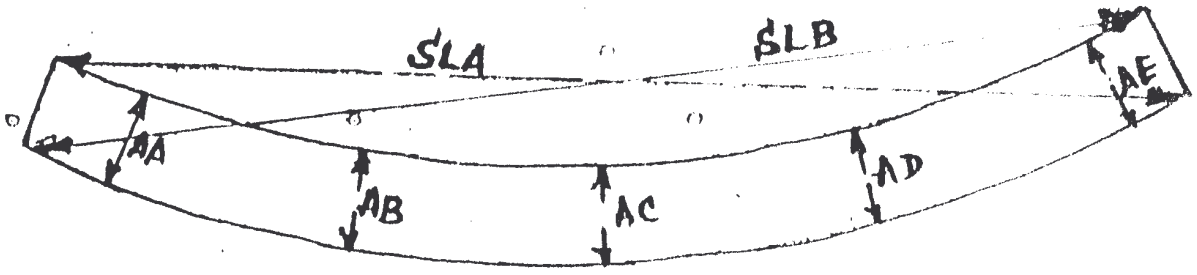
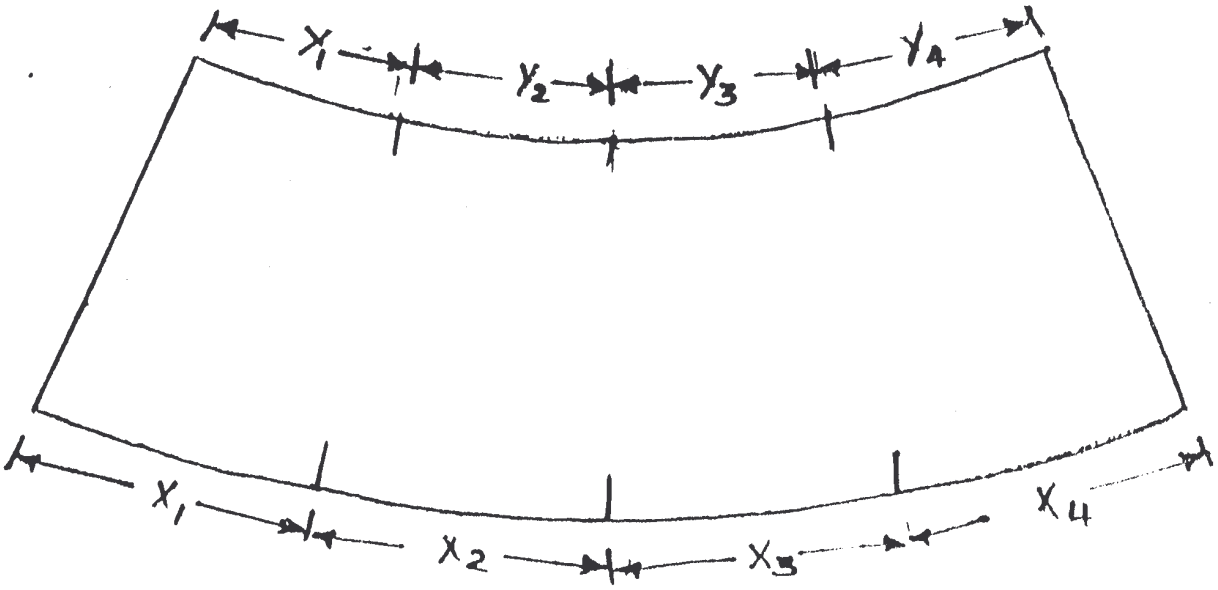


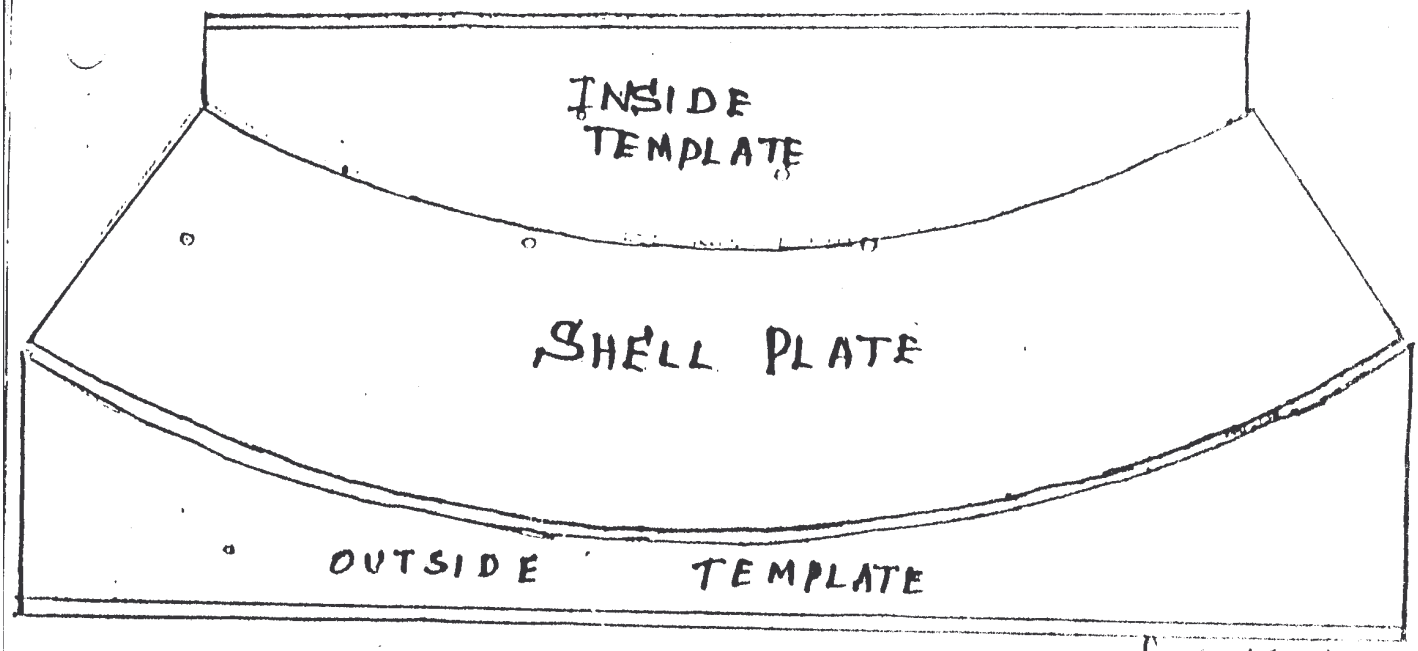
FIG-2



$Y_1 = Y_2 = Y_3 = Y_4$

$X_1 = X_2 = X_3 = X_4$

FIG-3



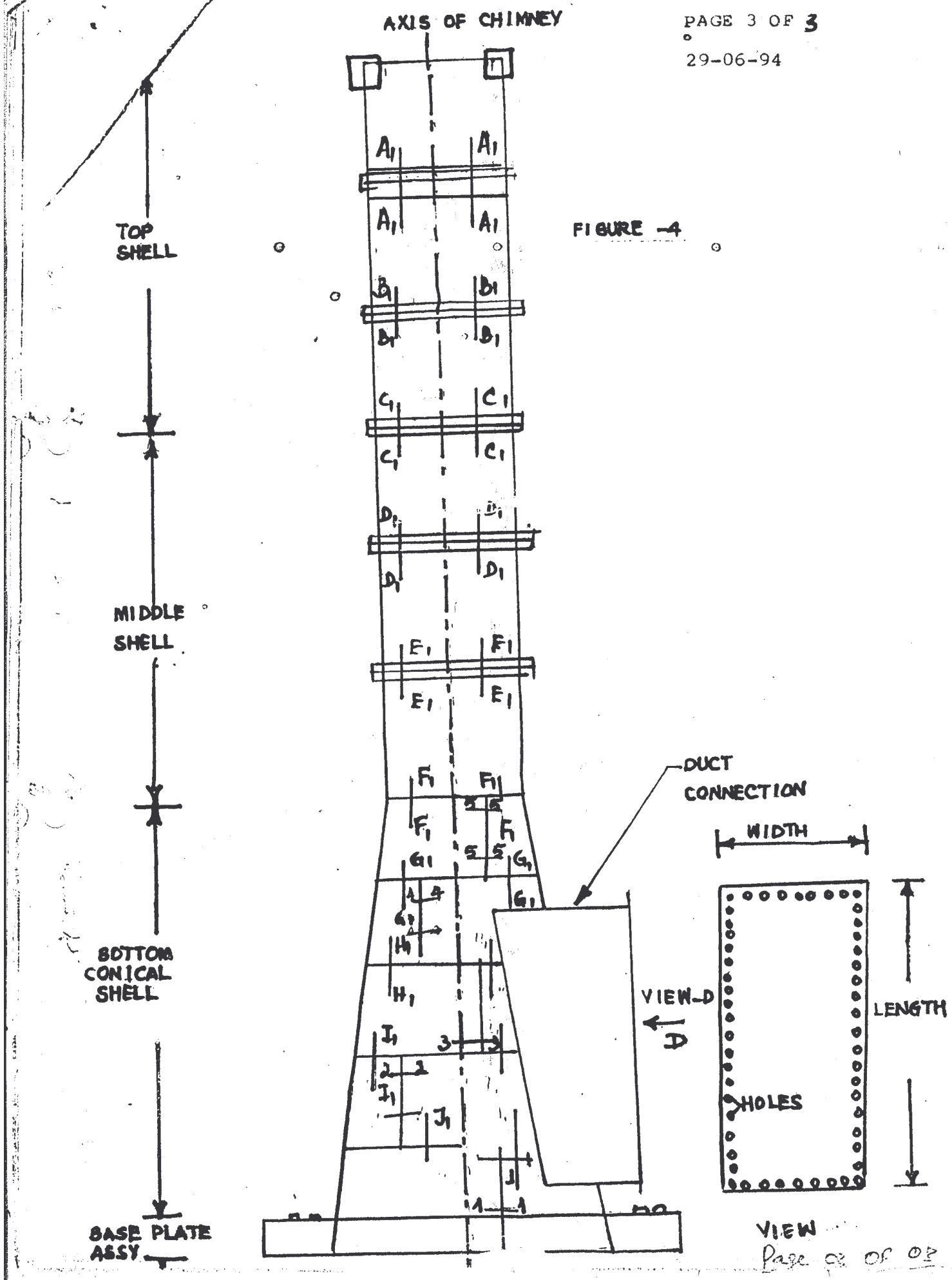

AXIS OF CHIMNEY
TOP SHELL
MIDDLE SHELL
BOTTOM CONICAL SHELL
BASE PLATE ASSY
A1
B1
C1
D1
E1
F1
G1
H1
I1
J1
DUCT CONNECTION
VIEW-D
WIDTH
LENGTH
HOLES
VIEW

FIGURE -4

BHEL:BAP:RANIPET
QUALITY DEPARTMENT

PROCEDURE FOR	SURFACE PREPARATION AND PAINTING OF WIND ELECTRIC GENERATOR TOWER AND NOCELLE ASSEMBLY.
EFFECTIVE DATE	27-05-95

	NAME	SIGNATURE &DATE
PREPARED BY	V JAYARAMAN	V. Jayaraman 27/5/95
REVIEWED BY	H ANANTHANARAYAN	H Ananthanarayan

ISSUED BY : SM/QA

CONTROL COPY NUMBER V. AB10

ISSUED TO: V. Jayaraman. DM/QA.

PC FILE NAME: PRQA518(FLOPPY NO:PRQA1)

MASTER COPY

1.0 SCOPE:

This procedures specifies the requirements of surface preparation and painting of WIND ELECTRIC GENERATOR Tower Structures and Nacelle Assembly.

2.0 Procedure:

2.1 All the Tower Components which are Hot Dip Galvanized shall be wiped clean with Cotton rags and if any oil or grease is seen on the surface it shall be cleaned by swabbing with cotton soaked in mineral Turpentine .

2.2 Wash Primer Application:

2.2.1 Thoroughly mix the contents of the two cans of the wash primer separately. Then mix them in the proportion given in the manufacturer's catalogue/datasheet. Thoroughly mix using a paddle stirrer.

2.2.2 Apply one coat of the wash primer by brushing. Allow to dry for atleast 12 hours.

2.3 Epoxy White Enamel Application:

2.3.1 Mix the contents of the two cans of the Epoxy Enamel paint. Mix the base and hardener in the proportion given in the supplier's catalogue. Do not mix too much paint.Just required paint only shall be mixed after calculating the area to be painted. The paint requirement can be calculated based on the nominal covering capacity of 7 sq mtrs/lit of the mixed paint.

2.3.2 Apply by brushing or Air spraying the mixed paint within 2 hours after mixing.

2.3.3 Do not remove the job for packing or despatch until 8 hours after the painting was done.

2.4 Nacelle Assembly:

2.4.1 Corp. R&D Design Nacelle Assembly cover

2.4.1.1 Surface preparation & cleaning:

Remove rust by rotary wire brush and cleaning by emery and compressed air.Apply Ruskil rust convertor over the surface allow to dry for 12 hours.

2.4.1.2 Then apply by spraying/brushing One coat of Epoxy Zinc rich primer on the interior followed by one coat of Epoxy white enamel paint.Total thickness shall be not less than (30+30) 60 microns.

2.4.1.3 Apply one coat of Red oxide Zinc chrome primer to is 2074 on the ontside. After 18 hours apply one coat of Synthetic Enamel white paint to IS 2932 preferably by spray.Total thickness shall be not less than (25+25) 50 microns.

2.4.2 Nordex Design

Please refer QCP W-003, (Latest)

PC:FILE:NAME:A:PRQA518(FLOPPY No:PRQA1)

BHEL :: BAP :: RANIPET

QUALITY DEPARTMENT

PROCEDURE FOR **TRIAL ASSEMBLY FOR CYLINDRICAL STEEL CHIMNEY SHELLS**

EFFECTIVE DATE ::: **09 / 03 / 99**

	NAME	DESIGN & DEPT	SIGNATURE
PREPARED BY	A ILANGO	INSPN ENGR/QA	
REVIEWED BY	V JAYARAMAN	MANAGER/QA	
APPROVED BY	H ANANTHANARAYANAN	DGM / QA	

ISSUED BY :: Q A

ISSUED TO CONTROLLED COPY NO

MASTER COPY

TRIAL ASSEMBLY PROCEDURE FOR CYLINDRICAL STEEL CHIMNEY SHELLS

01 SCOPE

THIS PROCEDURE IS APPLICABLE FOR CONDUCTING THE TRIAL ASSEMBLY OF CYLINDRICAL, STEEL CHIMNEY SHELLS.

02 PROCEDURE

02 . 01 TRIAL ASSEMBLY WILL BE CARRIED OUT FOR FLANGED SHELLS AFTER DIMENSIONAL CHECK OF INDIVIDUAL SHELLS. FOR UNFLANGED SHELLS ONLY DIMENSIONAL CHECK IS APPLICABLE SINCE THEY ARE OF SAME THICKNESS

02 . 02 MATCH THE ADJACENT SHELLS IN LEVELLED HORIZONTAL SUPPORTS. THE FOLLOWING ARE TO BE ENSURED.

(a) AXIS DEVIATION TO BE WITHIN 1/1000 0F SHELL HEIGHT.

(b) OUT OF SQUARENESS BETWEEN TWO ADJACENT SHELLS TO BE WITHIN LIMITS SPECIFIED IN THE DRAWING.

(c) ROOT GAP BETWEEN THE ADJACENT SHELLS TO BE WITHIN LIMITS SPECIFIED IN THE DRAWING.

02 . 03 AFTER TRIAL ASSEMBLY MARK MATCH MARKS ON THE ADJACENT SHELLS AS **A1-A1 ; B1-B1 ; C1-C1 ... etc.**

02 . 04 RECORD THE FIT UP OBSERVATION AND MATCH MARKS IN THE DIMENSIONAL REPORT / HISTORY CARD.

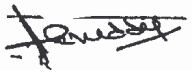
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BHARAT HEAVY ELECTRICALS LIMITED
TIRUCHIRAPALLI 620 014

QUALITY ASSURANCE

SIP : NP : 08

QUALITY REQTS FOR MFG. OF SEALS FOR LOUVER/BIPLANE DAMPERS & GATES

REV.	DATE	PREPARED	REVIEWED	APPROVED
				
00	15/07/96	P.S.Narayanan	A.R.Reddy	V.Raghavendran

REVISION STATUS

REVISION NO:	CLAUSE NO	DETAIL OF REVISION
00	-----	1) PR: QE: 063/01 renumbered as SIP: NP: 08. 2) Editorial corrections for clarity.

1.0 SCOPE

1.1 This procedure details out the quality requirements for the manufacture of seals used in Louvre / Biplane Dampers and Guillotine Gates.

2.0 MATERIAL

2.1 Materials Normally used are given below.

Seal sheets : ASTM B626 UNS 10276

lates, Sheets : IS 2062, ASTM A588Gr A

2.2 Raw materials other than Hastealloy shall be checked for straightness before taking up for fabrication. Out of straightness of 2mm for the length of 2.5m can be permitted for louver/biplane dampers. For gates out of straightness shall be within 1mm/M subject to a max. of 2mm for the length of 3.6m.

2.3 Seal strips shall be laid on level surface. It shall be held tight at ends by hands or by clamping. Seal shall be checked for flatness and straightness over the full length. Strips shall be checked for side bend and flatness. Strips shall not have waviness more than 3 waves per metre with an amplitude of 0.25mm and length of 75mm. Strips having waviness on both edges shall not be accepted.

2.4 Raw material shall be stored properly in a covered storage to avoid damage. prior to taking up for fabrication.

3.0 PREPARATION

3.1 Preparation of seals for Guillotine Gate

3.1.1 Seals strips for bonnet, side and bottom seals shall be cut to length by hand or machine shearing. Ends shall be square to the edges.

3.1.2 In all strips, slots shall be punched ensuring pitch with suitable die and punch.

3.1.3 Retainer sheet (1.6 mm) shall be marked to size and cut by shearing only.

3.1.4 Reatainer plate (6 mm) shall be marked to size and cut by shearing or flame cutting.

3.1.5 Position of tapped holes shall be marked, drilled and tapped on retainers.

3.1.6 The seal shall be assembled with retainers and held tight with clamps.

3.1.7 Plates retainer and seals shall be spot welded keeping spot diameter 3-6mm and tested by peel off test as detailed in this procedure.

3.2 PREPARATION OF SEALS FOR LOUVER DAMPER

3.2.1 BLADE SEAL

3.2.1.1 Hastelloy, corten steel retainers shall be marked to length and cut by shearing and ends shall be square.

3.2.1.2 Where the length of seal exceeds 2.5 M, splicing shall be done as per relevant drawing.

3.2.1.3 Corten steel retainers shall be clamped with hastelloy and spot welded keeping spot diameter within 3-6 mm.

3.2.1.4 Soundness of spot weld shall be tested by peel off test as detailed in this procedure.

3.3 JAMB SEALS FOR LOUVER AND BIPLANE

3.31 Hastelloy sheets, bend plate and retainer sheets shall be marked to length and cut to size by shearing and ends shall be square.

3.3.2 Plate shall be marked for bending and bent to shape in a suitable press maintaining the height and stud hole location.

3.3.3 Bent plates shall be checked for profile with suitable template.

3.3.4 Slots shall be punched in all seal strips with suitable die and punch maintaining the pitch dimensions.

3.3.5 Jamb seals shall be trial assembled using screws, washers and nuts and checked for overall dimensions.

3.3.6 Matching parts shall be identified with necessary match marks on parting lines.

3.4 BLADE TIP SEALS FOR BIPLANE DAMPER

3.4.1 Hastealloy sheets, retainer plate and back up sheets shall be cut by shearing with ends square.

3.4.2 Mark the axis and pitches of holes dia 12mm and punch these holes with retainers and deburr.

3.4.3 Assemble the retainer, back up sheet and seals with using screws, washers and nuts.

4.0 INSPECTION AND TOLERANCES

4.1 All seals shall be inspected visually for and damage, kinks, waviness, burning etc.

4.2 All seals shall be inspected for overall dimensions and if made in number of pieces, shall be match assembled and match marked.

4.3 Height of bent plate of jamb seal shall be measured by keeping the plate on surface plate and lugs facing upside. Height shall be within + 1mm,- 2mm.

4.4 Hole axis on either side of the lugs shall not vary +/- 1mm from the edges of the lugs.

4.5 Bend in bent plates in lateral direction shall be within 1mm/metre subjected to a max. of 5mm

4.6 Bow in bent plates i.e. level variation of hole axis when placed upside down on level surface shall not exceed +- 2mm.

4.7 Tolerance on pitch of slots and holes.

Individual pitches	: +- 1mm
Cumulative	: +- 2mm
Length	: +0. 00 -3. 00mm
Side bend shall be restricted to	: 2mm
for 2.5m length of seal	:

4.8 Alignment of holes and straightness after welding shall be within +/- 1mm subjected to max. of 2mm

4.9 Completed seal sub-assembly shall be inspected for dimensions and no. of strips as per drawing.

4.10 Seal assembly shall be checked by keeping the seals pressed in installed orientation on a level surface. The seal must touch the surface over the entire length. A gap upto 0.5mm to a length of 50mm at 2 places in a metre length of seal may be accepted as deviation.

4.11 The side seal length of gates when exceeding 3.6 meters shall be made in modules and shall be overlapped as shown in the drawing and seal length after trial assembly shall be within +/-2mm.

5.0 PEEL OFF TEST FOR SEALS

5.1 The method of carrying out the peel off test for spot welds done on seals used in dampers and gates is described below.

5.2 This test shall be carried out before the production welds of any day/batch in the presence of BHEL/Authorised inspection agency.

5.3 METHODOLOGY

5.3.1 Preparation of test piece.

5.3.1.1 Sample pieces of seals of different sizes or cover strip or retainer plate shall be prepared to a length of 300mm.

5.3.1.2 Forming operation if any shall be completed as per original seal assembly drg.

5.3.1.3 All the matching surfaces shall be cleaned and free from oil, grease, dust or dirt.

5.3.1.4 All the above pieces shall be stacked as per original assembly drawing.

5.4 TEST WELD

5.4.1 Trials to ensure the stable condition of the machine shall be carried out initially.

5.4.2 All the welding parameters shall be recorded after stabilizing them.

5.4.3 Three sample test piece shall be welded with the parameters determined.

5.5 PEEL- OFF TEST

5.5.1 The peel of test is performed as detailed below.

1) grip the test piece in vice or with suitable device and bend to convenient position and peel off the pieces apart with chisel and hammer.

5.6 The test welds are considered satisfactory, if,

a) The fusion of weld is good.
b) The seals tear off on parent material.
c) Button like holes are observed in seals/retainers after testing.

5.6.1 In case of failure, fresh samples shall be welded after adjusting the parameters and retested.

5.6.2 All the tested samples shall be identified clearly with weld parameter, date of welding, etc.

5.7 Production can proceed only after the satisfactory completion of the above test.

6.0 IDENTIFICATION AND PACKING

6.1 Seal sub- assemblies shall be packed in box type crates as per drawing, identified separately for separate style, PGMA wise. Individual seal packs shall be marked with W.O. PGMA and manufacturers code, description of seal viz " seal for sides ", etc.

6.2 Packed seals shall be handed over to BHEL stores/shop.

6.3 Stores shall receive and issue the seals in packed condition only.

QUALITY ASSURANCE DEPARTMENT
AMENDMENT TO QUALITY WORK INSTRUCTIONS (Q.W.I)

Q.W.I.NO:SQP:NP:03 REV:01 AMENDMENT SL NO: A 2

DESCRIPTION: LOUVER & BIPLANE DAMPERS DATE:27.02.2002

DETAILS

CLAUSE NO.	AMENDED AS ...	BASIS FOR AMENDMENT/ REMARKS.
Add Clause 5.3.5.3 under NOTE 5	For Bi-plane dampers with seals the gap shall be restricted as follows: Blade tip to tip and blade tip to frame : 0.1mm max. Blade end to jamb seal bend plate individually on each side : 0.8mm max. The checks shall be made as per ICL:DAM:502 Rev. 00.	As per feed back from BAP/ Ranipet.

Prepared by
R.Arthanareeswaran

Reviewed & Approved by:
C.R.Raju

Distributuion.

S/Sri
R.Jayapal.....SDGM/OP&C/FB/Bldg 2&4
P.Soundararajan.....DGM/BPN/RM/Bldg 2&4
J.Kannan.....DGM/QC/Bldg 2&4
V.Ravikumar.....Mgr/QC/Bldg 2&4
G.Mohan.....Sr.Mgr/QC/OLI/ET Hostel
S.Anbalagan .....DGM/AD/Bldg 53
B.Srinivasa Rao.....Mgr/QA/BAP-RANIPAT
K.Ananthanarayanan.....DGM/QA/BAP/Ranipet
K.Nagarajan.....Mgr/D&D/PE/FB/Bldg 2&4
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QUALITY ASSURANCE DEPARTMENT
AMENDMENT TO QUALITY WORK INSTRUCTIONS. (Q.W.I)

Q.W.I.NO:SQP:NP:03 REV:01 AMENDMENT SL NO: A 1

DESCRIPTION: LOUVER & BIPLANE DAMPERS DATE:12.08.2000

D E T A I L S

CLAUSE NO.	AMENDED AS	BASIS FOR AMENDMENT/ REMARKS.
NOTE-3 Clause 3.1.9	Clause no.3.1.9 added as follows. For plates/Channels up to 2 meter, no joint is permitted. Above 2 mtr but less than 5 mtr. 1 joint is permitted. Above 5 mtr. 2 joints are permitted. In any case more than 2 joints are not allowed. However the min.length of a joint shall be 500 mm.	For better clarity
NOTE-5 CLAUSE 5.3.5.1	Reworded as Gap for Louver &Biplane damper with out seals shall be as given below.	For better clarity
5.3.5.2	Reworded as for Louver damper & Biplane damper with seals the gaps shall be restricted as below.	For better clarity
NOTE-7 CLAUSE 7.2	The damper shall be supported suitably to avoid damages during handling and transportation.	For better clarity

Prepared by: A.Francis. Reviewed R.Arthanareeswaran Approved by: C.R.Raju

BHARAT HEAVY ELECTRICALS LIMITED
TIRUCHIRAPPALLI 620 014 INDIA

STANDARD QUALITY PLAN FOR	*LOUVER AND BIPLANE DAMPERS*	SQP:NP:03/01
		Page 01 of 15

Prepared by Quality Assurance	*P.S.Narayanan*

REVIEWED BY	SIGNATURE
ENGINEERING *(S.Thangavelu)*	
ANCILLARY DEVELOPMENT *(S.Murugesan)*	
QUALITY CONTROL *(S.Muthiah)*	
QUALITY ASSURANCE *(A.R.Reddy)*	

REV.NO.	DATE	APPROVED BY	SIGNATURE
00	01.04.93	Sr.Manager/QA	
01	01.02.95	Sr.Manager/QA	

Proprietary Data - For Internal Use Only

QUALITY ASSURANCE

RECORD OF REVISIONS

Rev. No.	Clause No.	Details of revision
00		This document consolidates all requirements of various previous SQPs.
01		Totally revised incorporating all amendments issued and latest TDC numbers.

L. O.	COMPONENT AND OPERATION.	CHARACTERISTICS	TYPE OF CHECK	QUANTUM OF CHECK	REF.DOCUMENT/ ACCEPTANCE STD.	TYPE OF RECORD	AGENCY	REMARKS SQNP03/01 Page 3of15
	MATERIAL							
	Plates,Sheets, Rolled Sections & Rounds	Chemical & Mechanical Properties	Review of documents	100%	TDC/Matl.Spec. Note 1	TC	QC	
	SUB-DELIVERIES							
.1	Actuators	Type & Routine Test	Review of documents	100%	Drawing/ Purchase Spec	TC	QC	
.2	Blowers&Motors for Biplane dampers	Conformance to Purchase order	Review of Documents	100%	Drawing/ Purchase Spec.	TC	QC	
	INPROCESS CONTROLS (Ref.QCP 002 for details)							
	Marking,cutting and preparation	Shape,Size and EP	Measurement	100%	Drawing Note 2	--	QC	
	Welding	Procedure and. Personnel Qlfn	Review of	100%	PR:QE 172	R	QC	
		Process controls	Surveill - ance	Random	Note 3	-	QC	
	Weld Inspection	Weld Size	Visual	100%	PR:QE:021	-	QC	
		Weld quality	LPI/MPI	100%	BHE:NDT:PB:PT1/ MT1, QCP 002	R	QC	

SL. NO.	COMPONENT AND OPERATION.	CHARACTERISTICS	TYPE OF CHECK	QUANTUM OF CHECK	REF.DOCUMENT/ ACCEPTANCE STD.	TYPE OF RECORD	AGENCY	REMARKS SQPNP03/01 Page4 of15
0	FINAL INSPECTION							
1	Assembly	Dimensions Match marks	Measurement Trial assy	100%	Drawings Note 4	R	QC	
2	Trial operation	Free operation of Damper	Open/Close movement	100%	Drawings Note 5	R	QC	
		Seal tightness	Check with Feeler gauge	100%	Drawing Note 5	R	QC	
3	Painting and Preservation	Paint finish coat thickness	Visual Measurement	-- Random	PR:QE:104 Note 6	-	QC	
4	Identification and Packing	WO No., DU No. Match marks Flow direction	Visual	--	Drawings Note 7	-	QC	
5	Certification	AS per check List & Test Report	Sign off	--	--	R	QC	

NOTE 1

1.0 Materials normally used and their TDC nos are given below:

Material	Specification	TDC Nos
Rolled sections	IS 2062 Gr.A&B	As per Specification
	AS588 Gr.A	-do-
	SA240 Tp 304	As per Specification
Rounds	ASTM A564 GRXM.25	0:305
	ASTM A276Tp304/316	As per Specification
	AISI 450 SS	-do-
	SA479 Tp 304	0:306
	ASTM A105	0:309
Sheet for Seals	ASTM B575 UNS 10276	0:304
	ASTM B 75	As per Specification

NOTE 2

2.0 The requirements of marking, cutting and preparation are detailed below:

2.1 Blade skin plates diagonal shall not vary by more than 3mm.

2.1.1 Plates for truss shall be cut to size and deburred. Width of vertical stiffeners shall be closely controlled.

2.1.2 Holes for plug welding and pin connection shall be marked and drilled to size.

2.1.3 Holes for seal air blower mounting shall be marked and drilled if required.Cut out for seal air entry shall be marked and cut.

2.2 The following are the norms applicable for splicing of blades.

2.2.1 For blades of length upto 2M no joint is permitted. Above 2M and upto 5M one joint is permitted.Above 5M two joints are permitted and in no case more than two joints is permitted.

2.2.2 For biplane dampers, max. two joints can be permitted for top and bottom plate of blades and the joints are to be staggered on top and bottom.

2.2.3 Any variation from the above shall have the approval of Quality Assurance.

NOTE 3 **FABRICATION**

3.1 **FRAME**

3.1.1 The requirements of preheating and welding control is detailed out in QCP 002.

3.1.2 The holes for shafts can be gas cut with allowance and ground.

3.1.3 Plates for mounting plate, lug plates and rib plates shall be marked and cut.

3.1.4 Holes for lug plates shall be match-drilled with mounting plates. Holes on mounting plate for actuator shall be match drilled.

3.1.5 Formed channels shall be assembled on a level surface and welded with temporary retainers at all corners to avoid distortion. The inside of frame corner welding shall be dressed up to suit blade corner.

3.1.6 The Mounting plate shall be in tack welded condition only till the actuator is mounted and adjusted.

3.1.7 Square washer shall be welded with frame co-axially with lifting holes.

3.1.8 Gland assembly shall be positioned, held tightly with frame and tack welded.

3.2 **BLADE END BLOCKS AND SHAFTS:**

3.2.1 Plates for blocks shall be marked to size and machined on all sides maintaining squareness.

3.2.2 One side of the block shall be marked for boring and block outer face shall be square to the side marked.

3.2.3 The bore shall be machined in stages maintaining the perpendicularity of the bore axis to the machined face.

3.2.4 Blade block machined completely shall be deburred.

3.2.5 Pin holes shall be drilled only after matching the shafts in assembly.

3.2.6 The blade blocks shall be inspected for dimensions as per drg.

3.2.7 Bore shall be checked with a shop made cylindrical type plug gauge.

3.2.8 Stub shafts shall be machined to size and finish.

3.2.9 Shafts and end blocks shall be match assembled maintaining the orientation of key way. Shaft inner end shall be kept as per drg. with end block, so as to maintain the projected length of shaft.

3.2.10 Each such assembly shall be match marked by punching on outer flat face of shaft and outer edge of block.

3.2.11 Holes for pins shall be match drilled to size and finish.

3.2.12 Shaft and end blocks shall be dismantled retaining the match marks.

3.3 **BLADES**

3.3.1 After marking the bend line skin plates shall be pressed to correct angle in a press.

3.3.2 Blade profile shall be checked using a template. Blade end cover plates shall be marked to size and shape.

3.3.2.1 The blade inside surface shall be painted with one coat of red oxide primer.

3.3.3 The blade skins shall be assembled in suitable fixture.

3.3.4 Bottom skin shall be assembled with end blocks.

3.3.5 Blocks shall be tack welded and top skin shall be assembled.

3.3.6 Both top and bottom skin plates shall be held tightly and tackwelded. Any twist noticed shall be removed.

3.3.7 Welding of blades shall be completed progressively.

3.3.8 Blade end cover plates shall be assembled and welded.

3.4 **GLAND ASSEMBLY**

3.4.1 Plates for glands, follower and pipes, rounds for gland and bearing holder shall be marked and cut to size by saw cutting or flame cutting.

3.4.2 Holes for shaft and studs shall be marked correctly.

3.4.3 Stud holes shall be drilled and deburred. The shaft holes shall be bored to size and finish.

3.4.4 Gland and bearing holders shall be machined to size and finish as per drg.

3.4.5 Studs shall be machined and threaded as required.Thread shall be checked by thread ring gauges.

3.4.6 Gland plate shall be positioned with gland ring.Care shall be taken to ensure the surface of gland plate. Matching frame and gland ring are in the same plane and ring shall not protrude to create gap between gland plate and frame.(A shim can be used to ensure this).

3.4.7 Welding between ring and gland shall be completed in the same position with necessary preheating.

3.4.8 Studs shall be positioned in holes of gland plate maintaining squareness.Note: Whole gland assembly can be made in upside down position on a level surface by maintaining the gap between gland plates and follower plates by a thickness block to ensure the depth of plug welding of studs. This method of assembly ensures proper alignment of studs and reduced distortion.

3.5 **LEVERS**

3.5.1 Rods/rounds for hub shall be cut to size by saw.

3.5.2 Plate for levers shall be marked using template.

3.5.3 Lever plates shall be marked and cut by flame after checking with suitable template.

3.5.4 Lever plates shall be set on hubs maintaining squareness with respect to hub axis.
Note: Proper fixtures shall be used for matching and welding of lever plates to hubs.

3.5.5 Welding shall be completed in sequence to avoid distortion.

3.5.6 Shaft holes shall be bored to size and finished as per drg.Holes for pins shall be drilled in a fixture to ensure the lever distance.

3.5.7 Key way shall be marked in correct orientation with respect to lever plate orientation and cut to size and finish.

3.5.8 Completed levers assy.shall be inspected only in a fixture for size and orientation.

3.5.9 Holes for lock screw shall be marked, drilled and tapped to size. This shall be checked with thread plug gauge.

3.6 **KNUCKLES AND ADJUSTING LINKS**

3.6.1 Square bars for knuckles and rods for adjusting link shall be marked and cut to size by saw.

3.6.2 Hole for connecting pin shall be marked at centre of square bar on one face. Hole shall be drilled with axis perpendicular to rod axis.

3.6.3 Tapped holes of knuckles shall be drilled and tapped, maintaining the alignment of axes of both side holes.

3.6.4 Adjusting link rods shall be machined and threaded as required.

3.6.5 All threaded components shall be checked with thread gauges.

3.6.6 Nuts for spanner shall be assembled with link rod and welded as per part drg. before assembling the link rod with knuckle.

3.7 Seals shall be manufactured as per PR:QE:063 and supplied as sub assembly. Check for any damage before assembly.

NOTE 4

4.0 **ASSEMBLY**

4.1 Frame shall be positioned on a level surface.

4.2 Jamb seals for drive /non drive end shall be held tightly against the frame using clamps ensuring holes for shafts are aligned.

4.3 Assembly of blades in damper shall be from centre towards ends. Care shall be taken to position the drive blade at the correct location.

4.4 Blade shall be positioned inside frame and supported so as to facilitate the stub shaft assembly.

4.5 Match marking shall be verified before assembly of shafts.

4.6 Shaft connecting pins shall be used for positioning the shafts.

(Match drilled holes will ensure the correct projection of shaft outside).

4.7 Both drive and nondrive end shafts shall be assembled progressively.

4.8 Plug welding of blade skins with block and pins with blades shall be completed.

4.9 Blade assemblies shall be supported on adjusting stands, shafts can be centered with respect to frame holes. Blade rotation shall be ensured.

4.10 All gland plates shall be welded after ensuring free rotation of blade.

4.11 Gland packing shall be provided in position as rings as given in drg. Care shall be taken to provide lantern ring if seal air arrangement is envisaged.

4.12 Grafoil sheets shall be cut to size and formed to shape by mending on the shaft. Assemble gland with grafoil in position and tighten with lock nut.

4.13 All blades shall be positioned horizontally and edges aligned.

4.14 Blade edge matching shall be done starting from middle blade.
Hot correction can be be adopted to ensure perfect matching of blades. Out of straightness shall be reduced to as minimum as possible to achieve better tightness.

4.15 Blade seals shall be positioned and stitch welded on blade edges as 10 (100) 10 (200). End seal bars shall be matched with blade end and welded with frame after assembly of blade, jamb seals and collar. Care shall be taken to avoid any damage due to weld spatters and stray arc.

4.16 Levers shall be assembled on to shafts and keyed. Locking screw shall be fixed.

4.17 Link and knuckles shall be assembled with Nylon bushes on to levers. Care shall be taken to prevent damage to Nylon bush during assembly.

4.18 Links shall be adjusted from middle to end for maximum tightness.

4.19 Mounting bracket shall be positioned with respect to drive shaft and held temporarily.

4.20 Actuator shall be assembled on to drive shafts and the assembly shall be completed.

4.21 Actuator shall be de-clutched and checked for movement with the help of hand wheel.

4.21.1 If pneumatic drive is envisaged, mounting bracket shall be welded after ensuring the satisfactory operation.

4.22 All the blades shall be pulled towards drive side and collar shall be tightened maintaining distance between blade to frame, such that the initial compression of seals as envisaged in drg. is achieved.

4.23 All the lock screws of hubs shall be tightened with shafts.

4.24 Lock tabs shall be provided when assembly is completed. Complete the welding of mounting bracket with damper frame.

NOTE 5

5.0 **FINAL INSPECTION AND TESTING**

5.1 Dampers shall be match assembled and match marked if they are supplied in pieces as per drawing.The final inspection shall be carried out using the check list enclosed and documented.

5.1.1 Seal tightness between blades and blade and jamb seal shall be checked and recorded.

5.2 **TEST PROCEDURE**

5.2.1 The louver dampers and biplane dampers shall be tested in site orientation position as indicated in the key plan. Proper supports shall be provided and the damper shall be leveled by water level.

5.2.2 Ensure that all components have been installed and inspected.Ensure setting of correct rating of motor/actuator w.r.t C&I data sheet and TC.

5.2.2.1 Ensure the free operation of actuator manually before assembling with damper.

5.2.2.2 Connect the Actuator electrically as per wiring diagram. Set the torque required for ambient operation of the damper as in the actuator.

5.2.3 The damper shall be operated through ten cycles with the actuator in position and the following characteristics shall be recorded.

Electric actuator :	Amperage,voltage,Temperature
Mechanical Operator :	Weight
Pneumatic operator :	Air pressure

5.2.3.1 In case of pneumatic actuator regulate the air pressure to 60 psi at the start of every stroke.

5.2.4 At the end of ten cycles the damper shall be closed with specified torque for ambient condition.The gap between the blades and blade and jamb seals shall be checked using feeler gauge.The readings of gap shall be recorded.

5.2.5 Bulb seals shall be tightened fully after setting the gap.

5.2.6 After the completion of the test the damper shall be visually inspected for any damage to blades,seals etc.

5.2.7 In the absence of actuator the damper shall be operated manually and tightness of seals checked with torque equal to ambient torque applied by dead weights.

5.2.8 The test results shall be recorded in the test report format enclosed and certified by Quality control.

5.3 **TOLERANCE**

5.3.1 Tolerances given in the drawing shall be followed. When not specified in drawing the following tolerances also shall be followed.

5.3.2 Pitch distance of holes for shaft:

Individual: ± 1 mm Cumulative: ± 2 mm

Frame: Length : ± 1mm/meter subject to a max. of ± 5mm.

Width : + 3mm, -0.00 mm

Diagonal difference :2mm/metre limited to 5mm max.

5.3.3 Blade length: +0mm,-3mm.

5.3.4 Alignment of shaft holes on frame : ± 2 mm

5.3.5 Dampers shall be adjusted to have proper closing and with minimum gap. However, the following may be accepted as deviation for both parallel and opposed levers.

5.3.5.1 Gap for Louver Damper without seals shall be as given below.

Blade tip to tip : 1.5 mm (Max.)
Blade tip to frame : 2.5 mm (Max.)
Blade end to frame : 1.5mm (over and above the washer thickness)
The above also applies to control louver dampers closed with specified torque.

5.3.5.2 For Louver Damper with seals the gaps shall be restricted as below:
Blade tip to tip and blade tip to frame : 0.25 mm (max.)
Blade end to jamb seals (over and above washer thickness) individually on both sides :1.5 mm (max.)

5.3.6 Alignment of left and right hand threaded holes shall be checked. Off-set/inclination of 2 mm for a length of 500 mm from knuckle face ref.is permitted.

5.3.7 The blade position in open condition shall be within ± 2.5° to vertical.

5.3.8 Alignment of lever pins in both open and close position shall be limited to 2 mm from neutral position.

5.4 **NON DESTRUCTIVE EXAMINATION**

5.4.1 All NDE for gas cutting shall be as per QCP 002.

5.4.2 100% LPI shall be carried out on blade block welding, mounting bracket welding and stud welding with gland plate.

5.4.3 100% LPI/MPI shall be carried out on all blade splice joints.

NOTE 6

6.0 **PAINTING, PRESERVATION AND IDENTIFICATION**

6.1 All fasteners (except SS) shall be applied with high temp.lubricants.

6.1.1 Grafoil bearing shall not be lubricated.

6.2 The surface preparation and painting shall be as per PR:QE:104.

6.3 Match marking shall be done on all parting lines by stenciling and punched and bordered with white paint.

6.4 Blade orientation shall be indicated by welding small rods on to shaft or marking a vee groove on the shaft.

6.5 Opening and closing direction of blades shall be marked by punching on the damper frame.

6.6 Flow direction shall be indicated by means of stickers, arrow plates or paint stenciling.

NOTE 7

7.0 **PACKING**

7.1 Packing shall be performed at shipping unless otherwise specified in OPS/PURCHASE ORDER.

7.2 The damper shall be packed in steel crates to avoid damages during handling and transist.

7.2.1 The blades shall be arrested from moving during shipping and shall be kept as per drg.

7.2.2 Components / subassemblies,like DP switch,actuators,blowers etc. shall be packed separately in polythene sheet and crated in wooden boxes.

TEST REPORT FOR LOUVER/BIPLANE DAMPER

1.0 **GENERAL** :

CUSTOMER :

WORK ORDER NO. :

DAMPER SIZE : DU NO.:

NO.OF BLADES:

APPLICATION :

TYPE : LOUVER/BIPLANE

2.0 Actuator name plate details:

Electrical Actuator

3.0 Blower name plate details: (If applicable)

4.0 Test results : Tested with electrical actuator:

Cycles	1	2	3	4	5	6	7	8	9	10
Amps - Opening										
Amps - Closing										
Temp - Opening										
Temp - Closing										

b) Tested with pneumatic actuator (Air pressure shall be set at 60psi before every operation)

Cycle No.	Air pressure	Closing	Opening
1.			
2.			
3.			
4.			
5.			

5.0	Gap between Jamb seal & frame (Gap measured with feeler gauge)
1.	
2.	
3.	
4.	
5.	

6.0	Gap between blades: Blade edge No.	Gap measured with feeler gauge.
1.		
2.		
3.		
4.		
5.		

7.0	Deviation if any shall be referred to Q.A.	
8.0	Damper operation:	Satisfactory/Not satisfactory.
9.0	Blade tightness :	
10.0	Test results :	Acceptable/Not acceptable.

Signature/Date

Firm Inspection.

BHEL Inspection.

Customer Inspection.

CHECK LIST FOR LOUVER/BIPLANE DAMPER

W.O. No. : D.U. No :

Drawing No. :

Supplier Code :

General dimensions:

I.Squareness of blade skins.

II.Length of blades.

III:BEARING ASSEMBLY.

i)Welding of gland plate. : ok/not ok

ii)Bearing holder assembly
iii)Grafoil sheet :provided/not provided
Free rotation :ok/not ok

IV)TRIAL OPERATION OF BLADE MOVEMENT:

i)Individual :ok/not ok

V)LINK AND LEVERS

i)Nylon bush :provided/not provided
ii)Thread of knuckle :Checked with gauge
:ok/not
iii)Alignment of links :ok/not ok

VI)DAMPER OPERATION:
i)Opening and closing of blades :sat./not sat.
ii)Free operation of links :sat./not sat.

iii)Records of :

a)Gap between flap and seal plates :

b)Gap between blades end and jamb seals :

VII)GENERAL WORKMANSHIP: :Sat./Not sat.

VIII)PAINTING OF DAMPERS: :Done/not done as per QCP

IX)IDENTIFICATION OF DAMPERS :Done/not done.

SUBCONTRACTOR QC/BHEL

QUALITY ASSURANCE DEPARTMENT
AMENDMENT TO QUALITY WORK INSTRUCTIONS.(Q.W.I)

Q.W.I.NO:SQP:NP:04 REV: 01 AMENDMENT SL NO: A 1

DESCRIPTION:GUILLOTINE GATES DATE:04.12.96

D E T A I L S

CLAUSE NO.	AMENDED AS ...	BASIS FOR AMENDMENT/ REMARKS.
2.3.1	Splicing of gate plate may be either horizontal or vertical. Minimum width of plate shall be 500 mm for blade joint and no joint shall be permitted within 200 mm from the middle of the blade for vertical joints.	Based on feed back and discussions with Shop, OP&C, Quality of BAP/ Ranipet and Engineering/ DD/FB during Nov.96.
5.2.3	Diagonal variation shall be within 1 mm/metre limited to 5 mm Max.	Based on feed back and discussions with Shop, OP&C and Quality of BAP/Ranipet during Nov.96.

QUALITY ASSURANCE
BAP: BHEL: RANIPET.
MASTER COPY

Prepared by:A.R.Reddy Reviewed & Approved by:V.Raghavendran

Signature & Dt: Reddy 04-12-96 Signature & Dt: 4/12/96

BHARAT HEAVY ELECTRICALS LIMITED
TIRUCHIRAPPALLI 620 014 INDIA

STANDARD QUALITY PLAN FOR *GUILLOTINE GATES* SQP:NP:04/01

Prepared by Quality Assurance	*R.S.Narayanan*

REVIEWED BY	SIGNATURE
ENGINEERING *(V.Balasubramanian)*	
ANCILLARY DEVELOPMENT *(S.Murugesan)*	
QUALITY CONTROL *(S.Muthiah)*	
QUALITY ASSURANCE *(A.R.Reddy)*	

REV.NO.	DATE	APPROVED BY	SIGNATURE
00	01.04.93	Sr.Manager/QA	---
01	01.02.95	Sr.Manager/QA	

Proprietary Data - For Internal Use Only

QUALITY ASSURANCE
BAP : BHEL : RANIPET
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RECORD OF REVISIONS

Rev. No.	Clause No.	Details of revision
00	--	This document consolidates all requirements of various previous SQPs.
01	--	All amendments issued has been regularised and editorial correction made for better clarity . Latest applicable TDC Nos incorporated.

SL. NO.	COMPONENT AND OPERATION.	CHARACTERISTICS	TYPE OF CHECK	QUANTUM OF CHECK	REF.DOCUMENT/ ACCEPTANCE STD.	TYPE OF RECORD	AGENCY	REMARKS SQP:NP:04/01 Page 3 of 14
1.0	MATERIAL							
1.1	Plates,Sheets, Sections,Rounds & Tubes.	Chemical & Mechanical Properties	Review of documents	100%	TDC/Matl Spec. Note 1	TC	QC	
1.2	SUB DELIVERIES							
1.2.1	Actuators	Performance	Review of Records	100%	Drawing Purchase Spec	TC	QC	
1.2.2	Power cylinder	Performance	Review of Records	100%	Drawing Purchase Spec.	TC	QC	
1.2.3	Sprockets	Mechanical Properties	Review of Records	100%	Drawing Purchase Spec.	TC	QC	
1.2.4	Chains	Chemical, Mechanical Properties & Dimensions	Review of Records	100%	Drawing Purchase Spec.	TC	QC	
1.2.5	Isolation valve limit Switches	Performance	Review of Records	100%	Drawing Purchase Spec.	TC	QC	
1.2.6	Check valve,Filter cum Lubricator, Solenoid valve	Performance	Review of Records	100%	Drawing Purchase Spec.	TC	QC	
2.0	INPROCESS CONTROLS (Refer QCP 002 for details)							
2.1	Marking,cutting and preparation	Shape,size & EP	Measurement	100%	Drawing Note 2	R	QC	

SL. NO.	COMPONENT AND OPERATION.	CHARACTERISTICS	TYPE OF CHECK	QUANTUM OF CHECK	REF.DOCUMENT/ ACCEPTANCE STD.	TYPE OF RECORD	AGENCY	REMARKS SQP:NP:04/01 Page 4 of 14
2.2	Welding	Procedure & Personnel Qlfn	Review of Documents/ Records	100%	PR:QE:172	R	QC	
2.3	Weld Inspection	Weld quality	LPI/MPI	100%	BHE:NDT:PB:PT1/ MT1,QCP 002	R	QC	
		Weld size	Visual	100%	PR:QE:021,Note 7			
2.5	Seal assy	Dimension	Measurement	100%	Drawings PR:QE:063	R	QC	
3.0	FINAL INSPECTION							
3.1	Assembly	Over all Dimensions& Diagonals	Measurement	100%	Drawings Note 3,4 & 5	R	QC	
3.2	Trial operation	Free operation of Gate	Open/Close movement	100%	Drawings Note 6	R	QC	
3.3	Painting and Preservation	Paint finish Paint thickness	Visual Measurement	100% Random	PR:QE:104 Drawings Note 8	R	QC	
3.4	Identification And packing	WO No., DU No. Match marks	Visual		Drawings Note 9	-	QC	
3.5	Certification	As per check List	Sign off		--	R	QC	

NOTE 1

The materials normally used and their TDC Nos are given below:

Materials	Specification	TDC NO.
Plates, Rolled Sections	IS 2062 Gr.A&B	As per Specification
	SA 588 GRA	-do-
Rounds	ASTM A108 Gr10450 (1045 CRS)	0:305
	AISI 304	As per Specification
	SA 193 B7	0:309
Tubes	SA106 GRB	0:101
	ASTM B75	As per Specification
Seals	ASTM B575 UNS 10276	0:304
Castings	IS 210	As per Specification

NOTE 2

The requirements for marking, cutting and preparation are detailed below:

2.1 Holes on frames for matching with duct flanges and holes for studs shall be marked correctly. These holes may either be punched or drilled.

2.2 Whenever the frame channel size is substituted, seal clamping hole dimensions with respect to groove shall be maintained with respect to centre line of both channels.

2.3 **SPLICING OF GATE PLATE:**

2.3.1 Splicing of gate plate may be either horizontal or vertical.

2.3.2 No splicing is permitted if plate width is 1.2 meter or less.

2.3.3 For plates of width upto 2.4 M. only one joint is permitted. For width greater than 2.4 M, maximum two joints are permitted.

2.3.4 Any deviation from the above norms shall have the approval of Quality Assurance.

NOTE 3

3.1 **FRAME**

3.1.1 Frames shall be made on a level platform. Flange top and bottom surfaces of adjacent members shall be leveled. Studs shall be welded on to frame parts as per drawing prior to assembling the sides into frame.

3.1.2 Suitable fixture shall be used for the assembly of frame maintaining dimensions and distance between studs w.r.t. axis of blade movement on all sides.

3.1.3 Super structure frame shall be made such that the guide angles are placed at correct distance from the centre line of the channel.

3.1.4 Weld the guide beams as per drawing in port side in level with frame. A curved plate shall be welded with guide beam at entry side to avoid struck up of gate plate.

3.1.5 Ensure that the " T " bar shall be welded square to the gate plate through pin plate to accommodate differential expansion. Connecting nut for piston rod shall also be welded / fastened square to the " T " bar. Plate centre line, piston rod centre line and nut centre line shall be in one axis. Out of squareness if found, shall be corrected by grinding / machining.

3.2 **SEALS**

3.2.1 Seals shall be manufactured as per PR:QE:063 and supplied as subassemblies. Check for any damage before assembly.

3.3 **MACHINING AND ASSEMBLY OF SHAFTS**

3.3.1 Plain turned drive shafts shall be marked for key way milling and milled suitably to size and finish as per drawing.

3.3.2 The rings shall be machined to diameter, edge prepared and welded with the shaft and checked by MPI/LPI.

3.3.3 Finish machined shafts shall be checked for size, finish, eccentricity and key way dimensions.

3.3.4 Tolerance on bearing and sprocket locating dimensions:
Outside Diameter = +0.00/ -0.10mm.
Eccentricity = 0.5mm.

3.3.5 Set the shaft sub assembly and tube in assembling fixture as given in the sketch-1.

3.3.5.1 Ensure the co axiality of the shafts and tube assembly by dial gauge after aligning the key ways if provided.

3.3.5.2 Plug weld the shaft and tube and complete the welding of shaft sub- assembly with tube on either side maintaining the fillet size.

3.3.5.3 Completed shaft shall be checked for coaxiality, size, finish, eccentricity, key way orientation,etc as per drg.

3.3.5.4 100% LPI/MPI on fillet / plug welds of assembly shall be carried out.

3.3.6 Machined shafts shall be applied with rust preventive oil.

3.4 **AIR TANK**

3.4.1 Pipes and end covers for air tank shall be cut to size. Weld edges shall be prepared as per drawing. Where pipes are made of plates, it shall be rolled and welded.

3.4.2 Butt welds and long seam of PFP shall be spot radiographed in addition to MPI/LPI as per approved procedure. If unacceptable defect is noticed during spot radiography 100% radiography shall be carried out.

3.4.3 Completed air tank shall be hydraulically tested as envisaged in drg.

NOTE 4

4.1 The frame shall be assembled with super structures. Assembly shall be done in horizontal position, ensuring that the whole frame is in single plane. Corner welds of angle frame shall be ground to accommodate the seating of seals.

4.2 Position the mounting plate and assemble the air tank and blower.

4.3 Assemble the cylinder onto the frame and connect the piston rod and ensure the co axiality of piston rod and gate plate.

4.3.1 Check that the piston rod, gate plate and cylinder are in the same plane using spirit level.

4.4 Assemble the pneumatic fittings of correct size and qty. starting from the ports of air cylinder. (4 way solenoid valve, transparent type filter cum lubricator etc.). Use teflon tape for threaded connections.

4.5 Assemble the junction box for electrical connections. Assemble the limit switches at the correct locations. Complete the electrical connections and identify the wires.

4.6 Defect free seals shall be assembled in position in correct orientation as per drg.

4.7 Connect the air cylinder to pneumatic lines and check for free operation of gate plate and piston. Adjust the limit switches ensuring the stroke length of blade.

4.8. Sprockets shall be assembled with shaft together with end collars.

4.9. Assemble the drive shaft and idler shaft assemblies on the mounting brackets. Ensure the offset of axis of both drive and idler shafts. Ensure that the bearings are filled with Grease Servogem HTXX before assembling with shaft.

4.10 Ensure the correctness of drive chain size, pitch,length etc., and assemble keeping the plate in open position and locked, over sprocket with gate plate and complete the assembly.

4.11 Seal sub/assemblies shall be inspected and trial assembled maintaining match marks prior to assembly for modular construction. Defect free seals, shall be assembled in position in correct orientation as per drawing.

4.12 Assemble brace angles of super structure in position and complete welding.

4.13 Adjust the chain length and tighten equally on both sides.

4.14 Sagging of chain shall be checked on top side of the chain with bottom side of chain resting on gate plate. This sagging shall be set equal to or less than thickness of chain while gates are in horizontal position.

4.15 A clear gap of 6 mm shall be ensured between gates plate and sprocket. while the gate is kept in horizontal position so as to ensure free travel of chain with out climbing on the blade during operation.

4.16 Install the actuator mounting brackets on to frame and complete the welding.

4.17 Install the relevant drive in position with all accessories and connections.

4.18 Assemble isolation valve with transition,if required.

4.19 Install the blower assembly with transition if required.

NOTE 5

5.1 The final inspection shall be carried out using the check list and documented.

5.2 Tolerances given in the drawings shall be followed. If not specified in drawing the following tolerances shall apply.

5.2.1 Pitch of holes for matching flanges shall be within ± 1 mm (individual) and ± 3mm max.(cumulative).

5.2.2 Linear tolerance on length/width ± 1mm/meter. Max 5 mm.

5.2.3 Diagonal variation shall be within 1mm/metre with a max of 3mm.

5.2.4 Waviness of finished gate plate shall be within 6mm. Max.

5.3 The gate plates shall be locked using mechanical blade lock assembly.

NOTE 6

6.1 **TESTING**

6.1.1 Position the gate in the testing stand maintaining verticality on sides and face (flow direction). It shall not have any twist.

6.1.2 Connect the Actuator electrically as per wiring diagram.

6.1.3 Adjust the gate in such a way that gate plate is in the middle of its stroke.

6.1.4 Set the torque required for ambient operation of the gate as in the actuator data sheet.

6.1.5 Gate shall be operated with actuator for 5 complete cycles.(with an idle time of 10 minutes in between every two cycles.)

6.1.6 Record amperage, voltage, time taken for each stroke in case of electrical actuator and record air pressure and time for pneumatic actuator.

6.1.7 During the test ensure that gate plate is operating freely without rubbing the throat support beam.

6.1.8 In case the gate is not lifted with minimum setting of the torque switch / Air pressure, torque rating / air pressure shall be slowly increased so as to enable free operation of the gate. In no case this value shall exceed the no load operating condition indicated by Engineering / C & I.

6.1.9 Normal / running current shall not exceed the permitted value. In case current drawn at no load is more than the acceptable value the same shall be referred to Engineering / C & I for approval.

6.1.10 The gate shall be visually inspected for any damage to blades, seals etc. Ensure the gate plate is in open position. Provide the lock tab and lock it.

6.1.11 The test results shall be recorded as per the test report and certified by Quality control.

6.1.12 Set the blade stopper bracket on beam and ensure the stroke length of blade and corner closing.

6.1.13 Provide chain guards in position. Provide drain holes in frame and dust guard on super structure.

NOTE 7

7.1 Mounting bracket welds, "T" bar welding of gate plate, collar welding on shaft, Blower and air mounting bracket welds shall be checked by MPI. Welding of splice joints of gate plates shall be checked with MPI/LPI. Defects revealed shall be repaired and tested again.

NOTE 8

8.1 Gate plate, Chain and all machined surfaces shall be applied with Rust preventive coating.

8.2 Match marking shall be done on all parting lines by stenciling and by punching and bordered with white paint. Mark the flow direction on the frame.

NOTE 9

9.1 Identification marks shall be as per QCP 002.

9.2 Packing shall be performed at shipping unless otherwise specified in OPS/Purchase Order.

9.3 The gate shall be packed in steel crates to avoid damages during handling and transit. Air cylinder in case of hot air gate shall be suitably protected from damages.

9.3.1 The blades shall be arrested from moving during shipping and shall be kept as per drawing.

9.3.2 Components / Sub assemblies like DP switch, actuator, blower etc. shall be packed separately is polythene sheet and crated in wooden boxes.

TEST REPORT OF GUILLOTINE GATE

1.0 General

Customer :
Work order No : Du No.
Gate size :
Application :
Type :

2.0 Actuator Name Plate Details :

GMS particulars

3.0 Test results of gate operation :

a) Torque required :

b) Torque set :

Cycles	1	2	3	4	5
Amps. opening					
Amps. closing					

4.0 Gate operation : Satisfactory/Not satisfactory.

5.0 Test results : Acceptable/Not acceptable/Rework-Identified.

Firms inspection
BHEL inspection
Customer inspection.

CHECK LIST:

PROJECT: W.O.NO:

UNIT : D.U.NO:

SIZE : DRG.NO:

SL.NO : DG/DL/DB:XXX:XXX/HAG:XXX:XXX

A1 FRAME ASSEMBLY:

Pitch of holes for seals
Distance between top and bottom row holes.
Alignment of holes.
Location of the groove from the top of channel flange.
Width of the groove.
Straightness of the groove.
Chamfering/deburring on the rear edge of the groove.

A2 DIMENSION OF FRAME:

1.LENGTH
2.WIDTH
3.DIAGONALS

B DIMENSIONS OF SUPER STRUCTURES:

1.WIDTH
2.LENGTH
3.DIAGONALS

d. The bracket should be ensured for squareness before fitting it on the frame.

e. POSITIONING OF BRACKET:
(To be full welded only after final assembly and testing)

c. ASSEMBLY OF TOTAL FRAME:
a. Back gauging and LPI from second side
(To be witnessed by Inspector)
b. Dimensions:
i) Overall Length.
ii) Diagonals

D COMPONENTS:
i) Shaft Dimensions Drive Idler
a) Length of shaft
b) Dia at Bearing location
c) Dia at actuator mounting portion of shaft

ii) Sprocket:
a.Bore
b.Key-way dimensions

E GATE PLATE:

a. Splicing - (If carried out)
i. No. of joints.
ii. NDT
b. Overall Dimensions:
i. Length
ii. Width
iii. Diagonals
c. Edge beveling with respect to flow direction.
d. Beveling dimensions.

F 'T' BAR:

A. DIMENSIONS
1.LENGTH
2.WIDTH
3.ADJUSTING BOLT HOLE DIMENSIONS
A.PITCH
B.DIAMETER

B. "T" BAR AND CONNECTING NUT DIMENSIONS
I.LENGTH
II.WIDTH
III.SQUARENESS

G ASSEMBLY Of GATE:

a. Shaft assembly Drive S/NS Idler S/NS

1.Sprocket assembly

2.Bearing assembly
a) Bearing Type & No.
b) Bearing assy on shaft.

3.Bearing housing assy.
4.Lubrication
a. Type of lubrication
b. Brand name
5. Trial operation
6. Assembly of drive shaft such assy. with mounting brackets/S/NS.
7. Free rotation check
b. Assembly of seal sub-assy. in position
c. Positioning of gate plate in super structure
d. Positioning of stopper on cross beam
e. Assembly of chain with sprocket and plate

f. Sagging of chain
g. Assembly of actuator/Blower/Air cylinder/Pneumatic cylinder

h. Air cylinder piston, connecting nut, gate plate all should be in one axis.
i. Positioning of limit switch

H TRIAL OPERATION:

1. Orientation of Gate:

a. Theoretical

b. Test Position

2 Gates operated -- Manually/with actuator/with pneumatic cylinder
Name plate details of actuator/Air cylinder

a. No. of cycle operated.

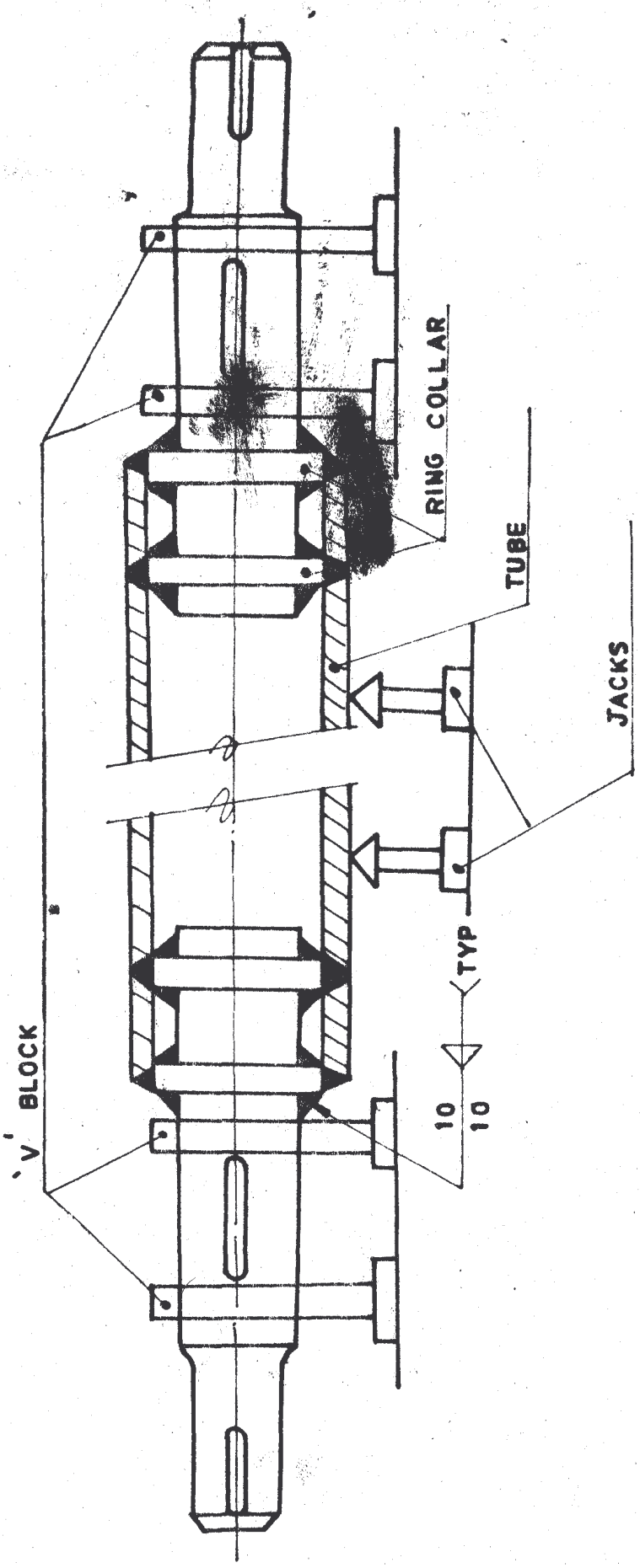
b. Condition of the seal after operation
c. Movement of blades:
Smooth/Difficult/Jerk/Stick-up
d. Current drawn
5 Rectification of defect noticed.
6 Retest results.
NOTE:(trial operation shall be repeated till satisfactory operation is achieved)

I General workmanship

J Mechanical blade lock provided/not provided

K Rust preventive oil applied after testing for gate plate.

Sketch 1



MASTER COPY

	QUALITY ASSURANCE DEPT. **BOILER AUXILIARIES PLANT** **BHEL - RANIPET** **TAMIL NADU – 632 406**	**INSPECTION CHECK LIST** *System / Sub system Description:* **Bi-Plane Dampers**

QP: Ref:	**ICL:DAM:502**
Rev. No:	**0 0**
Date :	**28 02 2002**
Page No.:	**01 OF 02**

SL NO 1	COMPONENT & OPERATION 2	CHARACTERISTICS 3	TYPE OF CHECK 5	QUANTUM OF CHECK 6	REFERENCE DOCUMENTS 7	ACCEPTANCE NORMS 8	FORMAT OF RECORD 9	AGENCY 10			REMARKS 11
								M	B	N	
	Specific Notes : 1. This Inspection Check List (ICL) has to be read along with the SQP:NP:03 - Louvers and Bi-plane Dampers for additional requirements to meet the Leak tightness efficiency of the Bi-plane Dampers. 2. This ICL is valid only for the projects, where tight shut off duty (leak tightness) has to be proved for the Bi-plane Dampers.										
1.0	**INSPECTION CHECK LIST**										
1.1	Jamb seal plate	Flatness of the plate	Measurement	100 %	As per drawing		--	P	W	-	
1.2	Blade Plate	Flatness & straightness of the plate after tip bending	Measurement	100 %	As per drawing		--	P	W	-	

Legends:
M – Manufacturer / Subcontractor (as applicable) - Record maintenance by QC for shop made items and by sub-contractor for off-loaded items. ,
B - BHEL (QC) / Authorized Inspection Agencies (AIA) N = N T P C P - Perform , V - Verification, W - Witness , D R = Dimensional Report

Prepared By	Reviewed By		Approved By
	OP&C		
	Production		
	QC		
	QA		

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	QUALITY ASSURANCE DEPT. **BOILER AUXILIARIES PLANT** **BHEL - RANIPET** **TAMIL NADU – 632 406**	**INSPECTION CHECK LIST** *System / Sub system Description:* **Bi-Plane Dampers**	QP: Ref: **ICL:DAM:502** Rev. No: **0 0** Date : **28 02 2002** Page No.: **02 OF 02**

SL NO 1	COMPONENT & OPERATION 2	CHARACTERISTICS 3	TYPE OF CHECK 5	QUANTUM OF CHECK 6	REFERENCE DOCUMENTS 7	ACCEPTANCE NORMS 8	FORMAT OF RECORD 9	AGENCY 10			REMARKS 11
								M	B	N	
1.3	Blade block hole & blade pin	Diameter	Measurement	100 %	As per drawing		D R	P	W	--	
1.4	Blade truss	Height of Blade truss	Measurement	100 %	As per drawing		D R	P	W	--	
1.5	Provision of 3 D Washers	Conformance to Col.2	Verification	100 %	As per drawing		--	P	W	--	
1.6	Provision of machined end strip on each end of the blade (3.15mm thick sheet)	Conformance to Col.2	Verification	100 %	As per drawing		--	P	W	--	**Note:** A Schematic sketch may be drawn to indicate the gaps (for every 300mm pitch) as measured (on both planes) for the Sl.no. 1.8
1.7	Seal plate crust	Coincidence of tip of blade with crust of seal plate	Visual	100 %	Conformance to col. 3		--	P	W	--	
1.8	Gap in various places of Damper	a) Gap between blade end and jamb seal b) Blade tip to tip & blade tip to frame	Measurement (Refer remarks col. 11)	100 %	As per drawing, Remarks col.11 & Linkage adjustments		D R	P	W	W	

General Notes:

1. *Extra length of seal in blade tip seal may be provided while fixing the end strip on each end of the blade, which may be trimmed exactly.*
2. *Extra length of jamb seal plate & seal may be provided to suit & trim exactly to the frame height dimension at shop itself.*

Ranipet	**PRQA** **FOR** ***REQUIREMENTS OF BALANCING MANDREL*** **Product: FAN**	Doc Ref:	**PRQA:302**
		Rev.No.	**01**
		Date:	**03 02 03**
		Page No	**01 of 01**

1.0 Scope

1.1 This procedure details out the requirements of the mandrels used for balancing of fan components.

2.0 Reference documents:

2.1 ISO 1940

3.0 Requirements:

3.1 The mandrel shall be fully machined from a solid piece or shaft and flange welded and machined type.

3.2 The run out and face out of the mandrel journal area and other mating / coupling areas shall be within 0.02 mm (refer sketch given below)

3.3 The journal area and coupling / mating surface of the mandrel shall be completely free from dents and projects due to damages (refer sketch- given below)

3.4 The mandrel shall be dynamically balanced to grade one of ISO 1940.

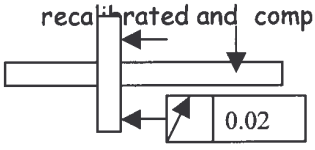
3.5 The mandrel and the matting / coupling surface of the components shall be in H7 / k6 fit.

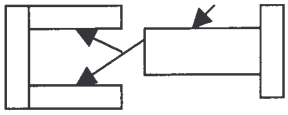
3.6 The mandrel shall be preserved by applying rust preventive after use to avoid any rusting on the journal / mating surfaces.

3.7 The mandrel shall be periodically calibrated once in every 12 months and the unbalancement value shall be verified within the allowance limit and records shall be maintained. In case, the mandrel usage is not frequent as above, the calibration shall be done before use .

3.8 Any addition/removal of mass in mandrel for unbalancement shall not affect the assy of the components balanced with mandrel.

3.9 Any alteration made in the mandrel for assembly of components shall be recalibrated and comply with all the points referred above. (3.1 to3.8)





Run out and face out of the mandrel shall be Within 0.02mm

Fit shall be H7/K6

. No,dent ,scoop,damages shall be allowed.

Prepared by	Reviewed by	signature	Approved by
	QC		
	QA	B. Sundaravadivel	(Head/QA)

Issued by QUALITY ASSURANCE

Rev No	clause	Revision made	Date
00	--	**ORIGINAL ISSUE**	18 10 01
01	-	Totally modified	03 02 03

1.0 **SCOPE:**

This procedure details out the re blading / repair of CZECK type Axial impellers & AN impellers

2.0 REFERENCE DOCUMENTS

Drawing .

3.0 Procedures

3.1 REMOVAL OF DAMAGED PARTS

3.1.1 Check for removal of defective parts by gas cutting with 5mm projection for removal by grinding.

3.2 Ensure for no removal of parent metal during grinding.

3.3 Check by MPI the above prepared hub on its entire surface -both sides including raw material portion & examine the locations where the blades were located by LPI also.

4.0 GAS CUTTING AND WELDING

4.1 Verify the raw material attestation with RMA card and transfer the attestation details In to cut pieces and hard stamp with inspector seal.

4.2 Check the Gas cut blades, ring, root stiffener, cone for the following Requirements as applicable

4.2.1 Grinding off the gas cut notches.

4.2.2 Edge preparation (incase of root stiffeners& blades EP shall be done only during blade fit up after suiting the blade to hub by trial and error method.)

4.2.3 Check blades profile on the checking fixture before fit up.

4.2.4 VERIFICATION FIT UP & WELDING

4.2.5 Check fit up dimensions& orientation ,profile as applicable with respect to drg,& check for square ness also in case of ring fit up

4.2.6 Mark for identification on the hub for blade setting. (The blade shall be located in between the already removed blades)

4.2.7 Check for EP & the root gap for max. 2 mm maximum & use of electrode E 7018.

4.2.8 Check for the Back grinding of weld root LPI.

4.2.9 ark for identification on the hub for blade setting. (The blade shall be located in

4.2.10 verify for Tack welding of suitable temporary stiffeners to avoid distortion

4.2.11 check for excess weld which will interfere with face of root stiffener and *ensure* proper size of the finished weld shall be ensured

4.2.12 Very for through dressing of the weld on root stiffener side. Look for any undercuts at both sides along the length & correct as required(Undercuts shall not exceed 0.8mm). carry MPI on welds and ensure no defects

4.2.12 Verify the suiting of the root stiffener and suit to the parent blade. Cutting ,if required ,shall be done at the lower radius edge. The gap between parent metal of blade and root stiffener shall not exceed 1 mm.

Note: a) *Root shall made minimum 3 holes of dia 10 as per drg.*
b) If the original weld hampers fit up of root stiffener , this weld can be suitably ground to facilitate proper fit up .

4.2.13 fter welding check for the plugging of holes of root stiffener by welding leaving one of the centre plug hole.

NOTE:: A length of 10x 10 mm weld shall be left un welded at one corner to facilitate venting for trapped gas.

4.2.14 Carry out cleaning and grinding and conduct MPI.

4.3.0 HEATTREATMENT

4.3.1 Verify the stress relieve cycle of impeller as at 530 -580 °C for Hub/Blade materials of P355NH and & for IS 2062 materials stress relief at 600 -650°C (refer BAP:HT:001/Latest for other details)

4.3.2 The soaking shall not exceed 90 min in case P355NH material. The rate of heating and rate of cooling shall be 100 °C / Hr Max . Impeller loading and unloading from furnace shall not be done when the furnace temperature more than 300°C .(soaking time 1 Hr / 25 mm thickness of weld.)

4.3.3 Verify for the blasting cleaning of the impeller and painting with one coat of red oxide primer leaving the un welded portion. Complete the 10 mm length left out welding in cone and root stiffener & plugging of the centre hole left out on the root stiffener.

4.3.4 Ensure flush grinding of welds and removal of all the temporary stiffeners

4.4 Blade profile checking:

4.4.1 Check the blade profile by using the checking fixture and the gap shall within the limit given in the table-1

4.4.2 Cross check the chord length already checked.

4.4.3 Blade profile shall be thermally corrected after heat treatment wherever Required The variation allowed shall be as per table 1.

4.4.4 Carry out profile checking with the help of checking fixture which is fixed in the corresponding distance to the impeller center on base plate. The impeller is carried on a pivot (centre) as shown in fig.1

4.4.5 Axial Fan impellers are of welded design. The correct form and the location of the impeller blades can be corrected on the completed (finish work) impellers by the application of heat with proper blow pipes (gas torches).

4.4.6 The following measurements are made, where the bearing surfaces of the checking template should lie (fit) against the blade.

Gaps between the impeller blade and the checking template on location of the blade. (Refer Figure 2).

4.4.7 1) Entry (after the entry radius), 2) Middle, 3) Exit (Refer figure 2,3). For the evaluation, the outer section is used. The measurement at the inner section serve merely the information and interpretation when large deviations are present at the outer section.

4.4.8 Carry out MPI on welds.

4.5 MACHINING

4.5.1 Check the impeller setting on the machine true to the hub bore and face.

Note: Machine the blade tip OD as per drawing and inspect.(P.O shall be referred in case of spare orders for any specific remarks on OD)

4.5.2 Check the dimensions of first side and after setting the second side check for the second side for the run out and face out .

4.6 BALANCING

4.6 Remove by grinding/add mass by welding to bring the unbalance within the PRU values as per drawing & inspect

4.7 Check for the unbalancement as per drg.

5.0 IDENTIFICATION & PRESERVATION

5.1 Apply one coat of synthetic enamel finish paint to IS 2932 shade smoke grey. Machined areas shall be applied with temporary rust preventive.

5.2 Impeller shall be identified with W.No.DU No., DU sl.No. by paint and number punching.

Table-1

FAN SIZE
Allowable aver

	Allowable parallel Gap(mm)	Allowable deviation from parallel gap	Allowable average parallel gap	Allowable deviation from parallel gap
> 1300- <1800	4	2	4	1.5
>1800 - <2000	5	2.5	5	2
>2000- < 2100	6	3	6	2
>2100 < 2200	6	3	6	2
>2200 < 2500	7	3.5	7	2.5
>2500 < 2800	8	4	8	2.5
2800 < 3000	8	~	8	2.5
>3000 < 3100	8	4	8	2.5
>3100-< 3300	9	4.5	9	3

FIG-1

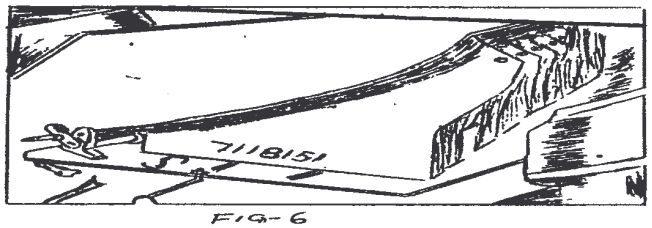


FIG-6

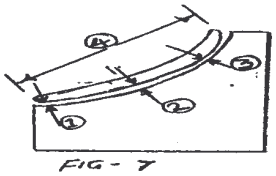
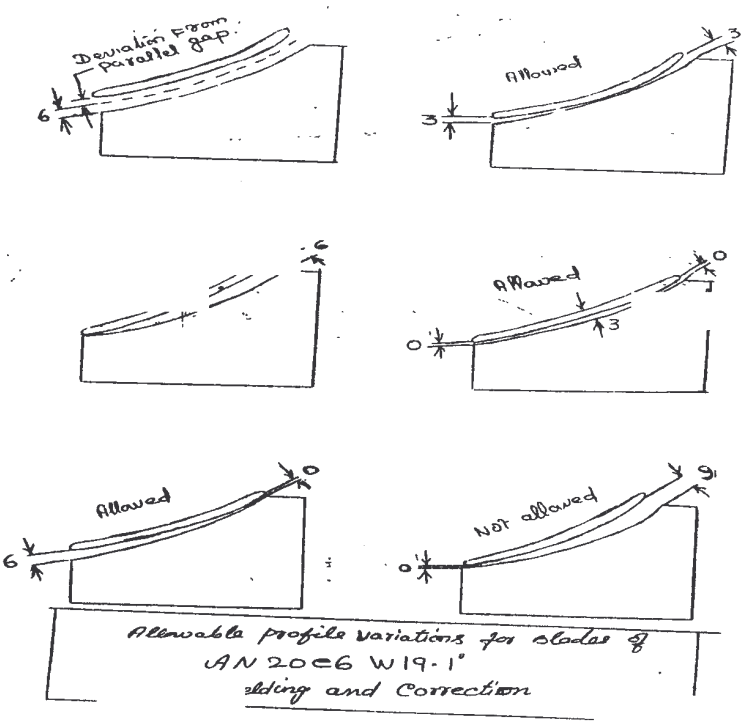

FIG-7



FIG-8


FIG-9

FIG-2



Rev No	Clause revised	Revision made	Date
00	–	ORIGINAL ISSUE	13 11 01
01	-	Totally modified	03 02 03

Ranipet	**PRQA** **FOR** **TRIAL ASSY OF FAN SPIRAL CASINGS** **Product: FAN**	Doc Ref: Rev.No. Date: Page No	**PRQA:305** **02** **15 03 10** **01 of 01**

1.0 **SCOPE**:

1.1 This procedure details out the minimum requirements conditions for horizontal and vertical trial assy of NDV,NDZV,NDFV,SF Fan spiral casings.,

2.0 REFERENCE DOCUMENTS:

2.1 DRAWING

3.0 REQUIREMENTS FOR HORIZANTAL TRIAL ASSY

3.1.1 All down hand welding of the stiffeners, side wall, and extension tube, and supports are to be completed

3.1.2 All the vertical and overhead welds are to be done with root runs

3.1.3 Spiral casing assembly shall be inspected for all possible dimensions and alignment at this stage.

3.1.4 Full welding of spiral casing is to be carried out after dismantling.

3.1.5 The spiral casing supports are to be welded to the spiral casing assembly.

3.2 Requirements for Vertical trial assembly:

3.2.1 Assembly of spiral casing as per sketch , supported on temporary structural's, in erected condition is to be offered for inspection. All dimensions and alignments shall be within tolerances specified.

3.2.2 Welding of footplates to spiral casing supports are to be done.

3.2.3 Before dismantling all matched parts are to be clearly identified by suitable method.

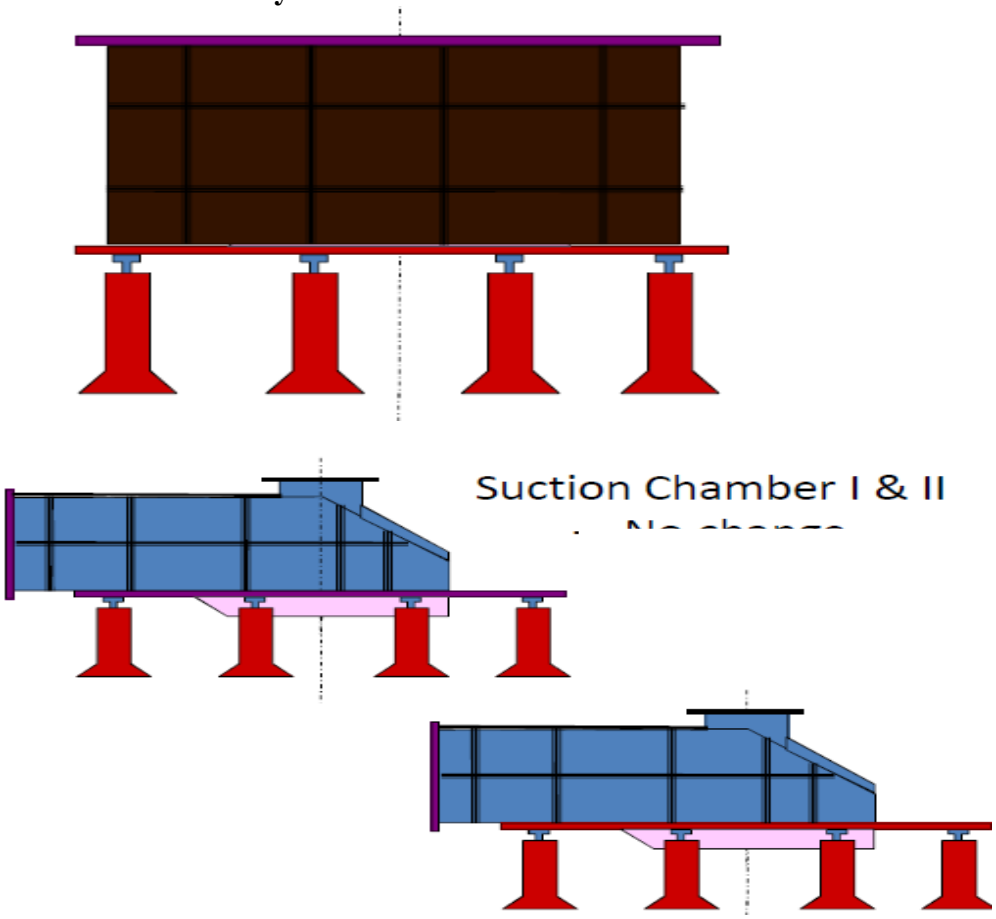
3.2.4 Incase of 45 sidor the boat portion shall be removed after horizontal trial assy & same thing need not be assembled in vertical trial assy.

Prepared by	**Reviewed by**	**signature**	**Approved by**
	QA		 **(Head/QA)**
Issued by *QUALITY ASSURANCE*			

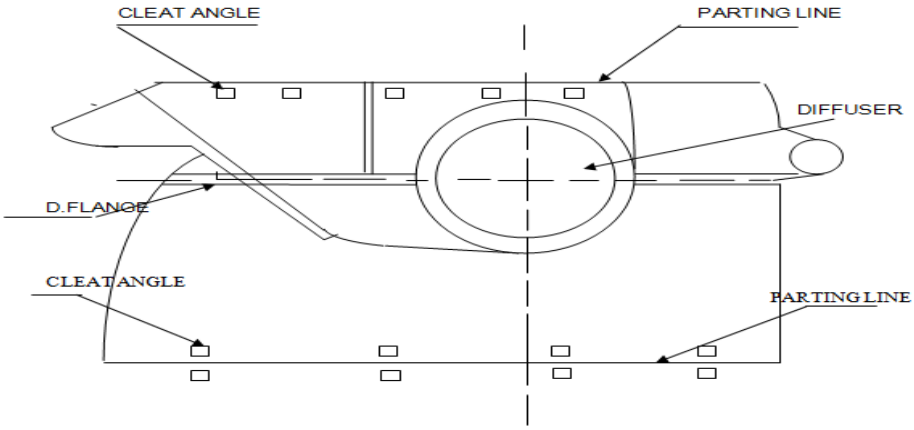
Rev No	Clause revised	Revision made	Date
Rev 00	--	**ORIGINAL ISSUE**	12 10 02
01	-	Totally modified	03 01 03
02	3.2.1	Clause modified	15 03 10

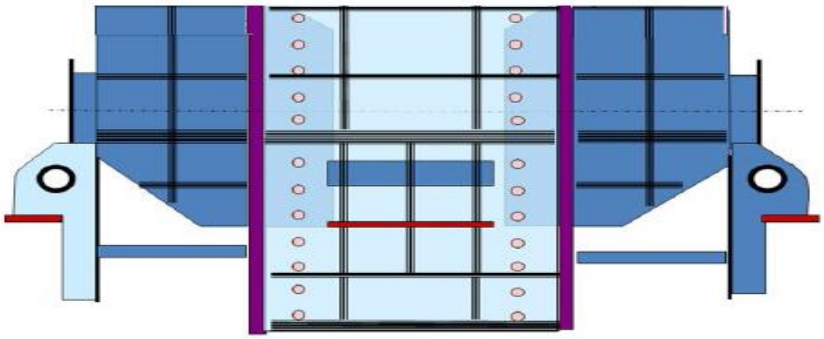
Ranipet	PRQA FOR TRIAL ASSY OF FAN SPIRAL CASINGS Product: FAN	Doc Ref:	PRQA:305
		Rev.No.	02
		Date:	15 03 10
		Page No	02 of 01

Horizontal Trial assy of Radial Double suctions size >31sidor

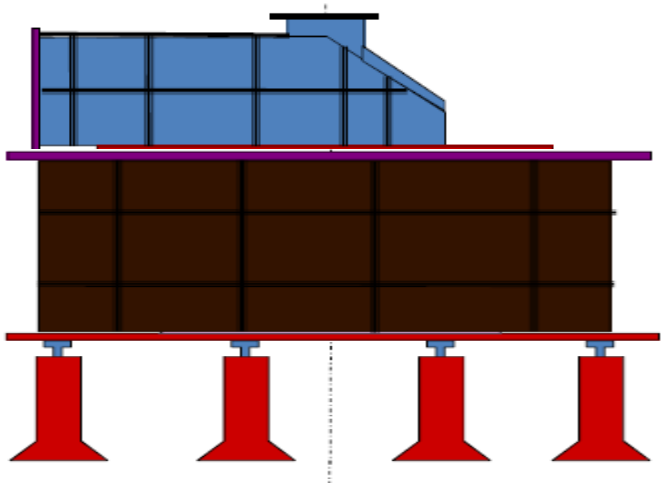


Radial double suctions vertical trial assy -all sizes fans

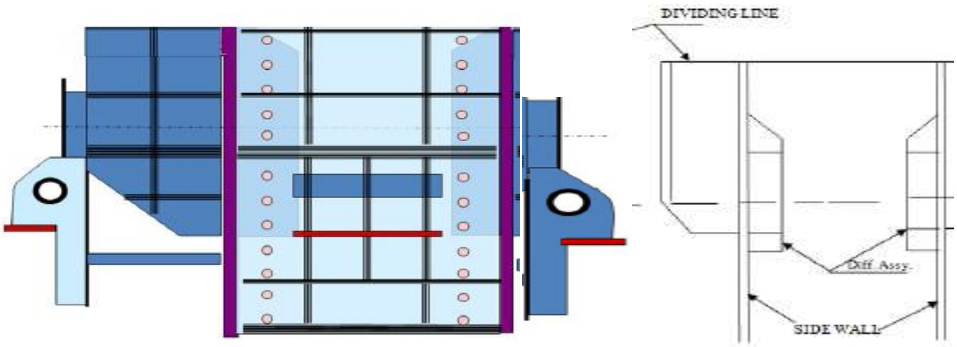




Horizontal Trial assy of Radial single suctions & radial double suction below <31 sidor.



Radial Single suctions -Vertical Trial Assy for all sizes



	RECCOMENDED BALANCING SPEED OF FAN COMPONENTS PRODUCT : FAN	Doc Ref:	PRQA: 309
		Rev. No.	11
		Date:	09.11.2020
		Page No.	01 of 01

Tolerance on speed is +/- 50 rpm, *Tolerance on speed is +/- 10 rpm for ABRO & +/- 15 rpm for H70V

Sl. No.	Components	Balancing speed in RPM Balancing machine				
		R73	**R43**	**ABRO H-10 ***	**H-70 ***	**ABRO H-30**
1.0	**AN Fan (Up to size 28)**					
1.1	Shaft Assembly	660	--	725	725	--
1.2	Impeller Assembly	450	--	250	250	--
2.0	**AP Fan**					
2.1	Shaft	660	670	725	725	670
2.2	Piston Assembly with adjusting disc and connecting rod with adjusting disc	660	670	725	725	670
2.3	Hub disc	660	670	725	725	670
2.4	Servo Motor cylinder	660	650	650	650	650
2.5	Impeller Assembly without blades	660	--	650	650	--
2.6	Rigiflex coupling intermediate shaft	660	--	650	650	--
2.7	Rigiflex coupling box	--	670	--	--	670
2.8	ID / SAF / FGD Booster Fan (Hub Diameter up to 21.2)	450	--	450	450	--
2.9	ID / SAF / FGD Booster Fan (Hub Diameter above 21.2 up to 30)	--	--	305	305	--
3.0	**Radial Fan NDV Fan**					
3.1	Shaft Assembly up to size 25 (including BW & SF)	660	--	725	725	--
3.2	Impeller with CC plate up to size 25	450	--	305	305	--
3.3	Impeller (BW & SF) with CC plate	265	--	305	305	450
3.4	**Rotors**					
3.4.1	Up to size 20	450	--	305	305	--
3.4.2	Beyond size 20 and up to size 25	265	--	305	305	--
4.0	**Radial Fan NDZV Fan up to 47**					
4.1	Shaft Assembly (including BW & SF)					
4.1.1	Up to size 25	450	--	465	465	--
4.1.2	Above 25& up to 33	—	--	400	400	--
4.1.3	Above 33 & up to 47	--	--	350	350	--
4.2	**Impeller / Rotor Assembly (including BW & SF)**					
4.2.1	Up to size 25	265	--	305	305	--
4.2.2	Above 25 & up to 33	--	--	200	200	--
4.2.3	Above 33 & up to 45*	--	--	90	130	--
4.2.4	Above 45 & up to 47*	--	--	90	130	--

Prepared By	Reviewed by	Name	Signature	Approved By
RENJITH K	M&S	S.CHENNAKESAVAN.		AGM / QC & QA K.SAKETHARAMAN
	QA	R.Arunachalam		
	QC	K.KOVARTHANAN		

Issued by QUALITY ASSURANCE

Rev	Clause revised	Revision made	Date
00		**ORIGINAL ISSUE**	26 05 93
01	-	RPM modified for R73	16 12 94
02	2.1	RPM modified for H7OV	08 12 98
03		RPM modified	06 09 00
04		Totally modified	03 02 03
05		ABRO H10 ADDED	27 01 07
06	4.2.3 & 4.2.4	Clause modified	26 02 09
07	Table revised	ABRO H-30 ADDED	03 09 12
08	2.8 Introduced	AP Fan (size SAF 37.5/21.2)	22 01 13
09	2.9 Added	AP Fan (size SAF 38.5/25.1-1)	12 05 14
10	2.9 Revised	AP Fan (size SAF 42.2/26.1-1)	09 01 15
11	2.5, 2.8 & 2.9 revised	2.5 clarified as Impeller Assy without blades, 2.8 & 2.9 modified to include all size, 3.3 Speed added for H30	09 11 20

Ranipet	PRQA FOR *VERIFICATION PERFOMANCE OF BALANCING MACHINE WITH MASTER ROTOR*	Doc Ref:	**PRQA:314**
		Rev.No.	**05**
		Date:	**05 01 09**
		Page No	**01 of 02**

1.0 **SCOPE:**

This procedure details out the verification of performance of balancing machine with master rotor (proving Rotor)

2.0 REFERENCE DOCUMENTS:
ISO 1940/1-1986

3.0 **GENERAL CHECKS:**

3.1.1 Rotor & journal Bearing surface should be free from dent, projections and journals should have proper curvature to have line contact with journal area.

3.1.2 Ensure the proper tightening of pedestal/carriage bolts and diagonal difference within 5 mm.

3.1.3 Coupling mating surface should be free from mechanical damages.

4.0 **PREPARATION:**

4.1.1 The test masses shall be in the form of bolts, studs etc. for attachment in the proving rotor test planes. Prepare two sets of test masses (ie one set = 2 test masses having equal weight)

4.1.2 Verify for the supports roller centre distance from the test planes of either side. The distance should be equal or greater than the half of the distance of test planes of the proving rotor.
ie $A \geq B/2$; $C \geq B/2$

Prepared by	Reviewed by		Signature	Approved by
	MQS	MEENAKSHISUNDARAM		
		A.S.RAVICHANDRAN		(Head/QA)
Issued by	QUALITY ASSURANCE			

5.0 Procedure

5.1..1 Check the PRU Values of the Master against the required values as called in respective formats of M&S for the balancing machines.

5.1.2 Turn the universal coupling shaft 180 deg apart and check the machine read out.

5.1.3 Conduct trials and record unbalance read out amount and angles reading as per the enclosed formats pertaining to H70 ,R73 ,R43& H10

5.1.3 The trial weight and speed shall be inline with relevant format as applicable.

5.1.4 Run the rotor at different speeds viz lower & higher speeds.

5.1.5 Calculate the Percentage by which the machine indications is differing from the actual value

5.1.7 Variation of machine read out with respect to added mass and angles shall be within 10% and ±7 ° respectively .Out of six trials one can deviate beyond the limits.

5.1.8 If the variation in the machine indication is more than stated in Cl. 5.1.7. Recalibration is to be done.

5.1.9 Verification shall be deemed valid for a period of 12 months. QC shall maintain verification records against respective machines.

Rev No	Clause revised	Revision made	Date
Rev 00	--	ORIGINAL ISSUE	11 08 93
01	--	Totally modified	16 12 94 28 12 98
02		Totally modified	03 02 03
03	--	Totally modified	
04		CLAUSE MODIFIED & ANNEXURES MADE	11 10 03
05	-	Totally modified	05 01 09

Ranipet	REPORT ON *VERFIFICATION OF BALANCING MACHINE WITH MASTER ROTOR*	MACHINE	**H70V CAB 690**
		Date:	
		Page No	**01 OF 01**

MACHINE: H70V CAB 690	PROVING ROTOR DRG NO: 1-RT-50-00130	WEIGHT: 526.904 KGS	PRU VALUE: 1575 Gr.mm/Plane

A:	B: 380mm	C:	RL: 190mm	RR: 190mm

RESIDUAL UNBALANCEMENT	LEFT PLANE:	RIGHT PLANE:
INDEXING UNIVERSAL COUPLING BY 180°	LEFT PLANE:	RIGHT PLANE:

TRIAL WEIGHT : 40 gr (+10 %) — RPM: 1000 + / - 50 rpm

LEFT PLANE				RIGHT PLANE			
ADDED		RESULT (READOUT)		ADDED		RESULT (READOUT)	
WT In Gms.	Angle	WT In Gms.	Angle	WT In Gms.	Angle	WT In Gms.	Angle
	0°				90°		
	0°				180°		
	0°				270°		
	90°				270°		
	180°				270°		
	270°				0°		

TRIAL WEIGHT : 280 gr (+ / - 10 %)

LEFT PLANE: — RIGHT PLANE:

RL: — RR: — RPM: 305 + / - 50 rpm **with BIASING mode.**

	0°				90°		
	0°				180°		
	0°				270°		
	90°				270°		
	180°				270°		
	270°				0°		

Allowable Error magnitude: +/- 10%
Angle Variation: +/-7 degrees

Performance :
Next Calibration Due On:

M&S

QC

Verification done inline with PRQA 314/Latest

BHEL Ranipet	REPORT ON *VERFIFICATION OF BALANCING MACHINE WITH MASTER ROTOR*	MACHINE	MACHINE: R73CAB590
		Date:	
		Page No	**01 OF 01**

MACHINE: R73CAB590	PROVING ROTOR DRG NO: 1-RT-50-00130	WEIGHT: 526.904 KGS	PRU VALUE: 1575 Gr.mm/Plane

A:	B: 380mm	C:	RL: 190mm	RR: 190mm

RESIDUAL UNBALANCEMENT	LEFT PLANE:	RIGHT PLANE:
INDEXING UNIVERSAL COUPLING BY 180°	LEFT PLANE:	RIGHT PLANE:

TRIAL WEIGHT :40 gr (+ 10 %) | RPM: 805 +/- 50 rpm

LEFT PLANE				RIGHT PLANE			
ADDED		RESULT (READOUT)		ADDED		RESULT (READOUT)	
WT In Gms.	Angle	WT In Gms.	Angle	WT In Gms.	Angle	WT In Gms.	Angle
	0°				90°		
	0°				180°		
	0°				270°		
	90°				270°		
	180°				270°		
	270°				0°		

TRIAL WEIGHT : 280 gr (+ 10 %)

LEFT PLANE: | RIGHT PLANE:

RL: | RR: | RPM: 396 +/- 50 rpm

	0°				90°		
	0°				180°		
	0°				270°		
	90°				270°		
	180°				270°		
	270°				0°		

Allowable Error magnitude: +/- 10%
Angle Variation: +/-7 degrees
Performance : Satisfactory & Acceptable

Date of calibration :

Next Calibration Due On

M&S

QC

Verification done inline with PRQA 314/Latest

Ranipet	REPORT ON ***VERFIFICATION OF BALANCING MACHINE WITH MASTER ROTOR***	MACHINE	MACHINE: **R43**
		Date:	
		Page No	**01 OF 01**

MACHINE: R43 SOFT BEARING	PROVING ROTOR DRG NO: 1-RT-50-00236	WEIGHT: 167KG.	PRU VALUE: 417.5 grmm.

PRQA:314/Latest			RL: 130mm	RR:130mm
RESIDUAL UNBALANCEMENT	LEFT PLANE.		RIGHT PLANE:	
INDEXING UNIVERSAL COUPLING BY 180°	LEFT PLANE:.		RIGHT PLANE.	
TRAIL WEIGHT:18 gr.(10%)		RPM: 1000 +/ -50 rpm		

LEFT PLANE				RIGHT PLANE			
ADDED		RESULT (READOUT)		ADDED		RESULT (READOUT)	
WT In Gms.	Angle	WT In Gms.	Angle	WT In Gms.	Angle	WT In Gms.	Angle
	0°				90°		
	0°				180°		
	0°				270°		
	90°				270°		
	180°				270°		
	270°				0°		

LEFT PLANE:			RIGHT PLANE: °		
RL: 50 gr + / - 10 %		RR: 50 gr + / - 10 %		RPM: 670 +/- 50 rpm	
	0°			90°	
	0°			180°	
	0°			270°	
	90°			270°	
	180°			270°	
	270°			0°	

Allowable Error magnitude: +/- 10% Angle Variation: +/-7 degrees Performance : Date of calibration : Next Calibration Due :	M&S	QC

Verification done inline with PRQA 314/Latest

Ranipet	**Report on** **VERIFICATION OF BALANCHING MACHINE WITH MASTER ROTOR**	Machine	Machine:ABRO H10 – K MP102(B)
		Date:	
		Page No.	**01 OF 01**
Machine:ABRO H10 – K MP102(B)	**Proving Rotor Drawing No. 1-RT-50-00130**	Weight 526.904 Kgs.	PRU VALUE: 1575 Grmm/ Plane

A:	B: 380 MM	C:	RL: 190 MM	RR: 190 MM

Residual unbalacement	Left plane:	Right plane:
INDEXING UNIVERSAL COUPLING BY 180^{O}	Left plane:	Right plane:

TRIA WEIGHT: 50 gr (+10%)				RPM: 900 +/- 50 RPM			
LEFT PLANE				RIGHT PLANE			
Added		Result (Readout)		Added		Result (Readout)	
Wt. in g.	Angle	Wt.in g.	Angle	Wt.in g.	Angle	Wt.in g.	Angle
	0^{o}				90^{o}		
	0^{o}				180^{o}		
	0^{o}				270^{o}		
	90^{o}				270^{o}		
	180^{o}				270^{o}		
	270^{o}				0^{o}		
Trial Weight: 300 gr (+ 10%)							
LEFT PLANE:				RIGHT PLANE:			
RL:205 mm		RR: 205 mm		RPM: 305 +/- 50			
	0^{o}				90^{o}		
	0^{o}				180^{o}		
	0^{o}				270^{o}		
	90^{o}				270^{o}		
	180^{o}				270^{o}		
	270^{o}				0^{o}		

Allowable Error magnitude +/- 10% Angle Variation : +/- 7 degrees Performance: Calibrated on: Next Calibration Due on:	M & S	QC
Verification done inline with PRQA: 314/ latest		

1.0 SCOPE

1.1 This procedure specifies the methods of unbalance correction by removing the mass by drilling / milling/grinding or by suitable combination of these methods for solid shafts, servomotor cylinders, hub discs, piston assy. and AP fan shafts.

2.0 Reference:

2.1 Respective drawings

3.0 PROCEDURE:

3.1 General

3.1.1 Balancing speeds shall be as per PRQA 309 latest.
3.1.2 Cleanliness of roller supports of balancing M/c shall be ensured before balancing
3.1.3 Balancing reference numbers shall be punched on the component at suitable location
3.1.4 Balancing details shall be documented in history card
3.1.5 Balancing machine rollers shall be covered suitably during grinding on the component for unbalancement correction

3.2 Method

3.2.1 For Servomotor Cylinder

Table 1

Weight removal in gm per plane	Method
up to and including 100	By drilling in identified place (refer table2)
more than 100 & up to and including 500	By grinding on the inner circumference(refer sketch-1) of cylinder /cover. Depth of grinding shall not be more than 5mm (app) at any place
more than 500 & upto and including 1500	By milling and grinding on the inner circumference(refer sketch-1) of cylinder/cover to a maximum depth of 5mm.In addition the rib can also be milled to a depth of 10 mm subject to 1/3 rd the length of the rib. Grinding may be done for fine balancing
More than 1500	Refer to QA & Engg

3.2.2 **For solid shafts, Hub discs and Piston assy:**
3.2.2.1 Drilling and grinding only. Pl ref Table 2 for drill hole size.
3.2.2.2 Ligament thickness shall not be less than 5 mm.
3.2.2.3 Wherever applicable balancing key shall be fitted during balancing operation,

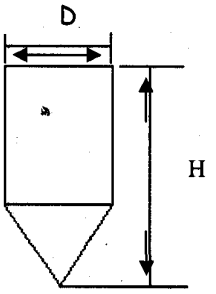
Table 2

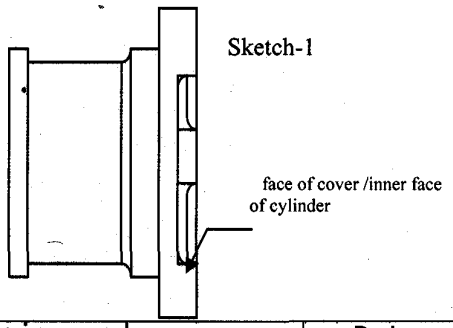
Hole size in mm & mass removed in gm

Drill Dia 'D' in mm	8	10	12	15	18
Wt in gm	Height 'H' in mm				
1	4.1	3.5	--	--	--
2	6.6	5.2	4.6	--	--
3	9.1	6.8	5.7	5.0	--
4	11,7	8.4	6.8	5.8	5.5
5	14.2	10.0	7.9	6.5	6.0
6	16.7	11.7	9.0	7.2	6.5
7	19.3	13.3	10.2	7.9	7.0
8	21.8	14.9	11.3	8.6	7.5
9	24.3	16.5	12.4	9.3	8.0
10	26.9	18.1	13.6	10.0	8.5
11	32.0	21.4	15.8	11.5	9.5
12	37.0	24.6	18.0	13.0	10.5

Note:

1. The above table shows the drill hole depth (H)(see sketch below) for the standard drill diameter 'D' (OD) for equivalent weight in grams.
2. For maximum drill hole depth and dia refer to the individual component drawing .





Sketch-1

Rev No	Clause revised	Revision made	Date
00	--	Original issue	11 07 94
01	-	Revised to include cylinder assy, piston assy ,hub disc& shafts	17 09 00
02	3.4	Clause modified to include servomotor cylinder rib drilling	16 12 00
03	-	Totally modified	03 02 03
04		Modified to include method of correction wrt unbalance amount .	26 02 07

QUALITY DEPARTMENT
Amendment to Quality Work Instructions (PRQA)
QWI NO:PRQA 323 REV: 03 DT. 03 03 07 **Amendment no: A 1 DT. 27 08 09**
Description **: GUIDE LINES FOR FIXING OF BALANCING MASS BY MEANS OF WELDING /SCREWING IN FAN ROTATING PARTS.**

Details of Amendment		
Note Sl.no.	**Amended As**	**Basis For Amendment**
1	Note The material of the Balancing Mass can be IS 2062 quality at the least .	

Prepared by	Reviewed By		Approved By
	QC	B. Sivasankara Rao 27/8	27/8/09
	ENGG		

Ranipet	**PRQA** **FOR** **GUIDELINES FOR FIXING OF UNBALANCE MASS IN ROTATING PARTS OF FANS LIKE SHAFT & IMPELLER BY MEANS OF WELDING /SCREWING.** **Product:FAN**	Doc Ref:	**PRQA: 323**
		Rev.No.	**03**
		Date:	**03 03 07**
		Page No	**01 of 04**

1.0 **SCOPE**

1.1 This procedure specifies the methods of unbalance correction by mass addition by Welding Screwing/ riveting (hereinafter called fasteners).

2.0 **REFERENCE**

Respective drawing

3.0 **Procedure:**

3.1 General guidelines

3.1.1 Balancing speeds shall be as per PRQA 309 latest.

3.1.2 Cleanliness of roller supports of balancing M/c shall be ensured before balancing

3.1.3 Balancing reference numbers shall be punched on the component at suitable location

3.1.4 Balancing details shall be documented in history card

3.1.5 Balancing machine rollers shall be covered suitably during grinding on the component for unbalancement correction

3.2 **Guideline for screw selection/revitting &fixing**

3.2.1 Minimum number of fasteners required for one kg of balancing mass shall be as per table 1. subject to the least number of fasteners two . When there is a fraction of fasteners, the same shall be rounded to next higher number.

3.2.2 Position of corner fasteners (M) and longitudinal pitch of fasteners (LP) shall be as per table 2. Number of rows of fasteners shall be as per Table 3.

3.2.3 Screws used for fastening shall be of at least 8.8 grades.

3.2.4 Balancing mass profile shall match with that of parent body. No visible gap is permitted between them. All edges of balancing mass shall be chamfered throughout to 45 deg with 2mm land as shown in fig 1.

This clause is applicable for hollow shafts only. Balancing mass location shall be as per respective Drawing. Depth of threaded hole in parent metal shall be at least 1.5 times the dia of screw subject to maximum of 60 % of tube wall thickness. For tubes of wall thickness 20mm and below where the wall thickness is less than 1.5 dia. of screw, through holes may be made. The location of mass shall be at least 50mm away from pin end.

3.2.5 Arrangement of balancing mass fasteners is shown in fig 2. Countersinking shall Match with screw/rivet head.

3.2.6 Tightening torque for screws shall be as per PRQA312/latest

3.2.7 All the screw heads shall be peened to have positive locking.(ref fig-2a)

Prepared by	**Reviewed by**	**signature**	**Approved by**
	QC		**(Head/QA)**
	QA	B. Sundaram	
Issued by	*QUALITY ASSURANCE*		

Rev No	Clause revised	Revision made	**Date**
Rev	--	**ORIGINAL ISSUE**	10 08 94
01	3.1.6	Class altered	12 03 96
02	--	Totally modified	03 02 03
03	-	Totally modified	03 03 07

3.3 ***Guidelines for correction on the respective components***

Sl no	**Description**	**Methods of correction**	**Remarks**
1.0	**Radial Fans**		
1.1	Hollow shafts	Screwing	-
2.0	Impellers (KKK & CZECH design)		
2.1	Alloy steel impellers (Naxtra -70,13CrMO4,Stainles steel, etc.)	Riveting	-
2.2	Carbon steel impellers (P355NH, A36,IS 2062 etc)	Welding	-
3.0	**AP Fans**		
3.1	Impeller	Welding & screwing	Impeller assy with blade brg assy mass addition shall be done by screwing only.
3.2	AP impellers of TLT Design	Welding	-
4.0	**AN Fans** (KKK & CZECH design)		
4.1	**Shafts**	Screwing	-
4.2	**Impellers**	Welding	-

Note: PRQA 321 /latest shall be referred for items subjected to unbalance correction by Mass removal

3.4 BALANCING MASS FIXING BY WELDING

3.4.1 Balancing mass profile shall match with that of parent body. All sides of balancing mass shall be fillet welded. Fillet welding of balancing mass with parent body Shall be smoothly merged. This weld shall be checked by PT or MT and acceptance norm shall be as per BHE:NDT:RP:MT01/BHE:NDT:RP:PT01/latest.

TABLE - 1

MINIMUM NUMBER OF FASTENERS/Kg of unbalance correction Mass

	ITEM	SCREWS OF Min 8.8 GRADE M10	SCREWS OF Min 8.8 GRADE M12	RIVETS OF SA105MATL DIA 10	RIVETS OF SA105MATL DIA 12
1.0	**IMPELLERS**				
1.1	RADIAL FAN				
	a) Tip dia up to 2500mm	1.95	1.35	3.90	2.70
	b) -do- >2500- 3500mm	1.25	0.85	2.50	1.70
	c) -do- >3500 -5000mm	1.00	0.70	2.00	1.40
1.2	**AP FAN**				
	a) 11 & 12 Size	0.95	0.65	1.90	1.30
	b)16 & 20 Size	0.70	0.50	1.40	1.00
1.3	AN FAN				
	a)Tip dia up to 2200mm	1.70	1.20	3.40	2.40
	b) -do- >2200 -2800mm	1.0	0.70	2.00	1.40
2.0	**SHAFTS**				
2.1	RADIAL FANS				
	a) up to NDV/NDZV 25	1.95	1.35	NO REVITTING IS PERMITTED	
	b) Beyond NDZV up to NDZV 33	1.25	0.90		
	c) Beyond NDZV 33 & up to NDZV 47	1.00	0.70		
2.2	**AN FANS**				
	a) up to AN 22	1.70	1.20		
	b) Beyond AN22 & up to AN 28	1.00	0.70		
3.0	**AP FAN ITEMS**				
3.1	**Servomotor cylinder with cover**				
	a) 11 & 12 size	0.95	0.65		
	b) 16 & 20 sizes	0.70	0.50		
3.2	HUB DISC				
	a) 12 sizes	0.95	0.65		
	b) 16 & 20 sizes	0.70	0.50		

TABLE -2

Fastener Size (mm)	**M** Min	**LP** Min
10/12	35	25

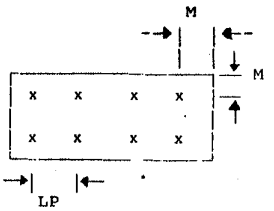


TABLE -3

Fasteners dia 10 mm		**Fasteners dia 12 mm**	
Width mm	No of Rows	Width mm	No of Rows
≤ 60	ONE	< 70	ONE
60-100	TWO	70-120	TWO
199-160	TWO**	120-200	TWO**
>160	THREE	>200	THREE

**** In addition to the two rows, provide 3 extra screws as shown below.**

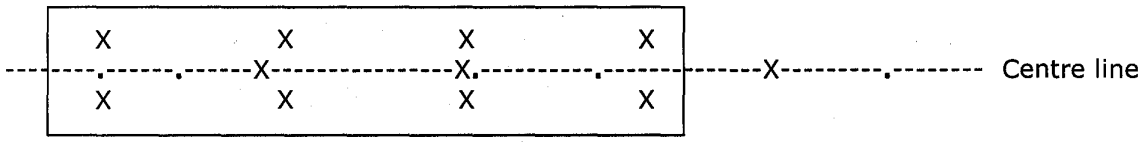


FIG 1

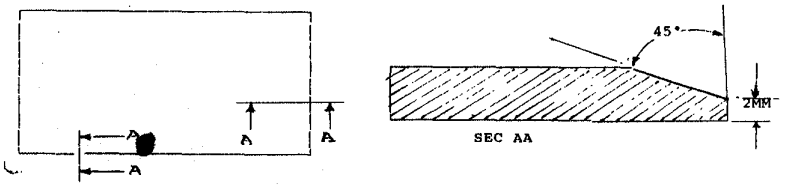
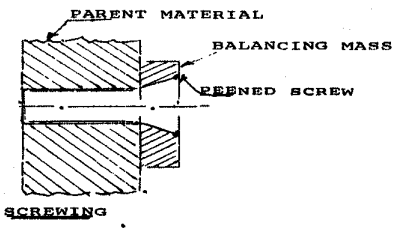
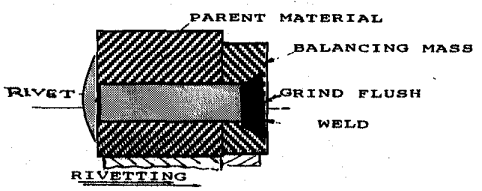


FIG 2 a



b



Ranipet	**PRQA** **FOR** ***HOT PRESSING OF AN IMPELLERS BLADES, ROOT STIFFENERS, AND GUIDE VANES OF AP, AN STATIC PARTS*** **Product:FAN**	Doc Ref:	**PRQA326**
		Rev.No.	**01**
		Date:	**03 02 03**
		Page No	**01 of 01**

1.0 SCOPE:

1.1 This procedure details out the hot pressing of AN Impeller blades, Guide Vanes of AP, AN Housings, OGVs&Diffusers and Root stiffeners.

2.0 REFERENCE DOCUMENTS
Drawing

2.0 PROCEDURE:

2.1 Check for the blade hot pressing temp within 850 and 1050 deg C and soaking time of 30 minutes.

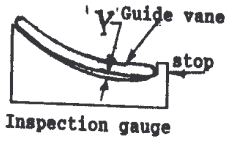
2.3 check for air cooling in still air to room temperature

2.5 check for profile dimensions confirmation using profile checking fixture.

2.5.1 Refer SQP FAN328/Latest for permissible Profile gaps of AN fan blades.

2.5.2 For others following table shall be referred for permissible values

< = Tabulated value 'Y'



HUB DIA IN MM	HOUSING DIA RANGE IN MM	PERMISSIBLE GAP 'Y' Max.
1000 To 1413	1334 To 2818	1.5 MM
1585 TO 1778	2114 TO 3548	2.0 MM
1995 TO 2239	2661 TO 4467	2.5 MM
2512 TO 2818	3350 TO 5623	3.2 MM
3162 TO 3548	4217 TO 7080	4.0 MM

Prepared by	Reviewed by	signature	Approved by
	QC		(Head/QA)
	QA	B. Sundarasan	

Issued by *QUALITY ASSURANCE*

Rev No	Clause revised	Revision made	Date
Rev 00	–	**ORIGINAL ISSUE**	18 10 01
01	–	Totally modified	03 02 03

Ranipet	**PRQA** **FOR** Assembly and functional test **shaft with Bearing assembly** of non tubular /non tubular type. **Product: FAN**	Doc Ref:	**PRQA:329**
		Rev.No.	**01**
		Date:	**03 02 03**
		Page No	**01 of 04**

1.0 SCOPE

This procedure specifies the requirements for the Assembly and functional test of NDFV fan shaft with Bearing assembly of non tubular /non tubular type.

2.0 REFERENCE DOCUMENTS
drawing

3.0 PROCEDURE

3.1 PREASSEMBLY AND ASSEMBY CHECKS:

Ensure that all component parts are available before commencing the assembly. Check the general condition of all the parts.

3.1.2 ensure through cleanliness of surfaces and verify for e any trace of rust on the surface/face of shaft or other parts especially at sealing areas.

Note : *All the parts shall be thoroughly cleaned. Use of Undried Compressed air is not permissible. Burrs are to be removed, if present, Check and verify that no clips are left in the drilled holes (blind/through)*

3.1.3 verify the radial and axial clearance of the before mounting

3.1.4 Measure the clearance between angular ring and roller bearing by placing the angular ring on roller bearing . If the clearance exceeds the drawing Limit, grind the angular ring portion as shown in the sketch (i)

a) Measure the depth of angular ring (Y)
b) Measure the depth of bearing to top face of inner ring (X).
Clearance is X -Y=C

If the clearance 'C' is less than drawing limit grind the face of the angular ring.

3.2.3 Check the history cards of all the parts of the bearing assembly to ensure their dimensional compliance. Counter check at random some of the parts.

Prepared by	Reviewed by	signature	Approved by
	QC		(Head/QA)
	QA	B. Srinivasa Rao	

3.3 ASSEMBLY PROCEDURE

3.3.1 IMPELLER SIDE OF SHAFT

3.3.1.1. Ensure the Pushing of the distance ring (13) on the shaft & . Heating of the Spacer (20) to about 80 to 90 degree C in oil and assemble on the shaft (Ref fig -1).

3.3.1.2 Ensure the Heating of angular contact ball bearing (3) in the oil to about 80 to 90 Degree C and mounting of the same on the shaft.

3.3.1.3 Ensure Heating of the distance ring (14) and the inner race of the Cylindrical roller bearing (2) in oil about 80 to 90 Degree C and mounting on the shaft. As shown in sketch.

3.3.1.1 Verify the Assembly of the angular ring , (4) , lock washer (7) and Tightening of the lock nut (5) Folding of the lock nut only when It reaches room temperature.

3.3.2 COUPLING SIDE OF SHAFT

3.3.2.1 On the coupling side first mount the distance ring (13)

3.3.2.2 Ensure Heating of the inner race with the rollers of the cylindrical roller bearing (1) to about 80 to 90 Degree Celsius and mounting it on to the shaft.

3.3.2.3 Ensure Assembly of the lock washer (8) and the screw the lock nut (6) and tighten the same. (Refer cl 3.3.23) Fold the lock washer after cooling down to room temperature.

3.3.3 Verify Mounting of the outer race of cylindrical roller bearing(1_in the housing by means of mounting fixtures till makes complete contact with circlip (15). Cooling of bearing below the ambient temperature will facilitate easy assembly.

3.3.5 Ensure the Mounting of the spacer (21) in the housing.

3.3.8 Ensure Placing of the distance ring (16) and put the grub screw to lock it with the housing. Mount the outer race with the rollers of the Bearing (2). In the housing Cooling of bearing below ambient temperature will facilitate easy mounting.

3.3.11 verify the Assembly of the angular ring (4) ,lock washer , (7) Locknut, (5) and assemble the labyrinth end cover (10) and tighten the screws.

3.3.12 Check the axial float by means of fixing a dial gauge On the shaft as given below.

Mount the dial gauge on magnetic stand as shown in Fig 3. Lift the shaft vertically upwards. Note the maximum dial deflection. Lower the shaft and note the minimum dial deflection. The difference between the above renders the axial gap between the bearing roller and angular ring. While doing this, slowly rotate the shaft. Repeat this test a few times to ensure consistency of dial readings.

3.3.15 Check the radial clearance of bearings (1) & (2) by means of feeler gauge and record it.

3.3.16 Mount a dial gauge on the shaft and find out the face out Of outer race of bearings (1) and (2) as shown in fig 2. The dial reading from top and bottom and right to left should not vary more than 0.04 mm.

3.3.17 Reassemble the angular ring , lock washer and lock Nut. Tighten locknut by using tool for tightening locknut and using 2 LB hammer for tightening. Tighten the labyrinth end covers (9& 10) to housing with suitable gasket to prevent the oil leakage.

3.3.18 This assembly should be done in clean room to avoid Any dust , dirt & foreign material.

4.0 **FINAL INSPECTION**

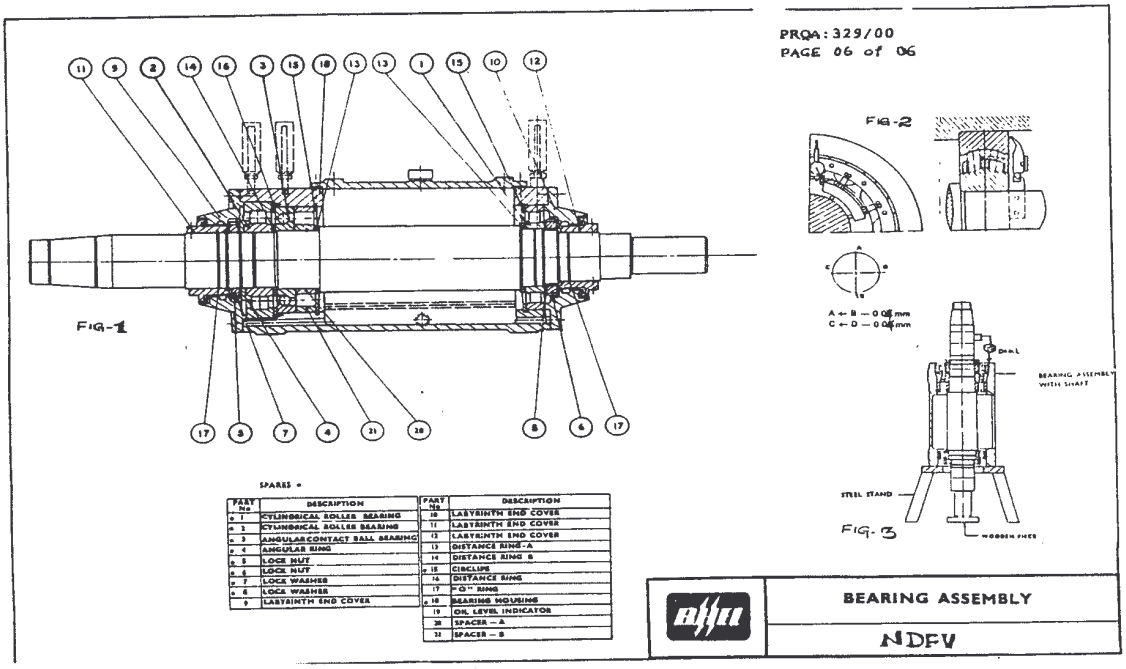
4.1 Fill with servoprime17/turbine oil 17 to the level.

4.2 Ensure free rotation of shaft

4.3 Ensure painting & preservation. Ref.PR:QA:590 for the Same

4.4 Shaft with bearing assy shall be suitably packed to avoid transit damage.

Ranipet	**PRQA** **FOR** Assembly and functional test **shaft with Bearing assembly** of non tubular /non tubular type. **Product: FAN**	Doc Ref:	**PRQA:329**
		Rev.No.	**01**
		Date:	**03 02 03**
		Page No	**04 of 04**



Rev No	Clause revised	Revision made	Date
Rev 00	--	**ORIGINAL ISSUE**	02 02 96
01	-	Totally Modified	03 02 03

Ranipet	**PRQA** **FOR** *ENSURING SPECIFIED INTEFERENCE FIT INCASE OF DEVIATION IN SHAFT TUBE BORE* **Product :FAN**	Doc Ref:	**PRQA:333**
		Rev.No.	**01**
		Date:	**03 02 03**
		Page No	**01 of 01**

1.0 Scope

1.1 This procedure details out the machining of shaft pins, in case of deviation in shaft tube bore, to ensure the specified interference fit.

2.0 REFERENCE DOCUMENTS

2.1 Respective drawings.

3.0 PROCEDURE

3.1 Measure the bore of the shaft tube.

3.2 The ovality and the taper shall be within the tolerances as given in table 1.

3.3 Check the surface finish and ensure the same as per drawing.

3.3 The maximum deviation of the shaft tube bore shall not exceed ± 1.5 mm from the nominal bore size specified in drawing.

3.4 Production will furnish the tube bore details to OP & C.

3.4 OP & C will release OPS with details of pin diameter to be machined to achieve the require interference.

3.6 Machine the pin to the dimensions as indicated in the OPS.

3.7 Ensure the correctness of fit between shaft tube & pin before pin insertion.

Note: This procedure is applicable for all Fan shaft tube and pin irrespective of indication of this PRQA No. in the drawing.

Bore Dia in mm	Ovality/Taper in mm
80 - 120	0.035
120 - 180	0.04
180 - 250	0.046
250 - 315	0.052
315 - 400	0.057
400 - 500	0.063
500 - 630	0.07
630 - 800	0.08
800 - 1000	0.09

Prepared by	Reviewed by	signature	Approved by
	QC		(Head/QA)
	QA		
Issued by	QUALITY ASSURANCE		

Rev No	Clause revised	Revision made	Date
Rev	–	**ORIGINAL ISSUE**	05 12 00
01	–	Totally modified	03 02 03

Ranipet	Procedure for **Preservation & Packing of Fan shafts / Rotor Assembly**	Doc. No	**PRQA:341**
		Rev	**03**
		Date	**16 07 04**
		Page NO	**01 of 01**

1.0 Scope

1.1 This procedure details out the preservation and packing methodology for Fan shafts and Rotor assemblies.

2.0 Procedure

2.1 Before starting of preservation, clean the machined surfaces thoroughly with a cloth dipped in **TOLUOL**. Then clean the surface with white spirit. Presence of corrosion spots are not allowed.

2.2 Cleaned surface shall be dried in air for 20 to 30 minutes and only after that shafts should be preserved.

2.3 Cleaned surfaces shall not be touched by hands.

2.4 Apply one coat of TRP 1706 (specification number AA 55155 and Material code AA 5510055308 of Corporate R & D) followed by two coats of TRP 1710 (specification No. AA 55154 and matl code AA 5510054000 of Corporate R & D).

2.5 Drying time shall be min 12 Hrs for each coat .After complete drying up of coating, machined surfaces shall be wrapped with ***bitumen*** paper which shall be suitably fixed with adhesive tapes at the ends.

2.6 Then journal shall be wrapped with rubber sheet of 2 to 3 mm thickness followed by wrapping with aluminum foil of 0.05 mm to 0.1 mm thickness. These shall be finally tightened with adhesive tape.

2.7 Journals shall be covered with wooden boxes.

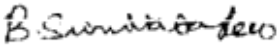
2.8 Shafts shall be stored in covered area at BAP shipping or at site.

2.9 Preservation shall be examined once in a month.

Source for supply of rust preventives

Shri K Nandy, **Ph:0755-2506594, e-mail:knandy@bhelbpl.co.in**
DGM (Coils and Insulation Sales-CIS)
Annexe Block No.6,
First Floor,
Central Wing ,
BHEL,Bhopal

Revision Number/Date	*Changes made*
00/17 07 96	Original issue
01/03 02 03	Totally modified
02/03 05 04	Revised based on site feedback
03/ 16 07 04	Drying Time included.

Prepared By	Reviewed By	Approved BY
		
Issued by Quality Assurance		

QUALITY DEPARTMENT

AMENDMENT TO QUALITY WORK INSTRCTIONS (Q C F)

Q. W. I. NO : 2 : 4 : 271 REV : 00 AMENDMENT SL NO : A 1

DESCRIPTION : IGV ASSY (ND TYPE FANS) DATE: 22/8/94

DETAILS

CLAUSE NO	AMENDED AS	BASIS FOR AMENDMENT REMARKS
3.6	AWS D1. 1. 75 shall be read as AWS D1.1 latest.	Document referenced Is to be latest.
4.3 & 4.4	For untoleranced dimensions, refer PR : QA : 500 / latest for tolerances.	PR : QA : 500 is the document for untoleranced dimensions.
6.30	History card shall be read as Dimensional report	Dimensional report is in vogue.
7.2	Painting shall be as per Rp0674199/latest	Painting schedule RP0674199.

Prepared by : B. Srinivasa Rao Approved by :

Distribution : As per standard distribution list.

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BHARAT HEAVY ELECTRICALS LTD.
TIRUCHIRAPALLI - 14
QUALITY ENGINEERING

QUALITY CONTROL PROCEDURE FOR

INLET GUIDE VANE UNIT ASSEMBLY (FOR ND TYPE FANS)

EFFECTIVE DATE 18-5-81

ACCEPTED BY	DEPARTMENT	DATE
	ENGINEERING AND DEVELOPMENT CENTRE	
	BOILER PRODUCTION	
	OPERATION, PLANNING AND CONTROL	
	QUALITY ASSURANCE AND CONTROL	

ISSUED BY
QUALITY ENGINEERING

REVISION NO :
DATE : 18-5-81

1.0 SCOPE

1.1. This procedure specified the quality requirements for manufacture of inlet Guide Van Unit Assembly for ND type fans.

1.2 This procedure is valid only for those products which are under the inspection purview of BHEL or its authorized agencies.

1.3 Special requirements if any shall be specified separately.

2.0 MATERIALS:

2.1 Materials used shall be as per the drawing requirement.

3.0 WORKMANSHIP :

3.1 The product made for this procedure shall have workman like finish. Also it will be the responsibility of the fabricator to organise to produce a quality product.

3.2 Any deviation in Engineering and material preparation joint shall have prior approval of BHEL product engineering department.

3.3 Plates and sheets shall be cut to size by shearing, machine cutting or flame cutting. Flame cut edges shall be cleaned to remove slag, and uneven edges shall be dressed by grinding. Gas cutting notches shall be filled up by welding and ground before taking up for further fabrication.

3.4 Ensure drying of electrodes.

3.5 Ensure correct selected of electrodes.

3.6 Welders employed in the production shall be qualified as per AWS D 1.1.75. The finished product shall be completely free from detects which are injurious to the component strength or to the appearance.

3.7 Proper welding sequence shall be adopted to minimice distortion.

4.0. DIMENSION AND OTHER DETAILS :

4.1 All dimensions shall be as per the latest production drawing concerned.

4.2 Wherever tolerances have been indicated in the drawing the same shall be strictly followed.

4.3 For untoleranced dimension, the following tolerances shall be followed for fabrication (DIN 7168)

Nominal Size (mms)	Tolerance (mms)
Upto 315	+/- 1.0
Over 315 to 1000	+/- 2.0
Over 1000 to 2000	+/- 3.0
Over 2000 to 4000	+/- 4.0
Over 4000 to 8000	+/- 5.0
Over 8000 to 12,000	+/- 6.0
Over 12,000 to 16,000	+/- 7.0
Over 16,000 to 20,000	+/- 8.0

4.4 For untoleranced dimension, the following tolerance shall be followed for machining (DIN 7168).

Nominal Size (mms)	Tolerance (mms)
Over 0.5 to 3	+/- 0.10
Over 3 to 6	+/- 0.10
Over 30 to 120	+/- 0.20
Over 120 to 315	+/- 0.30
Over 315 to 1000	+/- 0.50
Over 1000 to 2000	+/- 0.80
Over 2000 to 4000	+/- 1.20
Over 4000 to 8000	+/- 2.00
Over 8000 to 12,000	+/- 3.00
Over 12,000 to 16,000	+/- 4.00
Over 16,000 to 20,000	+/- 5.00
	+/- 6.00

4.5 The parting flanges shall all be in the same Plane. also the flanges shall be free from bend, distcration and out of squareness.

4.6 The deviation from the flatness of flanges shall be 1 mm/metre or part thereof subject to a maximum of 3 mm.

4.7 For circular flanges, the centre distance of diametrically, opposite bolt holes shall not exceed +/- 1.5 mm.

4.8 Pitch distance of two consequative holes shall be within +/- 1 mm.

4.9 The deviations from flatness of contact faces shall not exceed 3 mm. (wherever not shown in the drawing).

5.0 WELDING :

5.1 Welds shall be free from burn through.

5.2 Welds shall be free from slag, spatter and the tacks shall be ground off.

5.3 Welds shall be checked for its size and appearance.

5.4 Undercuts and all defects shall be repaired. Notches or burning of metal more than 0.8 mm shall be termed as under cuts.

5.4 The individual component shall be free from skew or twist.

5.0 MANUFACTURE :

6.1 The input guide vane assembly unit shall be fabricated as per the latest drawing.

6.2 The ovality of the housing shall be checked and shall not be more than 3 mm.

6.3 The diagonal, height of the housing shall be checked as per the drawing.

6.4 The bush hole diametron the housing shall be checked as per the drawing.

6.5 The distance between the bushed shall be checked after welding. Care Shall be exercised during welding to minimise distortion, and also for proper positioning of grease nipple hole in bush.

6.6 Ensure that the axis of the bust and housing centre are in one line.

6.7 Check for the blade profile and straightness.

6.8 The blade/shaft dimension profile and straightness.

6.9 The assembly of the blade shaft shall be checked.

6.10 Ensure shaft centre and the blade edge (longitudinal) are in one line.

6.11 The soundness of the rivet in the shaft assembly shall be checked by hammer test.

6.12 Ensure proper fit of cast Iron bush with steel bush. welded on to the housing.

6.13 Ensure proper fixing of screw for looking between cast Iron bush and steel bush.

6.14 Check the free movement of the IGV shaft assembly in the bush without any shake.

6.15 Check whether the centreline of the blade edge coinsides with the Housing centre. (in open position)

6.16 Care shall be exercised for styles during assembly of regulating ring.

6.17 Check for the free movement of regulating ring with rollers without any shake. Care shall be should be taken to ensure proper dwelling for regulating

6.18 Ensure movement of angular joint without any shake, (separately)

6.19 Ensure full opening and full closing of guide vanes, by manual operation.

6.20 Check for control lever position, tightness of all fasteners.

6.21 Overlapping between two blades shall be as per drg. the gap at the overallaping shall not exceed 2 mm.

6.22 Ensure proper gap between inside diameter of housing and edge of the blades.

6.23 The circle diameter at the centre of the housing shall be checked after full closing of the blades.

6.24 The position of the control lever and the articulated piece with repsect to style shall be checked during assembly of control lever.

6.25 The free movement of the control lever without any lateral shake shall be checked.

6.26 The angular displacement of the control lever at full opening shall be checked with respect to centerline of the housing.

6.27 Ensure proper tightness of all fasteners.

6.28 The position of stoppers and dial plate for full opening and full closing shall be checked as per the drawing

6.29 Ensure proper greasing of all bushe is and lever assembly.

6.30 The completed assembly of the Inlet Guide Vane Unit shall be checked and recorded in the History Card. No : 49 - 391.

6.31 Ensure assembling of split cottar pin in the control lever assembly.

6.32 Check the free rotation of the roller in the roller assembly without any shake.

7.0 PAINTING AND PRESERVATION :

7.1 The Inlet Guide Vane Assembly unit shall be thoroughly

cleaned to remove spatter, slag, rust oil or grease or any other foreign materials.

7.2 The Inlet Guide Vane Assembly unit shall be painted as per the painting schedule. BPS : 027601 - 7601.

7.3 All the machined surfaces shall be given one cost of rust preventive oil.

7.4 The component shall be clearly identified with the following details.

Work Order Number

DU Number

Product number

8.0 PACKING AND DESPATCH :

8.1 The Inlet Guide Vane unit assembly shall be suitably despatched to avoid transit damage.

8.2 Transport stoppers shall be provided for regulating ring to arrest the movement of the regulating ring.

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QUALITY DEPARTMENT

AMENDMENT TO QUALITY WORK INSTRUCTIONS (Q C P)

Q.W.I.NO:2:4:272 REV:00 AMENDMENT SL NO: A 1

DESCRIPTION:TGV ASSY (AN TYPE FANS) DATE: 22/8/94

DETAILS

CLAUSE NO	AMENDED AS	BASIS FOR AMENDMENT REMARKS
3.6	AWS D1.1.75 shall be read as AWS D1.1 latest.	Document referred is to be latest.
4.3 & 4.4	For untoleranced dimensions, refer PR:QA:500/latest.	PR:QA:500 is the document for untoleranced dimensions.
6.11.18	History card shall be read as Dimensional report.	Dimensional report is in vogue.
7.2	Painting shall be as per RP0674199/latest	Painting schedule RP0674199

Prepared by B. Srinivasa Rao Approved by

Distribution: As per standard distribution list

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QCP:2:4:272
PAGE 1 OF 9

QUALITY CONTROL PROCEDURE FOR

INLET GUIDE VANE UNIT ASSEMBLY (FOR AN TYPE FANS)

EFFECTIVE DATE: 18-5-81

ACCEPTED BY	DEPARTMENT	DATE
	ENGINEERING AND DEVELOPMENT CENTRE	
	BOILER PRODUCTION	
	OPERATION, PLANNING AND CONTROL	
	QUALITY ASSURANCE AND CONTROL	

ISSUED BY
QUALITY ENGINEERING

REVISION NO.:
DATE :18-5-81

QUALITY CONTROL PROCEDURE FOR INLET GUIDE VANE

UNIT ASSEMBLY (FOR AN TYPE FANS)

1.0 SCOPE:

1.1. This procedure specifies the quality requirements for manufacture of Inlet Guide Vane Unit Assembly for AN type fans.

1.2. This procedure is valid only for those products which are under the inspection purview of BHEL or its authorised agencies.

1.3. Special requirements if any shall be specified separately.

2.0. MATERIALS:

2.1 Materials used shall be as per the drawing requirement.

3.0 WORKMANSHIP:

3.1 The product made for this procedure shall have workman like finish. Also it will be the responsibility of the fabricator to organise, to produce a quality product.

3.2. Any deviation in Engineering and material preparation joint shall have prior approval of BHEL product Engineering department.

3.3. Plates and sheets shall be cut to size by shearing, machine cutting or flame cutting. Flame cut edges shall be cleaned to remove slag and uneven edges shall be dressed by grinding. Gas cutting notches shall be filled up by welding and ground before taking up for further fabrication.

3.4. Ensure drying o_ electrodes.

3.5. Ensure correct selection of electrodes.

3.6 Welders employed in the production shall be qualified as per AWS D 1.1.75. The finished product shall be completely free from defects which are injurious to the component strength or to the appearance.

3.7 Proper welding sequence shall be adopted to minimise distortion.

4.0 DIMENSION AND OTHER DETAILS:

4.1 All dimensions shall be as per the latest production drawing concerned.

4.2 Wherever tolerances have been indicated in the drawing the same shall be strictly followed.

4.3 For untoleranced dimension, the following tolerances shall be followed for fabrication (Din 7168)

Nominal size (mms)	Tolerance (mms)
Upto 315	+/- 1.0
Over 315 to 1000	+/- 2.0
Over 1000 to 2000	+/- 3.0
Over 2000 to 4000	+/- 4.0
Over 4000 to 8000	+/- 5.0
Over 8000 to 12000	+/- 6.0
Over 12000 to 16000	+/- 7.0
Over 16000 to 20000	+/- 8.0

4.4 For untoleranced dimension, the following tolerances shall be followed for machining (DIN 7168)

Nominal size (mms)	Tolerance (mms)
Over 0.5 to 3	+/- 0.10
Over 3 to 6	+/- 0.10

Over 6 to 30	+/- 0.20
Over 30 to 120	+/- 0.30
Over 120 to 315	+/- 0.50
Over 315 to 1000	+/- 0.80
Over 1000 to 2000	+/- 1.20
Over 2000 to 4000	+/- 2.00
Over 4000 to 8000	+/- 3.00
Over 8000 to 12000	+/- 4.00
Over 12000 to 16000	+/- 5.00
Over 16000 to 20000	+/- 6.00

4.5 The parting flanges shall all be in the same plane. Also the flanges shall be free from bend, distortion and out of squareness.

4.6 The deviation from the flatness of flanges shall be 1 mm/metre for part there of subject to a maximum of 3 mm.

4.7 For circular flanges, the centre distance of diametrically opposite bolt holes shall not exceed +/- 1.5 mm.

4.8 Pitch distance of two consequative holes shall be within +/- 1 mm.

4.9 The deviation from flatness of contact faces shall not exceed 3 mm. (wherever not shown in the drg.).

5.0 WELDING:

5.1 Welds shall be free from burn through

5.2 Welds shall be free from slag, spatter and the tacks shall be ground off.

5.3 Welds shall be checked for its size and appearance.

5.4. Undercuts and all defects shall be repaired. Notches or burring of metal more than 0.8mm shall be termed as undercut.

5.5 The individual components shall be free from skew or twist.

6.0 MANUFACTURE:

6.1. The inlet Guide Vane Assembly Unit shall be fabricated as per the latest drawing.

6.2. The ovality of the housing shall be checked and shall not be more than 3mm.

6.3. The diameter, height of the housing shall be checked as per the drawing.

6.4. The pitch distance between the shaft holo shall be checked.

6.5. Ensure dowelling of parting flanges of housing.

6.6. The blade shaft hole diameter on housing and also the axis shall be checked as per the drawing.

6.7. Ensure correct dimension of grooves (baring pedestal seating area) as per drawing.

6.8. The location of studs for bearing pedestal fixing shall be checked as per drawing.

6.9. Check for the blade profile and straightness.

6.10. The blade shaft shall be checked as per the drawing.

6.11 BEARING ASSEMBLY:

6.11.1 Check for proper location of cap springs, nylon ring, bearings, spring plate, soagar ring.

6.11.2 Ensure the tightness of the bearing pedestal assembly with IGV assembly to the required torque as given in the drawing.

6.11.3 Check the location and position of guide suspension holes on housing as per drawing.

6.11.4 Check the free movement of angular joint (separately) without any shake.

6.11.5 The ovality of the regulating ring and other dimension shall be checked as per the drawing.

6.11.6 The position of the angular joint fixing with regulating ring shall be checked as per the drawing.

6.11.7 The guide roller assembly (suspension assembly) shall be checked for position as per the drg. care shall be exercised for hard and soft suspensions holes.

6.11.8 Ensure shaft centre and blade edges are CO-axial on blade and shaft assembly.

6.11.9 Ensure proper sorewing of blade to the blade shaft. Check for the free movement of the IGV shaft assembly in the bearing pedestal assembly without any shake.

6.11.10 Check Whether the centerline of the blade edge with the housing centre are in one line.

6.11.11 Care shall be exercised for styles during assembly of regulating ring.

6.11.12 Ensure proper fixing of brackets with guide suspension assembly.

6.11.13 Check for the free movement of regulating with rollers without any shake. Care shall be exercised to ensure proper dowelling of the joint.

6.11.14 Ensure proper contact of rollers with IGV casing during bracket assembly.

6.11.15 The position of the angular joint, lever guide suspension shall be checked as per the drawing.

6.11.16 Ensure dowelling of guide roller bracket.

6.11.17 Ensure full opening and full closing of inlet guide vanes.

6.11.18 Overlapping of the blades shall not exceed 2 mm.

6.11.19 Ensure proper gap between inside diameter of housing and edge of the blades.

6.11.20 The core circle diameter at the centre of the housing shall be checked after full closing of the blades.

6.11.21 The position of the lever and articulated piece with respect to style shall be checked during assembly of control lever.

6.11.22 The free movement of the lever without any lateral shake shall be checked.

6.11.23 The lever axis shall be as per drawing at o deg position.

6.11.24 Ensure proper tightness of all

6.11.25 Ensure greasing of bearing pedestal openings to avoid dust collection.

6.11.26 Ensure greasing of guide suspension assembly.

6.11.27 The position of stoppers and dial plate for full opening and full closing shall be checked as per the drawing.

6.11.28 The completed assembly of the Inlet Guide Vane Unit shall be checked and recorded in the History card No. 49-391,

6.11.29 Before parting the assembly, transport stiffners shall be provided in the assembled condition and also areas the movement of the regulating ring by suitable method, and

6.11.30 Check the rotation of the roller in the fork shaft assembly without any shake.

7.0 PAINTING AND PRESERVATION:

7.1 The Inlet Guide Vane Assembly unit shall be thoroughly cleaned to remove spatter, slag, rust, oil or grease or any other foreign material.

7.2 The Inlet Guide Vane Assembly shall be painted as per the painting schedule. BPS:027601 - 7601.

7.3 All the machined surfaces shall be given one coat of rust preventive oil.

7.4 The component shall be clearly identified with the following detail.

Work Order Number.
DU Number
Product Number.

8.0 PACKING AND DESPATCH.

8.1 The Inter Guide Vane Unit assembly shall be suitably despatched to avoid transit damage.

8.2 Transportation stopper shall be provided for regulating ring to arrest the movement of the regulating ring.

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QUALITY DEPARTMENT

AMENDMENT TO QUALITY WORK INSTRUCTIONS (Q C P)

Q.W.T.NO:2:4:273 REV: 00 AMENDMENT SL NO: A 1

DESCRIPTION: AN FAN STATIC PARTS DATE: 22/8/94

DETAILS

CLAUSE NO	AMENDED AS	BASIS FOR AMENDMENT REMARKS
3.6	AWS D1.1.75 shall read as AWS D1.1 latest.	Document referred is to be latest.
4.3 & 4.4	For untoleranced dimensions, PR:QA:500/latest shall be referred for tolerances.	PR:QA:500 is the document for untoleranced dimensions.
6.1.3 6.2.4 6.6.6 6.7.7	History card shall be read as Dimensional report	Dimensional report is in vogue.
6.3	QCP No is 2:4:272	Editional correction
9.2	Painting shall be as per RP0674199/latest	Painting schedule RP0674199.

Prepared by B. Sundaravadivel Approved by

Distribution: As per standard distribution list.

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QA&C

BAP:QA&C:6:
13-03-86

Sub: Amendment to QCP 2:4:273 "QCP for AN Fan static parts (KKK Design)

- - - - -

The following amendments are incorporated in the QCP 2:4:273 "QCP for AN Fan static parts (KKK Design)

"Clause 3.4
Existing: Ensure drying of electrodes.

As amended: Low hydrogen electrodes shall be baked for atleast tow hours between 230 deg C to 260 deg C and dried at 110 deg C and held in holding ovens at this temperature before use. If the electrodes are exposed for more than 4 hours to the atmosphere these shall be rebaked and dried in the same manner".

In addition a new clause is added as under:-

"Clause 3.8

All butt joints shall be back gouged to remove all slag, unfused areas etc before second side welding.

The amendment comes into immediate effect.

(PH. TAMBAKHE)
Dy. Manager/QA

DISTRIBUTION:

Shri V Alagappan/DM/EDC/Fans
Shri K Ponnambalam, Manager/Production
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BHARAT HEAVY ELECTRICALS LTD. TIRUCHIRAPALLI - 14 QUALITY ENGINEERING	QCP:2:4:273 PAGE 1 OF 10
QUALITY CONTROL PROCEDURE FOR	AN FAN STATIC PARTS (KKK DESIGN)
EFFECTIVE DATE:	18 05 81

ACCEPTED BY	DEPARTMENT	DATE
	ENGINEERING AND DEVELOPMENT CENTRE	
	BOILER PRODUCTION	
	OPERATION PLANNING AND CONTROL	
	QUALITY ASSURANCE AND CONTROL	

ISSUED BY QUALITY ENGINEERING	REVISION NO.: DATE:

QUALITY CONTROL PROCEDURE FOR AN FAN STATIC PARTS (KKK DESIGN)

1.0. SCOPE

1.1. This procedure specifies the quality requirements for manufacture of AN fan static parts of KKK design.

1.2. This procedure is valid only for those products which are under the inspection purview of BHEL or its authorised agencies.

1.3. Special requirements if any shall be specified separately.

2.0. MATERIALS

2.1. Materials used shall be as per the drawing requirements.

3.0. WORKMANSHIP:

3.1 The product made to this procedure shall have workman like finish. Also it will be the responsibility of the fabricator to organise to produce a quality product.

3.2 Any deviation in engineering and material preparation joins shall have prior approval of BHEL Product Engineering Department.

3.3. Plates and sheets shall be cut to size by shearing, machine cutting or flame cutting. Flame cut edges shall be cleaned to remove slag, and uneven edges shall be dressed by grinding. Gas cutting notches shall be filled up by welding and ground before taking up for further fabrication.

3. Ensure drying of electrodes.

3.5. Ensure correct selection of electrodes.

3.6. Welders employed in the production shall be qualified as per AWS D1.1.75. The finished product shall be completely free from defects which are injurious to the component strength or to the appearance.

3.7. Proper welding sequence shall be adopted to minimise distortion.

4.0. DIMENSIONS AND OTHER DETAILS

4.1. All dimensions shall be as per the production drawing concerned.

4.2. Wherever tolerances have been indicated in the drawing the same shall be strictly followed.

4.3. For untoleranced dimensions the following tolerances shall be followed for fabrication (DIN 7168)

Nominal Size (mms)	Tolerance (mms)
Upto 315	+/- 1.0
Over 315 to 1000	+/- 2.0
Over 1000 to 2000	+/- 3.0
Over 2000 to 4000	+/- 4.0
Over 4000 to 8000	+/- 5.0
Over 8000 to 12000	+/- 6.0
Over 12000 to 16000	+/- 7.0
Over 16000 to 20000	+/- 8.0

4.4. For untoleranced dimension, the following tolerance shall be followed for machining. (DIN 7168)

Nominal size (mms)	Tolerance (mms)
Over 0.5 to 3	+/- 0.10
Over 3 to 6	+/- 0.10
Over 6 to 30	+/- 0.20
Over 30 to 120	+/- 0.30
Over 120 to 315	+/- 0.50
Over 315 to 1000	+/- 0.80
Over 1000 to 2000	+/- 1.20
Over 2000 to 4000	+/- 2.00
Over 4000 to 8000	+/- 3.00
Over 8000 to 12000	+/- 4.00
Over 12000 to 16000	+/- 5.00
Over 16000 to 20000	+/- 6.00

4.5 The parting flanges shall all be in the same plane. Also, the flanges shall be free from bend, distortion and out of squareness.

4.6. The deviation from flatness of flanges shall be 1mm/metre or part there of subject to a maximum of 3mm.

4.7. For rectangular flanges, the centreline of the bolt holes on opposite faces shall be parallel within a limit of +/- 1.5mm

4.8. For circular flanges, the centre distance of diametrically opposite bolt holes shall not exceed +/- 1.5 mm

4.9. Pitch distance of two consequative holes shall be within +/- 1mm. However in case of rectangular flanges, the maximum cumulative variation in hole pitch shall not exceed +/- 2mm.

4.10. The deviation from flatness of contact faces shall not exceed 3mm. (Wherever not shown in the drawing.)

5.0. IMPORTANT CHARACTERISTICS:

5.1. Development to respective shapes as per drg. of individual parts shall be checked.

5.2. No projection shall be allowed inside the static parts after assembly in the air flow direction.

5.3. Welds shall be free from burn through.

5.4. The welds shall be free from slag, spatter and the tacks shall be ground off.

5.5. Welds shall be checked for its size and appearance.

5.6. Undercuts and all defects shall be repaired. Notches or burning of metal more than 0.8mm shall be termed as undercut.

3.7. The individual component shall be free from skew or twist.

6.0. MANUFACTURE

6.1 SUCTION CHAMBER:

6.1.1 The suction chamber shall be fabricated as per the latest drawing.

6.1.2 The individual dimension of the circular and square section of the suction chamber shall be checked before jointing.

6.1.3 The dimension of the completed suction chamber shall be checked and recorded in the History Car No. 49-813.

6.1.4 Ensure the centreline marking of the shaft axis in the suction chamber.

6.1.5 The suction chamber foot shall be checked as per the drawing after completing the machining.

6.1.6 The location of the suction chamber foot on to suction chamber shall be marked and checked as per the drawing.

6.1.7 Check the horizontally of shaft axis.

6.1.8 While fixing support for shaft protection tube ensure parting is vertical for FD application and horizontal for ID application (Viewed from suction side.)

6.2. SUCTION NOZZLES (TRANSITIONS I&II)

6.2.1 The suction nozzles (Transition I&II) shall be fabricated as per latest drawing.

6.2.2. The roundness of the flange shall be checked.

6.2.3. The height of the suction nozzles shall be checked after welding.

6.2.4. The dimensions of the completed suction nozzles shall be checked and recorded in the History Card No. 49-373.

6.3. INLET GUIDE VANE UNIT ASSEMBLY

Refer QCP No. 2:4:

6.4. HOUSING (IMPELLER)

6.4.1 The impeller housing shall be fabricated as per the latest drawing.

6.4.2. The ovality of the impeller housing shall be checked after welding.

6.4.3. Care shall be exercised in providing machining allowances during fabrication to maintain the height of the impeller housing and inside diameter.

6.4.4. Check the location of the outlet blade and ensure smooth grinding of gas cutopening for proper clearance between outlet blade and cut out in the housing for assembly, as given in the drawing. For ID application and also check the welding between black and the core in case of F.D. application.

6.4.5 The housing foot shall be checked as per the latest drawing.

6.4.6 The height of the housing shall be checked after welding and machining the foot.

6.5. HOUSING CORE:

6.5.1 The housing code shall be fabricated as per the latest drawing.

6.5.2 The ovality of the housing core shall be checked after welding.

6.5.3 Care shall be exercised in providing machining allowance during fabrication to maintain the dimension.

6.6. OUTLET GUIDE VANES: (EXCHANGABLE VANES)

6.6.1. The outlet guide vanes shall be checked and fabricated as per the latest drawing.

6.6.2 The profile of the outlet guide vanes shall be checked as per the drawing with template.

6.6.3. The position of exchangeable vanes (outlet blades) w.r.t. cut out on housing and hole in the core shall be as per drg. in the case of ID application. The position of outlet blades w.r.t. housing to the core shall be as per drawing for FD application.

6.6.4. Care shall be exercised that there is no gap between outlet blade and housing core outside diameter for ID application.

6.6.5. The concentricity between housing core and housing shall be checked and also ensure proper machining allowance on all mating faces.

6.6.6. The dimensions of the completed impeller housing shall be checked and recorded in the history Card No. 49-367.

6.7. DIFFUSER ASSEMBLY:

6.7.1. The diffuser assembly shall be manufactured as per the latest drawing.

6.7.2. The roundness of the diffuser core shall be checked after welding.

6.7.3. The location of the man hole door cut out in the diffuser shall be checked.

6.7.4. The width of the mono rail in the diffuser core, shall be checked as per the drawing.

6.7.5. The wedge shall be manufactured as per the latest drawing.

6.7.6. The dimension of the wedge shall be checked.

6.7.7. The completed dimension of the diffuser shall be checked and recorded in the History Card No. 49-362.

7.0. TRIAL ASSEMBLY

7.1. Trial assembly suction chamber with suction nozzle I (Transition I) and ensure match mark to take care of parting flange position and also ensure transfer of drilled holes.

7.2. Trial assembly suction nozzle I (Transition I) with inlet guide vane unit assembly and ensure match mark to take care of parting flange position and also the position of Inlet guide vane unit lever as given in the drawing.

7.3. Trial assembly Inlet guide vane unit assembly with suction nozzle II (transition II) and ensure match mark to take care of parting flange position and also ensure transfer of drilled holes.

7.4. Trial assemble suction nozzle II (Transition II) with impeller housing and ensure match mark to take care of parting flange position and also ensure transfer of drilled holes.

8.0. DIFFUSER TRIAL ASSEMBLY

8.1. Trial assembly diffuser core with wedge and check the angle of wedge with core and also with housing. Care shall be exercised in providing proper space for insulation at diffuser core, wedge entry, diffuser.

8.2. Trial assemble core with wedge and also with diffuser and check for concentricity, height angle of cut out, location of man-hole entry.

8.3. Trial assembly the above diffuser assembly with the Impeller housing and ensure match mark to take care of parting flange position and also ensure transfer of drilled holes.

9.0. PAINTING AND PRESERVATION

9.1. The components shall be thoroughly cleaned to remove spatter, slag, rust, oil or grease or any other foreign materials.

9.2. The inside and outside surface of the static parts of AN Fans shall be painted as per the BPS:027601-7601.

9.3. All the machined surface and weld edge preparation shall be given one coat of rust preventive oil.

9.4. The component shall be clearly identified with the following details.

WORK ORDER NUMBER

DU NUMBER

PRODUCT NUMBER

MATCH MARKS.

10.0 PACKING AND DESPATCH

10.1. All the components shall be suitably despatched to avoid transit damage.

10.2. The diffuser core and wedge shall be removed from the above assembly and proper temporary transport stiffners shall be provided.

BHEL
RANIPET

QUALITY DEPARTMENT

AMENDMENT TO QUALITY WORK INSTRUCTIONS (Q C P)

Q.W.I.NO:2:4:274 REV:00 AMENDMENT SL NO: A 1

DESCRIPTION: AP FAN STATIC PARTS DATE: 22 / 8 / 94

DETAILS

CLAUSE NO	AMENDED AS	BASIS FOR AMENDMENT REMARKS
3.6	AWS D1.1.75 shall be read as AWS D1. 1 latest.	Document referred is to be latest.
4.3 & 4.4	For untoleranced dimensions, PR:QA:500/latest shall be referred for tolerances	PR:QA:500 is the document for untoleranced dimensions.
6.0 6.2.6	History card shall be read as Dimensional report	Dimensional report is in vogue.
6.3.4	History card nos shall be read as R-036,R-009, R-013	History cards updated With Ranipet formating.
6.4.7	History card number shall be read as R- 026.	-do-
7.2	Painting shall be as per RP 0674199/latest.	Painting Schedule RP0674199.

PREPARED BY Approved by

Distribution: As per standard distribution list.

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BAP:QA&C:6:
dt. 14 3 86

Sub: Amendment to QCP 2:4:274
"QCP for AP fan static
Parts (KK) Design".

. . . . . .

The following amendments are incorporated in the QCP 2:4:274 "QCP for AP Fan Static Parts(KKK design)".

"Clause 3.4

Existing : Ensure drying of electrodes

As amended: Low hydrogen electrodes shall be baked for atleast two hours between 230 degree C to 260 degree C and dried at 110 degree C and held in holding ovens ovens at this temperature before use. If the electrodes are exposed for more than 4 hours to the atmosphere these shall be rebaked and dried in the same manner."

In addition a new clause is added as under:-

"Clause 3.8

All butt joints shall be back gouged to remove all slag, unf used areas etc., and then welded on the other side.

The amendment comes into immediate effect.

(P.H.TAMBAKHE)
DY.MANAGER (QA)

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BHARAT HEAVY ELECTRICALS LTD TIRUCHIRAPALLI - 14 QUALITY ENGINEERING	QCP:2:4:274 PAGE 1 OF 8
QUALITY CONTROL PROCEDURE FOR	AP FAN STATIC PARTS (KKKDESIGN)
EFFECTIVE DATE:	18 05 81

ACCEPTED BY	DEPARTMENT	DATE
	ENGINEERING AND DEPARTMENT CENTER	
	BOILER PRODUCTION	
	OPERATION, PLANNING AND CONTROL	
	QUALITY ASSURANCE AND CONTROL	

ISSUED BY QUALITY ENGINEERING	REVISION NO: - 00 DATE: 18 05 81

QUALITY CONTROL PROCEDURE FOR AP FAN STATIC PARTS (KKK DESIGN)

1.0 SCOPE:

1.1 This Procedure specifies the quality req-uirements for manufacture of AP fan static parts of KKK design.

1.2 This procedure is valid only for those products which are under the inspection purview of BHEL or its authorised agencies.

1.3 Special requirements if any shall be specified separately.

2.0 MATERIALS

2.1 Materials used shall be as per the drawing requirement.

3.0 WORKMANSHIP

3.1 The product made to this procedure shall have workman like finish. Also it will be the responsibility of the fabricator to organise to produce a quality product.

3.2 Any deviation in Engineering and Material Preparation joints shall have prior approval of BHEL product Engineering department.

3.3 Plates and sheets shall be cut to size by shearing, machine cutting or flame cutting. Flame cut edges shall be cleared to remove slag. and uneven edges shall be dressed by grinding, Gas cutting notches shall be filled up by welding and ground before taking up for further fabrication.

3.4 Ensure drying of electrodes.

3.5 Ensure correct selection of electrodes.

3.6 Welders employed in the product shall be qualified as per AWS D1.1.75. The finished product shall be completely free from defects which are injurious to component strength or to the appearance.

3.7 Proper welding sequence shall be adopted to minimise distortion.

4.0 DIMENSIONS AND OTHER DETAILS

4.1 All dimensions shall be as per the production drawing concerned.

4.2 Wherever tolerances have been indicated in the drawing the same shall be strictly followed.

4.3 For untoleranced dimension the following tolerance shall be followed for fabrication (DIN 7168)

Nominal size (mm)	Tolerance (mm)
Upto 315	+/- 1.0
Over 315 to 1000	+/- 2.0
Over 1000 to 2000	+/- 3.0
Over 2000 to 4000	+/- 4.0
Over 4000 to 8000	+/- 5.0
Over 8000 to 12000	+/- 6.0
Over 12000 to 16000	+/- 7.0
Over 16000 to 20000	+/- 8.0

4.4 Fover untolera-nced dimension, the following tolerance shall be followed for machining (DIN 7168)

...../-

Nominal size (mm)			Tolerance (mm)
Over 0.5	to	3	+/- 0.10
Over 3	to	6	+/- 0.10
Over 6	to	30	+/- 0.20
Over 30	to	120	+/- 0.30
Over 120	to	315	+/- 0.50
Over 315	to	1000	+/- 0.80
Over 1000	to	2000	+/- 1.20
Over 2000	to	4000	+/- 2.00
Over 4000	to	8000	+/- 3.00
Over 8000	to	12000	+/- 4.00
Over 12000	to	16000	+/- 5.00
Over 16000	to	20000	+/- 6.00

4.5 The parting flanges shall be in the same plane. Also the flanges shall be free from bend, distortion and out of squareness.

4.6 The deviation from flatness of flanges shall be 1 mm/metre or part ther of subject to a maximum of 3 mm/(wherever not shown in he drawing).

4.7 For rectangular flanges, the centreline of the bolt holes on opposite faces shall be parallel within a limit of +- 1.5 mm.

4.8 For circular flanges, the centre distance of diametrically opposite bolt holes shallnot exceed +- 1.5 mm.

4.9 Pitch distance of two consequtive holes shall be within +-1 mm. However, in case of rectangular flanges, the maximum cumulative varia-tion in hole pitch shall not exceed +- 2 mm.

...../-

4.10 The deviation from flatness of contact faces shall not exceed 3 mm (for unma-chined faces)

5.0 IMPORTANT CHARACTERISTICS
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5.1 Development to respective sha-pes as per drawing of individual parts shall be checked.

5.2 No projection shall be allowed inside the static parts after assembly in the air flow direction.

5.3 Welds shall be free from burn through

5.4 The welds shall be free from slag, spatter and the tacks shall be ground off.

5.5 Welds shall be checked for its size and appearance.

5.6 Undercuts and all defects shall be repaired. Notches or burning of metal more than 0.8 mm shall be termed as undercut.

5.7 The individual component shall be free from skew or twist.

6.0 MANUFACTURE:

6.1 SUCTION CHAMBER

6.1.1 The suction chamber shall be fabricated as per the latest drawing,

6.1.2 The individual dimension of the circular and square section of the suction chamber shall be checked before joining.

6.1.3 The dimension of the completed suction chamber shall be checked and recorded in the History card NO. 49-372(AP1 16/11, AP1 18/11, AP1 17/12).

...../-

6.1.4 Ensure the centreline marking of the shaft axis in the suction chamber.

6.1.5 The suction chamber foot shall be checked as per the drawing.

6.1.6 The location of the suction chamber foot on to the suction chamber shall be marked and checked as per the drawing.

6.1.7 Check the horizontallity of the shaft axis after welding the foot.

6.1.8 The height of the suction chamber shall be checked.

6.1.9 While fixing support for shaft protecting tube ensure parting is vertical 1 for FD application (View from suction side.).

6.2 SUCTION MOUTH WITH HUB.

6.2.1 Indivi, dual piece shall be checked for its profile after bending.

6.2.2. During fabrication of bullet assembly, care shall be exercised for position of bearing support plate with reference to bigger end of the bullet, with proper machining allowance.

6.2.3 Maintain uniform gap between the parting flange of the bullet.

6.2.4 During trial assembly of bullet (Hub 1100/1200) the concentricity of the bullet centre with suction mouth shall be checked. Also the projection of bullet (hub 1100/1200) bigger end with proper machining allowance shall be ensured.

...../-

6.2.5 Ensure machining allowance at the foot of suction mouty with hub ofter assembly.

6.2.6 The completed assembly of the suction mouth with hub shall be checked after machining

the foot and the dimensions shall be recorded in the History sheet No.49-370 (AP1 16/11, AP1 18/11, AP1 17/12).

6.3 IMPELLER CASING;

6.3.1 The impeller housing shall be fabricated as per the latest drawing,

6.3.2 The Ovality of the impeller housing shall be checked after welding.

6.3.3 Care shall be exercised in providing machining allowances during fabrication to mainta-in the height of the impeller housing and inside diameter.

6.3.4 Trial assembleimpeller casing, suction mouth with hub and suction chamber and the inside diameter shall be checked after inside machining as per drawing and record the dimension in the History Card No. 49-363.

6.4 DIFFUSER:

6.4.1 The outlet blades shall. be checked as per the latest drawing,

6.4.2 The location of the outlet blades sha-ll be checked as per the drawing.

6.4.3 The outlet blade welding shall be checked and care shall be exercised during welding to minimize distortion.

...../-

6.4.4 The dimension of the diffuser foot shall be checked as per the drawing.

6.4.5 The location of the diffuser foot shall be checked as per the drawing.

6.4.6 The height of the diffuser foot shall be checked as per the drawing.

6.4.7 The completed diffuser dimensions shall be checked and recorded in the History Card No. 49-363.

7.0 PAINTING AND PRESERVATION.

7.1 The component shall be thoroughly cleaned to remove spatter, slag, rust, oil or grease or any other foreign materials.

7.2 The inside and outside surface of static parts of AP Fan shall. be painted as per the BPS: 027601-7601

7.3 All the machined surfaces and wold edge preparations shall be given one coat of rust proventive oil.

7.4 The component shall be clea-rly identified with the following details:
WORK ORDER NUMBER
DU NUMBER
PRODUCT NUMBER
MATCH MARKS

8.0 PACKING AND DESPATCH

8.1 All the components shall be suitably despatched to avoid transit damage.

8.2 Proper temporary stiffeners shall be provided to avoid damage.

* * * * * * * * * * * * * *

Q.W.I.No. F: 002 (Rev: 02) Date: 05.12.2012

FAN DIFFUSER ASSEMBLY

Prepared by	Reviewed by	Signature	Approved by
RAM MANOJ CHHIPA Engr/QA	FANS/Engineering		G. BALASUBRAMANIAM SDGM/QA
	QC/OLI		
	OP&C		
	Part Processing		
	QC-SHOP		
	Quality Assurance		
ISSUED BY QUALITY ASSURANCE – BAP/ BHEL RANIPET			

FAN DIFFUSER ASSEMBLY

1.0 SCOPE

1.1 This procedure specifies the Quality requirements for manufacture of diffuser assembly (Axial Fan static parts)

1.2 This procedure is valid only for those products which are under the inspection purview of BHEL or its authorized agencies. Special requirements if any shall be specified separately.

2.0 MATERIALS

2.1 Materials used shall be as per the drawing requirement/GMS.

3.0 Manufacturing

3.1 The product made to this drawing shall have workman like finish. Also it will be the responsibility of the fabricator to organize to produce a quality product.

3.2 The number of joints for the diffuser cover and cone should be restricted to minimum.

3.3 The job should be proceeded only after getting cutting plan approval from Outsourcing Department.

3.4 **In any case, less than 500 mm joints should not be allowed**.

3.5 In all joints, 10% random LPI should be carried out.

3.6 Considering the availability of minimum size of the plate (PL.6x1250x6300 & PL.6x1510x6300) and existing rolling capacity, the maximum radial and axial joints are allowed as follows.

SL.NO	PROJECT	MAXIMUM RADIAL JOINTS	MAXIMUM AXIAL JOINTS	APPLICATION
01	210 MW	1	8	FD, PA
02	500 MW & above	2	9	FD, PA
03	660 MW & above	3	13	ID

3.7 If number of joints are more than the above norms, the layout should be approved by Engineering, subject to feasibility of design requirements.

FAN DIFFUSER ASSEMBLY

3.8 Plates and sheets shall be cut to size by shearing machining or flame cutting. Flame cut edges shall be cleaned to remove slag and uneven edges shall be dressed by grinding. Gas cut notches shall be filled by welding and ground before taking up further fabrication.

3.9 Welder employed in the production shall be qualified as per AWS:D.1.1.(latest)

3.10 The finished product shall be completely free from defect which is injurious to the component strength or the appearance.

3.11 Proper welding sequence shall be adopted to minimize distortion.

3.12 Weld reinforcement surface should be flush ground only on the inner side of the diffuser shell (on flow path).

3.13 Weld seams should not cross minimum distance should be at least 100mm.

3.14 Stiffener location should be away from the joints by about 50 mm. Radial stiffner length shall be minimum 1 meter.

3.15 Weld joint should be at least 30mm away from drill holes of flanges.

3.16 Plus joint is not allowed.

3.17 Gap between vertical joints shall be equal to or more than 500mm.

3.18 The offset distance between two axial joints shall be equal or more than 500 mm.

3.19 Flange: Length shall be minimum 1 meter subjected to number of joints as below in the Table

Diameter (in meter)	Number of Joints
2 to 3	4
3 to 4	6
4 to 5	7
5 to 6	9

FAN DIFFUSER ASSEMBLY

4. Dimensional and other details.

4.1 All dimensions shall be as per the production drawing concerned. Wherever tolerances have been indicated in the drawing, the same shall be strictly followed.

For untoleranced dimensions PR: QA: 500 latest shall be referred for tolerances.

4.1 For circular flanges the centre distance of diametrically opposite bolt holes shall be as per annexure 1. Holes shall be drilled.

4.2 Pitch distance of the consecutive holes shall be within ± 1mm. However in case of rectangular flanges the max. Cumulative variation in hole pitch shall not exceed ± 2mm.

4.3 After rolling the diameters of core and cover should be measured. The variation in diameter should not exceed ± 3mm.

4.4 The setting of the diffuser cover and core for assembly should be done on a leveled surface. The distance between the diffuser cover and core should be measured at every 45^0 and it should be maintained equally at top and bottom respectively. The surface of the diffuser core should be perpendicular to the leveled surface when the assembly is being done. The concentricity between the cover and core should be maintained within ± 3mm.

5. Important Characteristics

5.1 Development to respective shapes as per drawing of individual parts shall be checked.

5.2 **No projection shall be allowed inside the static parts after assembly in the flow direction.** Welds shall be free from burn through.

5.3 The weld shall be free from slag, spatter and the tacks shall be suitably removed.

5.4 Welds shall be checked for its size and appearance. Undercuts and all defects shall be repaired.
Notches or burning of metal more than 0.8 mm shall be termed as undercuts.

5.5 The ID of the diffuser cover at the bigger end and ID of the cylindrical piece to be welded to this piece should be same and within the specified tolerances.

5.6 Diffuser feet shall be welded on to diffuser maintaining level and height as per drawing.

5.7. If the flanges are made from segments, joints and edge preparations are to be made as per standard issued by OP & C / EDC.

5.8 Shell dimension to be checked and any variation in dimension to be corrected before Proceeding further assembly.

5.9 Core is to be checked for the dimension, ovality etc.

5.10 The outlet blades shall be checked and care should be exercised during welding of blade to minimize distortion.

5.11 The dimension of the diffuser foot shall be checked as per the drawing. The location and the height of the diffuser foot shall be checked as per the drawing. The completed diffuser dimensions shall be checked and recorded in the history card. Weld "T" rail in core in position.

5.12 Before checking final dimension, the flange warpage, water level, plumb out are to be corrected.

5.13 All the handles, required washers, taper washers are to be placed in position before dispatch.

5.14 All drilled holes are to be clear from the weld and proper space to be available for nut or bolt.

5.15 Ensure that all the transport stiffeners are welded and identified in yellow color. These should be welded without stress.

6.0 Painting and preservation.

6.1 The component shall be thoroughly cleaned to remove spatter, slag, rust, scale, oil or grease or any other foreign materials.

6.2 The inside and outside surfaces shall be painted as per applicable painting schedule.

6.3 All the machined surfaces and weld edge preparation shall be given one coat of rust Preventive oil.

6.4 The component shall be clearly identified with the following details.

FAN DIFFUSER ASSEMBLY

WO No.
DU No.
Product No.
IR No.
Match marks
NCR No. (if any)
Weight.
Quantity.
Drawing No.

7.0 Packing and Dispatch.

7.1 All the components shall be suitably dispatched to avoid transit damage. Proper stiffners shall be provided to avoid damage as shown in drawing.

ANNEXURE -1

Bolt size	Hole Dia.	Tolerance for pitch circle	Tolerance for Hole
M16	19	± 1 .00	± 0 .5
M20	24		
M24	28	± 1 .00	± 0 .8
M30	35		
M35	40		
M42	46		

FAN DIFFUSER ASSEMBLY

REVISION HISTORY

I) **Following amendments were carried out in Amendment A1 of Rev.00**

Clause No.	Amended As	Basis for Amendment / Remarks
3.4	AWS D1.1.83 shall be read as AWS D1.1 latest	Document referred is to be latest.
4.1	Following is added. "For untoleranced dimensions PR:QA:500/ latest shall be referred for tolerances: Annexure -1 is withdrawn.	PR: QA:500 is the document for untoleranced dimensions.
6.2	Painting shall be done as per RP 0674199/latest	Painting schedule RP 0674199

II) **Following amendments carried out in Amendment A2 Rev.00**

Clause No.	Amended As	Basis for Amendment / Remarks
5.7	Diffuser feet shall be welded on to diffuser maintaining level and height as per drawing.	Machining of Diffuser foot is not envisaged.
4.1	Annexure on tolerances is with drawn.	Editorial correction.

III) **Following amendments carried out in Rev.01**

Clause No.	Amendments carried out	Basis for Amendment / Remarks
3.2	Considering the availability of minimum size of Pl.6x 1250 width, the no. of radial and axial joints are altered for 210MW & 500 MW.	RND of meeting held on 12.08.11 to finalize the no. of joints in fan diffuser assy..
3.7	Flush grinding on both sides was amended as flush grinding only on inner side of the diffuser shell.	

FAN DIFFUSER ASSEMBLY

IV) **Following amendments carried out in Rev.02**

Clause No.	Amendments carried out	Basis for Amendment / Remarks
3.6	Considering the availability of minimum size of Pl.6x 1250 width , the no. of radial and axial joints are altered for 210MW, 500MW & above & 660MW and above MW	RND of meeting held on 04.12.2012
3.14	Radial stiffner length introduced.	
3.16	Plus joint not allowed.	
3.17	Gap between vertical joints Introduced	
3.18	Offset distance between two axial joints Introduced	
3.19	Table for flange length Introduced	
Annexure	Tolerance on PCD amended as ± 1 .00	

BHEL/Ranipet
Quality Assurance

QCP:F:007/01 Dt: 15/03/2018

Quality Control Procedure for

Axial Fan Suction Chamber

Prepared By	Reviewed by	Signature	Approved By
	Fans/ Engineering		
	OP&C		
	QC		
	QA		

1.0 SCOPE

1.1 This procedure specifies the quality requirements for the manufacture of AXIAL FAN SUCTION CHAMBER.

1.2 This procedure is valid only for those products, which are under the inspection purview of BHEL or its authorized agencies. Special requirements if any shall be specified separately.

2.0 MATERIALS

2.1 Materials used shall be as per the GMS reqts.

3.0 MANUFACTURING

3.1 The product made to the drg shall have workman like finish. Also responsibility of the fabricator to organize to produce a quality product.

3.2 The no. of joints made should be restricted to min. For 210 MW max. three joints and for 500MW &600MW max. four joints are allowed.

Material preparation segments (joints) for axial fan suction chamber 660MW and above as tabulated below:

A. Inlet Cone		
Sl No.	Description of item	No of segments (Joints) Max.
a	Cone I	6
b	Cone II	6
c	Cone III	6
d	Cylinder	2
B. Suction Box U- Plate		8
C. Suction Box side plate		3

Recommended to use higher width plate (1510 mm). If any material size Constraint, Engineering clearance to be obtained for additional joints (Layout). Plus joint should be avoided.

3.3 Plates and sheets shall be cut to size by shearing machine or flame cutting. Flame cut edges shall be cleaned to remove slag and uneven edges shall be dressed by grinding. Gas cut notches shall be filled up by welding and ground before taking up further fabrication.

3.4 Welding employed in the production shall be qualified as per AWSD1.1.

3.5 The finished product shall be completely free from defects.

3.6 Proper welding sequence shall be adopted to minimize distortion.

3.7 Surface should be flush ground on both sides of joints after welding.

3.8 Weld seams should not cross, min distance should be at least 100mm.

3.9 Stiffener location should be away from the joints by about 50mm.

3.10 Weld joint should be at least 30mm away from holes of flanges.

4.0 DIMENSIONAL AND OTHER DETAILS

4.1 All dimensions shall be as per the production drawing concerned. Wherever tolerances have been indicated in the drawing, the same shall be strictly followed.

4.2 Pitch distance of the consecutive holes shall be within +/- 1mm however in case of rectangular flanges the max cumulative variation in hole pitch shall not exceed +/- 2mm.

4.3 The deviations on the flatness of the circular rectangular flanges should not exceed 1.5mm.

4.4 After rolling, the diameters should be measured. The variation in diameter should not exceed +/- 3mm.

5.0 IMPORTANT CHARACTERISTICS

5.1 Diagonals at the entry to be checked and recorded.

5.2 Diameter at the circular outlet to be checked in 4 places.

5.3 Assy to be done on levelled surface.

5.4 The flanges at rectangular section to be levelled by water level within 2mm and plumb to be dropped from 4 points of the circular flange level should be within 2mm. check during tack welding and final welding.

5.5 Development of the items shall be as per drawing.

5.6 Ensure that all transport stiffeners are welded and painted in yellow colour. Transport stiffeners should be welded without stress.

5.7 During assly stage after levelling etc., the Centre at the suction entry should be projected on the levelled surface and the distance upto the circular flange at the exit must be checked.

6.0 PAINTING AND PRESERVATION

6.1 The component shall be thoroughly cleaned to remove spatter, slag, rust, scale, oil or grease or any other foreign materials.

6.2 The inside & outside surface shall be painted as per relevant customer approved painting schedule

6.3 All the machined surfaces shall be given one coat of rust preventive oil.

6.4 The component shall be clearly identified with the following details: --

WO No.
DU No.
Product No.
Match marks
IR No.

7.0 PACKING AND DISPATCH

7.1 All the components shall be suitably despatched to avoid transit damage. Proper temporary stiffeners shall be provided to avoid damage.

बी एच ई एल BHEL	MANUFACTURER'S NAME& ADDRESS M/S **BHEL: BAP : RANIPET** TAMIL NADU-632 406	**MANUFACTURING QUALITY PLAN** ITEM /SUBSYSTEM Bearing pedestal & Base frames for Hydraulic coupling & Motor	SQP :FAN::315 REV : NO:00 DATE: 16 03 04 PAGE :01 OF 05	PROJECT : **STANDARD** PACKAGE: : - CONTRACTOR : **BHEL / RANIPET**

SL NO	COMPONENT & OPERATION	CHARACTERISTICS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORDS	AGENCY M	AGENCY B	
1	2	3	5	6	7	8				10
1.0	RAW MATERIALS									
1.1	PLATES FOR CASING	CHEMICAL& MECHANICAL PROPERITIES	VERIFICATION OF GROUP TC	100%	RESPECTIVE MATERIAL STANDARD		TC	P	V	-
2.0	**INPROCESS INSPECTION OF**									
2.1	WELDING	SOUNDNESS	VISUAL &MT/PT	100%	DRAWING & Note- I&II BHE:NDT:RP:PT01/ BHE:NDT:RP:MT01		-	P	W	
2.2	DIMENSIONAL INSPECTION	DIMENSIONS COMPLIANCE TO	MEASUREMENT	100%	DRAWING &Note -III		DR	P	W	
2.3	STRESS RELIEF	STRESS RELIEF	VERIFICATION OF HT CHART	100%#	BAP: HT:005/LATEST& Note-IV		DR	P	W	# UP TO SIZE 33 NEED NOT BE STRESS RELIVED.
2.3	**MACHINING**	HEIGHT ,HOLES SIZE & PITCH DISTANCES ,PARALLELIISM,, THREADING	MEASUREMENT	100%	-DO-		DR	P	W	
3.0	**FINAL INSPECTION**									
3.1	IDENTIFICATION ,PAINTING& PRESERVATION	COMPLIANCE TO COMPANY STANDARD-	VISUAL	100%	PRQA:590/LATEST & Notes V		--	P	W	

LEGENDS:
M - MANUFACTURER / SUBCONTRACTOR
B - BHEL /AUTHORISED INSPECTION AGENCY.
P - PERFORM ED , V - VERIFICATION, W - WITNESS
R - REPORT T C - TEST CERTIFICATE

PREPARED BY :		APPROVED BY :
REVIEWED BY :	QC-OLI	
	QC-SHOP	
	QA	B. Srinivasa Rao

	MANUFACTURER'S NAME& ADDRESS M/S **BHEL: BAP : RANIPET** TAMIL NADU-632 406	**MANUFACTURING QUALITY PLAN** ITEM /SUBSYSTEM Bearing pedestal & Base frames for Hydraulic coupling & Motor	SQP :FAN::315 REV : NO:00 DATE: 16 03 04 PAGE :01 OF 05	PROJECT : **STANDARD** PACKAGE: : - CONTRACTOR : **BHEL / RANIPET**

SL NO	COMPONENT & OPERATION	CHARACTERISTICS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORDS	AGENCY M	AGENCY B
1	2	3	5	6	7	8	10		

I Gas cutting and fit up

1 The base plates shall be properly stiffened to avoid distortion (two base plates may be back to back tack welded to avoid distortion)
Plates shall be cut to size by shearing of flame cutting. Flame cut edges shall be dressed by grinding. Gas cut notches shall be filled up by welding and ground before taking up further fabrication. The plates shall be free from any gas cut /shearing defects

2 The fit up gaps shall not exceed 1 mm

3 Squarness of the base plates /ribs shall be ensured.

4 Hole should not foul with area where another hole is coming . No gap between pad plate and main plate is allowed.

II Welding & MPI

1 All the welds are to be checked by MPI.

2 The sequence of welding and MPI checking are very important in view of non- availability of accessibility once all welding is over.

3 Hence the following sequence can be followed.

a. Weld the bottom plate with stiffener plates
b. Check with MPI all the welds- correct, recheck, repeat till the defects are rectified.
c. Keep the top plate at the bottom, place the welded assembly upside down on this. Do the welding by manipulating the welding electrodes through various
Openings. After all welding is over check with MPI on all accessible areas, correct any defects any recheck. Repeat till all defects are rectified.

4 Welders employed in the production shall be qualified as per AWS D1.1.

5 The finished product shall be completely free from defects which are injurious to the component strength or to the appearance.

6 Proper welding sequence shall be adopted to minimise distortion.

7 The base plates shall be properly stiffened to avoid distortion (two base plates may be back to back tack welded to avoid distortion)

8 All the 45 Degree edges on the stiffener plates should be carefully cut so that they do not interfere with the weld profiles during assembly.

बी एच ई एल BHEL	MANUFACTURER'S NAME& ADDRESS M/S **BHEL: BAP : RANIPET** TAMIL NADU-632 406	**MANUFACTURING QUALITY PLAN** ITEM /SUBSYSTEM Bearing pedestal & Base frames for Hydraulic coupling & Motor	SQP :FAN::315 REV : NO:00 DATE: 16 03 04 PAGE :01 OF 05	PROJECT : **STANDARD** PACKAGE: : - CONTRACTOR : **BHEL / RANIPET**

SL NO	COMPONENT & OPERATION	CHARACTERISTICS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORDS	AGENCY	
								M	B
1	2	3	5	6	7	8		10	

III DIMENSIONAL AND OTHER DETAILS

1) For untoleranced dimensions tolerances follow PRQA:500/Latest

2) Parallelism should be maintained as per drawing. If it is not given in drawing, the maxi allowed is 4 mm for fabrication.

3) Enough machining allowance should be ensured after fabrication.

4) The marking shall be carried out on a leveled platform.

5) Wherever flatness exceeds more 1.5 mm, shall be locally heated to remove the distortion.

6) Breather holes shall be plugged before machining

IV Heat treatment

1) BAP:HT:001/Latest for Heat treatment

2) Pad plates seal welded on the surfaces should be provided with a small Han drilled hole of Diameter 10 mm (wherever no holes exits on the plate) to allow the Trapped gases to escape during stress relieving.

3) This hole should not foul with area where another hoe is coming. No gap between pad plate and main plate is allowed.

4) Enough machining allowance should be ensured after fabrication.

5) All the threading operations should preferably be done after stress relieving.

बी एच ई एल BHEL	MANUFACTURER'S NAME& ADDRESS M/S **BHEL: BAP : RANIPET** TAMIL NADU-632 406	**MANUFACTURING QUALITY PLAN** ITEM /SUBSYSTEM Bearing pedestal & Base frames for Hydraulic coupling & Motor	SQP :FAN::315 REV : NO:00 DATE: 16 03 04 PAGE :01 OF 05	PROJECT : **STANDARD** PACKAGE: : - CONTRACTOR : **BHEL / RANIPET**

SL NO	COMPONENT & OPERATION	CHARACTERISTICS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORDS	AGENCY	
								M	B
1	2	3	5	6	7	8			10

V Painting & despatch

1) The components shall be thoroughly cleaned to remove spatter, slag rust, scale, oil or grease or assembly other foreign materials.

2) The surface shall be painted as per painting schedule PRQA:590/Latest

3) All the machined surface shall be given one coat of rust preventive oil.

4) The components shall be clearly identified with the following details:-

DU No.,Product No.,IR No.,NCR No. (if any),Sub-contractors code No.

****

बी एच ई एल BHEL RANIPET-6	BHEL: BAP:RANIPAT TAMIL NADU – 632 406 QUALITY DEPARTMENT	**STANDARD QUALITY PLAN** **RVC ASSY**	QP:No **: FAN 302** Rev: No: 01 Date : 09 02 10 **Page 01 Of 14**
		NAME OF CONTRACT PACKAGE **STANDARD**	

SL NO 1	COMPONENT & OPERATION 2	CHARACTERISTICS 3	TYPE OF CHECK 4	CLASS 5	QUANTUM OF CHECK 6	REFERENCE DOCUMENTS 7	ACCEPTANCE NORMS 8	FORMAT OF RECORD 9	Agency 10		REMARKS 11
									M	B	
1.0	MATERIALS										
1.1	RAW MATERIALS										
1.1.1	PLATES,STEELS RODS	CHEM&MECH PROPERTIES	MAJOR	VERIFICATION	100%	RESPECTIVE MATERIAL SPECIFICATION		TC	P	V	
1.2	BOUGHT OUTY ITEMS										
1.2.1	DRY BUSH,DIAL PLATES,ECCENTRIC BUSH,FIXED BRG	COMPLIANCE TO P.O.	MAJOR	VERIFICATION	100%	PURCHASE SPEC		TC/DR	P	V	

LEGENDS:
M-MANUFACTURER /SUBCONTRACTOR
B- BHEL/BHEL AUTHORISED INSPECTION AGENCY

P- PERFORM, V- VERIFICATION, W-WITNESS
R-REPORT TC-TEST CERTIFICATE
LPI:LIQUID PENETRANT INSPECTION
MT:MAGNECTIC PARTICLE INSPECTION

PREPARED BY :

(KRajadurai)
DM/QA

REVIEWED & APPROVED BY:

(M G Rajashankar,DGM/QA)

Rev 00 dt 12 12 2000 ORIGINAL ISSUE : REV 01 DT 10 02 10 REVISED BASED ON THE SITE ISSUES FROM PARLI & REVIEWED WITH ENGG –FES & QC –OLI

RANIPET-6	BHEL: BAP:RANIPAT TAMIL NADU – 632 406 QUALITY DEPARTMENT	**STANDARD QUALITY PLAN** **RVC ASSY**	NAME OF CONTRACT PACKAGE **STANDARD**	QP:No **: FAN 302** Rev: No: 01 Date : 09 02 10 **Page 02 Of 14**

SL NO 1	COMPONENT & OPERATION 2	CHARACTERISTICS 3	TYPE OF CHECK 4	CLASS 5	QUANTUM OF CHECK 6	REFERENCE DOCUMENTS 7	ACCEPTANCE NORMS 8	FORMAT OF RECORD 9	Agency 10 M	Agency 10 B	REMARKS 11
2.0	INPROCESS INSPECTION										
2.1	GAS CUTTING/ SHEARING	SHAPE &SIZE	MAJOR	MEASUREMENT	100%	DRAWING NOTE 3		DR	P	W	
2.2	OUTER CONE ASSY										
2.2.1	ROLLING/ FORMING	ID,OD,HEIGHT PROFILE FLANGE DIMENSIONS	MAJOR	-DO-	100%	DRAWING NOTE 2		DR	P	W	
2.2.2	WELDING			-DO-	100%	DRAWING & NOTE 1		-	P	W	
2.2.3	WELD SOUNDNESS	WELD SIZE & FINISH	MAJOR								
		WELD SOUNDNESS.	MAJOR	PT	100%	BHE:NDT:RP:PT01/LATEST		NDT REPORT	P	W	

RANIPET-6	BHEL: BAP:RANIPAT TAMIL NADU – 632 406 QUALITY DEPARTMENT	**STANDARD QUALITY PLAN** **RVC ASSY**	NAME OF CONTRACT PACKAGE **STANDARD**	QP:No **: FAN 302** Rev: No: 01 Date : 09 02 10 **Page 03 Of 14**

SL NO 1	COMPONENT & OPERATION 2	CHARACTERISTICS 3	TYPE OF CHECK 4	CLASS 5	QUANTUM OF CHECK 6	REFERENCE DOCUMENTS 7	ACCEPTANCE NORMS 8	FORMAT OF RECORD 9	Agency 10		REMAR KS 11
									M	B	
2.2.4	MACHINING	PCD,HOLE DIA BUSH HOLE ORIENTATION FLANGE HOLES MATCHING, HT OF THE CONE, CIRCULARITY OF THE CONE, CONCENTRICITY OF INLET CONE W.R. TO FLANGE PCD OF FLANGE, HEIGHT OF CONE.	MAJOR	MEASUREMENT	100%	DRAWING NOTE 2			P	W	
2.3	INNER CONE ASSY										
2.3.1	ROLLING/ FORMING	ID,OD,HEIGHT OF CONE, SHELL ID, OD, HEIGHT	MAJOR	MEASUREMENT	100%	DRAWING NOTE 2		DR	P	W	
2.3.2	WELDING	WELD SIZE &FINISH	MAJOR	VISUAL	100%	DRAWING & NOTE 1		-	P	W	
		WELD SOUNDNESS	MAJOR	PT	100%	BHE:NDT:RP:PT01/LATEST		NDT REPORT	P	W	

RANIPET-6	BHEL: BAP:RANIPAT TAMIL NADU – 632 406 QUALITY DEPARTMENT	**STANDARD QUALITY PLAN** **RVC ASSY**	NAME OF CONTRACT PACKAGE **STANDARD**	QP:No **: FAN 302** Rev: No: 01 Date : 09 02 10 **Page 04 Of 14**

SL NO 1	COMPONENT & OPERATION 2	CHARACTERISTICS 3	TYPE OF CHECK 4	CLASS 5	QUANTUM OF CHECK 6	REFERENCE DOCUMENTS 7	ACCEPTANCE NORMS 8	FORMAT OF RECORD 9	Agency 10		REMARKS 11
									M	B	
2.3.3	MACHINING	DRILL HOLES PCD, HOLES DIA BUSH HOLE ORIENTATION FLANE FACING SHELL ID.	MAJOR	MEASUREMENT	100%	DRAWING NOTE 2			P	W	
2.4	BLADE ASSY										
2.4.1	PRESSING/ FORMING	SHAPE &SIZE	MAJOR	MEASUREMENT	100%	DRAWING NOTE 2		DR	P	W	
2.4.2	WELDING	FIT UP OF STRIP WIH BLADE	MAJOR	VISUAL	100%	ORIENTATION FOR CW/ ACW/ W.R. TO ROTATION.		DR	P	W	
		SIZE WELD FINISH	MAJOR	VISUAL	100%	DRAWING & NOTE 1		-	P	W	

RANIPET-6	BHEL: BAP:RANIPAT TAMIL NADU – 632 406 QUALITY DEPARTMENT	**STANDARD QUALITY PLAN** **RVC ASSY**	NAME OF CONTRACT PACKAGE **STANDARD**	QP:No **: FAN 302** Rev: No: 01 Date : 09 02 10 **Page 05 Of 14**

SL NO 1	COMPONENT & OPERATION 2	CHARACTERISTICS 3	TYPE OF CHECK 4	CLASS 5	QUANTUM OF CHECK 6	REFERENCE DOCUMENTS 7	ACCEPTANCE NORMS 8	FORMAT OF RECORD 9	Agency 10		REMARKS 11
									M	B	
2.5	OPERATING/ REGULATING RING										
2.5.1	ROLLING/ FORMING	ID,OD,HEIGHT, CONE ID, RING ID, OD	MAJOR	MEASUREMENT	100%	DRAWING NOTE 2		DR	P	W	
2.5.2	WELDING	WELD SIZE FINISH& SOUNDNESS	MAJOR	VISUAL	100%	DRAWING NOTE 1 BHE:NDT:RP:PT01/LATEST		DR	P	W	
2.5.3	MACHINING	RING OD THICKNESS FACE OUT DRILL HOLE ORIENTATION PCD, DIA LOCATIN OF RING & DRILLED HOLES ,PITCH DISTANCES	MAJOR	VISUAL	100%	DRAWING & NOTE 2		DR	P	W	

RANIPET-6	BHEL: BAP:RANIPAT TAMIL NADU – 632 406 QUALITY DEPARTMENT	**STANDARD QUALITY PLAN** **RVC ASSY**	NAME OF CONTRACT PACKAGE **STANDARD**	QP:No **: FAN 302** Rev: No: 01 Date : 09 02 10 **Page 06 Of 14**

SL NO 1	COMPONENT & OPERATION 2	CHARACTERISTICS 3	TYPE OF CHECK 4	CLASS 5	QUANTUM OF CHECK 6	REFERENCE DOCUMENTS 7	ACCEPTANCE NORMS 8	FORMAT OF RECORD 9	Agency 10		REMAR KS 11
									M	B	
2.6	EXTENSION ASSY										
2.6.1	ROLLING	SHELL ID, OD HEIGHT & FLANGE DIMENSIONS	MAJOR	MEASUREMENT	100%	DRAWING NOTE 2		DR	P	W	
2.6.2	WELDING	WELD SIZE & SHAPE	MAJOR	MEASUREMENT	100%	DRAWING NOTE 1		DR	P	W	
2.6.3	MACHINING	DRILL HOLE PCD, ID & ORIENTATION OF RING, STEP MACHINING,PITCH DISTANCE & VERITICALITY OF HOLES ,	MAJOR	MEASUREMENT	100%	DRAWING & NOTE 2		DR	P	W	

RANIPET-6	BHEL: BAP:RANIPAT TAMIL NADU – 632 406 QUALITY DEPARTMENT	**STANDARD QUALITY PLAN** **RVC ASSY**	NAME OF CONTRACT PACKAGE **STANDARD**	QP:No **: FAN 302** Rev: No: 01 Date : 09 02 10 **Page 07 Of 14**

SL NO 1	COMPONENT & OPERATION 2	CHARACTERISTICS 3	TYPE OF CHECK 4	CLASS 5	QUANTUM OF CHECK 6	REFERENCE DOCUMENTS 7	ACCEPTANCE NORMS 8	FORMAT OF RECORD 9	Agency M	Agency B	REMARKS 11
									10		
2.7	ACUATING SHAFT ASSY										
2.7.1	MACHINING	OD,LENGTH,KEY WAY DIEMSIONS ,KEY OFFEST,THRED SIZE CHECKING BY GAUGE,STEP OD	MAJOR	MEASUREMENT	100%	DRAWING NOTE 2		DR	P	W	
2.8	CONTROL LINK ASSY										
2.8.1	WELDING	WELD SIZE	MAJOR	VISUAL	100%	DRAWING & NOTE-1		DR	P	W	
2.8.2	CONTROL LINK ASSY	LENGTH, PERPENDICULARITY,	MAJOR	MEASUREMENT		DRAWING NOTE 2		DR	P	W	

RANIPET-6	BHEL: BAP:RANIPAT TAMIL NADU – 632 406 QUALITY DEPARTMENT	**STANDARD QUALITY PLAN** **RVC ASSY**	NAME OF CONTRACT PACKAGE **STANDARD**	QP:No **: FAN 302** Rev: No: 01 Date : 09 02 10 **Page 08 Of 14**

SL NO 1	COMPONENT & OPERATION 2	CHARACTERISTICS 3	TYPE OF CHECK 4	CLASS 5	QUANTUM OF CHECK 6	REFERENCE DOCUMENTS 7	ACCEPTANCE NORMS 8	FORMAT OF RECORD 9	Agency 10		REMARKS 11
									M	B	
2.9	ACTUATING LEVER ASSY										
2.9.1	GAS CUTTING	SHAPE & SIZE	MAJOR	MEASUREMENT	100%	DRAWING & NOTE 3		DR	P	V	
2.9.2	WELDING	WELD SIZE	MAJOR	VISUAL	100%	DRAWING & NOTE-1		DR	P	W	
2.9.3	MACHINING CLEVIS	LENGTH, ,DEPTH, HOLE ORIENTATION AND DIA, BORE DIA, KEY WAY DIMENSIONS ,SURFACE FINISH	MAJOR	MEASUREMENT	100%	DRAWING NOTE 2		DR	P	W	
2.10	INNER SPINDLE										
2.10.1	GAS CUTTING	SHAPE & SIZE	MAJOR	MEASUREMENT	100%	DRAWING &NOTE 3		DR	P	V	

RANIPET-6	BHEL: BAP:RANIPAT TAMIL NADU – 632 406 QUALITY DEPARTMENT	**STANDARD QUALITY PLAN**		QP:No **: FAN 302** Rev: No: 01 Date : 09 02 10 **Page 09 Of 14**
		RVC ASSY	NAME OF CONTRACT PACKAGE **STANDARD**	

SL NO 1	COMPONENT & OPERATION 2	CHARACTERISTICS 3	TYPE OF CHECK 4	CLASS 5	QUANTUM OF CHECK 6	REFERENCE DOCUMENTS 7	ACCEPTANCE NORMS 8	FORMAT OF RECORD 9	Agency 10		REMAR KS 11
									M	B	
2.10.2	INNER SPINDLE										
	MACHINING	OD,LENGTH, SLOT LENGTH & DEPTH,HOLE DIA ,PIN DIMENSIONS, LEVER BOSS DIMENSIONS, LEVER PLATE ORIENTATION W.R.T SLOT	MAJOR	MEASUREMENT	100%	DRAWING NOTE 2		DR	P	W	
2.10.4	WELDING	WELD SIZE & WELD QUALITY	MAJOR	VISUAL& DP	100%	BHE:NDT:RP:PT:01/LATEST		REPORT	P	V	
2.11	OUTER SPINDLE		MAJOR	VISUAL	100%	DRAWING & NOTE-2		DR	P	W	
2.11.2	MACHINING CLEVIS	LENGTH,SLOT WIDTH,DEPTH, HOLE ORIENTATION AND DIA, THREAD SIZE CHEKING BY RING GAUGE, END BLOCK THRED CHECK BY PLUG GAUGE,	MAJOR	MEASUREMENT	100%	DRAWING NOTE 2		DR	P	W	

RANIPET-6	BHEL: BAP:RANIPAT TAMIL NADU – 632 406 QUALITY DEPARTMENT	**STANDARD QUALITY PLAN** **RVC ASSY**	NAME OF CONTRACT PACKAGE **STANDARD**	QP:No **: FAN 302** Rev: No: 01 Date : 09 02 10 **Page 010 Of 14**

SL NO 1	COMPONENT & OPERATION 2	CHARACTERISTICS 3	TYPE OF CHECK 4	CLASS 5	QUANTUM OF CHECK 6	REFERENCE DOCUMENTS 7	ACCEPTANCE NORMS 8	FORMAT OF RECORD 9	Agency M	Agency B	REMAR KS 11
									10		
3.0	FINAL INSPECTION										
3.1	RVC ASSY *	OVERALL DIMENSIONS, ASSY OF ALL COMPONENTS OPERATION BLADE OPENING AND CLOSING BLADE TO BLADE CLOSING GAP. ANGLE OF OPEN AND CLOSE. BLADE TO INNER CONE 7BLADE TO OUTER CONE GAP. DIRECTION OF OPENING	MAJOR	MEASUREMENT	100%	DRAWING& NOTE 4		DR	P	W	*** OPENING & CLOSING OPERATION SHALL BE DONE SAME AS THAT OF SITE ASSY CONDITION.**
3.2	PAINTING PRESERVATION IDENTIFICATION	IDENTIFICATION OF WO NO. DU NO.	MAJOR	VISUAL	100%	PRQA 590/LATEST		DR	P	W	

REV: 00 DATE 12 12 2000 ORIGINAL ISSUE ; REV: 01 DT 23 01 2010 TOTALLY MODIFIED.

RANIPET-6	BHEL: BAP:RANIPAT TAMIL NADU – 632 406 QUALITY DEPARTMENT	**STANDARD QUALITY PLAN**		QP:No **: FAN 302** Rev: No: 01 Date : 09 02 10 **Page 011 Of 14**
		RVC ASSY	NAME OF CONTRACT PACKAGE **STANDARD**	

SL NO 1	COMPONENT & OPERATION 2	CHARACTERISTICS 3	TYPE OF CHECK 4	CLASS 5	QUANTUM OF CHECK 6	REFERENCE DOCUMENTS 7	ACCEPTANCE NORMS 8	FORMAT OF RECORD 9	Agency M	Agency B	REMARKS 11
									10		

NOTE 1 (a) WELD PROCEDURES AND WELDERS SHALL BE QUALIFIED AS PER AWS D.1.1

(b) ALL THE ELECRODES HAVING LOW HYDROGEN COVERING SHALL BE PURCHASED IN HERMATICALLY SEALED CONTAINERS IMMEDIATELY AFTER OPENING THE HERMETICALLY SEALED CONTAINER, ELECTRODES SHALL BE STOCKED IN OVENS HELD AT TEMP OF ATLEAST 120 DEG C. ELECTRODES THAT HAVE BEEN WET SHALL BE NOT BE USED.

(c) ELECTRODES EXPOSED TO ATMOSPHERE FOR PERIODS OVER THAN 4 HRS SHALL BE BACKED FOR ATLEAS TWO HOURS HOURS BETWEEN 260 TO 430 AND HELD AT 120 DEG UNTIL THEY ARE USED.

(d) FUTILE COATED ELECTRODES SHALL BE DRED AT 120 DEG TO 130 DEG C FOR ONE HOUR BEFORE USE.

(e) IF THE ELECTRODES ARE EXPOSED FOR MORE THAN 4HRS TO THE ATMOSPHERE. THESE SHALL BE RE BAKED AND DRIED IN THE SAME MANNER

(f) WELDS SHALL BE CLEANED THOROUGHLY TO REMOVE THE SPATTER & SLAG
ALL BUTT JOINTS SHALL BE BACKGROUND TO REMOVE ALL SLAG, UNFUSED AREA ETC. AND LPI CHECKED BEFORE FURTHER WELDS. .

NOTE 2 CIRCULAR FLANGE &CONES
(a) PITCH DISTANCES FOR TWO CONSECUTIVE HOLES SHALL BE WITH +/- 1MM
(b) DEVIATION ON FLATNESS SHALL NOT EXCEED 3MM.
(c) INCASE OF CIRCULAR FLANGES THE DIAMETRICALLY OPPOSITE HOLE DISTANCES SHALL NOT EXCEED 1.5MM
(d) HOLES OFFSET WITH REFERANCE TO CENTER LINE OF PCD SHALL NOT EXCEED +/-1MM
(e) FOR UNTOLERANCED DIMENSIONS PRQA 500/LATEST SHALL BE REFERRED.
(f) SEPARATE DIEMSIONAL REPORT AGAINST EACH ITEM AS PER QP SHALL BE FOR ITEMS LIKE INNER SPINDLE, OUTER SPINDLE,LEVER,LINKAGE ASSY,ROLLER,REGULATING RING ,LEVER ASSY,BLADES,EXTENSION ASSY,INNER CONE ,OUTER CONE SWIVEL PIN,STUDS ETC. AND ALL THE REPORT VERIFIED DURING FINAL INSPECTION

NOTE -3 (a) GAS CUTTING NOTCHES EXCEEDING 0.8 MM DEPTH SHALL BE REPAIRED BY WELDING AND GRINDING.
(b) GAS CUT EDGES SHALL BE GROUND SMOOTH BEFORE WELDING.

NOTE-4 OPENING & CLOSING SHALL BE DONE IN SAME SITE ORIENTATION , NO FOULING OF LINKAGE ASY WITH INNER SPINDLE ASSY IS ALLOWED. BLADE OPENING & CLOSING GAPS & DIRECTIONS SHALL BE VERIFIED.

RANIPET-6	BHEL: BAP:RANIPAT TAMIL NADU – 632 406 QUALITY DEPARTMENT	**STANDARD QUALITY PLAN** **RVC ASSY**	QP:No **: FAN 302** Rev: No: 01 Date : 09 02 10 **Page 012 Of 14** NAME OF CONTRACT PACKAGE **STANDARD**

SL NO 1	COMPONENT & OPERATION 2	CHARACTERISTICS 3	TYPE OF CHECK 4	CLASS 5	QUANTUM OF CHECK 6	REFERENCE DOCUMENTS 7	ACCEPTANCE NORMS 8	FORMAT OF RECORD 9	Agency M	Agency B	REMARKS 11
									10		

CHECK LIST FOR RVC ASSY

WO NO
Drg No
DU No

ITEM DESCRIPTION :
FRM NO:

SLNO	DRG DIMENSIONS	ACTUAL	REMARKS

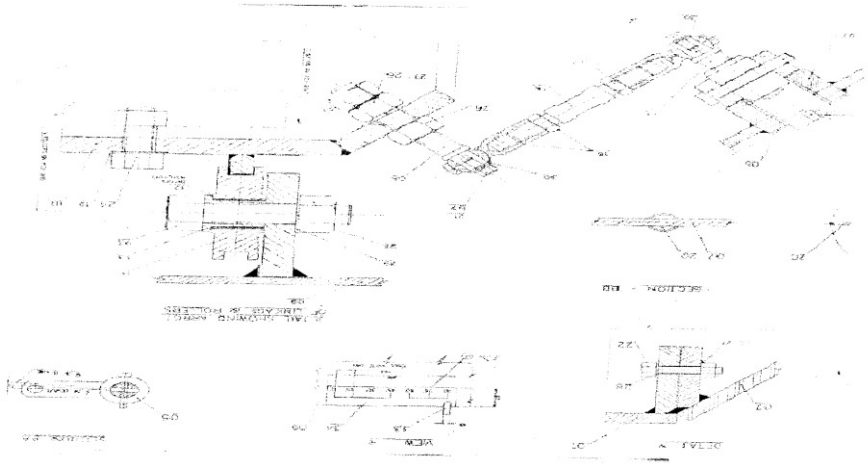
- ***ALL THE DIMENSIONS AS PER DRG SHALL BE RECOREDED AGAINST THE INDIVIDUAL ITEMS .***
- ***DP TEST WHERE EVER CALLED SHALL BE DONE.***
- ***THREADS SHALL BE CHECKED BY GAUGES AND SAME SHALL BE RECORDED .***
- ***ORIENTATIONS AND ANGULAR DIEMSIONS SHALL BE ENSURED BY SUITABLE JIG/FIXTURES AND SAME SHALL BE RECORDED.***
- ***THE STUD ORIENTATION,UNIFORM STUD LENGTH,VERITICALITY OF LEVER,ORIENTATION OF HOLES, SHALL BE VERIFIED.***
- ***NO FOULING OF LIKNAGE ASSY WITH EACH OTHER & WITH SPINDLE SHALL BE ENSURED..***
- ***ASSY TRIAIL OPERATION OF OPENING AND CLOSING SHALL BE DONE IN THE SAME DIRECTION OF SITE MOUNTING ORIENTATION.(AXIS HORIZANTAL)***

SIGNATURE OF TASK PERFORMAER

SIGNATURE OF BHEL /BHEL AUTHORISED INSPECTOR

RANIPET-6	BHEL: BAP:RANIPAT TAMIL NADU – 632 406 QUALITY DEPARTMENT	**STANDARD QUALITY PLAN** **RVC ASSY**	QP:No **: FAN 302** Rev: No: 01 Date : 09 02 10 **Page 013 Of 14** NAME OF CONTRACT PACKAGE **STANDARD**

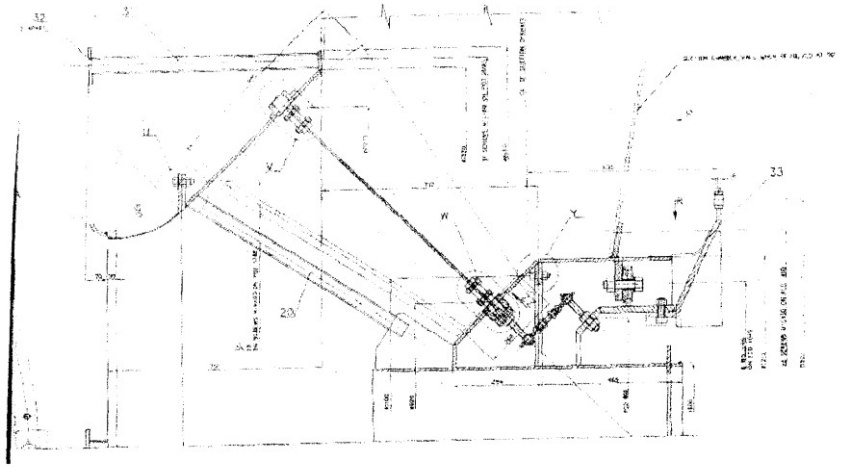
SL NO 1	COMPONENT & OPERATION 2	CHARACTERISTICS 3	TYPE OF CHECK 4	CLASS 5	QUANTUM OF CHECK 6	REFERENCE DOCUMENTS 7	ACCEPTANCE NORMS 8	FORMAT OF RECORD 9	Agency M	Agency B	Agency 10	REMAR KS 11
	Perpendicularity swivel pin with rod end assy .Roller contact with regulating ring & rotation during operation in site orientation-Axis horizontal											



	Identical orientation of lever for a given blade position .

RANIPET-6	BHEL: BAP:RANIPAT TAMIL NADU – 632 406 QUALITY DEPARTMENT	**STANDARD QUALITY PLAN** **RVC ASSY** NAME OF CONTRACT PACKAGE **STANDARD**	QP:No **: FAN 302** Rev: No: 01 Date : 09 02 10 **Page 014 Of 14**

SL NO 1	COMPONENT & OPERATION 2	CHARACTERISTICS 3	TYPE OF CHECK 4	CLASS 5	QUANTUM OF CHECK 6	REFERENCE DOCUMENTS 7	ACCEPTANCE NORMS 8	FORMAT OF RECORD 9	Agency M	Agency B	REMAR KS 11
									10		



Vane opening & closing angles as per drg & ease of operation shall be ensured . No fouling of linkage with each other is allowed

Ranipet-6	BHARAT HEAVY ELECTRICAL LTD, BOILER AUXILIARIES PLANT RANIPER-632 406	**STANDARD QUALITY PLAN** **ITEM : PENTHOUSE VENTILATION FAN / SEAL AIR FAN**	**QP NO.: FAN :304** **REV.NO.: 02** **DATE:07.08.2021** **PAGE: 1 OF 4**	**NAME OF THE CONTRACT & PACKAGE** **STANDARD**

SI. NO	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE STANDARDS	ACCEPTANCE STANDARDS	FORMAT OF RECORDS	M	B	REMARKS
									10**		
1	2	3	4	5	6	7	8	9	10		11
1.0	**Material**										
1.1	Raw Material	Chem & Mech Properties & Internal Soundness	Major	Chem, Tensile	Melt wise	Respective Material Standard	Respective Material Standard	TC	P	V	**Only indications corresponding to Equivalent Reflector size of 3 mm or less is acceptable by DGS method. @ UT shall be done for plates more than 12 mm thick to ASTM A435.
1.1.1	Shaft (if applicable)		Major	UT	-DO-	ASTM A388	ASTM 388**	TC	P	P	
1.1.2	Plates for Impellers	-DO-	Major	Chem , Tensile	Melt wise	Respective Material Standard	Respective Material Standard	TC	P	V	
			Major	UT @	-DO-	ASTM A435	ASTM A435	TC	P	V	
1.1.3	Plates for Spiral casing	-DO-	Major	Chem & Tensile	-DO-	-DO-	-DO-	TC	P	V	
1.1.4	Bearing Housing (If applicable)	Chem & Mech Properties	Major	-DO-	-DO-	Drawing	Drawing	TC	P	V	

LEGEND: M: Manufacturer B: BHEL/Authorized inspection agency P: Performed By, W: Witness by V:Verified By, TC : Test Certificate	Prepared and Reviewed By: Renjith K Manager / QA		Approved By: R. Arunachalam DGM / QA (Mech) & QC-OLI	

Ranipet-6	BHARAT HEAVY ELECTRICAL LTD, BOILER AUXILIARIES PLANT RANIPER-632 406	**STANDARD QUALITY PLAN** **ITEM : PENTHOUSE VENTILATION FAN / SEAL AIR FAN**	**QP NO.: FAN :304** **REV.NO.: 02** **DATE:07.08.2021** **PAGE: 2 OF 4**	**NAME OF THE CONTRACT & PACKAGE** **STANDARD**

SI. NO	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE STANDARDS	ACCEPTANCE STANDARDS	FORMAT OF RECORDS	M	B	REMARKS
									10**		
1	2	3	4	5	6	7	8	9	10		11
1.2	**Bought out Items**										##Motor capacity less than 30KW.
1.2.1	Motor	Type & routine test	Major	performance parameters	100%	PR:QA:550 /Latest ##	PR:QA:550 /Latest##	Report	P	V	@@Motor capacity 30 to 200 KW.
			Major	performance parameters	100%	SQP:QP:E:813 /Latest@@	SQP:QP:E:813 /Latest@@	Report	P	V	
2.0	**In process Inspection**										Welders and Weld procedures for rotating parts shall be qualified as per ASME Sec IX.
2.1	Impeller welds	Weld size	Major	Visual	100%	Drawing	Drawing	Report	P	V	
		Weld documents	Major	MPI /	100%	ASME SEC V Article-7	ASME SEC VIII-DIV-1,Appendix-6	Report	P	V	
				LPI	100%	ASME SEC V Article-6	ASME SEC VIII-DIV-1,Appendix-8	Report	P	V	Welders and Weld procedures
2.2	Impeller Machining	Impeller bore	Major	Measurement	100%	Drawing	Drawing	Report	P	V	For static parts shall be qualified as per AWS D1.1 / ASME Sec. IX
2.3	Casing Fabrication	Overall dimensions	Major	Measurement	100%	Drawing	Drawing	Report	P	V	

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BHARAT HEAVY ELECTRICAL LTD, BOILER AUXILIARIES PLANT RANIPER-632 406 Ranipet-6	STANDARD QUALITY PLAN	NAME OF THE CONTRACT & PACKAGE
	ITEM : PENTHOUSE VENTILATION FAN / SEAL AIR FAN QP NO.: FAN :304 REV.NO.: 02 DATE:07.08.2021 PAGE: 3 OF 4	STANDARD

SI. NO	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE STANDARDS	ACCEPTANCE STANDARDS	FORMAT OF RECORDS	M	B	REMARKS
									10**		
1	2	3	4	5	6	7	8	9	10		11
2.4	**Dynamic balancing**										
2.4.1	Impeller	Unbalancement Compensation	Major	Dynamic balancing	100%	ISO1940	ISO1940 Gr2.5	Report	P	V	*Tolerance for performance test Volume (-5%) Efficiency (-3%) power (+10%) **1.** # Motor casing Temperature at the drive and Non drive end (not exceed 75 deg C).
2.5	Performance testing	Performance Parameters Like Efficiency Power, noise, Vibration Brg temperature, Vibration, Noise	Major	Measurement	One of each type	IS 4894	*IS 4894	Report	P	W	
2.6	Run test	Motor casing Temperature#, Vibration @, Noise level$$ (Duration of Test Min. 2 Hours)	Major	Measurement	100%	T TFN 362 / Latest Customer approved painting schedule/ PRQA:590 (Latest)	TFN 362 / Latest Customer approved painting schedule/ PRQA:590 (Latest)	Report	P	W	**2.** @ Vibration at the motor drive end, Non drive end and pedestal (Satisfactory level as per ISO 10816-3:1998:PART 3). **3.** $$ Noise level limited to 85 dBA
3.0	Identification painting and packing	Painting & preservation	100%	Visual	100%			Report	P	W	

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SI. NO	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE STANDARDS	ACCEPTANCE STANDARDS	FORMAT OF RECORDS	M	B	REMARKS
									10**		
1	2	3	4	5	6	7	8	9	10		11

Note: Where ever Raw materials TC is not available the same shall be tested in NABL approved laboratories and TC shall be produced. This QP shall be read along with relevant Purchase Order, BHEL approved drawing & TDC and comply the requirements as noted.

Record of Revisions

Revision	Date	Revision details
00	29.10.2001	Original issue
01	11.09.2013	1. Clause 1.1.2 – ASTM A388 changed to ASTM A435 2. Clause 1.2.1 – PRQA:502 / Latest changed to PRQA 550 / Latest and SQP:QP:E:813 / Latest 3. Clause 2.1 – ASME Sec. VIII changed to ASME Sec. V 4. Clause 2.5 – Run test details not available changed to Temperature, Vibration & Noise level details furnished. 5. Clause 3.0 – PO Specification / drawing changed to customer approved painting schedule / PRQA 590 (Latest)
02	07.08.2021	1. Welder qualification ASME Sec. IX also included for static parts. 2. Clause 2.5 performance test reference standard changed to IS 4894 from BS 848 (obsolete standard) 3. Clause 2.6 Run test Reference documents and remarks changed based on latest document TFN 362, Rev. 01

LEGEND: M: Manufacturer B: BHEL/Authorized inspection agency P: Performed By, W: Witness by V:Verified By, TC : Test Certificate	Prepared and Reviewed By: Renjith K Manager / QA		Approved By: R. Arunachalam DGM / QA (Mech) & QC-OLI	

BHARAT HEAVY ELECTRICALS LTD BOILER AUXILIARIES PLANT RANIPET-632 406 (INDIA) QUALITY ASSURANCE DEPT.	QUALITY CONTROL PLAN FOR SEAL AIR FAN	NAME OF CONTRACT PACKAGE STANDARD	QP.NO.FAN306 REV.No.01 DATE:100694 PAGE 1 of 04

PREPARED BY: Gopi. REVIEWED BY: B Srinivasulu APPROVED BY: H Anand

S.No.	COMPONENT & OPERATION	CHARACTE-RISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE STANDARD	FORMAT OF REC	AGENCY	REMARKS
1	2	3	4	5	6	7	8	9	10	11
A.0	MATERIAL									
	MATERIAL FOR ROTATING PARTS									
	SHAFT FORGINGS	CHEM & MECH. PROPERTIES	MAJOR	REVIEW OF TEST CER-TIFICATES	100%	RESPECTIVE MATERIAL SPECIFICATION		TC	QC-PROCURE-MENT	
	BRG.HOUSING	-DO-	MAJOR	-DO-	-DO-	-DO-		-DO-	-DO-	
	PLATES FOR IMPELLER	-DO-	MAJOR	-DO-	-DO-	- DO -		-DO-	-DO-	
	SUB DELIVERIES									
	MOTOR	ROUTINE/TYPE TEST	MAJOR	-DO-	100%	PURCHASE SPECIFICATION		-DO-	SUPPLIER	
	COUPLINGS	1) DIMENSIONS	MAJOR	MEASUREMENT	100%	-DO-		-DO-	-DO-	
		2) DYNAMIC BALANCING	MAJOR	BALANCING	100%	-DO-		-DO-	-DO-	
	BEARINGS	COMPLIANCE WITH PURCH-ASE ORDER	MAJOR	REVIEW OF TCs &VISUAL INSPECTION OF BEARINGS	100%	PURCHASE ORDER		-DO-	-DO-	

MASTER COPY

STANDARD QUALITY CONTROL PLAN FOR

SEAL AIR FAN

QP.NO.FAN306
REV.NO.01
DATE:100694

1	2	3	4	5	6	7	8	9	10	11
2.0.	INPROCESS CONTROL									
2.1.	SHAFT	JOURNAL DIA LENGTHS, SIZE OF KEY WAY &OFFSET	MAJOR	MEASURE-MENT	100%	DRAWING	DRAWING	DR	SUBCONT-RACTOR	
2.2.	IMPELLER	BORE DIA & KEY WAY SIZE &OFFSET	MAJOR	-DO-	100%	DRAWING	DRAWING &NOTE 2	-DO-	-DO-	
2.3.	BLADES & IMPELLER RING	SHAPE & PROFILE	MAJOR	CHECK WITH TEMPLATE	100%	DRAWING	DRAWING &NOTE 2	-DO-	-DO-	
2.4.	BRG.HOUSING & COVER	1) BORE 2) LENGTH	MAJOR	-DO-	100%	DRAWING	DRAWING	-DO-	-DO-	
2.5.	WELD QUALITY	EXTERNAL FINISH&SIZE	MAJOR	VISUAL& MEASURE-MENT	100%	DRAWING	DRAWING &NOTE 1 &2	—	-DO-	
		BUTT WELDS OF IMPELLERS	CRIT-CAL	MT*	100%	BHE:NDT:RP:MT1/LATEST		NDT REPORT	-DO-	* MT FROM BOTH SIDES OF COVER PLATE
		FILLET WELDS FOR IMPELLERS AFTER STRESS RELIEF	CRIT	PT/MT	100%	BHE:NDT:RP:MT1/LATEST BHE:NDT:RP:PT1/LATEST		-DO-	-DO-	
2.6.	STRESS RELIEF OF IMPELLERS	COMPLIANCE TO STRESS RELIEF CYCLE	MAJOR	TIME&TEMP CHART VERIFI-CATION	100%	BAP:HT:001/LATEST		HEAT TREAMENT CHART	-DO-	

STANDARD QUALITY CONTROL PLAN FOR SEAL AIR FAN										QP.NO.FAN306 REV.NO.01 DATE:100694 PAGE;03 OF 04
1	2	3	4	5	6	7	8	9	10	11
2.7.	DYNAMIC BALANCING	RESIDUAL UNBALANCEMENT	CRITI-CAL	UNBALANCE COMPENSAT-ION	100%	DRAWING		BLNG. REPORT	SUBCON-TRACTOR	
2.8.	STATIC PARTS [SPIRAL CASING SUCTION CONE, BEARING PEDESTAL]	DIMENSIONS	CRITI-CAL	MEASURE-MENT	100%	DRAWING	DRAWING	DR	-DO-	
	FINAL INSPECTION	a) FINISH PAINTING , PRESERVATION IDENTIFICATION &PACKING DR : DIMENSIONS REPORT	MAJOR	VISUAL	100%	RP 0674199 AND PACKING DRAWING &NOTE 3		—	-DO-	

QUALITY CONTROL PLAN FOR

SEAL AIR FAN

Q.P.NO.306
REV.NO.01
DATE:100694
PAGE:04OF04

1	2	3	4	5	6	7	8	9	10	11

NOTE 1:1) WELDERS SAHLL BE QUALIFIED AS PER AWS D1.1. /ASME SECTION IX /LATEST

2) LOW HYDROGEN ELECTRODES SHALL BE BAKED FOR 2 HrS AT 350 DEG C' AND DRIED AT 150 DEG C' BEFORE WELDING.

3) ELECTRODES OPENED TO ATMOSPHERE MORE THAN 4 Hrs SHALL BE REBAKED

4) SEQUENCE OF WELDING SHALL BE ADOPTED

5) FULL PENETRATION WELD SHALL BE ENSURED BY BACK CHIPPING

6) DEFECTS LIKE CRACKS,POROSITY,UNFUSED METAL,SHALL BE REMOVED WHILE WELDING

7) WELD SHALL BE FREE FROM OIL GREASE,RUST ETC, & CRATER TO BE REMOVED

8) THE TOES OF THE FILLET WELDS SHALL BE SMOOTHLY GROUND FOR THE LENGTH AS SHOWN IN THE DRG.

09) BUTT WELDS SHALL BE GROUND FLUSH.

10) TACKS AND BRIDGES SHALL BE REMOVED BY CHIPPING

11) NO JOINT IS ALOWED ON THE BACK PLATE OR IMPELLER RING'

NOTE 2: 1) PLATES CUT BY FLAME SHALL BE CLEANED TO REMOVE SLAG &UNEVEN EDGES

2) GAS CUT NOTCHES SHALL BE FILLED BY WELDING .

NOTE 3: 1) THE IMPELLERS SHALL BE PAINTED AND PUNCHED WITH FOLLOWING DETAILS WORKODER NO,DU NO,SLNO&SUBCONTRACTOR CODE .DIRECTION OF ROTOTION OF IMPELLER SHALL BE P ON IMPEL

2) SHAFTS SHALL BE PUNCHED WITH ABOVE DETAILS ON BOTH FACES

****



Ranipet	MANUFACTURER'S NAME & ADDRESS BHEL RANIPET / BHEL APPROVED SOURCE	STANDARD QUALITY PLAN ITEM: LUB OIL SYSTEM FOR FANs.	QP. NO.: SQP: 312 Rev No. :03 Date: 14.03.2020 Page 1 of 6	PROJECT: AS PER PO.

SL NO	COMPONENT & OPERATION	CHARACTERISTICS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD		Agency			REMAR KS
					6						M	B	C	
1	2	3	4	5	M	B/C	7	8	9	D	10			11
1.0	**SUB DELIVERIES(BOIs)**													
1.1	LT MOTOR, COOLER, FILTER, FLEXIBLE HOSE, LEVEL SWITCH, PRESSURE GAUGE/SWITCH, TEMPERATURE GAUGE, DP GAUGE/ DP SWITCH, VALVES, PUMP. Transmitters, Strainer, Temperature control valve, NRV, PRV, Tank heaters etc. As applicable as per PO.	RESPECTIVE TESTS AS PER REPECTIVE P.O SPEC.	Major	AS PER COLUMN 3	100%	100%	Respective P.O. Spec	TC	√	P	V	-	-	
2.0	**IN PROCESS INSPECTION**													

M – Manufacturer / Subcontractor, B - BHEL /BHEL Authorized Inspection Agency, C - Customer, P - perform, NRV- V - Verification of reports, PRV- W - Witness, TC - Test certificate "D" – Record, identified with tick (√) shall be essentially included by Supplier in QA documentation.	Prepared by	Reviewed by			Approved by
	14.03.2020	14.03.2020	15.05.2020	16.05.2020	16/5/20
	QA	FANs Engg.	FES/FANs	QC-Proc.	Head QA

बी एच ई एल BHEL Ranipet	MANUFACTURER'S NAME & ADDRESS BHEL RANIPET / BHEL APPROVED SOURCE	STANDARD QUALITY PLAN ITEM: LUB OIL SYSTEM FOR FANs.	QP. NO.: SQP: 312 Rev No. :03 Date: 14.03.2020 Page 2 of 6	PROJECT: AS PER PO.

SL NO	COMPONENT & OPERATION	CHARACTERISTICS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK 6		REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD		Agency			REMAR KS
											M	B	C	
1	2	3	4	5	M	B/C	7	8	9	D	10			11
2.1	TANK FABRICATIO N	WELD QUALITY	Major	PT	100%	100%	## ASTM E 165		Report	√	P	V	-	** WELDERS & PROCE-DURES ARE QUALIFIED AS PER AWS D.1.1/ASME SEC IX. ## DEFECTS LIKE PIN HOLES, UNDER CUTS, LINEAR INDICATIONS ARE UNACCEPTABLE
		DIMENSION	Major	MEASUREMENT	100%	100%	DRAWING		Report	√	P	V	-	
2.2	TANK WATER FILL TEST	SOUNDNESS	Major	VISUAL	100%	100%	NO LEAK IS PERMITTED		Report	√	P	V	-	
2.3	SURFACE PREPARATIO N & PAINTING	SURFACE PREPARATION & PAINT DFT	Major	VISUAL & MEASUREMENT	100%	100%	REFER GENERAL GUIDELINES (Point 1 & 2)		Report	√	P	W $	-	$ DFT WITNESS DURING FINAL INSPECTION
3.0	**FINAL INSPECTION**													
3.1(a)	ROUTING & ASSY OF COMPONENT S	VERIFICATION & DIEMNSIONS	Major	VISUAL & MEASUREMENT	100%	100%	DRAWING		Report	√	P	W	-	REFER GENERAL GUIDELINES (Point 6)
3.1(b)	PERFORMAN CE TEST AT RATED PRESSURE	a) MEASURE-MENT OF DISCHARGE	Major	MEASUREMENT	100%	100%	BHEL PUR SPEC		Report	√	P	W	-	
		b) SMOOTH OPERATION	Major	VISUAL	100%	100%	BHEL PUR SPEC		Report	-	P	W	-	
		c) VERIFICATION OF SET POINTS/ WORKING OF ALL GAUGES/ TRANSMITTERS/ SWITCHES	Major	VISUAL	100%	100%	BHEL PUR SPEC		Report	√	P	W $	-	$- PROPER FUNCTIONING OF TRANSMITTERS DISPLAY TO BE CHECKED WHILE RUNNING OF LOS.

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B - BHEL /BHEL Authorized Inspection Agency,
C - Customer, P - perform, NRV-
V - Verification of reports, PRV-
W - Witness, TC - Test certificate
"D" – Record, identified with tick (√) shall be essentially included by Supplier in QA documentation.

Prepared by	Reviewed by			Approved by
14.03.2020	14.03.2020	15.05.2020	16.05.2020	19.05.20
QA	FANs Engg.	FES/FANs	QC-Proc.	Head QA

बी एच ई एल Ranipet	MANUFACTURER'S NAME & ADDRESS BHEL RANIPET / BHEL APPROVED SOURCE	STANDARD QUALITY PLAN ITEM: LUB OIL SYSTEM FOR FANs.	QP. NO.: SQP: 312 Rev No. :03 Date: 14.03.2020 Page 3 of 6	PROJECT: AS PER PO.

SL NO	COMPONENT & OPERATION	CHARACTERISTICS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK 6		REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD		Agency			REMAR KS
											M	B	C	
1	2	3	4	5	M	B/C	7	8	9	D	10			11
		d) VERIFICATION OF SET POINTS OF RELIEF VALVE/ OPERATION OF NRV, THROTTLE VALVE.	Major	VERIFICATION	100%	100%	NO LEAK	Report	√	P	W	-		
		e) VERIFICATION OF LEAKAGE	Major	VISUAL	100%	100%	NO LEAK	Report	√	P	W	-		
3.1 (c)	LEAKAGE TEST AT 1.5 TIMES WORKING PRESSURE (MIN 30 MINS)	VERIFICATION OF LEAKAGE	Major	VISUAL	100%	100%	NO LEAK	Report	√	P	V	-		
4.0	**PIPING & LOOSE FITTINGS**													
4.1	PIPING & LOOSE ITEMS	IDENTIFICATION & TRIAL ASSY*	Major	VISUAL & VERIFICATION	100%	100%	AS PER BHEL APPROVED PIPING LAYOUT DRAWING	Report	-	P	W	-		* TRIAL ASSY OF PIPING LAYOUT WITH FITTINGS FOR 1 ST OF LOS
5.0	**PAINTING , PACKING AND PRESERVATION**													
5.1	PAINTING & PACKING	IDENTIFICATION & PRESERVATION	Major	VISUAL & VERIFICATION	100%	100%	BHEL PUR. SPEC.	Report	√	P	V	-		

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	14.03.2020	14.03.2020	15.05.2020	16.05.2020	
	QA	FANs Engg.	FES/FANs	QC-Proc.	Head QA

बी एच ई एल BHEL Ranipet	MANUFACTURER'S NAME & ADDRESS BHEL RANIPET / BHEL APPROVED SOURCE	STANDARD QUALITY PLAN ITEM: LUB OIL SYSTEM FOR FANs.	QP. NO.: SQP: 312 Rev No. :03 Date: 14.03.2020 Page 4 of 6	PROJECT: AS PER PO.

SL NO	COMPONENT & OPERATION	CHARACTERISTICS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD		Agency			REMAR KS
					6						M	B	C	
1	2	3	4	5	M	B/C	7	8	9	D	10			11

GENERAL GUIDE LINES: -

1. **Tank inside paint:**
   a) Surface preparation: Blast cleaning to Sa2 ½.
   b) Primer coating: Epoxy zinc rich primer to IS 13238- DFT 40 µm min.
   c) Finish coating: Epoxy glossy finish paint (oil resistant type)- DFT 35 µm min. (White shade)

2. **Tank outside paint (unless specified otherwise following paint shall be adopted)**

   a) Surface preparation: Blast cleaning to Sa2 ½.
   b) Primer: Red oxide zinc phosphate paint to IS 12744 - DFT 25 µm min.
   c) Finish paint: Synthetic enamel paint to IS 2932- Smoke gray – Shade 692 of IS5 – DFT 20 µm min.
   d) Total DFT shall be 45 microns minimum.

3. **PIPES AND FITTINGS**

   a) Acid clean the pipes by filling the pipes with 10% V/V orthophosphoric acid after plugging one end suitably.
   b) Keep the solution for about three hours.
   c) Prepare a neutralizing solution with washing soda (sodium carbonate) and water (500 gms of washing soda for 10 liters of water). Rinse the acid cleaned pipelines with neutralizing solution several times. After neutralization, dry the tubes by compressed air. Then rinse with lubricating oil.

4. **INSTRUMENTS, CABLES AND ROUTINGS**
   a) Ensure the proper alignment between motor and pump during the assembly with coupling.
   b) Ensure the correct wiring in the junction boxes meant for instrument control cabling and power control cabling as per wiring diagram.
   c) Cables up to junction box shall be routed through flexible conduits.

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	14.03.2020	14.03.2020	15.05.2020	16.05.2020	16.05.2020
	QA	FANs Engg.	FES/FANs	QC-Proc.	Head QA

SL NO	COMPONENT & OPERATION	CHARACTERISTICS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD		Agency			REMAR KS
					6						M	B	C	
1	2	3	4	5	M	B/C	7	8	9	D	10			11

a) Support the cables in cable trays.
b) All the control cabling into junction boxes shall be identified with tags.
c) All indicating instruments and Switches with their respective root valves shall be mounted on a common panel on the tank.
d) Metallic nameplates of the respective components indicating the make, Year of manufacturing, model number, range etc., shall be available in the respective equipment. An anodized plate showing the lub oil system drawing shall be provided on the tank.
e) Verify for the current drawn at operating pressure.
f) Direction of Rotation of Motor to be marked with Paint.
g) Indicate the direction of fluid on the pipelines with paint mark.
h) The manometer of the local pressure indicators should be glycerin field manometer to have better dampening.
i) All transmitters' calibrated range shall be checked & demonstrated during inspection/testing.
j) Make Model no., range & S.no of Instruments to be check with approved drawings.
k) Canopy for covering the entire system to avoid entry of rainwater shall be ensured as per approved drawing.

5. PACKING AND PRESERVATION

a) Lub oil system shall be properly packed as per applicable packing specification.
b) The lifting location shall be indicated by painting.
c) Provide sufficient amount of silica gel in the packing box.
d) Mark the identification details of the system on the oil tank.

6. Easy access & space for maintenance of Duplex filter, cooler, heater & All Instruments of skid shall be provided.
7. Inspection agency shall verify Mounting Arrangement for TCV (Temperature Control Valve) if applicable) as per P&ID of LOS in the TLT Design LOS as per drawing during inspection.

M – Manufacturer / Subcontractor, B - BHEL /BHEL Authorized Inspection Agency, C - Customer, P - perform, NRV- V - Verification of reports, PRV- W - Witness, TC - Test certificate "D" – Record, identified with tick (√) shall be essentially included by Supplier in QA documentation.	Prepared by	Reviewed by			Approved by
	14.03.2020	14.03.2020	15.05.2020	16.05.2020	
	QA	FANs Engg.	FES/FANs	QC-Proc.	Head QA

SL NO	COMPONENT & OPERATION	CHARACTERISTICS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK 6		REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD		Agency M	Agency B	Agency C	REMAR KS
1	2	3	4	5	M	B/C	7	8	9	D	10			11

Record of revision

Rev no	Date	Description
00	12.01.2001	Original Issue – First submission.
01	08.03.2006	Totally Modified based on CQA Feedback.
02	13.03.2015	Clause 2.3, painting of oil tank inside witnessed by BHEL/BHEL AIA incorporated based on site feedback.
03	14.03.2020	Note 7 added as per FES Feedback received from Nabinagar site.

M – Manufacturer / Subcontractor, B - BHEL /BHEL Authorized Inspection Agency, C - Customer, P - perform, NRV- V - Verification of reports, PRV- W - Witness, TC - Test certificate "D" – Record, identified with tick (√) shall be essentially included by Supplier in QA documentation.	Prepared by	Reviewed by			Approved by
	14.03.2020	14.03.2020	15.05.2020	16.05.2020	16.05.2020
	QA	FANs Engg.	FES/FANs	QC-Proc.	Head QA

QUALITY DEPARTMENT

AMENDMENT TO QUALITY WORK INSTRUCTIONS (SQP)

QWI NO: SQP:FAN: 317 **REV: 04** DATE : 1108 97
AMENDMENT NO. A 2 DATE : 27 12 2000

DESCRIPTION: **RADIAL FAN IMPELLER ASSY**

DETAILS

CLAUSE NO	AMENDED AS	BASIS FOR AMENDMENT/ REMARKS
2.1.6	**BELL MOUTH IMPELLER COVER PLATES** **ROLLING/PRESSING OF INDIVIDUAL PARTS :** PROFILE SHALL BE CHECKED WITH TEMPLATE AS PER DRG. **WELDING:** WEDING SHALL BE DONE AS PER CL 2.1.3	NEW CLAUSE ADDED TO INCLUDE BELL MOUTH COVER PLATE
2.6.1	REMARKS : (1) BLADES SHALL BE SUITABLY TRIMMED BEFORE FIT UP (2) COVER PLATE ASSY OFFESET WITH CENTRE PLATE SHALL NOT BE MORE THAN 2 MM.	
NOTES		
16	PLATES LESS THAN 12 MM SHALL BE CHECKED BY D METER FOR LAMINATIONS(NOTE 16 IS REFERRED UNDER CLAUSE 1.1)	COST REDUCTION MEETING.
17	3 MM HOLE SHALL BE MADE IN THE AEROFOIL BLADE BEFORE HEATREATMENT AND SAME SHALL BE PLUGGED BY WELDING AND GRINDING AFTER HT.(NOTE 17 IS REFERRED IN CL 2.6.3)	NOTE ADDED TO TAKE CARE OF FIT OF AEROFOIL BLADED IMPELLERS

Prepared by	Reviewed by			Approved by
(K RAJADURAI)	B SRINIVASA RAO	QA		(H ANANTHANARAYANAN)
	D KRISHNASWAMY	QC		

BHEL

RANIPET

QUALITY DEPARTMENT		
AMENDMENT TO QUALITY WORK INSTRUCTIONS (SQP)		
Q.W.I.NO:FAN317 REV: 04 AMENDMENT SL NO: A 1		
DESCRIPTION:RADIAL FAN IMPELLER ASSY +CONICAL COVER PLATES		DATE:22 08 98
DETAILS		
CLAUSE NO	AMENDED AS	BASIS FOR AMENDMENT REMARKS
2.5.4 B	ADD THE FOLLOWING CHECK: REMAINING THICKNESS BELOW THE COUNTER BORE TO BE CHECKED	I PCM DT 03 08 98
Prepared by B Srinivasa Rao		Aproved by

Distribution: As per standard distribution list.

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BHEL RANIPET	STANDARD QUALITY PLAN FOR FANS	
REF.NO.	REVISION NO.	EFFECTIVE DATE
FAN:317	04	11 08 97

TITLE : RADIAL FAN IMPELLER ASSY+ CONICAL COVER PLATES

			SIGNATURE
PREPARED BY	:	B SRINIVASA RAO	B Srinivasa Rao
REVIEWED BY	:	V SUBRAMANIAM	
APPROVED BY	:	H ANANTHANARAYANAN	

ISSUED & CONTROLLED BY :: QUALITY ASSURANCE
BHEL, RANIPET-632 406

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	PAGE : 01 of 11

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BHEL RANIPET	RECORD OF REVISIONS	QPNO:FAN317 REV:04 DATE 11 08 97 PAGE 02 OF 11

REVNO	CL..NO	REVISION MADE	EFFECTIVE DATE
00	--	ORIGINAL ISSUE	22 11 93
01	--	MODIFIED BY MERGING SQPS FAN:312,313,314, 315 & 316	14-06-97
02		QC IS MODIFIED AS M.Q.C.D	20-07-95
	2.1.2C	INTRODUCED IN LINE WITH PCM-1/95-96	
	2.5.4	S.R REMOVED	
	2.6.6	F/O OF COVER PLATE INTRODUCED IN LINE WITH PCM-3/94-95	
03	2.1.3	PR:QE:017&PR:QA:106,REPLACED BY PR:QA:337&PR:QA:335 RESPECTIVELY.	01-07-96
	2.3.4	CLAUSE ADDED FOR AEROFOILE BLADES	
	2.4.5	PR:QE:017 IS REPLACED BY PR:QA:337	
	2.5.2	-DO-	
	2.5.4	-DO-	
	2.6.2	-DO-	
	2.6.8	-DO-	
	2.6.7 & 2.6.9	PR:QE:061 IS REPLACED BY PR:QA:338 AND NON APPLICABLITY OF THIS CLAUSE TO ID FAN FOR UTILITY BOILER IS INCLUDED .	
	3.1	PR:QA:512 IS WITHDRAWN	
04	2.6.2	ALLOY STEEL IMPELLERS ADDED IN COL..5	11 08 97
	2.6.6	NOTE 15 IS ADDED	
	2.6.9	NOTE 14 IS ADDED	

BHARAT HEAVY ELECTRICALS LTD BOILER AUXILIARIES PLANT RANIPET_632 406 (INDIA) QUALITY ASSURANCE DEPT.	QUALITY CONTROL PLAN FOR RADIAL FAN IMPELLERS AND CONICAL COVER PLATES	NAME OF CONTRACT PACKAGE STANDARD	QP.No.FAN317 REV.No.04 DATE 110897 PAGE 03of11

PREPARED BY:	REVIEWED BY:	APPROVED BY:

S.No.	COMPONENT & OPERATION	CHARACTE_ RISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE STANDARD	FORMAT OF REC	AGENCY	REMARKS
1	2	3	4	5	6	7	8	9	10	11
1.0.	MATERIALS									
1.1.	CENTRE PLATE/ BACK PLATE, WEAR PLATE, BLADE,COVER PLATE,IMPELLER RING,CONICAL COVER PLATE	CHEMISTRY& MECHANICAL PROPERITIES AND INTERNAL SOUNDNESS	MAJ	VERIFICA_ TION OF TEST CERTFICATES	100%	APPLICABLE MATERIAL	TDC & STANDARD	TC	QC/PROC	
1.2.	FORGINGS FOR IMPELLER RINGS AND HUBS	_DO_	MAJ	_DO_	100%	-DO-	-DO-	TC **	-DO-	
1.3.	FASTENERS	COMPLIANCE TO PURCHASE ORDER	MAJ	VERIFICA_ TION OF COMPLIANCE CERTIFICATE	100%	PURCHASE ORDER		C.CERT	-DO-	
2.0.	INPROCESS INSPECTION									
	MATERIAL SPEC TRANSFER AS APPLICABLE	RMA NO: SPEC: MELT NO;	MAJ	VISUAL	100%	RMA CARD		RMA CARD	MQCD	
2.1.	COVER PLATE ASSY									
2.1.1	GAS CUTTING OF COVER PLATES	INNER RADIUS &OUTER RADIUS	MAJ	DIMENSION- AL	100%	DRAWING & PR:QA:500		--	MQCD	

QC/PROC:QUALITY CONTROL /PROCUREMENT
**C.CERT:COMPLIANCE CERTIFICATE,MQCD:MANUFACTURERS QUALITY CONTROL DEPARTMENT

QUALITY CONTROL PLAN FOR RADIAL FAN IMPELLERS+ CONICAL COVER PLATES										Q.P.NO.FAN317 REV.NO.04 DATE:11 08 97 PAGE:04 OF11
1	2	3	4	5	6	7	8	9	10	11
2.1.2	IMPELLER RING OF WELDED DESIGN									
(a)	UT OF PLATE BEFORE ROLLING	INTERNAL SOUNDNESS	MAJ	UT	100%	SEL 072	CL.3 OF TABL 1&2/SEL 072 Note-1	NDT REPORT	NDTL	
(b)	WELDING OF IMPELLER RING	WELD SIZE& SURFACE QUALITY	MAJ	VISUAL	100%	DRAWIG & PR:QA:337		—	MQCD	
		WELD SOUNDNESS	MAJ	UT	100%	BHE:NDT:RP:UT:02 &NOTE 3		NDT REPORT	NDTL	
(c)	STRESS RELIEF	COMPLIANCE TO S.R CYCLE	MAJOR	VERIFICA_TION OF HT_CHART	100%	BAP:HT:001 & NOTE 12		HT CHART	MQCD	
2.1.3	WELDING OF COVER PLATES	ID,OD&HEIGHT RADIUS AS APPROPPRIATE	MAJ	MEASURE_MENT	100%	DRAWING &PR:QA:500 &NOTE 1&9		—	MQCD	
		EP&SURFACE QUALITY	MAJ	VISUAL	100%	DRAWING &PR:QA:337, PR:QA:335		—	MQCD	
		WELD SOUNDNESS	MAJ MAJ	UT MT	100% 100%	BHE:NDT:RP:UT:02 BHE:NDT:RP:MT:01& NOTE 3,10		NDT REPORT	NDTL	
2.1.4	IMPELLER RING MACHINING	ID,OD&EP	MAJ	MEASURE_MENT	100%	DRAWING&PR:QA:500		—	MQCD	
2.1.5	COVER PLATE ASSY(WELDING) [COVER PLATE+ IMPELLER RING]	SURFACE QUALITY&SIZE	MAJ	VISUAL	100%	PR:QA:337&DRAWING		—	MQCD	
		WELD SOUNDNESS	MAJ	MT	100%	BHE:NDT:RP:MT:01 NOTE 3,10		NDT REPORT	NDTL	
		HEIGHT	MAJ	MEASURE_MENT	100%	DRAWING & PR:QA:500		—	MQCD	
2.2	BACK PLATE/ CENTER PLATE									
2.2.1	NDT OF RAW** PLATE	INTERNAL SOUNDNESS	MAJ	UT	100%	SEL 072	CL.3 OF TABL 1&2OF SEL072	NDT REPORT	NDTL	**INCASE OF NON UT QUALITY
-----S.R CYCLE:STRESS RELIEF CYCLE,HT CHART:HEATTREATMENT CHART,NDTL:NON DESTRUCTIVE TESTING LABORATORY.-----										

QUALITY CONTROL PLAN FOR

RADIAL FAN IMPELLER ASSY +
CONICAL COVERPLATES

Q.P.NO.FAN317
REV.NO.04
DATE:11 08 97

1	2	3	4	5	6	7	8	9	10	11
2.2.2	GAS CUTTING	ID,OD	MAJOR	MEASURE-MENT	100%	DRAWING &PR:QA:500& NOTE :1		--	MQCD	
2.2.3	MACHINING	BORE,OD,HOLE DIA&PITCH	MAJOR	-DO-	100%	DRAWING&PR:QA:500		--	MQCD	
2.2.4	WELDING OF SAWTOOTH (IF APPLICABLE)	SURFACE QUALITY & EP	MAJOR	VISUAL	100%	DRAWING &PR:QA:337 NOTE 8,9		--	MQCD	
		WELD SOUNDNESS	MAJOR	MT UT/RT	100% 100%	BHE:NDT:RP:MT:01&NOTE3,10 BHE:NDT:RP:UT:02		NDT REPORT	NDTL	
2.2.5	GAS CUTTING* OF TEETH (FOR SAW TOOTH CENTRE PLATE ONLY)	RADII & PITCH OF TEETH	MAJOR	MEASURE-MENT	100%	DRAWING &PR:QA 500		--	MQCD	*GAS CUT EDGES SHALL BE GROUND BY 2 MM.MIN. OR MPI MAY BE DONE AS PER BHE:NDT:RP
2.3.	BLADE									:MT:01
2.3.1	GAS CUTTING OF BLADE	VARIOUS LENGTH&SHAPE	MAJOR	MEASURE_ MENT	F.O.T	DRAWING &PR:QA:500 NOTE 1		--	MQCD	
2.3.2	DRILLING & COUNTER SINKING OF HOLES	DIA,DEPTH& ORIENTATION OF HOLES	MAJOR	MEASURE_ MENT	RANDOM	DRAWING &PR:QA:500		--	MQCD	
2.3.3	ROLLING OF BLADES	BEND RADIUS	MAJOR	-DO-	100%	-DO-		--	MQCD	
2.3.4	AEROFOIL BLADE a)SHEARING OF SHEET b)GASCUTTNG OF STIFFENER c)SAWING OF ROUND	LENGTH&SHAPE	MAJOR	_DO_	100%	5 _DO_		__	MQCD	
2.3.4.1	PRESSING OF BLADE&SLOTTING	SHAPE&RADIUS	MAJOR	_DO_	100%	_DO_		__	MQCD	
2.3.4.2	WELDING OF BLADE	SURFACE QUALITY	MAJOR	VISUAL	100%	DRAWING&PR:QA:337		--	MQCD	
		SOUNDNESS	MAJOR	PT	100%	BHE:NDT:RP:PT:01		NDT REPORT	NDTL	

1	2	3	4	5	6	7	8	9	10	11
2.4.	WEAR PLATE									
2.4.1	GAS CUTTING	VARIOUS LENGTH AND SHAPE	MAJOR	MEASURE-MENT	F.O.T	DRAWING &PR:QA:500 & NOTE 1		--	MQCD	
2.4.2	DRILLING& COUNTER SINKING	HOLE DIA & PITCH	"	"	RANDOM	DRAWING &PR:QA:500		--	MQCD	
2.4.3	HOT PRESSING OF BLADES (IF APPLICABLE)	HOT PRESS_ING TEMP.	"	VISUAL	"	PR:QA:325		__	MQCD	
		BEND RADIUS AND HEIGHT	"	MEASURE-MENT	"	-DO-		--	MQCD	
2.4.4	ROLLING	BEND RADIUS	"	-DO-	RANDOM	DRAWING & PR:QA:500		__	MQCD	
2.4.5	WEAR PLATE ASSY (IF APPLICABLE)									
	WELDING OF WEAR PLATES AND CENTRE RIB	SURFACE QUALITY & WELD SIZE	"	VISUAL	100%	PR:QA:337 & DRAWING		__	MQCD	
		WELD SOUNDNESS	"	MT	100%	BHE:NDT:RP:MT:01 &NOTE 3		NDT REPORT	NDTL	
2.5.	CONICAL COVER PLATE									
2.5.1	COVER PLATE ROLLING	ID,OD AND HEIGHT OF CONE	MAJOR	MEASURE_MENT	100%	DRAWING &PR:QA:500		--	MQCD	

QUALITY CONTROL PLAN FOR RADIAL FAN IMPELLER ASSY + CONICAL COVER PLATE								Q.P.NO.FAN317 REV.NO.04 DATE:01 03 97 PAGE:07 of 11		
1	2	3	4	5	6	7	8	9	10	11
2.5.2	WELDING OF COVER PLATE	EDGE PREPARATION AND SURFACE QUALITY	MAJOR	VISUAL	100%	DRAWING&PR:QA:337 NOTE 1,9		--	MQCD	
		WELD SOUNDNESS	"	MT	100%	BHE:NDT:RP:MT:01 NOTE 3&10		NDT REPORT	NDTL	
2.5.4	CONICAL COVER PLATE ASSY									
A)	WELDING	SOUNDNESS & SURFACE QUALITY	"	MT VISUAL	100%	BHE:NDT:RP:MT:01 NOTE 3 & 10 PR:QA:337		"	"	
B)	MACHINING	DRILL HOLE SIZE, PITCH OF HOLES, THREADED HOLE SIZES(If Applicable) OD, ID AND HEIGHT	"	MEASURE_ MENT	100%	DRAWING & PR:QA:500		HISTORY CARD	MQCD	
2.6.	IMPELLER ASSY									*CENTRE PLATE SHALL BE STRAIGHTENED AND LEVELLED BEFORE FIT UP OF BLADES WITHIN 2 MM &SUBSEQUENTLY ARRESTED BEFORE TACK WELDING OF COVER PLATES
2.6.1	FIT UP OF* COVER PLATE, CENTRE PLATE/ BACK PLATE AND BLADES	HT BETWEEN CENTRE/BACK PLATE AND COVER PLATE DISCHARGE OPENING DIMENSION	MAJOR	MEASURE_ MENT	100%	DRAWING & PR:QA:500		—	MQCD	

QUALITY CONTROL PLAN FOR										Q.P.NO.FAN317 REV.NO.04 DATE:11 08 97 PAGE:08 OF 11
RADIAL FAN IMPELLER ASSY + CONICAL COVER PLATE										
1	2	3	4	5	6	7	8	9	10	11
2.6.2	WELDING **	WELD SOUNDNESS	MAJOR	VISUAL MT FOR ALLOY STEEL IMPELLERS BEFORE SR	100% 100%	PR:QA:337 BHE:NDT:RP:MT:01 NOTE 3,5,10		-- NDT REPORT	MQCD NDTL	STAINLESS **NOT APPLICABLE FOR AUSTENITIC STAINLESS STEELS
2.6.3	STRESS RELIEF OF IMPELLER ASSEMBLY	COMPLIANCE TO SR CYCLE	CRITI_CAL	VERIFI_CATION OF CHART	100%	BAP:HT:001 NOTE 4		HT CHART	MQCD	
2.6.4	PAINTING OF IMPELLER	COATING THICKNESS	MAJOR	VISUAL	100%	NOTE 2		--	MQCD	
2.6.5	NDT ON WELDS AFTER STRESS RELIEF	WELD SOUNDNESS	MAJOR	MT	100%	BHE:NDT:RP:MT:01		NDT REPORT	NDTL	
2.6.6	MACHINING	a)GROOVE DIA b)BORE DIA & OD OF IMPELLER c)IMPELLER RING ID d)HEIGHT OF IMPELLER f)TAPER CHECK OF HUB	MAJOR	MEASURE_MENT	100%	DRAWING &PR:QA:500 NOTE 15 NOTE 11		HISTORY CARD	MQCD	
		g)FACE OUT OF COVERPLATE	MAJOR	-DO-	100%	DRAWING &NOTE 13		-DO-	MQCD	
2.6.7	DYNAMIC* BALANCING OF IMPELLER WITH C.C.PLATE	RESIDUAL UNBALANCEMENT	CRTI_CAL	UNBALANCE COMPEN_SATION	ALL IMPELLER ASSYS	DRAWING &PR:QA:306,307 309,314,323,338 NOTE 14		HISTORY CARD	MQCD	*NOT APPLICABLE FOR THE ID FANS OF UTILITY BOILERS STAINLESS
					SR:STRESS RELIEF					

QUALITY CONTROL PLAN FOR RADIAL FAN IMPELLER ASSY + CONICAL COVER PLATE									Q.P.NO.FAN 317 REV.NO.04 DATE:11 08 97 PAGE:09 OF 11
1	2	3	4	5	6	7	8	9	10	11
2.6.8	ASSEMBLY OF IMPELLER WITH WEAR PLATES AND CONICAL COVER PLATES	i)PROPER ASSY AND TORQUE TIGHTNESS	MAJOR	VISUAL	100%	DRAWING & PR:QA:312 NOTE- 6		--	MQCD	
		ii)SOUNDNESS OF WEAR PLATE TO CENTRE PLATE & OF WEAR PLATE HALVES	MAJOR	VISUAL& MT	100%	PR:QA:337 BHE:NDT:RP:MT:01		NDT REPORT	NDTL	
2.6.9	DYNAMIC BALANCING OF IMPELLER WITH WEAR PLATES AND CONICAL COVER PLATES	RESIDUAL UNBALANCEMENT	CRITI-CAL	UNBALANCE COMPEN-SATION	ALL IMPELLERS	DRAWING & PR:QA:306,307 309,314,323,338 &NOTE 14		HISTORY CARD	MQCD	
3.0.	FINAL INSPECTION									
3.1.	PAINTING IDENTIFICATION PRESERVATION AND PACKING	COATING THICKNESS OF PAINT	MAJOR	MEASURE-MENT & VISUAL	RANDOM	PR:QA:590 PACKING DRAWING AND GMS NOTE 7		--	MQCD	
		PROPER PACKING& PRESERVATION								
3.2.	VERIFICATION OF IMPELLER DOCUMENTATION	COMPLETENESS	MAJOR	VERIFI_ CATION OF RECORDS OF COL 9 OF THIS QP	100%	SQP:FAN:317		--	MQCD	

QUALITY CONTROL PLAN FOR	Q.P.NO.FAN317 REV.NO.04
RADIAL FAN IMPELLER ASSY + CONICAL COVER PLATES	DATE:11 08 97 PAGE:10 OF 11

NOTE : ALL THE DOCUMENTS REFERED SHALL BE OF LATEST REVISION ONLY.

NOTES:

1) GAS CUT EDGES SHALL BE GROUND SMOOTH BEFORE WELDING.

2)IMPELLER SHALL BE GIVEN PRIMER COAT WITHIN 4 HOURS AFTER SHOT BLASTING AS PER PR:QA:590.WELD SHALL NOT BE PAINTED.

3)(i) IN CASE OF QUENCHED AND TEMPERED ALLOY STEELS LIKE NAXTRA 70, SA517 Gr.F,WELDOX700E/F,RQT701, DILLIMAX690E,WEL-TEN 780 A,MT /UT SHALL BE DONE AFTER 48 Hrs OF COMPLETION OF WELDING.

(ii) WELDERS SHALL BE QUALIFIED AS PER ASME SEC IX IN 3G POSITION MINIMUM.

(iii) LOW HYROGEN ELECTRODES SHALL BE BAKED FOR 2 Hrs BETWEEN 370C° TO 430C° AND HELD IN HOLDING OVEN AT 120-150 DEGREE C° BEFORE USE.

(iv) ELECTRODES OPEN TO ATMOSPHERE MORE THAN 5 MINUTES SHALL BE REBAKED AND DRIED IN THE SAME MANNER.

(v) ALL THE BUTT JOINTS SHALL BE BAGOUGED TO REMOVE SLAG,UNFUSED AREA ETC AND WELDED.

(vi) BUTT WELDS ON PLATES OF SIZE 10MM AND BELOW SHALL BE TESTED BY MT FROM BOTH SIDES AND FOR ABOVE 10 MM SIZE,UT AND MT SHALL BE DONE.

4)HEAT TREATMENT SCHEDULE BAP:HT:001 COVERS STRESS RELIEF OF CONVENTIONAL MATERIALS.
IF A NEW MATERAL IS USED IN IMPELLER CONSTRUCTION.STRESS RELIEF REQUIREMENTS WILL BE COMMUNICATED BY QA

5)BLADE WELDS SHALL BE TOE GROUND TO A MAX DEPTH OF 0.6 MM AT THE ENTRY AND EXIT OF FILLET WELDS FOR 100 MM LENGTH.BLADES WELDS WITH CENTRE PLATE AND COVER PLATES SHALL BE SMOOTHLY ROUNDED AT ENDS.

6) PROJECTION OF FLATNIBBED BOLTS SHALL NOT EXCEED 1.5MM.

7) IMPELLERS SHALL BE IDENTIFIED WITH W O.NO ,DU NO,&PRODUCT NO.
BY PAINTING &HARD PUNCHING.DIRECTION OF ROTATION SHALL BE PAINTED ON THE IMPELLER.

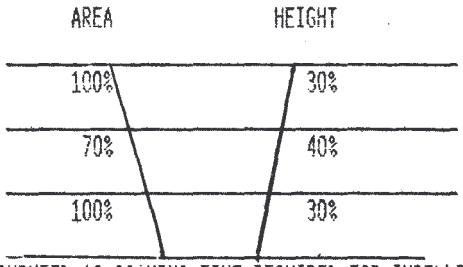
8) CENTRE PLATE/BACK PLATE SHALL BE STRAIGHTENED TO 1MM/Mt SUBJECT TO THE MAXIMUM OF 2 MM.

9) JOINTS SHALL BE FULL PENETRATION WELD JOINTS.

10) SURFACE CRACKS SHALL BE INSPECTED AS PER BHE:NDT:RP:PT1 BY PENETRANT INSPECTION IN CASE OF AUSTENITIC STAINLESS STEEL.

1	2	3	4	5	6	7	8	9	10	11

11) THIS IS APPLICABLE FOR IMPELLERS WITH TAPERED BORE HUB.
A THIN COAT OF PRUSSAIN BLUE SHALL BE UNIFORMLY APPLIED IN THREE BANDS AT 120 DEG. APART ON THE MALE PLUG TAPER GAUGE. THE GAUGE SHALL BE INSERTED IN THE TAPER BORE OF THE IMPELLER AND THE GAUGE SHALL BE ROTATED BY 120 DEG. BOTH CLOCKWISE AND ANTICLOCKWISE. THE GAUGE SHALL BE TAKEN OUT AND THE BLUE TRANSFER ON THE TAPER BORE GIVES THE EXTENT OF MATCHING OF BORES.THE BLUE SHALL BE HAVING 100% CONTACT AT THE SMALL AND BIG ENDS OF TAPER FOR 30% OF HEIGHT OF CONE FROM EITHER END AND OVER THE CENTRE 40% OF THE HEIGHT TO A MINIMUM OF 70 % THE BLUE TRANSFER SHALL BE OBTAINED AS SHOWN IN THE SKETCH GIVEN BELOW:



12) SOAKING TIME COMPUTED AS SOAKING TIME REQUIRED FOR IMPELLER RING SUBTRACTED BY SOAKING TIME REQUIRED FOR IMPELLER ASSY (WITHOUT CONSIDERING FOR BUTT WELD OF RING)

13) PERMISSIBLE FACE OUT ON THE IMPELLER COVER PLATE IS AS FOLLOWS.(IF NOT PROVIDED IN DRG.)

IMPELLER TIP DIA IN MM	MAXIMUM FACE OUT
UP TO 1000	3
>1000 UP TO 2500	5
>2500	6

14) PR:QA:306,307,308,338 ARE APPLICABLE FOR BHEL SHOP ONLY. SUBCONTRACTORS SHALL DEVELOP THEIR OWN BALANCING PROCEDURES BASED ON M/C MANUAL.

15) INSTRUMENT NO. FOR MEASUREMENTS OF FLANGE GROOVE DIA AND BORE SHALL BE RECORDED IN HISTORY CARD

16) For thickness of butt weld 12 mm, Radiography Checked by Ultrasonic.

BHARAT HEAVY ELECTRICALS LTD BOILER AUXILIARIES PLANT RANIPET-632 406 (INDIA) QUALITY ASSURANCE DEPT.	QUALITY CONTROL PLAN FOR CONNECTING RING&SUPPORTING RING	NAME OF CONTRACT PACKAGE STANDARD	QP.No.FAN323 REV.No.01 DATE 111294 PAGE 01of01

PREPARED BY: B. Srinivasulu REVIEWED BY: [signature] APPROVED BY: [signature]

S.No.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE STANDARD	FORMAT OF REC	AGENCY	REMARKS
1	2	3	4	5	6	7	8	9	10	11
	**									
1.0.	INTEGRAL TEST BAR CuA110N	CHEMISTRY	CRITICAL	ANALYSIS	EACH HEAT	DIN 17665		T.C	GOVT APPD. LAB	V @
2.0.	-DO-	MECHANICAL PROPERTIES	-DO-	TENSILE TESTING	-DO-		UTS:600 MPa MIN, YS:270 MPa MIN % ELONG:12 MIN	T.C T.C T.C	-DO- -DO- -DO-	
				HARDNESS*	-DO-		185 BHN MIN	T.C	-DO-	*HB 10/1000
	CONNECTING RING	DIMENSIONS	-DO-	MEASUREMENT	100%	DRAWING		DIMENSIONAL REPORT	VQCD	VQCD-VENDOR QUALITY CONTROL DEPT
		FINISH	MAJOR	CHECK WITH COMPARATOR	100%	DRAWING		-DO-	-DO-	
		FREEDOM FROM DEFECTS. CTS	MAJOR	VISUAL	100%	NO DEFECTS IMPAIRING ASSY OR PERFORMANCE ARE PERMITTED		-DO-	-DO-	CHP @
		HARDNESS	MAJOR	HARDNESS CHEKING	RANDOM	185 BHN MIN		T.C	-DO-	
4.0.	IDENTIFICATION ##		MAJOR	VISUAL	100%	---	---	--	-DO-	
	##	START FROM 001 AND CONTINUE UP TO 999, IRRESPECTIVE OF THE P.O								
5.0.	PRESERVATION PACKING	SURFACE PROTECTION	MAJOR	VISUAL	100%	$$	$$	--	-DO-	

* : ONE MORE INTEGRAL TEST BAR SHALL BE CAST ALONGWITH EACH CAST LOT AND SENT TO M/S BHEL ALONG WITH COSIGNMENT

$$: TO BE COATED WITH PLASTIPEEL COATING.AND PACKED PROPERLY TO AVOID DAMAGE.

@ V: VERIFICATION OF TEST CERTIFICATES

@ CHP: CUSTOMER HOLD POINT

BHARAT HEAVY ELECTRICALS LTD
BOILER AUXILIARIES PLANT
RANIPET-632 406 (INDIA)
QUALITY ASSURANCE DEPT.

QUALITY CONTROL PLAN FOR
ER FOR SERVOMOTOR.

E OF CONTRACT PACKAGE
STANDARD

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REV.No.01
DATE 151193
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PREPARED BY: B. Srinivasa Rao REVIEWED BY: APPROVED BY:

S.No.	COMPONENT & OPERATION	CHARACTE-RISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE STANDARD	FORMAT OF REC	AGENCY	REMARKS
1	2	3	4	5	6	7	8	9	10	11
1.0.	INTEGRAL TEST BAR GZ-CU-Sn-7Zn-Pb	CHEMISTRY	CRITI-CAL	ANALYSIS	EACH HEAT	DIN 1705		T.C	GOVT APPD. LAB	V @
2.0.	-DO-	MECHANICAL	-DO-	TENSILE TESTING	-DO-	-DO-		T.C	-DO-	
				HARDNESS*	-DO-	-DO-		T.C	-DO-	* HB 10/100
3.0.	BUSH	DIMENSIONS	-DO-	MEASURE-MENT	100%	DRAWING		DIMEN-SIONAL REPORT	VQCD	VQCD-VENDOR QUALITY CONTROL DEPT
		FINISH	MAJOR	CHECK WITH COMPARATOR	100%	DRAWING		-DO-	-DO-	
		FREEDOM FROM VISUAL DEFE-CTS	MAJOR	VISUAL	100%	DRAWING		-DO-	-DO-	CHP @
		HARDNESS	MAJOR	HARDNESS CHEKING	RANDOM	DIN 1705		T.C	-DO-	
	IDENTIFICATION ##		MAJOR	VISUAL	100%	---	---	--	-DO-	
	##	START FROM 001 AND CONTINUE UP TO 999, IRRESPECTIVE OF THE P.O								
	NOTE: ONE MORE INTEGRAL TEST BAR SHALL BE CAST ALONGWITH EACH CAST LOT AND SENT TO M/S BHEL ALONG WITH COSINGNMENT									
				@ V : VERIFICATION OF CERTIFICATES						
				@ CHP : CUSTOMER HOLD POINT						

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BHARAT HEAVY ELECTRICALS LTD BOILER AUXILIARIES PLANT RANIPET-632 406 (INDIA) QUALITY ASSURANCE DEPT.	QUALITY CONTROL PLAN FOR AN FAN SHAFT ASSY	NAME OF CONTRACT PACKAGE STANDARD	QP.NO.FAN326 REV.No.01 DATE:260795 PAGE 01of 06

PREPARED BY: B. Srinivasa Rao REVIEWED BY: APPROVED BY:

S.No.	COMPONENT & OPERATION	CHARACTE-RISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE STANDARD	FORMAT OF REC	AGENCY	REMARKS
1	2	3	4	5	6	7	8	9	10	11
1.0.	MATERIALS									
1.1.	CHEM&MECH PROPERITIES OF RAW MATERIALS									
1.1.1	SHAFT TUBE	CHEM & MECH. PROPERTIES	MAJOR	VERIFICA-TION OF TCs	100%	RESPECTIVE MATERIAL SPECIFICATION AND TDC,IF APPLICABLE		TC	QC/PROC	
1.1.2	SHAFT PINS	-DO-	MAJOR	-DO-	-DO-	-DO-		TC	-DO-	
1.1.3	FLANGE	-DO-	MAJOR	-DO-	-DO-	-DO-		TC	-DO-	
1.1.4	KEY	-DO-	MAJOR	-DO-	-DO-	-DO-		TC	-DO-	
1.2.	INTERNAL QUALITY OF RAW MATERIALS									
1.2.1	SHAFT TUBE	INTERNAL SOUNDNESS	MAJOR	VERIFICA-TION OF UT-CERT	100%	ASTM E213 AND APPLICABLR TDC		TC	-DO-	
1.2.2	SHAFT PINS	-DO-	MAJOR	-DO-	100%	SA 388 &APPLICABLE TDC		TC	-DO-	
1.2.3	FLANGE	-DO-	MAJOR	-DO-	100%	SEL 072 &APPLICABLE TDC		TC	-DO-	
1.3.	SUBDDELIVERIES									
1.3.1	FASTENERS	COMPLIANCE TO PURCHASE ORDER	MAJOR	REVIEW OF TCS	100%	PURCHASE ORDER		TC	-DO-	

QC/PROC:QUALITY CONTROL/PROCUREMENT ,TC: TEST CERTIFCATE

QUALITY CONTROL PLAN FOR

FAN SHAFT ASSY

GP.NO:FAN326
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1	2	3	4	5	6	7	8	9	10	11
2.0.	INPROCESS CONTROL									
2.1.	VERIFICATION OF MATERIAL SPECIFICATION									
2.1.1	SHAFT TUBE &SHAFT PIN &SHAFT FLANGE	VERIFICATION OF RMA,MELTNO ,MATL SPEC.	MAJOR	VERIFICA-TION	100%	RMA CARD		RMA CARD	MQCD	
2.2.	MACHINING									
2.2.1	FLANGE	OD,ID, DRILL HOLE DIA PDC	MAJOR	MEASURE-MENT	100%	DRAWING &PR:QA:500 NOTE 1		DR	MQCD	
2.2.2	SHAFT TUBE	OD,ID, LENGTHS , SURFACE FINISH STATIC UNBALANCE	MAJOR	-DO-	100%	DRAWING &PR:QA:322		DR	MQCD	
2.2.3	PINS	OD,LENGTH SURFACE FINISH	MAJOR	-DO-	100%	DRAWING		DR	MQCD	

DR :DIMENSIONAL REPORT

STANDARD QUALITY CONTROL PLAN FOR

AN FAN SHAFT ASSY

QP.NO.FAN326
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DATE:260795

1	2	3	4	5	6	7	8	9	10
2.3.	WELDING OF SHAFT + PIN FLANGE (If applicable)								
2.3.1	PIN+FLANGE WELDING	WELD SIZE& FINISH	MAJOR	VISUAL & MEASURE-MENT	100%	DRAWING &PR:QE017 NOTE 2&6		—	MQCD
		WELD SOUNDNESS	CRIT	MT	100%	BHE:NDT:RP:MT1		NDT REPORT	NDTL
2.3.2	STRESS RELIEF OF PIN+FLANGE WELDMENT	COMPLIANCE TO STRESS RELIEF CYCLE	MAJOR	VERIFICA-TION OF HT-CHART	100%	BAP:HT:001		HT CHART	MQCD
2.3.3	PIN+FLANGE WELDMENT AFTER STRESS RELIEF	WELD SOUNDNESS	CRIT	MT	100%	BHE:NDT:RP:MT1		NDT REPORT	NDTL
2.4.	TUBE +PIN ASSY	PROPER ASSY	MAJOR	VISUAL	100%	DRAWING ,NOTE 3		—	MQCD
2.5.	SHAFT ASSY WELDING	WELD SIZE &FINISH	MAJOR	MEASURE-MENT	100%	DRAWING ,PR:QE:017 NOTE 2&6		—	MQCD
		WELD SOUNDNESS	CRIT	MT	100%	BHE:NDT:RP:MT1		NDT REPORT	NDTL
				HT-CHART:HEATTREATMENT CHART					
				MQCD: MANUFACTURER'S QUALITY CONTROL DEPARTMENT					
				NDTL:NONDESTRUCTIVE TESTING LABORATORY.					

QUALITY CONTROL PLAN FOR

AN SHAFT ASSY

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1	2	3	4	5	6	7	8	9	10	11
2.6.	SHAFT ASSY MACHINING	JOURNAL DIA FLANGE STEP DIA KEY WAY SIZE & OFFSET END TAPPINGS FACE OUT RUN OUT SURFACE FINISH COUPLING SEATING DIA THREAD SIZE LENGTHS SLOT SIZE FOR LOCK WASHER	MAJOR	MEASURE-MENT	100%	DRAWING & PR:QA:500 NOTE 4		DR	MQCD	**INSTRUMENT NO.USED IN MEASURING JOURNAL DIA IMPELLER SEATING STEP DIA,COUPLING SEATING DIA, LENGTH&KEYWAY DEPTH&WIDTH SHALL BE RECORDED IN DR
2.7.	DYNAMIC BALANCING OF SHAFT ASSY	RESIDUAL* UNBALANCEMENT	CRIT	UNBALANCE COMPENSATION	100%	**DRAWING AND PR:QA:061, 306,307,309,314,323		HISTORY CARD	MQCD	*HALF KEY SHALL BE ASSEMBLED ON SHAFT
3.0.	FINAL INSPECTION									
3.1.	PRESERVATION PAINTING PACKING IDENTIFICATION	COMPLIANCE TO COMPANY STANDARD IN COL.7&8	MAJOR	VISUAL	100%	***PR:QA:512,PR:QA:590 PR:QA:0173,PACKING DRAWING NOTE 5		—	MQCD	***PR:QA:512 IS APPLICABLE FOR SUBCON-TRACTING ONLY

** PRQAs: 061,306,307,309 ARE APPLICABLE FOR BHEL SHOP ONLY.
SUBCONTRACTORS SHALL DEVELOP PROCEDURES BASED ON THEIR MACHINE MANUAL.

*****DOCUMENTS REFERED IN COLUMN 7&8 SHALL BE OF LATEST REVISION ONLY.*****

QUALITY CONTROL PLAN FOR

AN FAN SHAFT ASSY

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1	2	3	4	5	6	7	8	9	10	11

NOTE 1: 1) WHEREVER JIG IS NOT ENVISIGED THE SAME SHALL BE MARKED FOR DRILLING AND INSPECTED AND THEN ONLY TO BE DRILLED

NOTE 2:(i) WELDERS AND WELDING PROCEDURES SHALL BE QUALIFIED AS PER ASME SEC IX TO 3 G POSITION.

ii) WELD TOES SHALL BE GROUND. MAXIMUM DEPTH OF GRINDING PERMISSIBLE IS 0.5 MM.

iii) WELDS SHALL BE CLEANED IN BETWEEN PASSES AND FURTHER WELDING SHOULD BE CONTINIUED AFTER ENSURING COMPLETE REMOVAL OF DEFECTS.

NOTE 3: i)THE ACTUAL MACHINED DIMENSIONS OF END PIN OD AND HOLLOW SHAFT ID SHOULD BE VERIFIED AND RECORDED BEFORE PIPE IS HEATED FOR SHRINK FIT.

ii) HOLLOW TUBE SHALL BE HEATED ONLY BY PRODUCER GAS .OXYACETYLENE FLAME SHOULD NOT BE USED.
iii) THE PIN SHOULD BE INSERTED IN THE PIPE IN VERTICAL POSITION ONLY.
THE PIN AXIS SHOULD NOT BE INCLINED WITH REFERENCE TO PIPE AXIS .PIN INSERTION SHALL BE COMPLETED BEFORE PIPE TEMPARATURE FALLS DOWN FROM 300 DEG C.

NOTE 4: i) THE RELATIVE DISTANCE BETWEEN THE BEARING SEATS WITH REFERENCE TO FLANGE SHALL BE STRICTLY AS PER DRAWING.
ii) KEYWAY OFFSET PERMITTED SHALL BE AS PER TABLE SHOWN BELLOW.

DIA OF SHAFT IN MM	10-22	22-38	38-65	65-110	100-150
OFFESET PERMITTED IN MM	0.1	0.16	0.2	0.3	0.4

QUALITY CONTROL PLAN FOR

AN SHAFT ASSY

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1	2	3	4	5	6	7	8	9	10	11
	iii) OIL HOLES OF PINS SHALL BE CHECKED FOR LENGTHS ,DIA &THREADSIZES.									
	iv) ALWAYS DIMENSIONS SHALL BE MEASURED FROM ONE END ONLY AND ALL TOLERANCES ARE NON CUMULATIVE									
	v) SURFACE FINISH AT BEARING SEATING AREAS IS CRITICAL AND SHALL BE AS PER DRAWINGS.									
	NOTE 5: i) KEY SHALL BE ASSEMBLED TO THE SHAFT AND SCREWED.									
	ii) WO.NO,DU NO,PRODUCT NO,SUBCONTRACTOR FIRM CODE IF ANY SHALL BE PUNCHED AND PAINTED ON ON TH TUBE									
	NOTE 6: i) LOW HYDROGEN ELECTRODES SHALL BE BAKED FOR 2 Hrs ATLEAST 370 -430 DEG C' AND SHALL BE KEPT AT 120 -150 DEG C' BEFORE USE.IF THE ELECTRODES ARE EXPOSED TO ATMOSPHERE FOR MORE THAN 5 MINUTES THEY SHALL BE REBAKED IN THE SAME MANNER.									

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BHEL RANIPET	STANDARD QUALITY CONTROL PLAN FOR PISTON WITH ADJUSTING DISC ASSY	
REF.NO.	REVISION NO	EFFECTIVE DATE
FAN:327	01	28 09 96

PREPARED BY : B SRINIVASA RAO, DM/QA B. Srinivasa Rao

REVIEWED BY : V SUBRAMANIAN, SM/QC

APPROVED BY : H ANANTHANARAYANAN, DGM/QA

ISSUED & CONTROLLED BY :: QUALITY ASSURANCE
BHEL, RANIPET-632 406

DOCUMENT CONTROL NO:

ISSUED TO SHRI :

BHEL RANIPET	RECORD OF REVISIONS	QP.NO:FAN:327 REV.NO:01 PAGE 02 OF 05

REV NO:	CLAUSE NO	REVISIONS MADE	DATE
00	--	FRESH ISSUE	22 11 93
AMENDMENT-A1	--	REFERENCE DOCUMENTS SHALL BE OF LATEST REVISION ONLY	13 01 94
01	--	1)AMENDMENT A1 INCLUDED 2) FORMAT MODIFIED	28 09 96

ISSUED BY QUALITY ASSURANCE BHEL RANIPET-6

STANDARD QUALITY PLAN FOR

PISTON WITH ADJUSTING DISC ASSY

QPNO:FAN.
REV.No:01
DATE:280996

S.No.	COMPONENT & OPERATION	CHARACTE-RISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE STANDARD	FORMAT OF REC	AGENCY	REMARKS
1	2	3	4	5	6	7	8	9	10	
1.0	MATERIALS									
1.1	RAW MATERIALS									
1.1.1	FLANGE	CHEM & MECH PROPERTIES	MAJOR	VERIFICA-TION OF TEST CER-TIFICATES	100%	RESPECTIVE TDC		TEST CERTI-FICATES	QC/PROC	
1.1.2	SPINDLE	-DO-	-DO-	-DO-	-DO-	-DO-		-DO-	-DO-	
1.1.3	ADJUSTING DISC	-DO-	-DO-	-DO- CHART	-DO-	-DO-		-DO-	-DO-	
1.2	SUBDELIVERIES									
1.2.1	FASTENERS	COMPLIANCE TO PURCHASE ORDER	MAJOR	VERIFICA-TION OF COMPLIANCE CERTIFICATE	100%	PURCHASE ORDER		*C.CERT	QC/SD	
2.0	INPROCESS INSPECTION: NOTE1)RMA NO,SPEC.&MELT NO. SHALL BE VERIFIED INCASE OF ATTESTED MATERIALS 2)SPEC. SHALL BE VERIFIED IN CASE OF CERTIFIED MATERIALS									
2.1.	ROUGH MACHINING ID,OD,EP OF FLANGE& SPINDLE		MAJOR	MEASURE-MENT	100%	DRG &PRQA:500/LATEST		—	MQCD	
2.2.	WELDING									

QC/SD:QUALITY CONTROL SUBDELIVERY,QC/PROC:QUALITY CONTROL PROCUREMENT,
NDTL:NONDESTRUCTIVE TESTING LABORATORY,C.CERT:COMPLIANCE CERTIFICATE

QUALITY CONTROL PLANS FOR

PISTON WITH ADJUSTING DISC ASSY

QPNO:FAN:327
REV.No:01
DATE:280996

S.No.	COMPONENT & OPERATION	CHARACTE-RISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE STANDARD	FORMAT OF REC	AGENCY	REMARKS
1	2	3	4	5	6	7	8	9	10	
2.2.1	SPINDLE WITH FLANGE WELDING (PISTON ASSY)	SOUNDNESS	MAJOR	MT	100%	BHE:NDT:RP:MT:01/LATEST PR:QA:337/LATEST		NDT REPORT	NDTL	
2.3.	STRESS RELIEF OF PISTON ASSY	COMPLIANCE TO STRESS RELIEF CYCLE	MAJOR	VERIFICA-TION OF HEAT TRE-ATMENT CHART	100%	BAP:HT:001/LATEST		H.T CHART	MQCD	
2.4.	MACHINING OF PISTON ASSY (Before chrome plating)	ID,OD,GROOVE LENGTH,STEP BORE LENGTH CONCENTRICITY	MAJOR	MEASURE-MENT	100%	MANUFACTURING DRAWING		—	MQCD	
		DRILL HOLE SIZE,LOCATION HOLES PITCH& THREAD SIZE	MAJOR	MEASURE-MENT	100%	DRAWING&PRQA:500/LATEST		—	MQCD	

QUALITY CONTROL PLANS FOR

PISTON WITH ADJUSTING DISC ASSY

QPNO:FAN:327
REV.No:01
DATE:280996

S.No.	COMPONENT & OPERATION	CHARACTE-RISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE STANDARD	FORMAT OF REC	AGENCY	REMARKS
1	2	3	4	5	6	7	8	9	10	
2.5	CHROME PLAT-ING OF PISTON ASSY.	CHROME PLAT-ING THICKNESS &OD	MAJOR	-DO-	100%	-DO-		—	MQCD	
2.6.	MACHINING OF PISTON ASSY AFTER CHROME PLATING	-DO- &CONCENTRI-CITY	MAJOR	-DO-	100%	-DO-		DR	MQCD	
2.7.	ADJUSTING DISC M/CING	ID,OD,STEP DIA,LENGTH, HOLES PITCH& THREAD SIZE	MAJOR	-DO-	100%	-DO-		—	MQCD	
2.8.	PISTON WITH ADJUSTING DISC ASSY	PROPER ASSY &DOWELLING	MAJOR	VISUAL	100%	DRAWING&PR:QA:312/LATEST		—	MQCD	
2.9.	DYNAMIC BALANCING	RESIDUAL UNBALANCEMENT	CRITCAL	UNBALANCE COMPENS-ATION	100%	DRAWING&PR:QA:306,307,314 &338-LATEST		HISTORY CARD	MQCD	
3.0	IDENTIFICATION	PROPER INDENTIFICATION	MAJOR	VISUAL	100%	GMS		—	MQCD	

ISSUED BY QUALITY ASSURANCE BHEL RANIPET-6

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SL NO 1	COMPONENT & OPERATION 2	CHARACTERISTICS 3	TYPE OF CHECK 4	QUANTUM OF CHECK 5	REFERENCE DOCUMENTS 6	ACCEPTANCE NORMS 7	FOR MAT OF	Agency 9		REMARKS 10
								M	C	
1.0	MATERIALS PLATES FOR HUB, BLADE, COVER AND ROOT STIFFENER	CHEMICAL, MECHANICAL PROPERTIES & ULTRASONIC EXAMINATION	REVIEW OF TCs	100%	RESPECTIVE MATERIAL SPECIFICATION	RESPECTIVE MATERIAL SPECIFICATION	TC	P	V*	*Materials stocked after verification TC by BHEL
2.0	**PROCESS CONTROL**									
2.1.	ATTESTATION VERIFICATION									
2.1.1.	a) PETALS OR HUB ASSY b) BLADE c) ROOT STIFFENER (IF APPLICABLE)	RMA NO., MELT NO., MATERIAL SPECN.	VISUAL	100%	RMA CARD	RMA CARD	-	P	W	

Record of revisions

Rev 0 Original issue
Rev 01 dt 06 07 94 Revised editorial correction
Rev 02 dt 16 02 10 format modified and revised reference norms updated.

Best regards,M – Manufacturer
B - BHEL /BHEL Authorized Inspection Agency,
C -Customer, P - perform,
V - Verification of reports
W - Witness, TC - Test certificate
DR – Dimensional report.

Prepared BY	Reviewed and Approved by

Ranipet-6	BHEL: BAP:RANIPAT TAMIL NADU – 632 406	**MANUFACTURING QUALITY PLAN** Item/subsystem: **AN IMPELLER**	QP:No: **FAN 328** Rev: No: **02** Date: **16 02 10** Page : 2 of 010	PROJECT: **STANDARD** PACKAGE : -- CONTRACTOR: BHEL/RANIPET

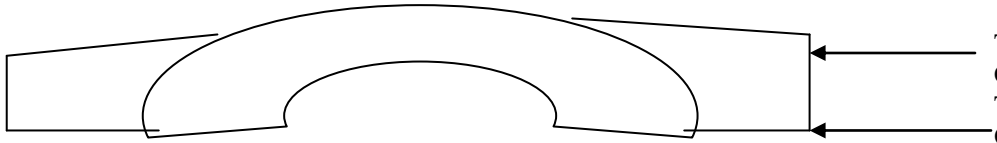
SL NO 1	COMPONENT & OPERATION 2	CHARACTERISTICS 3	TYPE OF CHECK 4	QUANTUM OF CHECK 5	REFERENCE DOCUMENTS 6	ACCEPTANCE NORMS 7	FOR MAT OF	Agency 9 M	Agency 9 C	REMARKS 10
2.2	HUB(DISHED END)									
2.2.2.	DIMENSIONS	PROFILE, OD, HEIGHT	VISUAL & MEASURE MENT	100%	DRAWING & NOTE 1	DRAWING &NOTE 1	DR	P	W	
	WELDING OF PETALS	1) WELDSIZE & FINISH	VISUAL & MEASURE MENT	100%	DRAWING & &NOTE 2	DRAWING &&NOTE 2	NOT REPORT	P	V	
		2)WELD SOUNDNESS	UT/RT	100%	BHE:NDT:RP:UT:02/LATEST &NOTE 2 bHE:NDT:RP:MT:01/ LATEST	BHE:NDT:RP:UT:02/LATEST &NOTE 2 bHE:NDT:RP:MT:01/ LATEST	-DO-	P	W	
2.3.	HUB WELDING WITH COVER									
2.3.1	WELD QUALITY	WELD SIZE AND FINISH & SOUNDNESS	VISUAL & MPT	100%	SRAWING AND bHE:NDT:RP:MT:01/ LATEST & NOTE 2	SRAWING AND bHE:NDT:RP:MT:01/ LATEST & Note 2	DR	P	W	
2.4.	HUBASSY MACHINING	BOARE DIA & HEIGHT	HEIGHT MEASUREMENT	100%	DRAWING	DRAWING &	DR	P	W	

Ranipet-6	BHEL: BAP:RANIPAT TAMIL NADU – 632 406	**MANUFACTURING QUALITY PLAN** Item/subsystem: **AN IMPELLER**	QP:No: **FAN 328** Rev: No: **02** Date: **16 02 10** Page : 3 of 010	PROJECT: **STANDARD** PACKAGE : -- CONTRACTOR: BHEL/RANIPET

SL NO 1	COMPONENT & OPERATION 2	CHARACTERISTICS 3	TYPE OF CHECK 4	QUANTUM OF CHECK 5	REFERENCE DOCUMENTS 6	ACCEPTANCE NORMS 7	FOR MAT OF	Agency 9		REMARKS 10
								M	C	
2.5.	BLADES									
2.5.1	HOT PRESSING	PROFILE	CHECKING WITH CHECKING FIXTURE	100%	DRAWING AND NOTE 4	DRAWING & NOTE-4	DR	P	V	
2.6.	IMPELLER ASSY									
2.6.1	HUB+BLADE WELDING	WELD** FINISH& SOUNDNESS	VISUAL & MT	100%	BHE:NDT:RP:MT:01/LATEST&NOTE 2	BHE:NDT:RP:MT:01/ LATEST&NOTE 2	NDT REPORT	P	W	****Blade with hub fit up shall be ensured before welding in a fixture**
2.6.2	ASSEMBLY CHECK	PROFILE CHECK & BLADE PITCH	VISUAL	100%	DRAWING & NOTE	BHE:NDT:RP:MT:01/ LATEST&NOTE 2	-	P	W	
2.6.3	HEAT TREATEMENT									
2.6.3	STRESS RELIEF	COMPLIANCE TO STRESS RELIEF CYCLE	TIME & TEMP.CHART VERIFT-CATION	100%	BAP:HT:001/LATEST AND NOTE 7	BAP:HT:001/LATEST AND NOTE 7	HT CHART	P	V	
2.6.4	PROFILE CORRECTION AFTER STRESS RELIEF	PROFILE	MEASUREMENT	100%	PROFILE SETTING FIXTURE	NOTE 8	DR	P	W	
2.6.5	NDT	WELD SOUNDNESS	MT	100%	BHE:NDT:RP:MT 01/LATEST	BHE:NDT:RP:MT 01/LATEST	NDT REPORT	P	W	

BHEL: BAP:RANIPAT TAMIL NADU – 632 406 Ranipet-6	MANUFACTURING QUALITY PLAN		PROJECT: **STANDARD**
	Item/subsystem: **AN IMPELLER**	QP:No: **FAN 328** Rev: No: **02** Date: **16 02 10** Page : 4 of 010	PACKAGE : -- CONTRACTOR: BHEL/RANIPET

SL NO 1	COMPONENT & OPERATION 2	CHARACTERISTICS 3	TYPE OF CHECK 4	QUANTUM OF CHECK 5	REFERENCE DOCUMENTS 6	ACCEPTANCE NORMS 7	FOR MAT OF	Agency 9		REMARKS 10
								M	C	
2.6.6	MACHINING									
2.6.6.1	IMPELLER	ID, OD,GROOVE DIA,HEIGHT, HOLES PCD,CHORD DISTANCE	MEASREMENT	100%	DRAWING	DRAWING	DR	P	W	
2.6.6.2	FLANGE	ID,OD,DRILL, HOLES, PCD,CHORD,STEP DIA, THICKNESS	-DO-	100%	DRAWING	DRWING	-DO-	P	W	
2.7.	DYANMIC BALANCING OF IMLLER	UNBALANCE CHECK	UNBALLANCE COMPENSATION	100%	DRAWIMG & NOTE 9	DRAWIMG & NOTE 9	REPORT	P	W	
2.8	NATURAL # FREQUENCY TESTING	NATURAL FREUENCY OF BLADES	RESONANCE CHECK	100%	PRQA 301/lATEST	PRQA 301/lATES	REPORT	P	W	**# SHALL BE CARRIED IF DRAWINGS CALLS FOR THE SAME**
3.0	FINAL INSPECTION	IDENTIFICATION PAINTING PRESERVATION	VISUAL	100%	PRQA 590/LATEST & PACKING DRAWING AND NOTE 10	PRQA 590/LATEST & PACKING DRAWING AND NOTE 10	-	P	V	



The OUTER DIAMETER SHALL BE CHECKED AT BOTH BOTTOM & TOP END TO ENSURE NO TAPER ON OD

बी एच ई एल BHEL Ranipet-6	BHEL: BAP:RANIPAT TAMIL NADU – 632 406	**MANUFACTURING QUALITY PLAN**			PROJECT: **STANDARD**
		Item/subsystem: **AN IMPELLER**	QP:No**:** **FAN 328** Rev: No: **02** Date: **16 02 10** Page : 5 of 010		PACKAGE : -- CONTRACTOR: BHEL/RANIPET

SL NO 1	COMPONENT & OPERATION 2	CHARACTERISTICS 3	TYPE OF CHECK 4	QUANTUM OF CHECK 5	REFERENCE DOCUMENTS 6	ACCEPTANCE NORMS 7	FOR MAT OF	Agency 9 M	Agency 9 C	REMARKS 10

NOTE 1: **HUB MANFACTURING**

1) PETALS SHAL BE CALIBRATED BEFORE USE.
2) THE PETAILS BE ASSEMBLED AND TACK WELDED IN ASSY FIXTURE
3) THE PROILE OF THE PETALS SHALL BE CHECKED AT THE CONVEX SIDE WITH TEMPLASTE AS PER FIG -1 AND MAXIUM BAP BETWEEN TEMPLETE AND PETAL SURFACE SHALL NOT EXCEED 2MM AT ANY PLACE.

NOTE 2: 1) ROOT MISMATCH OF WELD JOINT FIT UP OF PETAL ASSY. SHALL NOT EXCEED 1MM
2) THE GAP BETWEEN CIRCU;AR TEMPLATE AND THE PROFILE OF BUILT UP DISHED END AT THE WELD JOINTS SHALL NOT EXCEED 1.5MM(FIG.2).
3) ALL BUTT WELDS SHALL BE FULL PENETRATION TYPE.

NOTE 3: THE FLATNESS OF COVER PLATE SHALL BE LIMITED TO ONE THOUSANDS OF THE DISHED AND DIA IN MM(REF./FIG 3)

NOTE 4: BLADES SHALL BE HOT PRESSED AND COLD CALIBRATED.

NOTE 5: THE BLADE TO HUB WELDS SHALL BE FREE FROM UNDERCUTS, HEAVY RIPPLES AND WELDS SHALL BE SMOOTHLY MERGED BY WELD DRESSING USING SPECIAL TEMPLATE FOR WELDING SIZE CHECKING.

NOTE 6: 1) THE VERTICALLY OF ANY TWO BLADE SHALL NOT EXCEED 2MM WHILE CHECKING TEMPLATE (FIG.4).
2) THE GAP BETWEEN LEADING AND TRAILING EDGE OF BLADE SHOULD WITHIN THE MEDIUM TOLERANCE AS PER PR:QA:500/LATEST.
3) THE LEVEL VARIATION OF LEADING AND TRAILING EDGE SHALL NOT DIFFER BETWEEN ANY TWO BLADES BY 2MM (FIG.5).
4) THE BLADE PROFILE SHALL BE CHECKED WITH SETTING TEMPLATE AFTER WELDING.
5) THE IDENTIFICATION HOLE FOR LOCATION OF BLADE SHALL BE PLUGGED AFTER CHECKING.
6) THE FLANGE OF IMPELLER SHALL BE DRILED WITH DRILL JIG.

NOTE 7: **HEAT TREATMENT**

1) THE IMPELLER SHALL BE STRESS RELIEVED AFTER FULL WELDING.
2) SUFFICIENT CARE SHALL BE TAKEN TO AVOID DISTORITION.
3) STREES RELIEVING SHALL BE CARRIED OUT PRIOR TO FINAL MACHING AND AFTER ALL CORRECTION.
4) ONE ESCAPE HOLE OF DIA 6MM IS TO BE DRILLED ON THE COVER PLATE BEFORE STREES RELIEVEING AND THE SAME SHALL BE PLAGGED AFTER STREES RELEVEING.

SL NO 1	COMPONENT & OPERATION 2	CHARACTERISTICS 3	TYPE OF CHECK 4	QUANTUM OF CHECK 5	REFERENCE DOCUMENTS 6	ACCEPTANCE NORMS 7	FOR MAT OF	Agency 9 M	Agency 9 C	REMARKS 10

NOTE 8: PROFILE CORRECTION

1) BLADE PROFILE SHALL BE THERMALLY CORRECTED AFTER HEAT TREATMENT WHEREVER REQUIRED.
2) THE VARIATION ALLOWED SHALL BE AS PER TABLE 1.

NOTE 9:

1) PRODUCT NO. SHALL BE HARD STAMPED BEFORE DYNAMIC BALANCING.
2) ALL THE TACKS, UNDERCUTS SHALL BE FILLED. GROUND OFF OR CHIPPED.
3) THE BALANCING IS TO BE DONE WITH MANDREL. THE MANDREL SHALL BE FIRST DYNAMICALLY BALANCED TO GR.1 OF ISO 1940 THEN SHOULD BE ASSEMBLED WITH IMPELLER.
4) THE COMPENSATIONG MASS SHALL BE PROPERLY SECURED AS PER DRAWING. THE CUTOUTS ONCOVER PLATES SHALL BE REWELDED AFTER FIXING THE COMPENSATING MASS.

NOTE 10: THE IMPELLER SHALL BE IDENTIFIED WITH W.O.NO., D.U.NO., PRODUCT NO. AND SUB-CONTRACTOR CODE BY PAINTING AND HARD STAMPING

NOTE 11:

TOLERANCE FOR AN FAN IMPLLER BLADE CHECKING WITH THE TEMPLEATE AFTER WELDIMG TO THE HUB.

1. AN FAN IMPLLERS ARE OF WELDED DESIGN. THE CORRECT FORM AND THE LOCATION OF THE IMPELLER BLADES CAN BE CORRECTED ON THE COMPLETED (FINSH WORK) IMPELLERS BY THE APLICATION OF HEAT WITH PROPER BLOW PIPES (GAS ORCHES).

2. THE CHECING IS DONE WITH THE HELP OF CHECKING FIXURE WHICH IS FIXED IN THE CORRESPONDING DISTANCE TO THE IMPELLER CENTRE ON A BASE PLATE. THE IMPELLER IS LOCATED ON A PIVOT (CENTRE) AS SHOWN IN FIG.6.

3. THE TOLERANCE ARE SO ESTABLISHED, THE THE AERODYNAMIC REQUIREMENTS AS WELL AS THE MANUFACTURING METHOD CALCULATIONS ARE SUPPORTED.

THE FOLLOWING MEASUREMENTS ARE MADE, WHERE THE BEARING SURFACES OF THE CHECKING TEMPLATE SHOULD LIE (FIT) AGAINST THE BLADE.

(1) GAPS BETWEEN THE IMPELLER BLADE AND THE CHECKING TEMPLATE ON 3 LOCATION OF THE BLADE.(REFER FIGURE7).
a) ENTRY (AFTER THE ENTRY RADIUS), b) MIDDLE, C(EXIT (BEFORE THE CHMFERING)

i. THESE MEASUREMENTS ARE DEALT ESSENTIAL AT THE OUTER SECTION OF THE CHECKING TEMPLATE AS WELL AS AT THE SECTION THAT LIES UNIFORMLY OVER THE IMPELLER BOTTOM. (REFER FIGURE 8).

ii. FOR THE EVALUATION, THE OUTER SECTON IS USED. THE MEASU REMENT AT THE INNER SECTION SERVE MERELY THE INFORMATION AND INTERPRETATION WHEN LARGE DEVIATIONS ARE PRESENT AT THE OUTER SECTION. (REFER FIGHURE 9).

2) PROFILE CHORD LENGTH AT THE OUTER PROFILE SECTION.
3)THE DISTANCE (5) OF THE ENTRY EDGE FROM THE IMPELLER BOTTOM. WHEN THE LARGE DEVIATIONS ARE PRESENT IN

SL NO 1	COMPONENT & OPERATION 2	CHARACTERISTICS 3	TYPE OF CHECK 4	QUANTUM OF CHECK 5	REFERENCE DOCUMENTS 6	ACCEPTANCE NORMS 7	FOR MAT OF	Agency 9		REMARKS 10
								M	C	

DIMENSIONS (5) THE FOLLOWING INFLUENCING FACTORS ARE TO BE CHECKED.

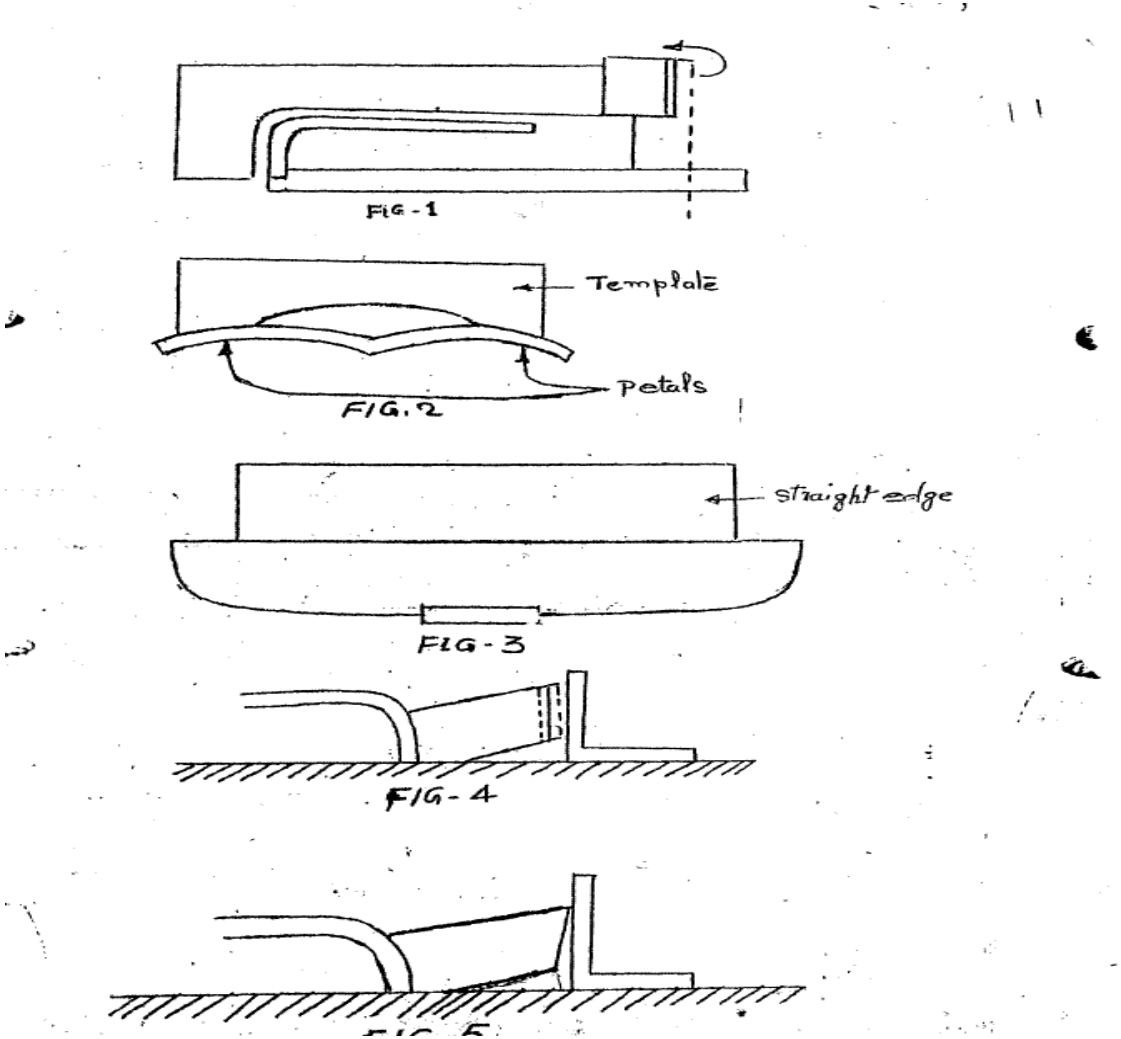
a) DIFFERENCE IN THE PROFILE CHORD (4)
b) THE FORM OF THE ENTRY RADIUS

TABLE-1

FAN SIZE	INDIVIDUAL BLADE WELDED ON TO IIMPELLER		SUM OF THE TOLERANCE OF BLADE ON IMPELLER	
	ALLOWABLE PARALLEL GAP IN (MM)	ALLOWABLE DEVIATION FROM PARALLEL GAP IN (MM)	ALLOWABLE AVARAGE PARALLEL GAP (MM)	ALLOWABLE DEVIATION FROM PARALLEL GAP IN (MM)
AN 13	4	2	4	1.5
AN 18	5	2.5	5	2
AN 20	6	3	6	2
AN 21	6	3	6	2
AN 22	6	3	6	2
AN 25	7	3.5	7	2.5
AN 28	8	4	8	2.5
AN 30	8	4	8	2.5
AN 31	8	4	8	2.5
AN 33	9	4.5	9	3
AN 35	9	4.5	9	3
AN 37	10	5	10	3
AN 40	11	5.5	11	3.5
AN 42	11	5.5	11	3.5
AN 45	12	6	12	3.5
AN 47	12	6	12	3.5
AN 50	13	6.5	13	4

BHEL: BAP:RANIPAT TAMIL NADU – 632 406 Ranipet-6	MANUFACTURING QUALITY PLAN		PROJECT: **STANDARD**
	Item/subsystem: **AN IMPELLER**	QP:No: **FAN 328** Rev: No: **02** Date: **16 02 10** Page : 8 of 010	PACKAGE : -- CONTRACTOR: BHEL/RANIPET

SL NO 1	COMPONENT & OPERATION 2	CHARACTERISTICS 3	TYPE OF CHECK 4	QUANTUM OF CHECK 5	REFERENCE DOCUMENTS 6	ACCEPTANCE NORMS 7	FOR MAT OF	Agency 9 M	Agency 9 C	REMARKS 10



SL NO 1	COMPONENT & OPERATION 2	CHARACTERISTICS 3	TYPE OF CHECK 4	QUANTUM OF CHECK 5	REFERENCE DOCUMENTS 6	ACCEPTANCE NORMS 7	FOR MAT OF	Agency 9 M	Agency 9 C	REMARKS 10

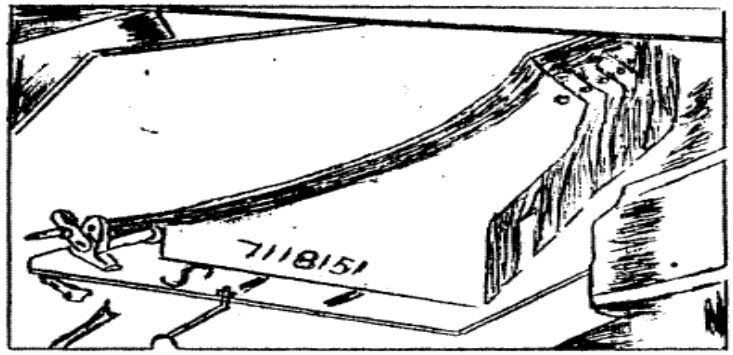


FIG-6

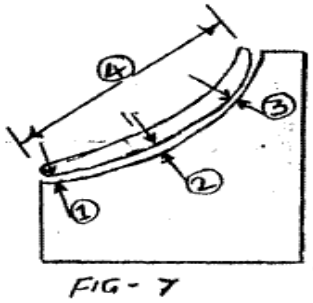


FIG-7

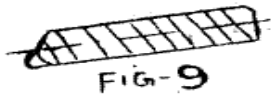


FIG-9

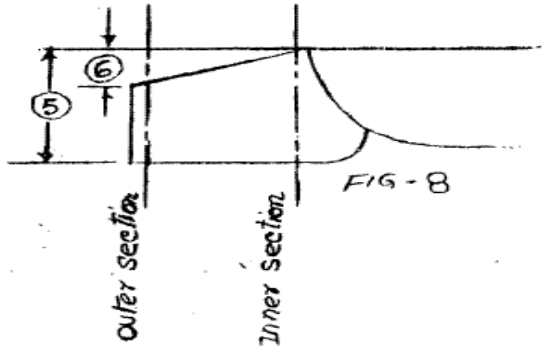
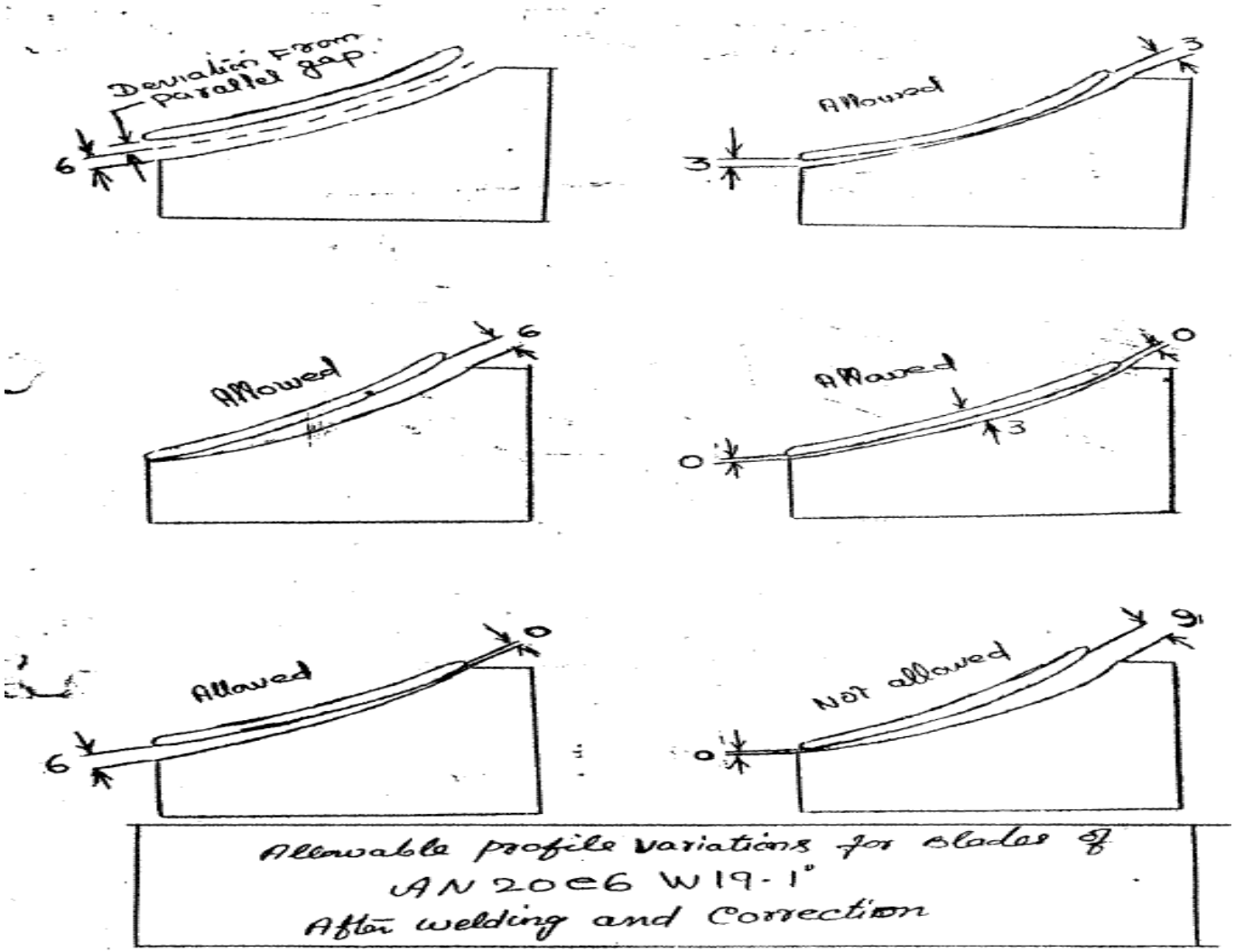


FIG-8

BHEL: BAP:RANIPAT TAMIL NADU – 632 406 Ranipet-6	MANUFACTURING QUALITY PLAN		PROJECT: **STANDARD**
	Item/subsystem: **AN IMPELLER**	QP:No: **FAN 328** Rev: No: **02** Date: **16 02 10** Page : 10 of 010	PACKAGE : -- CONTRACTOR: BHEL/RANIPET

SL NO 1	COMPONENT & OPERATION 2	CHARACTERISTICS 3	TYPE OF CHECK 4	QUANTUM OF CHECK 5	REFERENCE DOCUMENTS 6	ACCEPTANCE NORMS 7	FOR MAT OF	Agency 9 M	Agency 9 C	REMARKS 10



Allowable profile variations for blades of AN 20C6 W19-1" After welding and Correction

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RANIPET

QUALITY DEPARTMENT

AMENDMENT TO QUALITY WORK INSTRUCTIONS (SQP)

Q.W.I.NO: FAN329 REV: 00 AMENDMENT SL NO: A 1

DESCRIPTION: AP IMPELLER COVER PLATE DATE:13 01 94

DETAILS

CLAUSE NO	AMENDED AS	BASIS FOR AMENDMENT REMARKS
GENERAL	ALL DOCUMENTS REFERRED IN COLUMN 6&7 SHALL BE OF LATEST REVISION.	REVISION STATUS IS NOT MENTIONED IN THE DOCUMENTS REFERRED

Prepared by B. Sundaram Approved by

Distribution: As per standard distribution list.

BHARAT HEAVY ELECTRICALS LTD BOILER AUXILIARIES PLANT RANIPET 632 406 (INDIA) QUALITY ASSURANCE DEPT.	QUALITY CONTROL PLAN AP IMPELLER COVER PLATE	NAME OF CONTRACT PACKAGE STANDARD	QP NO : FAN329 REV NO: 00 DATE : 22 11 93 PAGE : 01 OF 01

PREPARED BY: B. Srinivasachar REVIEWED BY: APPROVED BY:

S No	COMPONENT & OPERATION	TYPE OF CHECK	QUANTUM OF CHECK	CHARACTERISTICS	REF STD	ACCPT STD	AGENCY	INSTRUMENTS REQUIRED	FORMAT OF RECORD	REMARKS
1	2	3	4	5	6	7	8	9	10	11
1.0	MATERIAL	VERIFICATION	100%	MELT NO:,SPEC RMA NO:	RMA CARD		QC	—	RMA CARD	
1.1	RING &COVER M/CING	MEASUREMENT	100%	ID,OD,	DRG &PRQA:500/ LATEST		QC	VERNIER CALIPER	LOG	
1.2	COVER PLATE WELDING	MT	100%	WELD SOUNDNESS	BHE:NDT:RP:MT1		NDT	MPI MACHINE	NDT REPORT	
1.3	COVER PLATE MACHINING	MEASUREMENT	100%	ID, OD,HEIGT,STEP DIAMETERS,DRILL HOLE DIMENSIONS	DRG&PRQA:500/ LATEST		QC	VERNIER,STEEL TAPE	LOG	
1.4	IDENTIFICATION	VISUAL	100%	SLNO.NO.NO,	OPS		QC	----	—	

BHEL
RANIPET

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QUALITY DEPARTMENT		
AMENDMENT TO QUALITY WORK INSTRUCTIONS (SQP)		
Q.W.I.NO: FAN330 REV: 00 AMENDMENT SL NO: A 1		
DESCRIPTION: AP HUB WITH SUPPORTING ASSY DATE:13 01 94		
DETAILS		
CLAUSE NO	AMENDED AS	BASIS FOR AMENDMENT REMARKS
GENERAL	ALL DOCUMENTS REFERRED IN COLUMN 6&7 SHALL BE OF LATEST REVISION.	REVISION STATUS IS NOT MENTIONED IN THE DOCUMENTS REFERRED
Prepared by B. Srinivasa Rao		Approved by

Distribution: As per standard distribution list.

RAT HEAVY ELECTRICALS LTD LER AUXILIARIES PLANT HPET 632 406 (INDIA) LITY ASSURANCE DEPT.	QUALITY CONTROL PLAN FOR AP HUB WITH SUPPORTING BODY	NAME OF CONTRACT PACKAGE STANDARD	QP NO : FAN 330 REV NO: 00 DATE : 22 11 93 PAGE : 01 OF 01

PREPARED BY: B Srinivasa Rao REVIEWED BY: S. Viswanath APPROVED BY: H Amin

No	COMPONENT & OPERATION	TYPE OF CHECK	QUANTUM OF CHECK	CHARACTERISTICS	REF STD	ACCPT STD	AGENCY	INSTRUMENTS REQUIRED	FORMAT OF RECORD	REMARKS
1	2	3	4	5	6	7	8	9	10	11
0	ASSY OF SUPPORT BODY & HUB	VERIFICATION	100%	CONCENTRICITY OF HUB AND SUPPORT BODY	—		QC	CONCENTRICITY CHECKING GAUGE	—	
0.1	DRILLING OF DOWEL PIN HOLE	-DO-	-DO-	SIZE OF HOLE	DRG &PRQA:500		-DO-	ID MIC	—	
1	MACHINING OF HUB AND SUPPORT BODY (LINE BORING)	MEASUREMENT	-DO-	BORE DIAMETERS & LENGTHS.	DRG &PRQA:500		-DO-	ID MIC, CONCENTRICITY CHECKING GAUGE	HC	
2	BALANCING	UNBALANCE VERIFICATION	-DO-	UNBALANCE COMPENSATION	-DO-		QC	BALANCING MACHINE	HC	
3	PRESERVATION	VERIFICATION	-DO-	SURFACE PROTECTION BY TEMPORARY RUST PREVENTIVE	—		QC	—	—	

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BHARAT HEAVY ELECTRICALS LTD BOILER AUXILIARIES PLANT RANIPET 632 406 (INDIA) QUALITY ASSURANCE DEPT.	QUALITY CONTROL PLAN FOR BLADE SHAFT	NAME OF CONTRACT PACKAGE STANDARD	QP NO : PAM 332 REV NO: 01 DATE : 20 06 94 PAGE : 01 OF 01
PREPARED BY: B. Srinivasan	REVIEWED BY: S. Viswanathan	APPROVED BY: H Ahmed	

S No	COMPONENT & OPERATION	TYPE OF CHECK	QUANTUM OF CHECK	CHARACTERISTICS	REF STD	ACCPT STD	AGENCY	INSTRUMENTS REQUIRED	FORMAT OF RECORD	REMARKS
1	2	3	4	5	6	7	8	9	10	11
1.0	MATERIAL	VERIFICATION	100%	MELT NO,SPEC		T C	QC	--	--	
1.1.0	BLADE SHAFT ROUGH M/CING	MEASUREMENT	100%	OD,LENGTH,RADIUS, THREAD SIZE,GROOVE DIMENSIONS,GRINDING ALLOWANCE.PIP DIMEN-SIONS	DRG,PRQA:500/ LATEST & OPS		QC	VERNIER,OD MIC,DEPTH VERNIER,THREAD RING GAUGE,DIAL GAUGE	LOG	
1.1.1	BLADE SHAFT MACHINING	MEASUREMENT	100%	OD,LENGTH,RADIUS THREAD SIZE,GROOVE DIMENSION,HOLE DIA &PCD,SURFACE FINISH KEY WAY DIMENSIONS, &OFFSET,R/OG F/O	DRG&PRQA:500/ LATEST		QC	VERNIER,OD MIC,DEPTH VERNIER.DIAL GAUGE WITH STAND,SURFACE FINISH COMPARATOR, SLIP GAUGES	HC *	* HISTORY CARD
1.1.2	IDENTIFICATION	VERIFICA-TION	100%	IDENTIFICATION BY SLNO.	--		QC	--	DR	
1.3	NDT	MT	100%	SURFACE PERFECTION	BHE:NDT:RP:MT2/ LATEST		NDT	WET METHOD(FLOURESENT) MPI MACHINE. SLIP GAUGES	NDT REPORT	
2.0	PRESERVATION	VISUAL	100%	PROPER PRESERVATION	TEMPORARY RUST PREVENTIVE SHALL BE SPRAYED SO THAT NO M/CED SURFACE IS EXPOSED.		QC	--	---	

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QUALITY DEPARTMENT

AMENDMENT TO QUALITY WORK INSTRUCTIONS (SQP)

Q.W.I.NO: FAN333 REV: 00 AMENDMENT SL NO: A 1

DESCRIPTION: CYLINDER ASSEMBLY DATE:13 01 94

DETAILS

CLAUSE NO	AMENDED AS	BASIS FOR AMENDMENT REMARKS
GENERAL	ALL DOCUMENTS REFERRED IN COLUMN 6&7 SHALL BE OF LATEST REVISION.	REVISION STATUS IS NOT MENTIONED IN THE DOCUMENTS REFERRED

Prepared by B. Sundaram Approved by

Distribution: As per standard distribution list.

BHARAT HEAVY ELECTRICALS LTD BOILER AUXILIARIES PLANT RANIPET 632 406 (INDIA) QUALITY ASSURANCE DEPT.	QUALITY CONTROL PLAN FOR CYLINDER ASSEMBLY	NAME OF CONTRACT PACKAGE STANDARD	QP NO : FAN 333 REV NO: 00 DATE : 22 11 93 PAGE : 01 OF 03
PREPARED BY: B. Srinivasa Rao	REVIEWED BY: HA	APPROVED BY: HA	

S No	COMPONENT & OPERATION	TYPE OF CHECK	QUANTUM OF CHECK	CHARACTERISTICS	REF STD	ACCPT STD	AGENCY	INSTRUMENTS REQUIRED	FORMAT OF RECORD	REMARKS
1	2	3	4	5	6	7	8	9	10	11
1.0	CYLINDER ASSY									
1.1	CYLINDER MACHINING	MEASURE-MENT	100%	BORE DIA, LENGTH STEP BORE DIA, BUSH BORE DIA WITH STEP. SURFACE FINISH FLATNESS, RUN OUT & FACE OUT	DRG &PRQA:500		QC	VERNIER, DEPTH VERNIER ID MIC, SURFACE FINISH COMPARATOR STRAIGHT EDGE DIAL GAUGE WITH STAND	DR	ONE COMMON REF TO BE ARRANGED FOR LINE BORING DURING ASSY MACHINING
1.1.1	CYLINDER DRILLING	MEASURE-MENT	-DO-	DRILL HOLE DIA, ORIENTATION, PCD THREADED HOLE SIZE	-DO-		-DO-	VERNIER, THREAD PLUG GAUGE, DEPTH VERNIER	-DO-	
1.2	COVER MACHINING	MEASURE-MENT	-DO-	STEP DIA BUSH BORE DIA WITH STEP GROOVE ON STEP, FLATNESS OF FLANGE. RUNOUT, FACEOUT, SURFACE FINISH	-DO-		QC QC	VERNIER, DEPTH VERNIER, DIAL GAUGE WITH STAND SURFACE FINISH COMPARATOR	-DO-	-DO-

QUALITY CONTROL PLAN FOR

CYLINDER ASSEMBLY

QP NO : FAN 333
REV NO: 00
DATE : 22 11 93
PAGE : 02 OF 03

S No	COMPONENT & OPERATION	TYPE OF CHECK	QUANTUM OF CHECK	CHARACTERISTICS	REF STD	ACCPT STD	AGENCY	INSTRUMENTS REQUIRED	FORMAT OF RECORD	REMARKS
1	2	3	4	5	6	7	8	9	10	11
1.2.1	COVER DRILLING	VERIFICATION & MEASUREMENT		DRILL HOLE DIA,PCD, ORIENTATION, OIL LEAK HOLE DETAILS, THREADED HOLE SIZE	DRG& PRQA:500		QC	VERNIER,DEPTH VERNI-ER, THREAD PLUG GAUGE	DR	
1.3	CYLINDER ASSY	VERIFICATION PRESSURE TEST(HYD)	100%	LEAK TEST AT 40 KG/CM² FOR 30 MTS	-DO-		SHOP/ QC	SUITABLE HYD TEST SYSTEM WITH PR. GAUGE HYD PUMP 100 KG/CM²	DR	NO LEAK PERMITTED
1.4	CYLINDER ASSY DISMANTLING	VERIFICATION	-DO-	CLEANLINESS	---		SHOP	---	--	---
1.4.1	NITRIDING OF CYLINDER	VERI. OF REPORT	-DO-	CASE DEPTH & HARDNESS	DRAWING		QC	---	R	---
1.4.2	ASSY OF BUSHES IN CYLINDER & COVERS	-DO-	-DO-	SEATING OF BUSHES	---		-DO-	FEELER GAUGE		
1.4.3	ASSY OF COVER & CYLINDER ASSY	-DO-	-DO-	DOWEL PIN FIXING TIGHTENESS OF FASTENERS	DRG&PRQA:312		QC	TORQUE WRENCH		

QUALITY CONTROL PLAN FOR CYLINDER ASSEMBLY										QP NO : FAN 333 REV NO: 00 DATE : 22 11 93 PAGE : 03 OF 03
PREPARED BY:				REVIEWED BY:			APPROVED BY:			
S No	COMPONENT & OPERATION	TYPE OF CHECK	QUANTUM OF CHECK	CHARACTERISTICS	REF STD	ACCPT STD	AGENCY	INSTRUMENTS REQUIRED	FORMAT OF RECORD	REMARKS
1	2	3	4	5	6	7	8	9	10	11
1.4.4	CYLINDER ASSY FINE BORING	MEASURE-MENT	100%	CONCENTRICITY OF BUSH BORE WITH CYLINDER ID/OD BUSH ID	DRG &PRQA:500		QC	ID MIC DIAL GAUGE WITH STAND	DR	REF POINT 1.1 & 1.2 FOR REMARKS
1.4.5	CYLINDER ASSY DYNAMIC BALANCING	UNBALANCE VERIFICA-TION	-DO-	UNBALANCE VALUE	-DRG-		-DO-	BALANBING M/C	H.C	
1.4.6	CYLINDER ASSY	IDENTIFI-CATION & PRESER-VATION	-DO-	SL NO REF &PRESER VATION WITH TEMPORA -RY RUST PREVENTIVE	OPS		QC	—	H.C	

Ranipet	MANUFACTURER'S NAME & ADDRESS **M/S BHEL / BAP / RANIPET 632 406**	**STANDARD QUALITY PLAN**		
		ITEM/SUB SYSTEM: **AP HUB DISC**	**Doc. No**	**FAN 334**
			Rev. No	**01**
			Date	**16 02 10**
			Page No	**01 OF 02**

Sl no 1	Component & operation 2	Characteristics 3	Type Of Check 4	Quantum of Check 5	Reference Documents 6	Acceptance Norms 7	Format Of Records 8	Agency 9		Remarks 10
								M	B	
1.0	Material	Mat spec., heat no, RMA NO.	Verification	100%	RMA card		RMA card	P	W	
1.1	Hub machining	Outside diameter, inside diameter, taper bore, surface finish, shape groove depth	measurement	100%	DRAWING		DR/LOG	P	W	
1.2	Hub drilling	Pitch distance , chord distance, hole size,threadedv hole size&orientattion	measurement	100%	DRAWING		DR/LOG	P	W	

LEGENDS:		
M – Manufacturer,(BHEL Shop / Subcontractor,) B - BHEL QC/ Authorized Inspection agency, CC –Compliance certificate P - Performed By, V - Verification Of Reports/Records W - Witness T C - Test Certificate R- report,	PREPARED BY	REVIEWED & APPROVED BY :

Ranipet	MANUFACTURER'S NAME & ADDRESS **M/S BHEL / BAP / RANIPET 632 406**	**STANDARD QUALITY PLAN**		
		ITEM/SUB SYSTEM: **AP HUB DISC**	**Doc. No**	**FAN 334**
			Rev. No	**01**
			Date	**16 02 10**
			Page No	**01 OF 02**

Sl no 1	Component & operation 2	Characteristics 3	Type Of Check 4	Quantum of Check 5	Reference Documents 6	Acceptance Norms 7	Format Of Records 8	Agency 9		Remarks 10
								M	B	
1.3	Hub Disc balancing	Unbalance compensation	Verification/witnessing	100%	DRAWING		DR	P	W	
1.4	Identification	Wo.no,sl.no, BAL ref NO.	Visual verification	100%	OPS/GMS		--	P	W	

FOR UNTOLERANCED DIMENSIONS PRQA 500/LATES SHALL BE REFFERED.

LEGENDS:		
M – Manufacturer,(BHEL Shop / Subcontractor,) B - BHEL QC/ Authorized Inspection agency, CC –Compliance certificate P - Performed By, V - Verification Of Reports/Records W - Witness T C - Test Certificate R- report,	PREPARED BY	REVIEWED & APPROVED BY :

Revision No	Date	Details
00	-	Original issue
01	16 02 10	TOTALLY MODIFIED

Ranipet	MANUFACTURER'S NAME & ADDRESS **M/S BHEL / BAP / RANIPET 632 406**	**STANDARD QUALITY PLAN**		
		ITEM/SUB SYSTEM: **AP FAN BEARING COVER**	**Doc. No**	**FAN 335**
			Rev. No	**01**
			Date	**16 02 10**
			Page No	**02 OF 02**

Sl no 1	Component & operation 2	Characteristics 3	Type Of Check 4	Quantum of Check 5	Reference Documents 6	Acceptance Norms 7	Format Of Records 8	Agency 9		Remarks 10
								M	B	
1.0	BRG cover half machining	Surface level, surface finish, half height	Measurement	100%	DRAWING	LOG		P	W	Incase cover is single piece CL.1.0 not applicable
1.0.1	BRG cover drilling	Drill hole size, position orientaion,taper,pin hole size(dowelling) Torque, surface cotact,level	Measurement	100%	DRAWING	DR/LOG		P	W	
1.1	BRG cover assy.	Torque &surface contact level	Visual measurement	100&	DRAWING & PRQA:312/LATEST	DR/LOG		P	W	
1.1.1	Cover assy machining	OD,ID,groove depth, step depth,thickness,step dia groove width run out & face out	measurement	100%	DRAWING	DR		P	W	

LEGENDS:
M – Manufacturer,(BHEL Shop / Subcontractor,)
B - BHEL QC/ Authorized Inspection agency, CC –Compliance certificate
P - Performed By, V - Verification Of Reports/Records
W - Witness T C - Test Certificate R- report,

PREPARED BY

REVIEWED & APPROVED BY :

Ranipet	MANUFACTURER'S NAME & ADDRESS **M/S BHEL / BAP / RANIPET 632 406**	**STANDARD QUALITY PLAN**		
		ITEM/SUB SYSTEM: **AP FAN BEARING COVER**	**Doc. No**	**FAN 335**
			Rev. No	**01**
			Date	**16 02 10**
			Page No	**02 OF 02**

Sl no 1	Component & operation 2	Characteristics 3	Type Of Check 4	Quantum of Check 5	Reference Documents 6	Acceptance Norms 7	Format Of Records 8	Agency 9		Remarks 10
								M	B	
1.1.2	Cover assy. milling	Position, orientation of slots Position,orientation ,tereaded holes ,thermometer threaded holes Fixing of seals	Measurement	100%	DRAWING	LOG		P	W	
1.1.3	Cover assy. drilling	Inside dia. of seal run out & face out	Measurement	100%	DRAWING	LOG		P	W	
1.2	Assy. of labyrinth seal Seal assy.	Fixing of seals	visual	100%	DRAWING	LOG		P	W	
1.2.1	machining	Inside dia of seal ,run out & face out	measurement	100%	DRAWING	LOG		P	W	

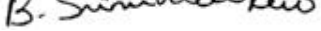
FOR UNTOLERANCED DIMENSIONS PRQA 500/LATEST SHALL BE REFFERED.

LEGENDS:		REVIEWED & APPROVED BY :
M – Manufacturer,(BHEL Shop / Subcontractor,) B - BHEL QC/ Authorized Inspection agency, CC –Compliance certificate P - Performed By, V - Verification Of Reports/Records W - Witness T C - Test Certificate R- report,	PREPARED BY	

Revision No	Date	Details
00	-	Original issue
01	16 02 10	TOTALLY MODIFIED

QUALITY DEPARTMENT	
Amendment to Quality Work Instructions (SQP)	
QWI NO:SQP FAN 336 REV: 00	**DT. 22 11 93**
Amendment no: A 2	**DT. 11 04 08**
Description : Impeller hub+ Blade brg assy.	

Details of Amendment		
Note Sl.no.	**Amended As**	**Basis For Amendment**
1	Clause No 1.0.6 : 1.0.6 a) Column no 6 & 7 as Drg /PRQA 331/Latest 1.0.6 b) Minimum 3 nos of any blades of same family shall be Assembled progressively and checked for free movement of blades without fouling with hub as well as among the Blades.	***PRQA No 082 is replaced by PRQA 331*** **Included Based on the shop practice**
2	1.0.07 column no 6&7 shall be read as packing drg & PRQA 590/Latest	

Prepared by	Reviewed By	Approved By
		

BHEL
RANIPET

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QUALITY DEPARTMENT

AMENDMENT TO QUALITY WORK INSTRUCTIONS (SQP)

Q.W.I.NO: FAN336 REV: 00 AMENDMENT SL NO: A 1

DESCRIPTION: DATE:13 01 94
IMPELLER HUB+BLADE BEARING ASSY

DETAILS

CLAUSE NO	AMENDED AS	BASIS FOR AMENDMENT REMARKS
GENERAL	ALL DOCUMENTS REFERRED IN COLUMN 6&7 SHALL BE OF LATEST REVISION.	REVISION STATUS IS NOT MENTIONED IN THE DOCUMENTS REFERRED

Prepared by B. Srinivasan Approved by

Distribution: As per standard distribution list.

BHARAT HEAVY ELECTRICALS LTD BOILER AUXILIARIES PLANT RANIPET 632 406 (INDIA) QUALITY ASSURANCE DEPT.	QUALITY CONTROL PLAN FOR IMPELLER+BLADE BEARING ASSY	NAME OF CONTRACT PACKAGE STANDARD	QP NO : FAN 336 REV NO: 00 DATE : 22 11 93 PAGE : 01 OF 03
PREPARED BY: B. Srinivasa Rao	REVIEWED BY: S. Vinay	APPROVED BY:	

S No	COMPONENT & OPERATION	TYPE OF CHECK	QUANTUM OF CHECK	CHARACTERISTICS	REF STD	ACCPT STD	AGENCY	INSTRUMENTS REQUIRED	FORMAT OF RECORD	REMARKS
1	2	3	4	5	6	7	8	9	10	11
1.0	IMPELLER AFTER LINE BORING	VERIFICATION	100%	DIMN, SL NO, PREVIOUS STAGES CLEARANCE	DRG & OPS		QC	——	—	
1.0.1	ASSY COMPONENTS LIKE BLADE SHAFTS DISTANCE RING BUSH, STEEL BALLS, OIL SEALS, LOCK NUTS, LEVER BRGS, LUBRICANT ETC	VISUAL & VERIFICATION		DIMENSIONS, CLEANLINESS, SHARP EDGES REMOVAL, QUANTITY	DRG & DR		-DO-	——	—	
1.0.2	ASSY OF BLADE BRG ASSEMBLY	VISUAL	-DO-	PROPER FIT, LOCATION TIGHTNESS	QCP:1600011529 (4)		-DO-	TORQUE WRENCH, VERNIER DEPTH GAUGE	LOG	
1.0.2.1	HYDRAULIC TEST AT10BAR	VISUAL G	-DO-	PRESSURE DROP	-DO-		QC	PRESSURE GAUGE, HYDRAULIC PUMP	LOG	AFTER 30 MIN PRESSURE DROP MAX.1BAR
1.0.2.2	TORQUE TEST	-DO-	-DO-	TORQUE VALUE ON A PARTICULAR LOAD			-DO-	HYDRAULIC PUMP, TORQUE WRENCH	-DO-	PERMITTED

QUALITY CONTROL PLAN FOR

BLADE BEARING ASSEMBLY

QP NO : FAN 336
REV NO: 00
DATE : 22 11 93
PAGE : 02 OF 03

PREPARED BY:				REVIEWED BY:			APPROVED BY:			
S No	COMPONENT & OPERATION	TYPE OF CHECK	QUANTUM OF CHECK	CHARACTERISTICS	REF STD	ACCPT STD	AGENCY	INSTRUMENTS REQUIRED	FORMAT OF RECORD	REMARKS
1	2	3	4	5	6	7	8	9	10	11
1.0.2.3	HUB TO BLADE SHAFT DISTANCE	MEASUREMENT	100%	DEPTH, RADIAL DISTANCE FROM CENTER.	-DRG-		QC	VERNIER DEPTH GAUGE	LOG	
1.0.2.4	LEVER ASSY	VISUAL TORQUE	-DO-	POSITION, TIGHTENING OF SCREW	DRG &PRQA:312		-DO-	TORQUE WRENCH	—	
1.0.3	BLADE BEARING ASSEMBLY	VISUAL	-DO-	OIL FILLING	-DRG-		QC	OIL CAN WITH MEASUREMENT	—	
1.0.4	COVER PLATE ASSY,	VIUSAL	-DO-	FIXING THE COVER PLATE WITH IMPELLER	DRG &PRQA:312		QC	TORQUE WRENCH	—	
1.0.5	BALANCING OF IMPELLER ASSY	UNBALANCE COMPENSATION	-DO-	UNBALANCE VALUE	-DRG-		-DO-	BALANCING MACHINE	HC	

QUALITY CONTROL PLAN FOR BLADE BEARING ASSY											QP NO : FAN 336 REV NO: 00 DATE : 22 11 93 PAGE : 03 OF 03
PREPARED BY:				REVIEWED BY:			APPROVED BY:				
S No	COMPONENT & OPERATION	TYPE OF CHECK	QUANTUM OF CHECK	CHARACTERISTICS	REF STD	ACCPT STD	AGENCY	INSTRUMENTS REQUIRED	FORMAT OF RECORD	REMARKS	
1	2	3	4	5	6	7	8	9	10	11	
1.0.6	ROTOR/IMPELLER ASSY	VISUAL TORQUE STROKE	100	STROKE, SYNCRONISE MOVEMENT IF 2 STAGE	DRG&PRQA 082/ LATEST		QC	WITNESSING	HC		
1.0.7	INDENTIFICA-TION, PRESERVA-SION&PACKING	VISUAL	-DO-	WO.NO., P.NO, PROPER PRESERVATION & PACKING	PACKING DRG & RP0674199/LATEST		QC	——	—		

PC File A:FAN328.KSU

Ranipet	MANUFACTURER'S NAME & ADDRESS **M/S BHEL / BAP / RANIPET 632 406**	**STANDARD QUALITY PLAN**		
		ITEM/SUB SYSTEM: **SUPPORTING BODY**	**Doc. No**	**FAN 338**
			Rev. No	**01**
			Date	**16 02 10**
			Page No	**01 of 02**

Sl no 1	Component & operation 2	Characteristics 3	Type Of Check 4	Quantum of Check 5	Reference Documents 6	Acceptance Norms 7	Format Of Records 8	Agency 9		Remarks 10
								M	B	
1.0	Material verification	SPEC: RMA NO: MELT NO:	Verification of attestation details	100%	RMA card		RMA card	P	W	
1.1	Marking for machining	Hole position ,center of the hole,MATL for machining allowance.	Verification of attestation details	100%	DRAWING		--	P	W	
1.2	Rough machining & final machining	position ,center of the bore, step diameter od,radil,width,run cut, face out	measurement	100%	DRAWING		LOG/DR	P	W	

LEGENDS:		
M – Manufacturer,(BHEL Shop / Subcontractor,) B - BHEL QC/ Authorized Inspection agency, CC –Compliance certificate P - Performed By, V - Verification Of Reports/Records W - Witness T C - Test Certificate R- report,	PREPARED BY	REVIEWED & APPROVED BY :

Ranipet	MANUFACTURER'S NAME & ADDRESS **M/S BHEL / BAP / RANIPET 632 406**	**STANDARD QUALITY PLAN**		
		ITEM/SUB SYSTEM: **SUPPORTING BODY**	**Doc. No**	**FAN 338**
			Rev. No	**01**
			Date	**16 02 10**
			Page No	**01 of 02**

Sl no 1	Component & operation 2	Characteristics 3	Type Of Check 4	Quantum of Check 5	Reference Documents 6	Acceptance Norms 7	Format Of Records 8	Agency 9		Remarks 10
								M	B	
1.2.1	Machine of holes in horizontal boring M/C	Diameter and depth of holes, run out, face out, surface roughness	Measurement	100%	DRAWING	LOG/DR	P	W	
1.2.2	Support body drilling tapping	Pitch distance ,threades,position of threaded holes, orientation of holes	Measurement	100%	DRAWING	LOG/DR	P	W	
1.2.3	Identification &preservation	WO NO,SL NO, preservation with rust preventive coat	Measurement	100%	OPS/GMS	-	P	V	

For all untoleranced dimensions , PRQA 500/Latest shall be referred for tolerances .

LEGENDS:		RE3VIEWED & APPROVED BY :
M – Manufacturer,(BHEL Shop / Subcontractor,) B - BHEL QC/ Authorized Inspection agency, CC –Compliance certificate P - Performed By, V - Verification Of Reports/Records W - Witness T C - Test Certificate R- report,	Prepared by	

Revision No	Date	Details
00	-	Original issue
01	16 02 10	TOTALLY MODIFIED

QUALITY DEPARTMENT		
Amendment to Quality Work Instructions (SQP)		
QWI NO: **SQP:FAN:342**	REV:01	DT. 29 11 94
Amendment no: A 1		**DT. 11 08 03**
Description Spiral casing assy		

Details of Amendment		
Note Sl.no.	**Amended As**	**Basis For Amendment**
Note8	1. Cross Joints should not be allowed. They shall be Staggered 2. Joints should be away from splits, flanges and, edges at a distance of 500 mm minimum. 3. Joints are to be cleared from the stiffener location by min 100mm. 4. Between joints there should be a min distance of 1000mm. 5. Joints of Spiral wall ,bottom wall of suction chamber Joints should be parallel to the axis of the rolling or bending. 6. In rectangular flanges max. one joint is allowed in longer flange avoiding holes & no joint is allowed on Shorter flange. 7 In general joints shall be as minimum as possible,.	Joints details added .

Prepared by	**Reviewed By**	**Approved By**
	B. Srinivasarao	**Head (QA)**

Controlled Copy No	
Issued to Shri	

BHARAT HEAVY ELECTRICALS LTD : STANDARD QUALITY PLAN FOR : NAME OF CONTRACT PACKAGE : QP NO.FAN342
BOILER AUXILIARIES PLANT : : STANDARD : REV .NO. 01
RANIPET - 632 406 (INDIA) : SIPRAL CASINGS OF NDV,NDFV&NDZV : : DATE 29 11 94
QUALITY ASSURANCE DEPT : FANS : : PAGE 01 OF 04

PREPARED BY : B. Srinivasulu REVIEWED BY : APPROVED BY :

S .No	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE STANDARD	FORMAT OF REC	AGENCY	REMARKS
1	2	3	4	5	6	7	8	9	10	11
1.0	MARKING CUTTING & EDGE PREPARATION	SHAPE & SIZE	MAJOR	VISUAL	100 &	DRAWING & PRQA : 500/LATEST & NOTE 1	LOG		QC/ PROC	
2.0	SIDE WALL LAYOUT MARKIBG AND PUNCHING	LAYOUT DIMENSION	MAJOR	MEASURE - VISUAL	100 & 100 &	- DO -	LOG	QC QC		
3.0	WELDING	WELD SIZE ANDFINISH	MAJOR	VISUAL	100 &	DRAWING & NOTE 6 & 7	-	QC		
4.0	DIMENSIONAL INSPECTION									
41	HORIZONTAL TRIAL ASSY	DIMENSION * 1)DELLIVERY OPENING DIMN 2)DELIVERY DUNT CENTRE TO DIFFUSERD CENTRE DISTANCE 3)DIFFUSER ID REDIAL DIMENSION 4)SIDE WALL& DIFFUSER AREA WATER LEVEL 5)TOP SUCTION CHAMBER EXTENSION SHELL TO DIFFUSER CO-AXIALITY 6)SIDE WALL TO SIDE WALL BETWEEN DISTANCES 7)DIFFUSER TO DIFFUSER BETWEEN DISTANCES	MAJOR	MEASURE- MENT	100 &	DRAWING&PRQA:500/LATEST& PRQA : 092 / 02 &NOTE 2 & 5 PRQA : 112 / 00	HISTORY CARD R49-335 R49-392 R-037	QC	* INDICATED BELOW	
4.2	VERTICAL TRIAL ASSY	DIMENSIONS INDICATED BELLOW 1)DIFFUSER ID RADIAL DIMENSION 2)DIFFUSER ID DIFFUSER AND EXTENSION SHELL CO-AXILIRTY 3)DIFFUSER TO DIFFUSER BEWEEN DISTENCES 4)DIFFUSER PLUMB OUT 5)DIFFUSER CENTRE TO SUCTION FLANGE TOP CENTRE DISTENCE 6)SUCTION FLANG OPEN OUT DIMENSION 7)FOOT WATER OPEN OUT DIMENSION 8)FOOT LAY OUT DIMENSION	MAJOR	MEASURE- MENT	100 &	DRAWING &PRQA 500/LATEST & PRQA : 092/ 02 NOTE 2.3.4 PRQA : 112 / 00	-DO-	QC		

1	2	3	4	5	6	7	8	9	10	11
		8)SIDE BLOCK & BLOCK DISTANCE FROM CENTRE 9)FOOT HEIGHT FROM CENTRE OF THE SPIRALCASIG								
5.0	FINAL INSPECTION	CLEANING PAINTING & IDENTIFICATION (MATCH MARKS) P.NO.WO.NO & DUNO .	MAJOR	VISUAL	100 & RP 0674199 / 1A	DRG&GMS/OPS TEST	DRG/GMS/OPS -			QC

NOTE 1 : GASCUTTING NOTCHES EXCEEDING 0.8 MM SHALL BE REPAIRED
EDGE PREPARATIONS ARE TO BE MARKED BY PAINTS
MATCH MARKS ARE TO BE INDICATED

NOTE 1 : 1)FOR RECTAGULAR FLANGS
a) CENTRE LINE OF BOLT HOLES PARALALITY SHALL BE WITHIM +/- 2.5 MM
b) PITCH DISTENCES FOR TWOCONSECUTIVE HOLE SHALL BE WITHIN +/- MM
c) DEVIATION IN FLATENESS OF FLANGES SHALL NOT EXCEED 3MM
d) DIAGONAL DISTENCE DIFFERENCE SHALL NOT EXCEED 1.5 MM/M
2) INSIDE OF CIRCULAR FLANGS THE DIMENTRCALLY OPPOSITE HOLE DISTENCES SHLL NO EXCEED 1.5 MM/M.

1 2 3 4 5 6 7 8 9 10 11

NOTE 3 : 1)INDIVIDUAL FOOT WATER LEVEL SHALL NOT EXCEED +/- 1MM
2)FOOT TO FOOT WATER LEVEL DIFFERENCE SHALL NOT EXCEED 2MM

NOTE4 : 1)PLUMB OUT OF FOOT CENTRE CENTRE WITH RESPECT TO THE LAY OUT SHALL NOT EXCEED +/- 2MM
2)DIFFUSER PLUMB OUT SHALL NOT EXCEED 3MM

NOTE 5 : AFTER HORIZONTAL TRIAL ASSY BEFORE VERTICAL TRIAL ASSY ALL PARTS TO BE DISMANTLED
ALL THEWELDING AND HEAT CORRECTION OF HAVINESS SHALL BE CARRIED OUT AND
COTCHES AND UNDER CUTS SHALL BE REMOVED

NOTE 6 : !)LOW HYDROGEN ELECTRODES SHALL BE BAKED FOR ATLEAST 2 HOURS AT 370 TO 430 DEG C
AND HELD IN GOLDING OVENS AT 120-150 DEG C BEFORE USE .
IF THE ELECTRODES ARE EXPOSED FOR MORE THAN 4 HOURS TO THE ATMOSPHERE THESE SHALL BE
REBAKED AND DRIED IN THE SAME MANNER
2) RUTIKE COATED ELECTRODES SHALL BE DRIED AT 120 - 130 DEG C FOR 1 HOUR BEFORE USF .

NOTE 7 : ALL BUTTJOINTS SHALL BE BAKGOUGED TO REMOVE ALL SLAG . UNFUSED ETC AND WELDED
ON THE OTHERSIDE .

QUALITY DEPARTMENT		
Amendment to Quality Work Instructions (PRQA)		
QWI NO: SQP:FAN:343	REV: 03	DT. 22 07 95
Amendment no: A3		**DT. 04 06 09**
Description: *DAMPER CONTROL ASSY*		

Details of Amendment		
Note Sl.no.	**Amended As**	**Basis for Amendment**
1	MPI on the damper housing flange butt joint weld shall be done. Reference & Acceptance norm BHE:NDT:RP:MT 01/02 Random (10%) LPI shall be done on other welds . Reference & Acceptance norm BHE:NDT:RP:PT:01/02	*BASED ON THE QC FEED BACK*

Prepared by	Reviewed By	Approved By
	B. Srinivasa Rao 6/6/09	6/6/09

QUALITY DEPARTMENT		
Amendment to Quality Work Instructions (SQP)		
QWI NO: **SQP:FAN:343**	:03	DT. 22 07 95
Amendment no: A 2		**DT. 02 01 03**
Description DAMPER CONTROL ASSY		

Details of Amendment		
Note Sl.no.	**Amended As**	**Basis For Amendment**
2.2.2	PT shall be done as per BHE:NDT:RP:PT01 for each layer of the weld for 10% of the damper shafts	Magnetic permeability results false indication in MT

Prepared by	**Reviewed By**		**Approved By**
	QC/NDT	K.R. Sunil	**Head (QA)**
	QA	B. Srinivasa Rao	

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QUALITY DEPARTMENT

AMENDMENT TO QUALITY WORK INSTRUCTIONS (SQP)

QWI NO: SQP:FAN:343 REV 03 DATE : 22 07 95
AMENDMENT NO. A 1 DATE : 09 05 2001

DESCRIPTION: *DAMPER CONTROL ASSY*

DETAILS

CLAUSE NO	AMENDED AS	BASIS FOR AMENDMENT/ REMARKS
2.2.2	MT ON WELDS SHALL BE 10%	PCM Ref BAP:QA:99:7079 dt 12 05 99 (6th PCM for 98-99, Cl No 2.14)

Prepared by	Reviewed by	Approved by
	B. Srinivasa Rao	

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BHARAT HEAVY ELECTRICALS LTD BOILER AUXILIARIES PLANT RANIPET-632 406 (INDIA) QUALITY ASSURANCE DEPT.	STANDARD QUALITY CONTROL PLAN FOR DAMPER CONTROL ASSY	NAME OF CONTRACT PACKAGE STANDARD	QP.No.FAM343 REV.No.03 DATE 220795 PAGE 010F06

PREPARED BY: B. Srinivasalu REVIEWED BY: [signature] APPROVED BY: [signature]

	COMPONENT & OPERATION	CHARACTE-RISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE STANDARD	FORMAT OF REC	AGENCY	REMARKS
1	2	3	4	5	6	7	8	9	10	11
1.0.	MATERIALS									
1.1.	CHEM&MECH PROPERITIES OF RAW MATERIALS									
1.1.1	PLATES& CHANNELS	CHEM&MECH PROPERITIES	MAJOR	VERIFICA-TION OF TCs	100%	RESPECTIVE MATEIRAL SPECIFICATION		TC	QC-PROC	
1.1.2	ROUNDS	-DO-	MAJOR	-DO-	100%	-DO-		-DO-	-DO-	
1.1.3	TUBES	-DO-	MAJOR	-DO-	100%	-DO-		-DO-	-DO-	
1.1.4	BEARING HSG	-DO-	MAJOR	-DO-	100%	-DO-		-DO-	-DO-	
1.2.	SUBDELIVERIES**									
2.1.	SEALING RING, FASTNERS SPLIT PINS, ROD ENDS ASSY DIAL PLATES, DIRECTION PLATES, KEYS,POINTER	COMPLIANCE TO PURCHASE ORDER	MAJOR	-DO-	100%	PURCHASE ORDER		-DO-	-DO-	**APPLICABLE AS APPROPRIATE

QC/PROC: QUALITY CONTROL PROCUREMENT
TC :TEST CERTIFICATE

MASTER COPY

QUALITY CONTROL PLAN FOR

DAMPER CONTROL ASSY

QP.No.FAN343
REV.No.03
DATE 220795
PAGE 020F06

1	2	3	4	5	6	7	8	9	10	11
2.0.	INPROCESS CONTROL									
2.1.	MARKING,CUTING,MACHINING									
2.1.1	DAMPER HOUSING AND FLAPS MARKING & GAS CUTTING	SHAPE & SIZE	MAJOR	VISUAL& MEASUREMENT	100%	DRAWING AND PRQA:500	NOTE 1 -DO-	-- --	MQCD MQCD	
2.1.2	DAMPER SHAFT &FLANGE EP	DIMENSIONS	MAJOR	-DO-	100%	DRG &PRQA:500		--	MQCD	
2.2.	WELDING									
2.2.1	WELDING OF FLAP,HOUSING, LEVER&LINK	WELD SIZE &FINISH	MAJOR	VISUAL	RANDOM	DRAWING &NOTE 2		--	MQCD	
2.2.2	DAMPER SHAFT WELDING (If applicalbe)	WELD SOUNDNESS	MAJOR	MT	100%	BHE:NDT:MT1		NDTL REPORT	NDTL	
2.3.	HEATTREATMENT									
2.3.1	DAMPER SHAFT (If applicable)	COMPLIANCE TO SR CYCLE	MAJOR	VERFICATION OF HT CHART	100%	BAP:HT:001		HT CHART	MQCD	

NDTL:NONDESTRUCTIVE TESTING LABORATORY
S.R : STRESS RELIEF HT: HEATTREATMENT

% ⇒ 100%

STANDARD QUALITY CONTROL PLAN FOR

DAMPER CONTROL ASSY

QP.No.FAN343
REV.No.03
DATE 220795

1	2	3	4	5	6	7	8	9	10	11
2.4.	DIMENSIONAL INSPECTION									
2.4.1	HOUSING	i)FLANGE HOLE DIMENSIONS ii)HOLES PITCH &DIAGONAL iii)HEIGHT OF HOUSING iv)WIDTH& LENGTH OF HSG v)BRG HOUSING HOLES LOCATION DRILLING & TAPPING	MAJOR	MEASURE-MENT	100%	DRAWING	QPR:QA:500 NOTE 3	HISTORY CARD	MQCD	
2.4.2	DAMPER SHAFT (If applicable)	i)OD OF SHAFT ii)OD OF FLANGE iii)KEY WAY DIMENSIONS &OFF SET iv)DRILL HOLE PCD&HOLE DIA	-DO-	-DO-	100%		-DO-	-DO-	MQCD	
2.4.3	BEARING HSG (If applicable)	ID,OD,DEPTH DRILL HOLE DIAMETER,PCD	-DO-	-DO-	100%		-DO-	-DO-	MQCD	

QUALITY CONTROL PLAN FOR

DAMPER CONTROL ASSY

QP.NO:FAN343
REV.NO:03
DATE:220795

1	2	3	4	5	6	7	8	9	10	11
2.4.4	PLAP	i)LENGTH ii)WIDTH iii)FLATNESS iv)DIALGONAL v)FLANGE DRILL HOLES PCD,DIA	MAJOR	MEASURE MENT	100%	DRAWING &PR:QA:500 NOTE 3		HISTORY CARD	MQCD	
2.4.5	LEVER	i)BORE ii)K., WAY WIDTH&DEPTH ,ORIENTATION &PARALLALITY OF BIG &SMALL HOLE	MAJOR	-DO-	100%	DRAWING &PR:QA:500		-DO-	-DO-	
2.4.6	LEVER BOSS	BORE,STEP DIA KEY WAY WIDTH,DEPTH	MAJOR	-DO-	100%	-DO-				
2.4.7	LINK ASSY	LENGTH THREAD SIZE OF LEFT&RIGHT HAND THREDS	MAJOR	-DO-	100%	-DO-		-DO-	-DO-	
2.4.8	PIN FOR CONNECTING LEVER&LINK	OD,LENGTH	MAJOR	100%	MEASURE MENT	-DO-		-DO-	-DO-	
2.4.9	ADJUSTING RIN	BORE, THICKNESS THREAD SIZE	MAJOR	100%	-DO-	-DO-		-DO-	-DO-	

STANDARD QUALITY CONTROL PLAN FOR

DAMPER CONTROL ASSY

Q.P.NO.FAN343
REV.NO:03
DATE: 220795
PAGE: 050F 06

1	2	3	4	5	6	7	8	9	10	11
3.0.	FINAL INSPECTION OF DAMPER ASSY									
3.1.		i)FLAP TO FLAP GAP(IN FULL CLOSE CONDITION) ii)HOUSING TO FLAP GAP	MAJOR	MEASUREMENT	100%	MAXIMUM 3 MM DRAWING &PR:QA:500 NOTE 5		HISTORY HOCD CARD		
3.2.	TRIAL OPERATION	EASY CLOSING & OPENING OF FLAPS	MAJOR	VISUAL	100%	FLAPS MUST FREELY OPEN & CLOSE ,NOTE 5		--	-DO-	
3.3.		i)CLEANING PAINTING,IDENTIFICATION AND PRESERVATION	MAJOR	VISUAL	100%	GMS&PR:QA:590		--	-DO-	
		NOTE:1 i)PLATES CUT BY FLAME SHALL BE CLEANED TO REMOVE SLAG &UNEVEN EDGES ii) GAS CUTTING NOTCHES EXCEEDING 0.8 MM SHALL BE FILLED BY WELDING BEFORE ASSY								
		NOTE:2 i) WELDERS EMPLOYED SHALL BE QUALIFIED AS PER AWS D.1.1 ii) LOW HYDROGEN ELECTRODES SHALL BE BAKED FOR 2 Hrs MIN AT 370 DEG C'TO 430 DEG C' AND HELD IN HOLDING OVEN AT 120-150 DEG C' BEFORE USE. iii) ELECTRODES OPENED TO ATM MORE THAN 4 Hrs SHALL BE REBAKED AND DRIED IN THE SAME MANNER. iv) RUTILE ELECTRODES SHALL BE DRIED AT 120-130 DEG FOR 1 HOUR BEFORE USE v) ALL THE BUTT JOINTS SHALL BE BACKGAUGED TO REMOVE SLAG,UNFUSED AREA ETC. AND WELDED ON THE OTHER SIDE								

STANDARD QUALITY CONTROL PLAN FOR

DAMPER CONTROL ASSY

Q.P.NO.FAN343
REV.NO.03
DATE:220795
PAGE: 060F06

1	2	3	4	5	6	7	8	9	10	11

*******DOCUMENTS REFERED IN COLUMN 7&9 SHALL BE OF LATEST ONLY.*******

NOTE:3 i) FOR RECTACULAR FLANGES THE CENTRE LINE OF BOLT HOLES ON OPPOSITE FACES SHALL BE PARALLEL WITH IN +/- 2 MM .

ii) PITCH OF TWO COSECUTIVE HOLES SHALL BE WITHIN +/- 1 MM.

iii) CUMULATIVE VARIATION ON PITCH DISTANCE SHALL NOT EXCEED +/- 2 MM.

iv) STRAIGHTNESS OF LINE JOINING HOLES SHALL BE WITHIN +/- 1 MM.

v) DIAGONAL DIFFERENCE SHALL NOT EXCEED +/- 1.5 MM /METRE SUBJECT TO MAX & 1 FOR HSG AND 3 MM FOR FLAPS.

vi) TOLERANCE FOR FLAP LENGTH &WIDTH 0 TO +2MM& DIAGONAL 0 TO +3 MM

vii) MAXIMUM CUT OF CO-OXIALITY IS 1 MM FOR SHAFT HOLES AND MAX TWIST ON FLAPS IS 2 MM.

viii) TOLERANCE FOR HOUSING INSIDE LENGTH &WIDTH IS 0 TO + 2MM AND FOR DIAGONAL IT IS 0 TO + 3MM.

ix) GAP BETWEEN FLAP FLANGE AND DAMPER SHAFT FLANGE SHALL BE MAX 0.2 MM AFTER ASSY

x) FIXTURE SHALL BE USED FOR DRILLING HOLES ON DAMPER SHAFT FLANGE WITH REFERENCE TO KEYWAYS.

NOTE 4 : MO.NO,DU,PRODUCT NO AND DIRECTION OF ROTATION SHALL BE PAINTED ON THE DAMPER.

NOTE 5: i) SUITABLE HOLE TO BE DRILLED DURING ASSY IN SHAFTS FOR FIXING POINTER/GRUB SCREW

ii) SPLIT PINS SHALL BE ENSURED IN ALL THE PINS CONNECTING LEVER AND LINK ASSY .

iii) ENSURE THAT AT FULL OPEN OF FLAPS POINTER IS FIXIED AT '0' DEG

iv) ENSURE THE FIXING OF DIRECTION PLATE AND DIAL PLATE CORRECTLY.

v) ENSURE THE WELDING OF TEMPORARY STOPPERS AND YELLOW PAINTING AFTER THE FINAL OPERATION

vi) MINIMUM GAP AS PER DRAWING SHALL BE MAINTAINED BETWEEN FLAPS AND HOUSING.

vii)ENSURE THE TACK WELDING OF GRUB SCREW NUT ON ADJUSTING RING .

viii) ENSURE PERPENDICULARITY OF FLAPS A ULL OPEN CONDITION. VERTICALITY SHALL BE 90 DEG +/- 3 DEG.

BHARAT HEAVY ELECTRICAL LTD, BOILER AUXILIARIES PLANT RANIPER-632 406 Ranipet-6	STANDARD QUALITY PLAN	NAME OF THE CONTRACT & PACKAGE
	ITEM : RADIAL FAN SHAFT OF TUBE WITH END PIN DESIGN QP NO.: FAN :345 REV.NO.: 01 DATE: 02.07.2014 PAGE: 1 OF 9	STANDARD

SI. NO	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE STANDARDS	ACCEPTANCE STANDARDS	FORMAT OF RECORDS	AGENCY		REMARKS
									M	B	
1	2	3	4	5	6	7	8	9	10		11
1.0	**MATERIALS**										
	a)SHAFT TUBE b)SHAFT PINS c)SHAFT FLANGE d)RINGS	CHEM & MECH PROPERTIES	MAJOR	REVIEW OF TCs	100%	RESPECTIVE MATERIAL SPECIFICATION	RESPECTIVE MATERIAL SPECIFICATION	TC	P	V	
1.2	INTERNAL QUALITY										
1.2.1	a)SHAFT TUBE b)SHAFT PINS c)SHAFT FLANGE d)RINGS	INTERNAL SOUNDNESS	MAJOR	REVIEW OF UT CERTI-FICATE	100%	RESPECTIVE MATERIAL SPECIFICATION	RESPECTIVE MATERIAL SPECIFICATION	TC	P	V	
2.0	**INPROCESS CONTROL**										
2.1	→ VERIFICATION OF MATERIAL SPECIFICATION										

LEGEND:	Prepared By:	QA		Approved By:
M: Manufacturer, B: BHEL/BHEL's Authorized inspection agency, P: Performed By, W: Witness by, DR: Dimensional report, V:Verified By, RMA: Raw material attestation, TC : Test Certificate, HT: Heat treatment.	Ram Manoj Chhipa			
	Reviewed By:	QA		J.Ravisankar
	R Arunachalam			

BHEL Ranipet-6	BHARAT HEAVY ELECTRICAL LTD, BOILER AUXILIARIES PLANT RANIPER-632 406	STANDARD QUALITY PLAN	NAME OF THE CONTRACT & PACKAGE
		ITEM : RADIAL FAN SHAFT OF TUBE WITH END PIN DESIGN QP NO.: FAN :345 REV.NO.: 01 DATE: 02.07.2014 PAGE: 2 OF 9	STANDARD

SL NO	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE STANDARDS	ACCEPTANCE STANDARDS	FORMAT OF RECORDS	AGENCY		REMARKS
									M	B	
1	2	3	4	5	6	7	8	9	10		11
2.1.1	a)SHAFT TUBE b)SHAFT PINS c)SHAFT FLANGE d)RINGS	VERIFICATION OF RMA, MELT No. & MATL SPEC	MAJOR	REVIEW OF RMA CARD & ENSURE MATERIAL AS PER GMS	100%	RMA CARD	RMA CARD	RMA CARD	P	V	
2.2	**MACHINING**										
2.2.1	FLANGE	OD,ID,DRILL HOLES DIA, PCD,CHORD & EP*	MAJOR	MEASURE-MENT	100%	DRAWING & PRQA:500/ LATEST & NOTE1	DRAWING & PRQA:500/ LATEST & NOTE1	DR	P	V	*EDGE PREPARATION
2.2.2	RINGS	ID & OD	MAJOR	MEASURE-MENT	100%	DRAWING & PRQA:500/ LATEST	DRAWING & PRQA:500/ LATEST	DR	P	V	
2.2.3	SHAFT TUBE	OD , ID, LENGTH	MAJOR	MEASURE-MENT	100%	DRAWING & PRQA:333 / LATEST	DRAWING & NOTE 2	DR	P	V	

LEGEND:	Prepared By:	QA		Approved By:
M: Manufacturer, B: BHEL/BHEL's Authorized inspection agency, P: Performed By, W: Witness by, DR: Dimensional report, V:Verified By, RMA: Raw material attestation, TC : Test Certificate, HT: Heat treatment.	Ram Manoj Chhipa			
	Reviewed By:	QA		J.Ravisankar
	R Arunachalam			

BHARAT HEAVY ELECTRICAL LTD, BOILER AUXILIARIES PLANT RANIPER-632 406 Ranipet-6	STANDARD QUALITY PLAN	NAME OF THE CONTRACT & PACKAGE
	ITEM : RADIAL FAN SHAFT OF TUBE WITH END PIN DESIGN QP NO.: FAN :345 REV.NO.: 01 DATE: 02.07.2014 PAGE: 3 OF 9	STANDARD

SI. NO	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE STANDARDS	ACCEPTANCE STANDARDS	FORMAT OF RECORDS	AGENCY M	AGENCY B	REMARKS
1	2	3	4	5	6	7	8	9	10		11
2.3	**WELD QUALITY**										
2.3.1	WELDING OF TUBE+RING +FLANGE	WELD SIZE & FINISH	MAJOR	VISUAL& MEASURE-MENT	100%	DRAWING AND NOTE 3 & 8	DRAWING AND NOTE 3&8	–	P	V	
2.3.2	WELDING OF TUBE+RING +FLANGE	#WELD SOUNDNESS BEFORE & AFTER STRESS RELIEF	CRITICAL	MPI and LPI	100%	BHEL:NDT:RP: MT:01/LATEST and BHEL:NDT:RP: PT:01/LATEST	BHEL:NDT:RP:MT:01/LATEST and BHEL:NDT:RP: PT:01/LATEST	NDT REPORT	P	W	# WELD SOUNDNESS AFTER S.R FOR CARBON STEEL SHAFTS AND BEFORE & AFTER S.R FOR ALLOY STEEL SHAFTS.
2.4	**STRESS RELIEF**										
2.4.1	SHAFT TUBE + RING + FLANGE	COMPLIANCE TO HEATTREAMENT CYCLE	MAJOR	TIME AND TEMPARAT-URE CHART	100%	BAP:HT:001/ LATEST& NOTE4	BAP:HT:001/ LATEST& NOTE4	HT CHART	P	V	
2.5.	MACHINING → CHECK FOR THE FACE OUT OF THE FLANGE BEFORE MACHINING WHICH SHALL BE WITHIN 2mm.										
2.5.1	SHAFT TUBE ASSY	BORE DIA LENGTHS OF CC RING, FINISH	MAJOR	MEASURE-MENT	100%	DRAWING PRQA:500 / LATEST	DRAWING PRQA:500 / LATEST	DR	P	V	

LEGEND:	Prepared By:	QA		Approved By:
M: Manufacturer, B: BHEL/BHEL's Authorized inspection agency, P: Performed By, W: Witness by, DR: Dimensional report, V:Verified By, RMA: Raw material attestation, TC : Test Certificate, HT: Heat treatment.	Ram Manoj Chhipa			
	Reviewed By:	QA		J.Ravisankar
	R Arunachalam			

Ranipet-6	BHARAT HEAVY ELECTRICAL LTD, BOILER AUXILIARIES PLANT RANIPER-632 406	STANDARD QUALITY PLAN	NAME OF THE CONTRACT & PACKAGE
		ITEM : RADIAL FAN SHAFT OF TUBE WITH END PIN DESIGN QP NO.: FAN :345 REV.NO.: 01 DATE: 02.07.2014 PAGE: 4 OF 9	STANDARD

SI. NO	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE STANDARDS	ACCEPTANCE STANDARDS	FORMAT OF RECORDS	AGENCY		REMARKS
									M	B	
1	2	3	4	5	6	7	8	9	10		11
2.5.2	PINS	OD & LENGTH, FINISH,OIL HOLE SIZE	MAJOR	MEASURE-MENT	100%	DRAWING NOTE 6(iii)	DRAWING NOTE 6(iii)	DR	P	V	
2.6	TUBE + PIN ASSY	PROPER ASSY WITH INTERFERENCE	MAJOR	MEASURE-MENT	100%	DRAWING & NOTE 5 & 8	DRAWING & NOTE 5 & 8	DR	P	V	
2.6.1	WELDING OF PINS WITH SHAFT TUBE	WELD SOUNDNESS	MAJOR	MPI	100%	BHEL:NDT:RP: MT:01/LATEST	BHEL:NDT:RP: MT:01/LATEST	NDT REPORT	P	W	
2.7	FINAL MACHINING	JOURNAL DIA OD,FLANGE GROOVE OD,ID LENGTHS, KEY WAY SIZE & OFFSET, END TAPPING, THRUST COLLAR GROOVE DIA & WIDTH,	CRITICAL	MEASURE-MENT	100%	DRAWING & PRQA:500/ LATEST & NOTE 6	DRAWING & PRQA:500/ LATEST & NOTE 6	DR	P	W	

LEGEND:	Prepared By:	QA		Approved By:
M: Manufacturer, B: BHEL/BHEL's Authorized inspection agency, P: Performed By, W: Witness by, DR: Dimensional report, V:Verified By, RMA: Raw material attestation, TC : Test Certificate, HT: Heat treatment.	Ram Manoj Chhipa			
	Reviewed By: R Arunachalam	QA		J.Ravisankar

BHEL Ranipet-6	BHARAT HEAVY ELECTRICAL LTD, BOILER AUXILIARIES PLANT RANIPER-632 406	STANDARD QUALITY PLAN	NAME OF THE CONTRACT & PACKAGE
		ITEM : RADIAL FAN SHAFT OF TUBE WITH END PIN DESIGN QP NO.: FAN :345 REV.NO.: 01 DATE: 02.07.2014 PAGE: 5 OF 9	STANDARD

SL NO	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE STANDARDS	ACCEPTANCE STANDARDS	FORMAT OF RECORDS	AGENCY		REMARKS
									M	B	
1	2	3	4	5	6	7	8	9	10		11
		FACE OUT, RUN OUT, FINISH & COUPLING SEATING DIA									
2.8	DYNAMIC BALANCING	RESIDUAL* UNBALANCE-MENT	MAJOR	UNBALANCE COMPENS - ATION	100%	DRAWING & PRQA:309/ LATEST	DRAWING & PRQA:309/ LATEST	BALANCING REPORT	P	W	PRQA: 309 IS APPLICABLE ONLY TO BAP SHOPS.
3.0	**FINAL INSPECTION**										*HALF KEY SHALL BE ASSEMBLED ON THE SHAFT
3.1	PRESERVATION PACKING & IDENTIFICATION PACKING	PROPER PRESERVATION & IDENTIFICATION	MAJOR	VISUAL	100%	PRQA:590/ CUST APPD PAINTING SCHEDULE FOR PAINTING AND PRQA :341 FOR PRESERVATION & PACKING/ PACKING DRAWING	PRQA:590/ CUST APPD PAINTING SCHEDULE FOR PAINTING AND PRQA :341 FOR PRESERVATION & PACKING/ PACKING DRAWING	–	P	V	

LEGEND: M: Manufacturer, B: BHEL/BHEL's Authorized inspection agency, P: Performed By, W: Witness by, DR: Dimensional report, V:Verified By, RMA: Raw material attestation, TC : Test Certificate, HT: Heat treatment.	Prepared By: Ram Manoj Chhipa	QA		Approved By: J.Ravisankar
	Reviewed By: R Arunachalam	QA		

Ranipet-6	BHARAT HEAVY ELECTRICAL LTD, BOILER AUXILIARIES PLANT RANIPER-632 406	STANDARD QUALITY PLAN ITEM : RADIAL FAN SHAFT OF TUBE WITH END PIN DESIGN	QP NO.: FAN :345 REV.NO.: 01 DATE: 02.07.2014 PAGE: 6 OF 9	NAME OF THE CONTRACT & PACKAGE STANDARD

SI. NO	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE STANDARDS	ACCEPTANCE STANDARDS	FORMAT OF RECORDS	AGENCY		REMARKS
									M	B	
1	2	3	4	5	6	7	8	9	10		11

NOTE 1: WHEREVER JIG IS NOT ENVISAGED THE SAME SHALL BE MARKED FOR DRILLING AND INSPECTED AND THEN ONLY TO BE DRILLED.

NOTE 2: THE SHAFT TUBE SHALL BE CHECKED FOR STRAIGHTNESS. THE MAXIMUM DEVIATION SHALL BE 1MM/M SUBJECT TO THE MAXIMUM OF 3MM.

NOTE 3: (i)THE WELDERS AND WELDING PROCEDURES SHALL BE QUALIFED AS PER ASME SEC IX TO 3G POSITION.

ii) WELDS SHALL BE FREE FROM UNDERCUTS EXCEEDING 0.25 mm DEPTH AND OTHER INJURIOUS DEFECTS. UNACCEPT UNDERCUTS SHALL BE REPAIRED BY WELDING.

iii) WELDS SHALL BE CLEANED IN BETWEEN PASSES AND FURTHER WELDING SHOULD BE CONTINUIED AFTER ENSURING COMPLETE REMOVAL OF DEFECTS.

iv) WELDING OF FLANGE TO TUBE SHALL NOT BE CARRIED OUT INVERTICAL CONDITION. IT SHALL BE DONE ON ROLLERS WITH PIPE AXIS HORIZONTAL.

NOTE 4: ALL SHAFT TUBES WELDED WITH FLANGE & RING SHALL BE STRESS RELIEVED. STRESS RELIEVE SHALL BE COMPLETED BEFORE BORE FINISHING & END PIN INSERTION.

ii) SR SHALL NOT BE CARRIED ON THE SHAFTS WITH PIN INSERTED.

iv) PROPER STIFFINERS SHALL BE PROVIDED ON THE FLANGE TO AVOID DISTORTION DURING WELDING.

v) THE SHAFT SHALL BE PROPERLY POSITIONED TO AVOID DISTORTION.

LEGEND: M: Manufacturer, B: BHEL/BHEL's Authorized inspection agency, P: Performed By, W: Witness by, DR: Dimensional report, V:Verified By, RMA: Raw material attestation, TC : Test Certificate, HT: Heat treatment.	Prepared By: Ram Manoj Chhipa	QA		Approved By: J.Ravisankar
	Reviewed By: R Arunachalam	QA		

Ranipet-6	BHARAT HEAVY ELECTRICAL LTD, BOILER AUXILIARIES PLANT RANIPER-632 406	STANDARD QUALITY PLAN	NAME OF THE CONTRACT & PACKAGE
		ITEM : RADIAL FAN SHAFT OF TUBE WITH END PIN DESIGN QP NO.: FAN :345 REV.NO.: 01 DATE: 02.07.2014 PAGE: 7 OF 9	STANDARD

SI. NO	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE STANDARDS	ACCEPTANCE STANDARDS	FORMAT OF RECORDS	AGENCY		REMARKS
									M	B	
1	2	3	4	5	6	7	8	9	10		11

NOTE 5: I)THE ACTUAL MACHINED DIMENSIONS OF END PIN OD AND HOLLOW SHAFT ID SHOULD BE VERFIED AND RECORD BEFORE PIPE IS HEATED FOR SHRINK FIT.

ii) HOLLOW TUBE SHALL BE HEATED ONLY BY LPG GAS. OXYACETYLENE FLAME SHOULD NOT BE USED.

iii) THE PIN SHOULD BE INSERTED IN THE PIPE IN VERTICAL POSITION ONLY.

THE PIN AXIS SHOULD NOT BE INCLINED WITH REFERENCE TO PIPE AXIS. PIN INSERTION SHALL BE COMPLETED BEFORE PIPE TEMPARATURE FALLS DOWN FROM 300 ° C.

NOTE 6: i) THE RELATIVE DISTANCE BETWEEN THE BEARING SEATS WITH REFERENCE TO FLANGE SHALL BE STRICTLY AS PER DRAWING.

ii) KEYWAY OFFEST PERMITTED SHALL BE AS PER TABLE SHOWN BELLOW:

DIA OF SHAFT IN MM	10-22	22-38	38-65	65-110	100-150
OFFESET PERMITTED IN MM	0.1	0.16	0.2	0.3	0.4

iii) OIL HOLES OF PINS SHALL BE CHECKED FOR LENGTHS DIA & THREADSIZES (IF APPLICABLE)

IV) ALWAYS DIMENSION SHALL BE MEASURED FROM ONE END ONLY AND ALL TOLERANCES ARE NON CUMULATIVE.

LEGEND:	Prepared By:	QA		Approved By:
M: Manufacturer, B: BHEL/BHEL's Authorized inspection agency, P: Performed By, W: Witness by, DR: Dimensional report, V:Verified By, RMA: Raw material attestation, TC : Test Certificate, HT: Heat treatment.	Ram Manoj Chhipa			
	Reviewed By:	QA		J.Ravisankar
	R Arunachalam			

SI. NO	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE STANDARDS	ACCEPTANCE STANDARDS	FORMAT OF RECORDS	AGENCY		REMARKS
									M	B	
1	2	3	4	5	6	7	8	9	10		11

V) SURFACE FINISH AT BEARING SEATING AREAS FLANGES THRUST COLLAR SURFACES AND THRUST COLLAR SEATING AREAS ARE CRTTICAL AND SHALL BE AS PER DRAWINGS.

NOTE 7: i) KEY SHALL BE ASSEMBLED TO THE SHAFT AND SCREWED.

ii) WO. NO, DU NO, PRODUCT NO, SUBCONTRACTOR FIRM CODE SHALL BE PUNCHED AND PAINTED ON THE SHAFT TUBE.

NOTE 8: 1) WELDERS & WELD PROCEDURES SHALL BE QUALIFIED AS PER ASME SEC IX TO 3 G POSITION. LOW HYDROGEN ELECTRODES SHALL BE BAKED AT 370° C TO 430° C FOR 2 Hrs AND HELD AT 120° C TO 150° C BEFORE WELDING.

2) ELECTRODES OPEN TO ATMOSPHERE MORE THAN 5 MINUTES SHALL BE REBAKED.

LEGEND:	Prepared By:	QA		Approved By:
M: Manufacturer, B: BHEL/BHEL's Authorized inspection agency, P: Performed By, W: Witness by, DR: Dimensional report, V:Verified By, RMA: Raw material attestation, TC : Test Certificate, HT: Heat treatment.	Ram Manoj Chhipa			
	Reviewed By:	QA		J.Ravisankar
	R Arunachalam			

BHEL Ranipet-6	BHARAT HEAVY ELECTRICAL LTD, BOILER AUXILIARIES PLANT RANIPER-632 406	STANDARD QUALITY PLAN	NAME OF THE CONTRACT & PACKAGE
		ITEM : RADIAL FAN SHAFT OF TUBE WITH END PIN DESIGN QP NO.: FAN :345 REV.NO.: 01 DATE: 02.07.2014 PAGE: 9 OF 9	STANDARD

SI. NO	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE STANDARDS	ACCEPTANCE STANDARDS	FORMAT OF RECORDS	AGENCY		REMARKS
									M	B	
1	2	3	4	5	6	7	8	9	10		11

RECORD OF REVISIONS

REV NO.	REV DATE	DESCRIPTION	REMARKS
01	02.07.2014	1. CL NO. 2.1.1 REVISED AS "REVIEW OF RMA CARD & ENSURE MATERIAL AS PER GMS" IN PLACE OF "REVIEW OF UT CERTIFICATE". 2. CL NO. 2.3.2 REVISED AS "MPI and LPI" IN PLACE OF "MPI". 3. WELDING OF PINS WITH SHAFT TUBE INCLUDED.(CL NO. 2.6.1 ADDED) 4. NOTE 3 (ii), UNDERCUT DEPTH REVISED FROM 0.50 mm to 0.25 mm BASED ON FAILURE ANALSIS AND WRI RECOMMENDATION. 5. CONTENTS OF AMENDMENT A1, DT: 19.08.1997 INCORPORATED. a) Cl. No. 2.3.1 col. 7& 8- PRQE:017 REPLACED WITH PRQA:337. FURTHER PRQA:337 WITHDRAWN AND DRAWING & NOTES REFERENCE INCORPORATED. b) CL. No.2.3.2, WELD SOUNDNESS AFTER S.R FOR CARBON STEEL SHAFTS AND BEFORE & AFTER S.R FOR ALLOY STEEL SHAFTS. Col 7 & 8, BHEL: NDT: RP: MT: 01/LATEST ADDED. c) CL No. 3.1, Col. 7 & 8 REVISED TO INCORPORATE PRQA : 590 FOR PAINTING AND PRQA:341 FOR PRESERVATION & PACKING ADDED. d) NOTE 8 UPDATED. BAKING SHALL BE DONE BETWEEN 370° C to 430° C FOR 2 Hrs AND HELD AT 120° C to 150° C BEFORE USE.	
00	06.07.1994	ORIGINAL ISSUE	

LEGEND:	Prepared By:	QA		Approved By:
M: Manufacturer, B: BHEL/BHEL's Authorized inspection agency, P: Performed By, W: Witness by, DR: Dimensional report, V:Verified By, RMA: Raw material attestation, TC : Test Certificate, HT: Heat treatment.	Ram Manoj Chhipa			
	Reviewed By: R Arunachalam	QA		J.Ravisankar

MANUFACTURER'S NAME & ADDRESS: BOILER AUXILIARIES PLANT BHEL, RANIPET PIN – 632406	**MANUFACTURING QUALITY PLAN** **ITEM: SOLID SHAFTS OF RADIAL FANS**	QP NO : FAN: 346 REV NO : 01 DATE : 23 04 2001 PAGE NO : 01 OF 05	NAME OF THE CONTRACT & PACKAGE **STANDARD**

S.NO	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE STANDARD	FORMAT OF REC	AGENCY 10		REMARKS
1	2	3	4	5	6	7	8	9	M	B	11
1.0 1.1	MATERIALS a) SHAFT-ROUND b) FLANGE	CHEM & MECH PROPERTIES	MAJOR	REVIEW OF TCs	100%	RESPECTIVE MATERIAL SPECIFICATION & TDC		TC	P	V	
1.2	**INTERNAL QUALITY**										
1.2.1	a) SHAFT-ROUND b) FLANGE	INTERNAL SOUNDNESS	MAJOR	REVIEW OF UT CERTIFICATE	100%	TDC		TC	P	V	
2.0	INPROCESS CONTROL										
2.1	VERIFICATION OF MATERIAL SPECIFICATION										
2.1.1	a) SHAFT-ROUND b)FLANGE	VERIFICATION OF RMA, MELT NO &MATL SPEC.	MAJOR	-DO-	100%	RMA CARD		RMA CARD	P	V	

RECORD OF REVISIONS

REV:00 DT 3/0195 — *ORIGINAL ISSUE*

REV:01 DT 23 04 2001 — *HEAT TREATMENT ADDED UNDER CLAUSE NO:2..4 & PRQA NOS ARE CHANGED IN CL NO 2.3..1 ,2.6,3.1 UNDER COLUMN NO 8*

PREPARED BY : (K.RAJADURAI)

REVIEWED BY :

B. SRINIVASA RAO

D KRISHNASWAMY

APPROVED BY :

(H ANANTHANARAYANAN)

LEGEND: **M**: MANUFACTURE/SUB CONTRACTOR ,**B**: BHEL/BHEL AUTHORISED INSPECTION AGENCY

	MANUFACTURER'S NAME & ADDRESS: BOILER AUXILIARIES PLANT BHEL, RANIPET PIN – 632406	MANUFACTURING QUALITY PLAN ITEM: SOLID SHAFTS OF RADIAL FANS	QP NO : FAN: 346 REV NO : 01 DATE : 23 04 2001 PAGE NO : 02OF 05	NAME OF THE CONTRACT & PACKAGE STANDARD

S.N O	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS / ACCEPTANCE STANDARD	FORMAT OF REC	AGENCY 10 M	AGENCY 10 B	REMARKS
	2	3	4	5	6	7 8	9	M	B	11
2.2	**MACHINING**									
2.2.1	SHAFT-ROUND	OD & LENGTHS	MAJOR	MEASUREMENT	100%	DRAWING PRQA 500 /LATEST	DR	P	W	
2.2.1	FLANGE	OD, ID, DRILL HOLES DIA, PCD, CHORD WIDTH EDGE PREPARATION	MAJOR	-DO-	100%	DRAWING & PRQA 500/LATEST & NOTE 1	DR	P	W	
2.3	WELD QUALITY	(Applicable only for shafts with flange welded type)								
2.3.1	WELDING OF SHAFT +FLANGE	WELD SIZE & FINISH &	MAJOR	MEASUREMENT		DRAWING, PRQA:337/LATEST AND NOTE 2	DR	P	W	
		WELD SOUNDNESS	CRIT	MT		BHE:NDT:RP:MT 1/LATEST	NDT REPORT	P	W	

	MANUFACTURER'S NAME & ADDRESS: BOILER AUXILIARIES PLANT BHEL, RANIPET PIN – 632406	MANUFACTURING QUALITY PLAN ITEM:SOLID SHAFTS OF RADIAL FANS	QP NO : FAN: 346 REV NO : 01 DATE : 23 04 2001 PAGE NO : 03 OF 05	NAME OF THE CONTRACT & PACKAGE STANDARD

S.NO	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE STANDARD	FORMAT OF REC	AGENCY		REMARKS
									M	B	
	2	3	4	5	6	7	8	9	10		11
2.4 2.4.1	**HEAT TREATMENT** STRESS RELIEF HEAT TREATMENT OF SHAFT WITH FLANGE	COMPLIANCE TO SR CYCLE.	MAJOR	VERIFICATION OF HT CHART	100%	BAP:HT:005/LATEST		HT CHART	P	V	
2.4.5	MACHINING	CHECK FOR THE FACE OUT OF THE FLANGE BEFORE MACHINING WHICH SHALL BE WITHIN 2MM OR AS PER DRAWING WHICHEVER IS LOWER IN CASE OF WELDED DESIGN									
2.5.1	SHAFT ASSY	JOURNAL DIA, OD, LENGTHS KEY WAY SIZE OFFSET, END TAPPING & DRILL HOLES FLANGE GROOVE (if applicable) ID, OD & DEPTH GROOVE DIA & WIDTH FACE OUT, RUN OUT, FINISH & COUPLING SEATING DIA. BLUE MATCHING OF TAPER PORTION(If applicable)	CRIT	-DO-	100%	DRAWING & PRQA:500/LATEST & NOTE3		DR	P	W	

	MANUFACTURER'S NAME & ADDRESS: BOILER AUXILIARIES PLANT BHEL, RANIPET PIN – 632406	MANUFACTURING QUALITY PLAN ITEM:SOLID SHAFTS OF RADIAL FANS	QP NO : FAN: 346 REV NO : 01 DATE : 23 04 2001 PAGE NO : 04 OF 05	NAME OF THE CONTRACT & PACKAGE STANDARD

S.NO	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS / ACCEPTANCE STANDARD	FORMAT OF REC	AGENCY 10		REMARKS
	2	3	4	5	6	7 / 8	9	M	B	11
2.6	DYNAMIC BALANCING	RESIDUAL** UN BALANCEMENT	MAJOR	UNBALANCE COMPENSATION	100%	DRAWING &PR:QA:309/LATEST & PRQA:314 / LATEST PRQA:321/LATEST	BLNG. REPORT	P	W	** PRQA:309 APPLICABLE ONLY TO BHEL BAP SHOPS
3.0	FINAL INSPECTION									
3.1	PRESERVATION IDENTIFICATION & PACKING	PROPER PRESERVATION, IDENTIFICATION & PACKING	MAJOR	VISUAL	100%	RP 0674199/LATEST ,PACKING DRAWING & NOTE 4 PRQA:341/LATEST	---	P	W	

MANUFACTURER'S NAME & ADDRESS: BOILER AUXILIARIES PLANT BHEL , RANIPET PIN -- 632406	MANUFACTURING QUALITY PLAN ITEM:SOLID SHAFTS OF RADIAL FANS	QP NO : FAN: 346 REV NO : 01 DATE : 23 04 2001 PAGE NO : 05 OF 05	NAME OF THE CONTRACT & PACKAGE STANDARD

OTE 1 : 1) WHEREVER JIG IS NOT ENVISAGED THE SAME SHALL BE MARKED FOR DRILLING AND INSPECTED AND THEN ONLY TO BE DRILLED.

OTE ; 2) WELD PROCEDURES AND WELDERS SHALL BE QUALIFIED AS PER ASME SEC IX TO 3 G POSITION MIN. UNDERCUTS SHALL BE REPAIRED.

(b) ALL THE ELECTRODES HAVING LOW HYDROGEN COVERING SHALL BE PURCHASED IN HERMETICALLY SEALED CONTAINERS. IMMEDIATELY AFTER OPENING THE HERMETICALLY SEALED CONTAINER, ELECTRODES SHALL BE STOCKED IN OVENS HELD AT TEMP OF ATLEAST 120 DEG C. ELECTRODES THAT HAVE BEEN WET SHALL NOT BE USED.

(c) ELECTRODES EXPOSED TO ATMOSPHERE FOR PERIODS MORE THAN 5 MINUTES SHALL BE BAKED FOR ATLEAST TWO HOURS BETWEEN 260 & 430 AND HELD AT 120 DEG C UNTIL THEY ARE USED,

(d) WELDS SHALL BE CLEANED THOROUGHLY TO REMOVE THE SPATTER & SLAG

(e) STIFFENERS MAY BE PROVIDED ON THE FLANGE TO AVOID DISTORTION DURING WELDING.

(e) THE SHAFT SHALL BE PROPERLY POSITIONED TO AVOID DISTORTION DURING STRESS RELIEF.

(f) WELD TOES SHALL BE GROUND TO MAXIMUM DEPTH OF 0.8 MM AND SMOOTHLY MERGED.

OTE : 3 i) THE RELATIVE DISTANCE BETWEEN THE BEARING SEATS WITH REFERENCE TO FLANGE SHALL BE STRICTLY AS PER DRAWING IN CASE OF FLANGE DESIGN.

ii) KEY WAY OFFSET PERMITTED SHALL BE AS PER TABLE SHOWN BELOW.

DIA OF SHAFT IN MM	10-22	22-38	38-65	65-110	>110
OFF SET PERMITTED IN MM	0.1	0.16	0.2	0.3	0.4

iii) BLUE MATCH SHALL BE ATLEAST 85% THROUGHOUT TAPER PORTION.

IV) OIL HOLES OF SHAFTS SHALL BE CHECKED FOR LENGTH, DIA & THREAD SIZE (if applicable)

V) SURFACE FINISH AT BEARING SEATING AREAS IS CRITICAL AND SHALL BE AS PER DRAWING.

OTE :4 i) KEY SHALL BE ASSEMBLED TO THE SHAFT AND SCREWED

ii) W.O. NO, DU.NO, PRODUCT NO, SUBCONTRACT CODE SHALL BE PUNCHED ON THE SHAFT FACE. / OD

BHARAT HEAVY ELECTRICALS LTD BOILER AUXILIARIES PLANT RANIPET-632 406 (INDIA) QUALITY ASSURANCE DEPT.	QUALITY CONTROL PLAN FOR IMPELLER OF CZECH DESIGN DL TYPE	NAME OF CONTRACT PACKAGE STANDARD	QPNO.FAN347 REV.No.02 DATE:200695 PAGE 01of 04

PREPARED BY: B. Srinivasa Rao REVIEWED BY: APPROVED BY: HA

S.No.	COMPONENT & OPERATION	CHARACTE-RISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE STANDARD	FORMAT OF REC	AGENCY	REMARKS
1	2	3	4	5	6	7	8	9	10	11
1.0.	MATERIAL									
1.1.	CHEM&MECH PROPERITIES									
1.1.1	PLATES FOR IMPELLER	CHEMISTRY& TENSILE PROPERITIES	MAJOR	VERIFICA-TION OF TCs	100%	RESPECTIVE MATERIAL STANDARD		TC	QC/RMS	
1.1.2	IMPELLER RING	-DO-	MAJOR	-DO-	-DO-	-DO-		-DO-	-DO-	
1.2.	INTERNAL QUALITY									
1.2.1	PLATES FOR IMPELLER	INTERNAL SOUNDNESS	MAJOR	-DO-	100%	SEL 072		-DO-	-DO-	
1.2.2	IMPELLER RING	-DO-	MAJOR	-DO-	100%	SA 609		-DO-	-DO-	

QC-RMS :QUALITY CONTROL RAWMATERIAL STORES
TC:TEST CERTIFICATES

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STANDARD QUALITY PLAN FOR
IMPELLERS OF CZECH DESIGN DL TYPE

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1	2	3	4	5	6	7	8	9	10	11
2.0.	INPROCESS CONTROL									
2.1.	WELDING									
2.1.1	WELDS OF IMPELLER	WELD SIZE	MAJOR	VISUAL & MEASUREMENT	100%	MANUFACTURING DRAWING &NOTE 1		--	VQCD	
2.1.2	-DO-	SOUNDNESS	MAJOR	MT/PT ON WELDS	100%	BHE:NDT:RP:MT1/LATEST BHE:NDT:RP:PT1/LATEST		NDT REPORT	-DO-	
2.2.	HEATTREATMENT									
2.2.1	STRESS RELIEF	COMPLIANCE TO STRESS RELIEF CYCLE	MAJOR	VERIFICATION OF HT CHART	100%	BAP:HT:001/LATEST		HT CHART	-DO-	
2.3.	MACHINING									
2.3.1	TURNING DRILLING TAPPING	BORE OF IMPELLER,OD OF IMPELLER OD&ID OF RING STEP DIA, BLADE WIDTH AT EXIT,PCD&THREAD SIZE	MAJOR	MEASUREMENT	100%	MANUFACTURING DRAWING PR:QA:500/LATEST		DIMEN. REPORT	-DO-	

NDT:NONDESTRUCTIVE TESTING
HT- CHART:HEATTREATMENT CHART
VQCD: VENDOR QUALITY CONTROL DEPARTMENT

STANDARD QUALITY CONTROL PLAN FOR

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1	2	3	4	5	6	7	8	9	10	11
2.4.	HARDFACING									
2.4.1	HARDFACING ON IMPELLER BLADES	HARDNESS	MAJOR	HARDNESS CHECK	**	MIN 500 BHN AND NOTE 2		REPORT	VQCD	**REF. NOTE1
2.5.	DYNAMIC BALANCING									
2.5.1	IMPELLER ASSY	RESIDUAL UNBALANCEMENT	CRITI-CAL	UNBALANCE COMPENSAT-ION	100%	MANUFACTURING DRAWING		BALANC-ING REPORT	-DO-	
3.0.	IDENTIFICATION PAINTING PRESERVATION	COMPLIANCE TO COMPANY STANDARD(CL.7&8)	MAJOR	VISUAL	100%	PR:QA:512 &NOTE 3		--	-DO-	

NOTE 1: a) WELDERS SHALL BE QUALIFIED AS PER ASME SEC IX IN 3G POSITION

b) FOLLOWING WPS SHALL BE REFERRED FOR WELDING:

MATERIAL COMBINATION	WPS
1) NAXTRA70+NAXTRA70	012
2) WStE355+WStE355	013
3) NAXTRA70+WStE355	014

c) GAS CUT EDGES SHALL BE GROUND SMOOTH BEFORE WELDING.

d) INCASE OF QUENCHED AND TEMPERED STEELS LIKE NAXTRA 70 OR EQUIVALENT, MT/UT SHALL BE DONE AFTER 48 HOURS OF COMPLETION OF WELDING.

e) LOW HYDROGEN ELECTRODES SHALL BE BAKED FOR 2 Hrs MIN. AT 370-430 °C AND HELD IN HOLDING OVEN AT 120-150 °C BEFORE USE.

f) ELECTRODES OPEN TO ATMOSPHERE FOR MORE THAN 5 MINUTES SHALL BE REBAKED AND DRIED IN THE SAME MANNER

g) BLADE WELDS SHALL BE TOE GROUND TO A MAXIMUM DEPTH OF 0.6 MM AT THE ENTRY AND EXIT OF FILLET WELDS.BLADE WELD WITH BACK PLATE AND COVER PLATE SHALL BE SMOOTHLY ROUNDED AT ENDS.

h) BACK PLATE SHALL BE STRAIGHTENED TO WITHIN 2 MM BEFORE WELDING.

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1	2	3	4	5	6	7	8	9	10	11
		NOTE 2: a) ELECTRODE FOR HARD FACING IS CITORAIL-III OF ADVANI-OERLIKON/BOR-C OF D&H/ GRIDUR-600 OF GENERAL ELECTRODES&EQUIPMENT LTD								
		b) PITCH OF HARDFACING RUN SHALL BE 50 MM.								
		c) WIDTH OF RUN SHALL NOT EXCEED 10 MM								
		d) MAXIMUM HEIGHT OF RUN SHALL BE 5 MM.								
		e) ONE MOCKUP PIECE OF SIZE 25×25 MM MINIMUM SHALL BE HARDFACED AND CHECKED FOR HARDNESS BEFORE HARDFACING ON BLADES ,FOR EACH IMPELLER.								
		NOTE 3: IMPELLERS SHALL BE IDENTIFIED WITH W.O.NO ,DUNO,AND PRODUCT NO. BY PAINTING AND HARD PUNCHING DIRECTION OF ROTATION SHALL BE PAINTED ON THE IMPELLER.								

O.LM

BHARAT HEAVY ELECTRICALS LTD BOILER AUXILIARIES PLANT RANIPET-632 406 (INDIA) QUALITY ASSURANCE DEPT.	STANDARD QUALITY PLAN FOR AP FAN HOUSINGS (SINGLE & DOUBLE STAGE) AND HUB FRONT PART	NAME OF CONTRACT PACKAGE STANDARD	QPNo.FAN348 REV.No.00 DATE 100696 PAGE 01of09

PREPARED BY: B. Srinivasa Rao REVIEWED BY: APPROVED BY:

S.No.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE STANDARD	FORMAT OF REC	AGENCY	REMARKS
1	2	3	4	5	6	7	8	9	10	11
1.0	INPROCESS INSPECTION									
1.1.	MARKING &GAS CUTTING	SHAPE & SIZE	MAJOR	VISUAL& MEASUREMENT	100%	DRAWING &PRQA:500/LATEST &NOTE 15,16,17,18	--		MQCD	
1.2.	HOUSING SHELL/HOUSING COATING									
1.2.1	ROLLING OF HOUSING SHELL AND FLANGES	ID,OD OVALITY	MAJOR	-DO-	100%	DRAWING&PRQA:500/LATEST	--		MQCD	
1.2.2	MACHINING a)FLANGES EP&DRILLING	EDGE PREPARATION	MAJOR	-DO-	100%	DRAWING&PRQA:500/LATEST &NOTE 20621	--		MQCD	
	b)DRILLING& THREADING OF PARTING PLANGES	SIZE OF HOLES &THREADING	MAJOR	MEASUREMENT	100%	DRAWING &PRQA:500/LATEST&	--		MQCD	
	c)LOCATING PINS	THREAD SIZE, LENGTH&OD	-DO-	-DO-	100%	-DO-	--		MQCD	
	d)EXTENSION FOR FLOW MEASURING DEVICE	THREAD SIZE& LENGTH	-DO-	-DO-	100%	-DO-	--		MQCD	
	e)FOOT PLATE DRILLING	THREAD SIZE &HOLE SIZE	-DO-	-DO-	100%	-DO-	--		MQCD	

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STANDARD QUALITY PLAN FOR

AP FAN HOUSING ASSY

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1	2	3	4	5	6	7	8	9	10	11
1.2.3	WELDING OF 1)HOUSING SHELL 2)STIFFENERS 3)FLANGES 4)EXTENSIONS (CL1.2.2d) 5) LIFTING LUGS 6)FEET 7)BASE PLATE 8)DIVIDING PLANGES	WELD SOUNDNESS	MAJOR	VISUAL	100%	DRAWING &NOTE 1,3,4, 19 AND 23		--	MQCD	
1.2.4	DIMENSIONS	ID,OD,R/O P/O,CIRCULARITY PERPENDICULARITY	MAJOR	VISUAL	100%	DRAWING &PR:QA500/LATEST		--	MQCD	
1.2.5	MARKING FOR PROFILE PIECE OPENING, MAN HOLE DOOR OPENINGS STIFFENERS & CUTTING OF MAN HOLE DOOR OPENING	CORRECTNESS& DIMENSIONS	MAJOR	VISUAL & MEASURE- MENT	100%	DRAWING&PRQA500/LATEST NOTE 18		--	MQCD	
1.3.	HUB ASSY/CORE/BULLET									
1.3.1	GAS CUTTING OF ID,OD, CORE SHELL CONES&PLANGES PARTING FLANGES BEARING HOUSING SEATING FLANGES	RADIUS,LENGTH	MAJOR	MEASURE - MENT	100%	DRAWING &PRQA:500/LATEST NOTE 15,16,17,18,		--	MQCD	
1.3.2	ROLLING OF CORE SHELL CONES&PLANGES	,ID,OD,	MAJOR	-DO-	100%	DRAWING &PRQA:500/LATEST		--	MQCD	
1.3.3	MACHINING 1)BEARING HSG SEATING FLANGES 2)PARTING FLANGES 3)EDGE PREPARATION	ID,OD, DRILL HOLES DIA,THREAD SIZE BP	MAJOR	-DO-	100%	-DO-		--	MQCD	

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1	2	3	4	5	6	7	8	9	10	11
1.3.4	WELDING OF [1]CORE SHELL [2]CONE&FLANGES [3]BEARING SEATING FLANGES	WELD SIZE& SHAPE	MAJOR	VISUAL & MEASURE-MENT	100%	DRAWING & NOTE 1,3,4,10 18,23	--	MQCD	
1.3.5	DIMENSIONS	,ID,OD,HT& CONCENTRICITY R/O,P/O	MAJOR	-DO-	100%	DRAWING &PRQA:500/LATEST CONCENTRICITY SHALL BE WITHIN 3 MM	--	MQCD	
1.3.6	MARKING FOR PROPER PIECE OPENING AND OPENING FOR THERMOCOUPLES OR THERMOMETER LEADS &GAS CUTTING OF OPENINGS	ORIENTATION& SIZE	MAJOR	VISUAL& MEASURE-MENT	100%	DRAWING & PRQA:500/LATEST NOTE 18	--	MQCD	
1.4.	HUB FRONT PART									
1.4.1	GAS CUTTING OF SHAPE&SIZE FLANGES CONES PARTING FLANGES		MAJOR	-DO-	100%	DRAWING &PRQA:500/LATEST NOTES 15,16,17,18		MQCD	
1.4.2	ROLLING OF CONES	,ID,OD,& CONCENTRICITY	MAJOR	-DO-	100%	DRAWING &PRQA:500/LATEST	--	MQCD	
1.4.3	MACHINING OF [a]FLANGES	ID,OD,	MAJOR	-DO-	100%	-DO-& &NOTE 20,21,22	--	MQCD	
	[b]PARTING FLANGES	DRILL HOLES DIA,THREAD SIZE	MAJOR	-DO-	100%	-DO-	--	MQCD	
1.4.4	WELDING OF [1]CONES [2]FLANGES [3]PARTING FLANGES [4]LIFTING EYE	WELD SIZE& SHAPE	MAJOR	VISUAL	100%	DRAWING&PR:QA:500/LATEST NOTES 1,3,4,19,23		MQCD	
1.4.5	MARKING FOR MACHINING	ID,OD,& CONCENTRICITY	MAJOR	-DO-	100%	-DO-	--	MQCD	
1.4.6	FINAL	ID,OD,HEIGHT	MAJOR	VISUAL&	100%	DRAWING & PRQA:500/LATEST	--	MQCD	

1	2	3	4	5	6	7	8	9	10	11
		THREADED HOLE SIZE,R/O&F/O								
1.5.	PROFILE PIECE									
1.5.1	CUTTING OF PLATES,CUTTING OF TUBES& BEND ING & EDGE PREPARATION	SHAPE&SIZE	MAJOR	VISUAL& MEASURE MENT	100%	DRAWING &PRQA:500/LATEST NOTES 15,16,17,18	--	MQCD		
1.5.2	WELDING OF TUBE WITH BENT PLATES &WELDING OF PLATES	WELD SIZE & SHAPE	MAJOR	-DO-	100%	DRAWING&PR:QA500/LATEST NOTES 1,3,4,19,23	--	MQCD		
1.5.3	FINAL DIMENSIONS	LENGTH	MAJOR	-DO-	100%	DRAWING,PR:QA:500/LATEST	--	MQCD		
1.6.	GUIDE VANES (FOR 2 STAGE FAN ONLY)									
1.6.1	SHEARING OF PLATES/GAS CUTTING	OVERALL DIMENSIONS	MAJOR	MEASURE- MENT	100%	DRAWING &PRQA:500/LATEST NOTE 15,16,17,18	--	MQCD		
1.6.2	EDGE MACHINING	LENGTH AND ORIENTATION	MAJOR	-DO-	100%	DRAWING&PR:QA:500/LATEST	--	MQCD		
1.6.3	HOT PRESSING	PROFILE GAP &PROFILE DIRECTION	MAJOR	-DO-	100%	DRAWING&PRQA:326/LATEST	LOG	MQCD		
1.7.	MAN HOLE DOOR	LENGTH,WIDTH RADIUS,HOLE SIZE,WELD SIZE&QUALITY	MAJOR	VISUAL& MEASURE- MENT	100%	DRAWING &PRQA:500/LATEST	--	MQCD		
1.8.	HOUSING ASSY WELDING									
1.8.1	WELDING OF CORE/BULLET/ HUB WITH HOUSING, STIFFENERS& PROFILE PIECES	WELD QUALITY &SIZE AND ORIENTATION OF STIFFENERS, PROFILE PIECES	MAJOR	-DO-	100%	DRAWING&PRQA:500/LATEST NOTE,1,3,4,19,23	--	MQCD		
1.8.2	WELDING OF DRAIN TUBE ASSY	WELD SOUNDNESS& SIZE	MAJOR	PT	100%	BHE:NDT:RP:PT01/LATEST NOTE3,4,19,23,25	NDT REPORT	NDTL		

STANDARD QUALITY PLAN FOR

AP FAN HOUSING ASSY

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1	2	3	4	5	6	7	8	9	10	11
1.8.3	WELDING OF GUIDE VANES IN CASE OF 2 STAGE FAN HOUSING	WELD SIZE& ORIENTATION OF VANES	MAJOR	VISUAL& MEASURE MENT	100%	DRAWING&PRQA:500/LATEST &NOTE 3,4,13,19,23	--	MQCD		
1.8.4	HYDRAULIC TEST OF DRAIN LINE	LEAK PROOFNESS	MAJOR	HYDRO TEST	100%	NOTE 5	--	MQCD		
1.8.5	WELDING OF FOOT SUPPORT AND FOOT PLATE	WELD QUALITY	MAJOR	PT/MT	100%	BHR:NDT:RP:PT01/LATEST BHR:NDT:RP:MT01/LATEST NOTE 3,4,19,23	NDT REPORT	NDTL		
1.8.6	DIMENSIONAL INSPECTION OF HOUSING	HOUSING ID,& FLANGE OD, DEPTH OF CORE FROM HSG FACE DEPTH OF BRG SEATING FLANGES AT FROM HSG.FACE IN BETWEEN DISTANCE OF BRG SEATING FLANGES RUN OUT&FACE OUT, CONCENTRICITY BETWEEN HUB ,HOUSING AND BRG SEATING FLANGES AT BOTH ENTRY &EXIT SIDE FOOT PLATE TO HOUSING CENTRE DISTANCE	MAJOR	MEASURE- MENTS	100%	DRAWING&PR:QA:500/LATEST	--	MQCD		
1.9.0	STRESS RELIEF OF HOUSING ASSEMBLY.	COMPLIANCE TO CRITI STRESS RELIEF -CAL CYCLE.		VERIFICA TION HT CHART	100%	BAP:HT:001/LATEST	H T CHART	MQCD		
1.1.0	FULL WELDING OF BEARING SEATING FLANGES &FOOT PLATES	WELD SIZE& SHAPE	MAJOR	VISUAL& MEASURE- MENT	100%	DRAWING &NOTE 3,4,19,23	--	MQCD		

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AP FAN HOUSING ASSY

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1	2	3	4	5	6	7	8	9	10	11
	(a)									
1.11	SPLITTING OF HOUSING ASSY AND WELDING OF PARTING FLANGES SHAPE IN CASING& CORE/BULLET	WELD SIZE&	MAJOR	-DO-	100%	DRAWING NOTE 2,3,4,19,22&23		--	MQCD	
	b)GRINDING OF PARTING FLANGES	FLATNESS OF PARTING FLANGES AFTER FLUSH GRINDING	MAJOR	VISUAL	100%	-DO-		--	MQCD	
	c)ASSY OF HOUSING HALVES	GAP BETWEEN HALVES	MAJOR	MEASUREMENT	100%	DRAWINGS		--	MQCD	
1.1.2	MARKING FOR MACHINING	MACHINING ALLOWANCES	MAJOR	MEASURMENT	100%	DRAWING		--	MQCD	
1.1.3	ASSY OF THERMOCOUPLE PASSAGE	PROPER ASSY	MAJOR	VISUAL	100%	DRAWING		--	MQCD	
2.0.	MACHINING OF HOUSING ASSY	ID OF HSG. STEP OF OGV SEATING FLANGE DISTANCE OF BRG HSG.SEATING FLANGE TO EXIT FLANGE OF HOUSING,BETWEEN DISTANCE OF BRG HSG.SEATING FLANGES,OD&ID OF HUB,HUB FACE TO HOUSING FACE,ID,DEPTH,PCD &THREAD SIZE OF SCREEN PLATE SEATING AREA,ID,PCD,F/O,R/O OF BRG HSG,SEATING FLANGES,HOLE SIZE MATCH DRILLING OF OGV SEATING FLANGES,	MAJOR	-DO-	100%	DRAWING NOTE 6,7,8,14		DR/ HISTORY CARD	MQCD	

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1	2	3	4	5	6	7	8	9	10	11
		FOOT TO HOUSING CENTRE HEIGHT ,FOOT HOLE DIA &DISTANCES R/O&P/O OF HOUSING HUB OD, TOTAL HT FOOT PARALLISIM &FLATNESS OF INDIVIDUAL FOOT								
3.0.	FINAL INSPECTION									
3.1.	PAINTING PRESERVATION IDENTIFICATION	VERIFICATION	MAJOR	VISUAL	100%	PRQA:590/LATEST,CMS NOTE 26		--	MQCD	

NOTE:

1 : a)SPIDER SHALL BE USED WHILE WELDING THE HOUSING SHELL WITH FLANGE ANG STIFFENERS
b) DIVIDING FLANGES SHALL BE MATCH DRILLED AND TO BE TACK WELDED .
c) DIVIDING ON CIRCULAR FLANGES SHALL NOT BE DONE BEFORE STRESS RELIEF
d) BULLET &CASING AFTER SR SHALL BE PLACED ON LAYOUT FOR CORRECT ASSY AND STIFFENERS/PROFILE PIECE SHALL BE WELDED
e) BULLET FLANGES (BEARING HOUSING SEATING)SHALL BE TACK WELDED BEFORE SR AND SHALL BE WELDED ONLY AFTER ASSY WITH HOUSING .
f) BEFORE FINAL WELDING OF BULLET WITH CASING ALL THE FIT UP,CONCENTRICITY,DIMENSIONS SHALL BE CHECKED

2 a) AFTER DIVIDING,THE DIVIDING FLANGE FACES SHALL BE GROUND FOR FLATNESS AND SHALL BE ASSEMBLED.
b) THE GAP BETWEEN THE FLANGES SHALL BE CHECKED AT FREE CONDITION AFTER PLACING THE MACHINED WASHER &TOP HALF OF HOUSING(BEFORE TORQUE TIGHTENING)
c) THE MAXIMUM GAP VARIATION SHALL NOT EXCEED 0.5 MM. IN FREE CONDITION
d) THICKNESS OF WASHER SHALL BE BETWEEN 4 TO 6 MM.

3: a)LOW HYDROGEN ELECTRODES SHALL BE BAKED FOR ATLEAST 2 HOURS AT 260 TO 430 DEG C AND HELD IN HOLDING OVENS AT 120-150 DEG C BEFORE USE.
IF THE ELECTRODES ARE EXPOSED FOR MORE THAN 4 HOURS TO THE ATMOSPHERE THESE SHALL BE REBAKED AND DRIED IN THE SAME MANNER
b) RUTILE COATED ELECTRODES SHALL BE DRIED AT 120 - 130 DEG C FOR 1 HOUR BEFORE USE.

1	2	3	4	5	6	7	8	9	10	11

4: PROPER WELDING SEQUENCE SHALL BE ADOPTED TO MINIMISE DISTORTION .

5: THE DRAIN TUBE ASSY SHALL BE HYDRAULIC TESTED AT 20 BAR FOR 30 MIN. A DROP OF MAXIMUM 1 BAR MAY BE ALLOWED&NO LEAK IS PERMITTED.

6: 1)THE BEARING HOUSING SEATING FLANGES SHALL BE DRILLED WITH JIG ONLY. AND WHILE DRILLING THE HOUSING SHALL BE CHECKED FOR FLATNESS. AND THE DRILL HOLES SHALL BE CONCENTRIC.FOR CORRECT LOCATION OF DRILL JIGS A LINE CAN BE MADE IN THE MACHINE ITSELF WHILE MACHINING ID.

7: REFERENCE LINE MARKING SAHLL BE DONE BEFORE MACHINING AND AVAILABILITY OF MACHINING ALLOWANCE AT ALL LOCATION SHALL BE ENSURED. ASSEMENT OF RESIDUAL THICKNESS AND PUNCHINING OF CENTRE LINE ON CASING FLANGE AND BEARING HOUSING SEATING FLANGE SHALL BE DONE.

8) OGV MATCH DRILLING SHALL BE VERIFIED BY ASSEMBLING

9 ----VACANT----

10 BULLET WELDS SHALL BE PLUSD GROUND AND SMOOTHLY MERGED ON OUT SIDE.

11 -----VACANT----------

12 DRAIN TUBE ASSY WELDING SHALL BE DONE AFTER STRESS RELIEF

13a)CARE SHALL BE TAKEN FOR SETTING THE FIRST VANE WHICH SHALL NOT COINCIDE WITH THE DIVIDING AXIXS. AND WELDING SHOULD NOT BE DONE ON THE MILLED PORTION OF THE VANES. -REFER DRAWING.

b) SPECIAL FIXTURE SHALL BE USED FOR BLADE SETTING.THE VANE SHOULD SEAT PROPERLY OON THE FIXTURE AND EXIT OF VANE SHOULD COINCIDE WITH THE MARKING ON HOUSING.CHECK FOR DIRECTIONS OF VANES.

c) LOCATION OF FIRST VANE SHOULD BE SET IN SUCH A WAY THAT EXIT EDGE OF VANE IS AWAY FROM MACHINE AXIS.

14 WHILE MACHINING THE PCD LINE CAN BE MARKED BY A LIGHT GROOVE .SO THAT SAME CAN BE USED FOR DRILLING HOLES .

15:MATERIALS SHALL BE AS PER GMS, AND ANY ADDITIONAL JOINTS SHALL BE APPROVED BY ENGG

16)PLATES TO BE CUT TO SIZE BY SHEARING /GAS CUTTING.

17)CARBON STEELS THICKER THAN 50 MM SHALL BE PREHEATED TO 100°C AND ALLOY STEELS ABOVE 25 MM THICK SHALL BE PREHEATED TO 150 DEG'C BEFORE GAS CUTTING.

18)GAS CUT NOTCHES SHALL BE DRESSED BY GRINDING AND NOTCHES SHALL BE FILLED UP BY WELDING AND GROUND BEFORE TAKING UP FURTHER FABRICATION.

19)WELDERS AND WELD PROCEDURES EMPLOYED SHALL BE QUALIFIED ASPER AWS D1.1 LATEST.

20) FOR CIRCULAR FLANGES TOLERANCES ARE AS GIVEN BELOW

BOLT SIZE	HOLE SIZE in MM	TOLERANCE FOR PCD	TOLERANCE FOR HOLE
M16	19	±0.70	±0.5
M20	24	±0.70	±0.5
M24	28	±1.0	±0.8
M30	34	±1.0	±0.8
M36	40	±1.0	±0.8
M42	46	±1.0	±0.8

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	21) PITCH DISTANCE OF ANY TWO CONSECUTIVE HOLES SHALL BE WITHIN ±1 MM.									
	22) OUT OF FLATNESS SHALL NOT EXCEED 3 MM .									
	23) a)GROOVE WELDS SHALL BE PREPARABLY MADE WITH MINIMUM REINFORCEMENT UNLESS OTHERWISE SPECIFIED. IN THE DRAWING AND IN CASE OF BUTT WELDS REINFORCEMENT SHALL NOT EXCEED 3.2 MM. b)SURFACE OF WELDS SHALL BE FREE FROM RIPPLES ,OVERLAPS &UNDER CUTS AND ABRUPT RIDGES . c)BUTT WELDS SHALL BE BACKGOUGED TO REMOVE ALL SLAG,UNFUSED AREA ETC.WELDED ON OTHER SIDE . d) WELD SHALL BE FREE FROM SPATTER AND SLAG.									
	24) ---VACANT--									
	25) WELD NECK FLANGES FOR DRAIN PIPE SHALL BE FULLY WELDED AFTER INSERTION OF DRAIN PIPE IN TO HOUSINGS AND TO BULLET .									
	26) HOUSING SHALL BE IDENTIFIED WITH NO.NO, DUNO,PRODUCT NO AND SUBCONTRACTORS CODES IF ANY.									

BHARAT HEAVY ELECTRICALS LTD
QPNO:FAN350
BOILER AUXILIARIES PLANT
00
RANIPET -632 406 (INDIA)
050695
QUALITY ASSURANCE DEPT.

QUALITY CONTROL PLAN FOR

EXPANSION JOINT FOR FANS

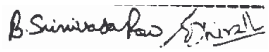
TIME OF CONTRACT PACKAGE

STANDARD

REV.NO :

DATE:

PREPARED BY : 

REVIEWED BY 

APPROVED BY : 

S.NO	COMPONENT & OPERATION	CHARACTE-RISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE STANDARD	FORMAT OF REC	AGENCY	REMARKS
1	2	3	4	5	6	7	8	9	10	
1.0	MATERIAL									
1.1	a) RUBBER BELT b) SS WIRE MESH c) WOOL d) ANGLES e) PLATES / SHEETS f) RODS g) FASTNERS	COMPLIANCE TO PURCHASE ORDER	MAJOR	REVIEW OF TCs	100%	PURCHASE ORDER	PURCHASE ORDER	TC	QC/PROC	
2.0	INPROCESS CONTROL									
2.1	GAS CUTTING	SIZE RADIUS AND EDGE PREPARATION	MAJOR	MEASURE-MENT	100%	DRAWING NOTE 1		--	VQCD	
2.2	WELDING VQCD	WELD SIZE& FINISH	MAJOR	RANDOM	100%	DRAWING NOTE 2			--	
2.3	ROLLING/ BENDING	RADIUS	MAJOR	-DO-	100%	DRAWING		--	VQCD	
2.4	DRILLING& SLOTTING	SIZE &	MAJOR	-DO-	100%	DRAWING NOTE 3		DR	VQCD	
2.5	RUBBER BELT	SIZE, EP	MAJOR	-DO-	100%	DRAWING &NOTE 4		--	VQCD	

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(If applicable)	VUCANISING OR BONDING	

1	2	3	4	5	6	7	8	9	10	11
3.0	FINAL INSPECTION	a) OPENING DIMENSIONS	MAJOR	MEASURE-MENT	100%		DRAWING		DR	VQCD
		b) WIDTH, HT &DIGONAL	MAJOR	-DO-	100%		DRAWING		DR	VQCD
		c) PROPER ASSY OF WOOL, WIIREMASH & RUBBER BELT	MAJOR	-DO-	100%		DRAWING NOTE 5		DR	VQCD
		d) PAINTING	MAJOR	VISUAL	100%		PR :QA 590&512	--	VQCD	
		e) PRESERVATION		-DO-	-DO-		-DO-			
		f) INDENTIFICATION		- DO-	-DO-	GMS/P.O	GMS/P.O	--	VQCD	
		VQCD: VENDOR QUALITY CONTROL DEPARTMENT							--	

NOTE 1: GASCUTTING NOTCHES EXCEEDING 0.8 MM SHALL BE FILLED BY WELDING BEFORE ASSY

NOTE 2: 1) WELDER SHALL BE QUALIFIED AS PER WAS AWS D1.1 / LATEST
2) LOW HYDROGEN ELECTRODES SHALL BE BAKED FOR 2 Hrs MIN AT 370 - 470 DEG C AND HELD IN HOLDING OVEN AT 120 - 150 DEG C BEFORE USE.
3) ELECTRODES OPENED TO ATMOSPHERE FOR MORE THAN 4 Hrs SHALL BE REBAKED AND DRIED
4) RUTILE ELECTRODES SHALL BE DRIED AT 120-130 DEG C FOR 1 HOUR BEFORE USE.
5) AVOID WELDING WHEREVER NOTE AS "NOTE TO BE WELDED" IS GIVEN IN DRAW.

NOTE 3: 1) DRILLING SHALL BE DONE WHEREEVER DRAWING CALLS FOR.
2) ALL THE DRILL HOLES SHALL BE DEBURRED
3) a)PITCH DISTANCE OF TWO CONSECUTIVE HOLES SHALL BE WITHIN +/- 1 MM
b) DEVIATION OF FLATNESS ON FLANGS SHALL NOT EXCEED 3 MM.
c) DIAGONAL DIFFERENCE SHALL NOT EXCEED 1.5 MM/METRE SUBJECT TO THE MAXIMUM OF 3 MM.

NOTE 4: 1) FOR JOINING RUBBER SHEETS VULCANISING OR ADHESIVE BONDING CAN BE ADOPTED.
2) ADHESIVE SHALL BE APPLIED BETWEEN STEEL STRUCTURE AND RUBBER ALSO MAINTAINING MINIMUM OVERLAP ASPER DRAWING.
3) JOINING SURFACES SHALL BE SMOOTH AND CLEAN.BONDING SHALL BE PREFERABLY DONE IN SEMICLOSED AREA TO AVOID DUST ENTRY.

NOTE 5: 1) PROPER BONDING OF RUBBER BELT WITH STELL STRUCTURE MAY BE CHECKED BY PULLING THE BELT BY HAND AND THE BELT SHOULD NOT DEBOND FROM THE STRUCTURE.

Ranipet	MANUFACTURER'S NAME& ADDRESS **M/S BHEL: BAP: RANIPET TAMIL NADU-632 406**	**MANUFACTURING QUALITY PLAN**	PROJECT: **STANDARD**
		Item/subsystem: **BEARING HOUSING (TUBULAR TYPE)** QP: No: **FAN:352** Rev No: **01** Date: **24.06.2016** Page: **1 Of 3**	CONTRACT: **BHEL, BAP-RANIPET**

SL NO 1	COMPONENT & OPERATION 2	CHARACTERISTICS 3	TYPE OF CHECK 4	QUANTUM OF CHECK 5	REFERENCE DOCUMENTS 6	ACCEPTANCE NORMS 7	FORMAT OF RECORD 8	Agency 9 M	Agency 9 B	Agency 9 C	REMAR KS 10
1.0	**RAW MATERIALS**										# Plates of thickness more than 40 mm and Roundness of dia more than 50 mm shall be UT tested.
1.1 1.2	BEARING HOUSING, PLATES	CHEMICAL& MECHANICAL PROPERITIES	CHEM & TENSILE	EACH HEAT	RESPECTIVE MATERIAL SPEC		TC	P	V	V	
1.3	BEARING HOUSING	SOUNDNESS	NDT (UT/RT)	100%	TDC:RTF:314/LATEST		TC	P	V	V	
1.4	SHAFT FORGING	-DO-	NDT(UT)	100%	TDC:RTF:308/LATEST		TC	P	V	V	
2.0	**INPROCESS INSPECTION**										
2.1	BEARING HSG COVER + SHEET WELDING	SOUNDNESS	MT	100%	BHEL:NDT:RP:MT		REPORT	P	W	V	
3.0	**DIMENSIONAL INSPECTION**										
3.1	BEARING HOUSING	BORE,GROOVE,ID OD	MEASUREMENT	100%	DRAWING		DR	P	W	V	
3.2	BEARING HOUSING COVER ASSY	-DO-	MEASUREMENT	100%	-DO-		DR	P	W	V	
3.3	SHAFT	SHAFT JOURNAL DIA & IMPELLER BORE	MEASUREMENT	100%	DRAWING		DR	P	W	V	

M – Manufacturer / Subcontractor,
B - BHEL /BHEL Authorized Inspection Agency,
C -Customer, P - perform,
V - Verification of reports
W - Witness, TC - Test certificate
DR – Dimensional report.

Prepared BY

24.06.2016

Reviewed & Approved by

24/6/16

Ranipet	MANUFACTURER'S NAME& ADDRESS **M/S BHEL: BAP: RANIPET TAMIL NADU-632 406**	**MANUFACTURING QUALITY PLAN**		PROJECT: **STANDARD**	
		Item/subsystem: **BEARING HOUSING (TUBULAR TYPE)**	QP: No: **FAN:352** Rev No: **01** Date: **24.06.2016** Page: **2 Of 3**	CONTRACT: **BHEL, BAP-RANIPET**	

SL NO 1	COMPONENT & OPERATION 2	CHARACTERISTICS 3	TYPE OF CHECK 4	QUANTUM OF CHECK 5	REFERENCE DOCUMENTS 6	ACCEPTANCE NORMS 7	FORMAT OF RECORD 8	Agency 9			REMAR KS 10
								M	B	C	
4.0	**DYNAMIC BALANCING**										
4.1	SHAFT (IF APPLICABLE)	UNBALANCE CORRECTION	DYNAMIC BALANCING	100%	DRAWING	REPORT	P	W	V		
5.0	**ASSEMBLY**										
5.1	ASSY OF SHAFT WITH BRGS,COVER & ACCESSORIES	PROPER ASSY,F/O ON BEARINGS & OVER ALL DIMENSION.	MEASUREMENT	100%	DRAWING/PRQA:312/LATEST	REPORT	P	W	V		
6.0	**FUNCTIONAL TEST**										
	SHAFT WITH BEARING ASSY	SPIN TEST FOR FREE ROTATION &LEAK PROOFNESS	VISUAL	100%	AS PER NOTE:02	REPORT	P	W	W		
6.1	**FINAL INSPECTION**										
	IDENTIFICATION, PAINTING & PRESRVATION	COMPLIANCE TO COMPANY STANDARD	VISUAL	100%	AS PER NOTE:03	REPORT	P	V	-		

M – Manufacturer / Subcontractor, B - BHEL /BHEL Authorized Inspection Agency, C -Customer, P - perform, V - Verification of reports W - Witness, TC - Test certificate DR – Dimensional report.	**Prepared BY**	**Reviewed & Approved by**
	24.06.2016	24/6/16

Ranipet	MANUFACTURER'S NAME& ADDRESS **M/S BHEL: BAP: RANIPET TAMIL NADU-632 406**	**MANUFACTURING QUALITY PLAN**		PROJECT: **STANDARD**
		Item/subsystem: **BEARING HOUSING (TUBULAR TYPE)**	QP: No: **FAN:352** Rev No: **01** Date: **24.06.2016** Page: **3 Of 3**	CONTRACT: **BHEL, BAP-RANIPET**

SL NO 1	COMPONENT & OPERATION 2	CHARACTERISTICS 3	TYPE OF CHECK 4	QUANTUM OF CHECK 5	REFERENCE DOCUMENTS 6	ACCEPTANCE NORMS 7	FORMAT OF RECORD 8	Agency 9			REMAR KS 10
								M	B	C	

NOTE 1

(a) R/O,F/O SHALL NOT BE MORE THAN 0.02MM(IF NOT GIVEN IN DRAWING)

(b) KEY WAY OFFSET SHALL NOT BE MORE THAN 0.1 FOR THE DIA OF 10-22MM,0.16MM FOR DIA OF 22-38MM,0.2MM FOR DIA OF 38-65MM,0.3MM FOR DIA OF 65-100MM,0.4MM FOR DIA MORE THAN 100MM.

NOTE 2

(1) KEEP THE SHAFT WIRH BEARING ASSY IN A LEVELLED SURFACE

(2)FILL ISOVG68 OIL TO LEVEL AS MENTIONED IN DRAWING.

(3) ROTATE THE SHAFT BY HAND 20-30 TIMES AND ENSURE FREE ROTATION.

(4) ENSURE NO LEAKAGE.

(5) ENSURE PUNCHING OF BRG NOS OM BEARING HOUSING AS PER DRAWING.

NOTE 3Painting: Surface preparation: power tool cleaning; One coat of red oxide zinc primer to IS 2074 (DFT= 25 microns)
Finish paint: One coat of synthetic enamel paint to IS 2932 shade IS-5 of smoke gray (DFT= 20 microns)
Machined surface shall be applied with rust preventive oil (DFT= 20 microns)

M – Manufacturer / Subcontractor, B - BHEL /BHEL Authorized Inspection Agency, C -Customer, P - perform, V - Verification of reports W - Witness, TC - Test certificate DR – Dimensional report.	**Prepared BY**	**Reviewed & Approved by**
	24.06.2016	24/6/16.

BHEL
RANIPET

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QUALITY DEPARTMENT

AMENDMENT TO QUALITY WORK INSTRUCTIONS (SQP)

Q.W.I.NO:SQP:FAN353/01 Dt 09 12 95

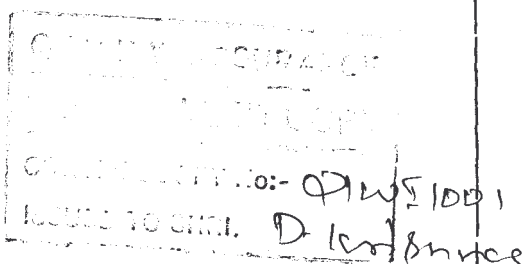
AMENDMENT SL NO: A 1

Dt:15 02 2000

DESCRIPTION:CONTROL ROD/CONTROL SLIDE/CONTROL SLEEVE

DETAILS

CLAUSE NO	AMENDED AS	BASIS FOR AMENDMENT REMARKS
1.1.1	EN10084 IS TO BE READ INPLACE OF DIN 17210	DIN 17210 IS OBSOLETE
1.1.2	STANDARD DIN 1691& 1693 ARE DELETED.	DIN 1691& 1693 ARE OBSOLETE



B. Sundaravadivelu
Prepared by

Approved by

Distribution: As per standard distribution list.

BHARAT HEAVY ELECTRICALS LTD BOILER AUXILIARIES PLANT RANIPET-632 406 (INDIA) QUALITY ASSURANCE DEPT.	QUALITY CONTROL PLAN FOR CONTROL ROD & CONTROL SLIDE/ CONTROL SLEEVE	NAME OF STATION BD	CONTRACT PACKAGE	QP.NO:FAN353 REV.No:01 DATE:091295 PAGE 01 OF03

PREPARED BY: S Srinivasan REVIEWED BY: [illegible] APPROVED BY: [illegible]

S.No.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE STANDARD	FORMAT OF REC	AGENCY	REMARKS
1	2	3	4	5	6	7	8	9	10	
1.0.	MATERIAL									590 M17 IN NORMALISED CONDITION 16MnCr56 IN SOFT ANNEALED CONDITION
1.1.	RAW MATERIALS									
1.1.1	CONTROL ROD	CHEMISTRY	MAJOR	ANALYSIS	MELT WISE	16MnCr56 OF DIN17210/ * 590M17 OF BS970 PART 1		TC	SUPPLR	V
1.1.2	CONTROL SLIDE/ CONTROL SLEEVE	CHEMISTRY TENSILE STRENGTH& HARDNESS FOR GG25 /UTS,YS AND %ELONG FOR GGG40.	MAJOR	CHEM&MECH TESTS	MELTWISE	** GG25 OF DIN1691/ FG260 OF IS 210 OR GGG40 OF DIN 1693 PART 1/ SG 400/15 OF IS 1865		TC	SUPPLR	V ** REFER DRAWING OR P.O FOR APPLICABLE MATL. SPEC

TC: TEST CERTIFICATES
SUPPLR: SUPPLIER
V :VERIFICATION OF TCs BY CUSTOMER

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QUALITY ASSURANCE
CONTROLLED COPY
CONTROL COPY No:- 01/05/100
ISSUED TO SHRI. D. Krishnamurthy MQP/Ver

QUALITY CONTROL PLAN FOR

CONTROL ROD AND CONTROL SLIDE/CONTROL SLEEVE

QP.NO:FAN363
REV.NO:01
DATE:091295

1	2	3	4	5	6	7	8	9	10	11
2.0.	INPROCESS CONTROL									
2.1.	MACHINING									
2.1.1	CONTROL ROD	OD,STEP OD STEP LENGTHS OIL HOLES SIZE,PCD, ORIENTATON OPENING OF LINEAR HOLES WITH CORRESPONDING RADIALLY DRILLED HOLES DEPTH OF HOLES TAPPED HOLES PCD,SIZE DEPTH,ORIENTATION, RUN OUT,FACE OUT GROOVE DETAILS TOTAL LENGTH CHAMFERING OF EDGES COUNTERSUNK DIA, SURFACE ROUGHNESS	MAJOR	MEASURE-MENT	100%		DRAWING & NOTE1	DR	SUPPLR	CHP
2.1.2	CONTROL SLIDE	OD,ID, STEP OD,ID,DEPTHS GROOVE ID, OD,WIDTH DRILL HOLES DIA, LOCATION, THREAD SIZE,PCD, DEPTH, LENGTHS RUN OUT,FACE OUT TOTAL LENGTH SURFACE ROUGHNESS	MAJOR	-DO-	100%		-DO-	DR	SUPPLR	CHP

DR:DIMENSIONAL REPORT ,CHP:CUSTOMER HOLD POINT

QUALITY CONTROL PLAN FOR

CONTROL ROD AND CONTROL SLIDE/CONTROL SLEEVE

QP.NO:FAN353
REV.NO:01
DATE:091295

1	2	3	4	5	6	7	8	9	10	11
2.2.	CASE HARDENING									
2.2.1	CONTROL ROD	CASE DEPTH& HARDNESS ON SIMULATED TEST PIECE	MAJOR	MEASURE-MENT	ONE FOR EACH BATCH OF CASE HARDENING		DRAWING	TC	SUPPLR	VERIFICATION OF T.C.
3.0.	FINAL INSPECTION									
3.1.1	IDENTIFICATION PRESERVATION PACKING	VERIFICATION	MAJOR	VISUAL	100%		NOTE 2	—	SUPPLR	
4.0.	DOCUMENT* PACKAGE	VERIFICATION OF RECORDS ASPER COLUMN 9 OF CL. 1.1 ,1.2&2.2	MAJOR	VERIFICA-TION	100%		QP:FAN353/LATEST	DOCUMENT PACKAGE	SUPPLR	*DOCUMENT PACKAGE IN TRIPLICATE SHALL BE SUBMITTED TO BHEL

NOTE 1:a)EDGES SHALL BE CHAMFERED BY .2 MM x45DEG.
b)CONTROL EDGES SHALL BE SHARP AND FREE FROM BURRS
c)ALL RADIUS AND GROOVE DIMENSIONS SHALL BE CHECKED.
d)OIL HOLES THROUGHNESS SHALL BE CHECKED IN CASE OF CONTROL ROD.

NOTE2:a)THE MACHINED SURFACES SHALL BE APPLIED WITH RUSTPREVENTIVE OIL AND OVER THAT PLASTIPEEL COATING SHALL BE DONE.
b)CONTROL ROD &CONTROL SLIDE SHALL BE IDENTIFIED WITH TAG AND PACKED SUITABLY BEFORE DESPATCH.

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QUALITY DEPARTMENT

AMENDMENT TO QUALITY WORK INSTRUCTIONS (SQP)

QWI NO: SQP:FAN:354 REV 00 DATE : 03 02 96
AMENDMENT NO. A 1 DATE : 05 12 2000

DESCRIPTION: RADIAL FAN ROTOR ASSY

DETAILS

CLAUSE NO	AMENDED AS	BASIS FOR AMENDMENT/ REMARKS
3.0	Following added. Under Ref & Acceptance standard Note 2 : Direction of rotation to be painted on the impeller and to be verified with reference to drawings.	CTQ Recommendation

Prepared by	Reviewed by	Approved by
	B. Srinivasa Rao	

BHARAT HEAVY ELECTRICALS LTD BOILER AUXILIARIES PLANT RANIPET-632 406 (INDIA) QUALITY ASSURANCE DEPT.	QUALITY CONTROL PLAN FOR RADIAL FAN ROTOR ASSEMBLY.	NAME OF CONTRACT PACKAGE STANDARD	QPNO: FAN354 REV.No:00 DATE:030296 PAGE 01 OF01

PREPARED BY: REVIEWED BY: B. Srinivasa Rao APPROVED BY:

S.No.	COMPONENT & OPERATION	CHARACTE-RISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE STANDARD	FORMAT OF REC	AGENCY	REMARKS
1	2	3	4	5	6	7	8	9	10	REMARKS
	NOTE: (1) This Q.P is applicable in case of drawing calls for ROTOR ASSY. (2) For Impeller Assy and Conical Cover Plates refer SQP:FAN317/Latest. (3) For Shafts refer SQP:FAN345/Latest and FAN346/Latest as applicable.									
1.0.	MATERIAL									
	a)FASTENERS	COMPLIANCE TO PURCHASE ORDER	MAJOR	VERIFICA-TION OF TC's	100%	PURCHASE ORDER		TC	QC/PROC	
	b) WASHERS &LOCATING PINS	-DO-	MAJOR	VERIFICA-TION OF DR	100%	-DO-		DR	QC/OLI	
2.0.	INPROCESS INSPECTION									
2.1.	SHAFT+ IMPELLER+ CC PLATES	PROPER ASSY TORQUE TIGHTNESS	MAJOR	VISUAL	100%	PRQA:312/LATEST		--	MQCD	** PRQA061, 306,307,309 ARE APPLICABLE FOR BHEL SHOPS ONLY.
2.2.	DYNAMIC BALANCING OF ROTOR ASSY	RESIDUAL UNBALANCEMENT	CRITI-CAL	UNBALANCE COMPENSATION	100%	DRG&PRQA:061,306,307,309 314,323/LATEST	**	BALAN-CING REPORT	MQCD	
3.0.	FINAL INSPECTION									
	PAINTING PRESERVATION INDENTIFICA-TION&PACKING	COATING THICKNESS OF PAINT,PROPER PACKING, PRESERVATION &CORRECTNESS OF IDENTIFICATION	MAJOR	MEASUREMENT &VISUAL	RANDOM FOR PAINTING &100% FOR OTHERS	PRQA590 &PRQA512@ PACKING DRAWING&GMS,NOTE1		--	MQCD	@PRQA:512 IS APPLICABLE FOR SUBCONT-RACTING ONLY
				NOTE 1:IDENTIFICATION OF ITEMS SHALL BE WITH WO.NO,DUNO,PRODUCT NO. VENDOR CODE IF APPLICABLE						

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BHARAT HEAVY ELECTRICALS LTD BOILER AUXILIARIES PLANT RANIPET-632 406 (INDIA) QUALITY ASSURANCE DEPT.	QUALITY CONTROL PLAN FOR HUB WITH FLANGE	NAME OF CONTRACT PACKAGE STANDARD	QP.No.FAN355 REV.No.00 DATE 260496 PAGE 01of02

PREPARED BY: S. Srinivasa Rao | REVIEWED BY: [illegible] | APPROVED BY: [illegible]

S.No.	COMPONENT & OPERATION	CHARACTE-RISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE STANDARD	FORMAT OF REC	AGENCY	REMARKS
1	2	3	4	5	6	7	8	9	10	11
1.0.	MATERIAL									
1.1.	HUB FORGING ROUND	CHEMICAL& MECHANICAL&	MAJOR	VERIFICA-TION OF TCs	100%	APPLICABLE MATL STANDARD AND TDC.		TC	QC-RMS	
1.2.	FLANGE	UT -DO-								
1.3.	ARRESTING RING	-DO-								
2.0.	INPROCESS CONTROL NOTE: ATTESTATION/CERTIFICATION TRANSFER SHALL BE ENSURED.									
2.1.	MACHINING									
2.1.1	ROUND FORGING	ID,OD,EP	MAJOR	MEASURE-MENT	100%	DRAWING		DR	MQCD	
2.1.2	FLANGE	ID,EP,HOLES PCD,HOLE DIA	MAJOR	-DO-	100%	-DO-		DR	MQCD	
2.1.3	ARRESTING RING If applicable	ID,OD, THICKNESS, HOLES DIA,PCD THREAD SIZE	MAJOR	-DO-	100%	-DO-		DR	MQCD	
2.2.	WELDING									
2.2.1	HUB-FLANGE WELDMENT	WELD SOUDNESS	MAJOR	UT RT&MT FOR 100% BUTT JOINTS& MT FOR FILLET WELDS		BHE:NDT:PB:MT01/LATEST BHE:NDT:PB:UT02/LATEST AND NOTE 1		NDT REPORT	NDTL	
2.3.	STRESS RELIEF	COMPLIANCE TO HT CYCLE	MAJOR	VERIFICA-TION OF STRESS RELIEF CYCLE	100%	BHE:HT:001/LATEST		HT CHART	MQCD	

MQCD:MANUFACTURER'S QUALITY CONTROL DEPARTMENT,NDTL:NONDESTRUCTIVE TESTING,DR:DIMENSIONAL REPORT
HT:HEATTREATMENT CYCLE, TC:TEST CERTIFICATE

QUALITY CONTROL PLAN FOR

HUB-FLANGE

QP.NO:FAN355
REV.NO:00
DATE: 26 04 96

1	2	3	4	5	6	7	8	9	10	11
2.4.	FINAL MACHINING									
2.4.1	HUB-FALNGE (HUB ASSY)	ID,OD,PCD, THREAD SIZE, THREAD HOLE DEPTH ,KEY WAY WIDTH, DEPTH,OFFSET, TOTAL LENGTH FLANGE OD STEP DIA,DEPTH FACE OUT& RUN OUT	MAJOR	MEASURE-MENT	100%	DRAWING&PRQA500/LATEST NOTE 3		DR	MQCD	
2.5.	DYNAMIC BALANCING									
2.5.1	HUB ASSY	RESIDUAL UNBALANCEMENT	MAJOR	UNBALANCE COMPENSATION	100%	DRAWING & NOTE 2		BLNG REPORT	MQCD	
3.0.	FINAL INSPECTION	PAINTING PRESERVATION PACKING	MAJOR	VISUAL	100%	DRAWING &PR:QA:590/LATEST		--	MQCD	

NOTE 1:FULL PENETRATION GROOVE WELDS SHALL ALSO BE UT RT & MPI TESTED.
PARTIAL PENETRATION GROOVE WELDS SHALL BE MT EXAMINED.INCASE OF ALLOY STEELS
NONDESTRUCTIVE EXAMINATIONS NDE, SHALL BE CONDUCTED AFTER 48 Hrs
AFTER COMPLETION OF WELDS.NDE SHALL BE CONDUCTED BEFORE & AFTER STRESS RELIEF.
NOTE 2:BALANCING SHALL BE CARRIED ON MANDREL SHAFT
AS PER DRAWING P.O REQUIREMENT.
MANDREL SHALL BE BALANCED TO A GRADE BETTER THAN HUB ASSY.

MNOTE 3:KEY WAY OFFSET PERMITTED SHALL BE AS PER TABLE SHOWN BELOW.

DIA OF SHAFT ~~IN MM~~	>10UPTO22	>22UPTO38	>38UPTO 65	>65UPTO 110	>110UPTO150
OFFSET PERMITTED IN MM	0.1	0.16	0.20	0.30	0.4

BHARAT HEAVY ELECTRICALS LTD BOILER AUXILIARIES PLANT RANIPET-632 406 (INDIA) QUALITY ASSURANCE DEPT.	QUALITY CONTROL PLAN FOR CUTLET GUIDE VANE ASSY	NAME OF CONTRACT PACKAGE STANDARD	QP.NO:FAN356 REV.No:01 DATE:100696 PAGE 01 OF05

PREPARED BY: B. Srinivasa Rao | REVIEWED BY: [illegible] | APPROVED BY: [illegible]

S.No.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE STANDARD	FORMAT OF REC	AGENCY	REMARKS
1	2	3	4	5	6	7	8	9	10	
1.0.	INPROCESS CONTROL									
1.1.	OGV SHELL									
1.1.1	GAS CUTTING OF SHELL,FLANGES,LIFTING LUGS	OVERALL DIMENSIONS	MAJOR	MEASUREMENT	100%	DRAWING &PR:QA:500/LATEST NOTES 2,3,4,5,11	-		MQCD	
1.1.2	ROLLING OF SHELL&FLANGES &EDGE PREPARATION	ID ,OD&EP	MAJOR	-DO-	100%	DRAWING & PR:QA:500/LATEST NOTE 9			MQCD	
1.1.3	WELDING OF SHELL,FLANGES &LIFTING LUGS	WELD SIZE & ID	MAJOR	-DO-	100%	DRAWINGS NOTE 6,10,13,14,16			MQCD	
1.2.	OGV CORE									
1.2.1	GASCUTTING OF CORE,FLANGES, ANGLES	OVERALL DIMENSIONS	MAJOR	-DO-	100%	DRAWING,PR:QA:500/LATEST NOTE 2,3,4,5,11	-		MQCD	
1.2.2	ROLLING OF CORE FLANGES& EDGE PREPARATION	ID,OD,EP	MAJOR	-DO-	100%	DRAWING,PR:QA:500/LATEST NOTE 9	-		MQCD	
1.2.3	DRILLING/ THREADING OF HOLES	HOLE SIZE	MAJOR	-DO-	100%	DRAWING &PR:QA:500/LATEST NOTE 7,8,9			MQCD	

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QUALITY CONTROL PLAN FOR

OUTLET GUIDE VANE ASSY

QP.NO:PAM356
REV.NO:01
DATE:100696

1	2	3	4	5	6	7	8	9	10	11
1.2.4	WELDING OF CORE&FLANGES	SIZE & ID	MAJOR	MEASURE-MENT	100%	DRAWING &PR:QA:500/LATEST NOTE 6,10,13,14,16		--	MQCD	
1.3.	GUIDE VANES									
1.3.1	GASCUTTING	OVERALL DIMENSIONS	MAJOR	-DO-	100%	DRAWING &PR:QA:500 NOTE:2,3,4,5,11		--	MQCD	
1.3.2	EDGE MACHINING	ORIENTATION& LENGTH	MAJOR	-DO-	100%	DRAWING&PR:QA:500/LATEST		--	MQCD	
1.3.3	HOT PRESSING OF VANES	PROFILE GAP& PROFILE DIRECTION	MAJOR	-DO-	100%	DRAWING&PRQA;326/LATEST		LOG	MQCD	
2.0.	OGV ASSY									
2.1.	WELDING									**
2.1.1	WELDING OF OGV SHELL WITH CORE& VANES	WELD SIZE& FINISH	MAJOR	VISUAL & MEASURE-MENT	100%	DRAWING&** NOTE 1b,6,10,13,14,16,17		--	MQCD	VANES SHALL BE SET BY FIXTURE AND 1ST VANE SETTING
2.1.2	DIMENSIONS	ID OF SHELL OD OF CORE OD OF FLANGE DEPTH OF VANE CONCENTRICITY R/O,P/O	MAJOR	MEASURE-MENT	100%	DRAWING &PR:QA:500/LATEST		--	MQCD	SHALL BE INSPECTED AS PER DRG.
2.2	STRESS RELIEF	COMPLIANCE TO S.R .CYCLE	MAJOR	VERIFICA-TION OF HT CHART	100%	BAP:HT:001/LATEST		HT CHART	MQCD	

QUALITY CONTROL PLAN FOR	QP.NO:FAN356
	REV.NO:01
OUTLET GUIDE VANE ASSY	DATE:100696
	PAGE 03 OF 05

1	2	3	4	5	6	7	8	9	10	11
2.3.	SPLITTING OF OGV ASSY & WELDING OF PARTING FLANGES	WELD SIZE& FINISH& IST VANE LOCATION	MAJOR	VISUAL& MEASURE-MENT	100%	DRAWING NOTE 1a,6,9,10,12,13,14		--	MQCD	
2.4.	ASSEMBLY OF OGV HALVES WITH WASHERS ,PACKING ROPE FIT BOLTS& FASTENERS	PROPER ASSY& ID OF OGV	MAJOR	-DO-	100%	DRAWING PR:QA:500/LATEST		--	MQCD	
2.5.	MACHINING OF OGV ASSY	FLANGE OD, ID OF CORE FLANGE,ID OF SCREEN COVER SEATING FLANGE &DEPTH FROM CASING FLANGE DEPTH OF CORE FROM CASING FLANGE,DEPTH OF VANES FROM CORE FACE. TOTAL HEIGHT PCD,HOLES MATCH DRILLING,SIZE R/O,P/O. PCD&THREAD SIZE.	MAJOR	100%	MEASURE-MENT	DRAWING&PR:QA:500/LATEST NOTE 7,8,15&18		HISTORY CARD	MQCD	
3.0.	PAINTING PRESERVATION IDENTIFICATION	VERIFICATION	MAJOR	VISUAL	100%	PR:QA:590/LATEST GMS&NOTE19		--	MQCD	

QUALITY CONTROL PLAN FOR	QP.NO:PAN356
	REV.NO:01
OUTLET GUIDE VANE ASSY	DATE:100696

1	2	3	4	5	6	7	8	9	10	11

NOTES:

1. a) DIVIDING FLANGES SHALL BE MATCH DRILLED AND TO BE TACK WELDED.

   b) OGV CASING SHELL AND CORE SHALL BE PLACED ON LAYOUT FOR CORRECT ASSEMBLY . AND VANES SHALL BE TACK WELDED USING FIXTURE.

2. MATERIAL SHALL BE AS PER GMS AND ANY ADDITIONAL JOINTS SHALL BE APPROVED BY ENGINEERING.

3. PLATES SHALL BE CUT BY SHEARING OR GAS CUTTING.

4 CARBON STEELS THICKER THAN 50 MM SHALL BE PREHEATED TO 100°C AND ALLOY STEELS MORE THAN 25 MM THICK SHALL BE PREHEATED TO 150 °C BEFORE GAS CUTTING.

5 GAS CUT NOTCHES SHALL BE DRESSED BY GRINDING AND NOTCHES SHALL BE FILLED UP BY WELDING AND GROUND BEFORE TAKING UP FURTHER FABRICATION.

6 WELDERS AND WELD PROCEDURES EMPLOYED SHALL BE QUALIFIED ASPER AWS D1.1 LATEST.

7 FOR CIRCULAR FLANGES TOLERANCES ARE AS GIVEN BELOW

BOLT SIZE	HOLE SIZE in MM	TOLERANCE FOR PCD	TOLERANCE FOR HOLE
M16	19	±0.70	±0.5
M20	24	±0.70	±0.5
M24	28	±1.0	±0.8
M30	34	±1.0	±0.8
M36	40	±1.0	±0.8
M42	46	±1.0	±0.8

QUALITY CONTROL PLAN FOR	Q.P.NO.PAN356
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OUTLET GUIDE VANE ASSY	DATE:100696
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1	2	3	4	5	6	7	8	9	10	11
	8. PITCH DISTANCE OF ANY TWO CONSECUTIVE HOLES SHALL BE WITHIN ±1 MM.									
	9. DEVIATION ON FLATNESS OF FLANGES SHALL NOT EXCEED 3 MM.									
	10 a)GROOVE WELDS SHALL BE PREFERABLY MADE WITH MINIMUM REINFORCEMENT UNLESS OTHERWISE SPECIFIED IN THE DRAWING AND IN CASE OF BUTT WELDS REINFORCEMENT SHALL NOT EXCEED 3.2 MM.									
	b)SURFACE OF WELDS SHALL BE FREE FROM RIPPLES ,OVERLAPS &UNDER CUTS AND ABRUPT RIDGES .									
	c)BUTT WELDS SHALL BE BACKGOUGED TO REMOVE ALL SLAG,UNFUSED AREA ETC.WELDED ON OTHER SIDE .									
	d) WELD SHALL BE FREE FROM SPATTER AND SLAG.									
	11 GAS CUT EDGES SHALL BE DRESSED BY GRINDING									
	12 a) AFTER DIVIDING,THE DIVIDING FLANGE FACES SHALL BE GROUND FOR FLATNESS AND SHALL BE ASSEMBLED.									
	b) THE GAP BETWEEN THE FLANGES SHALL BE CHECKED AT FREE CONDITION AFTER PLACING THE MACHINED WASHER &TOP HALF OF HOUSING(BEFORE TORQUE TIGHTENING)									
	c) THE MAXIMUM GAP VARIATION SHALL NOT EXCEED 0.5 MM. IN FREE CONDITION									
	d) THICKNESS OF WASHER SHALL BE BETWEEN 4 TO 5 MM.									
	13 a)LOW HYDROGEN ELECTRODES SHALL BE BAKED FOR ATLEAST 2 HOURS AT 260 TO 430 DEG C AND HELD IN HOLDING OVENS AT 120-150 DEG C BEFORE USE. IF THE ELECTRODES ARE EXPOSED FOR MORE THAN 4 HOURS TO THE ATMOSPHERE THESE SHALL BE REBAKED AND DRIED IN THE SAME MANNER									
	b) RUTILE COATED ELECTRODES SHALL BE DRIED AT 120 - 130 DEG C FOR 1 HOUR BEFORE USE.									
	14. PROPER WELDING SEQUENCE SHALL BE ADOPTED TO MINIMISE DISTORTION .									
	15. OGV SHALL BE MATCH DRILLED WITH HOUSING									
	16. PLATES MAY BE PREBENT BEFORE WELDING.									
	17. a)CARE SHALL BE TAKEN FOR SETTING THE FIRST VANE WHICH SHALL NOT FOUL WITH THE DIVIDING AXIS. AND WELDING SHOULD NOT BE DONE ON THE MILLED PORTION OF THE VANES-SEE DRAWING.									
	b) SPECIAL FIXTURE SHALL BE USED FOR BLADE S[illegible] VANE SHOULD SEAT PROPERLY ON THE FIXTURE AND EXIT OF VANE SHOULD COINCIDE WITH THE MARKING [illegible] CHECK FOR DIRECTION OF VANES.									
	c) LOCATION OF FIRST VANE SHOULD BE SET IN S[illegible] THAT EXIT EDGE OF VANE IS AWAY FROM MACHINE AXIS.									
	18. WHILE MACHINING THE PCD LINE CAN BE MARKED BY A LIGHT GROOVE .SO THAT SAME CAN BE USED FOR DRILLING HOLES .									
	19. OGV ASSY SHALL BE IDENTIFIED WITH WO.NO,DWG,PRODUCT NO,AND SUBVENDOR CODE IF ANY.									

M/S BHEL:BAP RANIPET 632 406 TAMIL NADU	STANDARD QUALITY PLAN FOR **STEEL COMPENSATING WEIGHT OF AP FAN**	NAME OF CONTRACT PACKAGE **STANDARD**	QP NO : FAN:357 RE :00 DATE : 05 12 2000 PAGE 01 OF 03

SL NO	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE STANDARD	FORMAT OF RECORDS	AGENCY		REMARKS
									M	C	
1	2	3	4	5	6	7	8	9			11
1.0	**MATERIAL**										
1.1	PLATES/ FORGINGS	CHEMICAL & MECHANICAL PROPERITIES	MAJOR	VERIFICATION OF TCs	100%	RESPECTIVE MATL SPEC.	RESPECTIVE MATL SPEC	T C	P	V	
2.0	**INPROCESS * INSPECTION**							—	P	W	* WELDERS SHALL BE QUALIFIED AS PER AWS D1.1
2.1	WELDING (AS APPLICABLE)	WELD SIZE	MAJOR	VISUAL	100%	DRAWING	DRAWING				
		SOUNDNESS	MAJOR	PT/M T	100%	BHE:NDT:RP:PT:01/LATEST BHE:NDT:RP:MT:01/LATEST	BHE:NDT:RP:PT:01/LATEST BHE:NDT:RP:MT:01/LATEST	REPORT	P	W	

LEGEND
P :PERFORMED BY,V : VERIFIED BY, W : WITNESSED BY
M: MANUFACTURER/SUBCONTRACTOR
C: BHEL/AUTHORISED INSPECTION AGENCY

PREPARED BY (K Rajadurai)	QA		
REVIEWED BY			**APPROVED BY** (H ANANTHANARAYANAN)
B Srinivasa Rao	QA	B. Srinivasa Rao	
P Rajasekaran	QC	P. Rajasekaran	

MANUFACTURER'S NAME & ADDRESS: M/S BHEL:BAP RANIPET 632 406 TAMIL NADU	STANDARD QUALITY PLAN FOR **STEEL COMPENSATING WEIGHT OF AP FAN**	NAME OF CONTRACT PACKAGE **STANDARD**	QP NO: FAN:357 RE :00 DATE : 05 12 2000 PAGE 02 OF 03

SL NO	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE STANDARD	FORMAT OF RECORDS	AGENCY		REMARKS
									M	C	
1	2	3	4	5	6	7	8	9	10 **		11
2.2	**MACHINING**										
2.2.1	**SURFACE DEFECTS**	WELD SURFACE DEFECTS AFTER MACHINING	MAJOR	PT	100%	BHE:NDT:RP:PT 01/LATEST	BHE:NDT:RP:PT01/LATEST	REPORT	P	W	
2.2.2	**DIMENSIONS**	BORE SIZE DRILL HOLES DIA,PITCH DISTANCE, THICKNESS OF THE LEVERPLATES, LENGTH, OUTSIDE DIA MATCHING OF HALVES	MAJOR	MEASUREMENT	100%	DRAWING& NOTE 1	DRAWING & NOTE 1	DR	P	W	
2.2.3	WEIGHING	WEIGHT OF EACH PIECE	MAJOR	WEIGHING	100%	DRAWING	DRAWING	DR	P	W	
3.0	PANTING, IDENTICATION& PRESERVATION	VERIFICATION OF IDENTIFICATION OF WO.NO,DU NO ,WT ,PAINTING & PRESERVATION	MAJOR	VISUAL	100%	GMS& RP 0674199	GMS& RP 0674199	--	P	W	

MANUFACTURER'S NAME & ADDRESS: M/S BHEL:BAP RANIPET 632 406 TAMIL NADU	STANDARD QUALITY PLAN FOR **STEEL COMPENSATING WEIGHT OF AP FAN**	NAME OF CONTRACT PACKAGE **STANDARD**	QP NO: FAN:357 RE :00 DATE : 05 12 2000 PAGE 03OF 03

NOTE. 1

1) EDGE PREPARATION OF THE PLATES SHALL BE ENSURED

2) WELDS SHALL BE FLUSH GROUND AS SHOWN IN DRAWING

3) SHIM SHALL BE USED FOR MACHINING AS SHOWN IN DRG

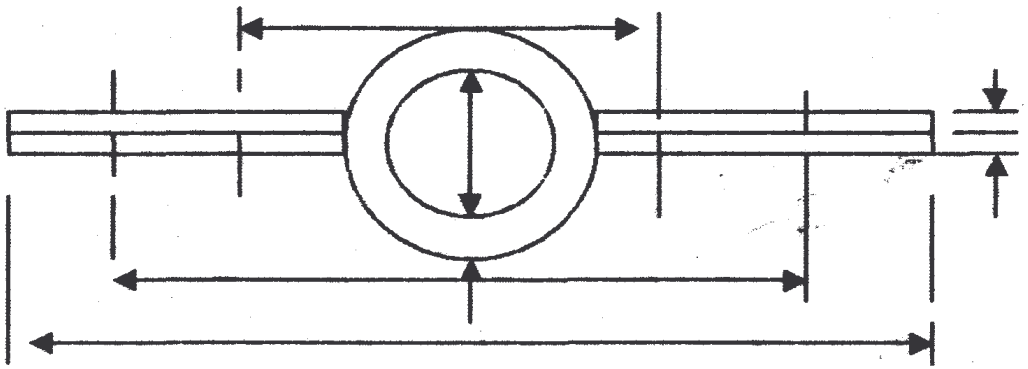
4) THE THICKNESS OF THE PLATES AFTER MACHINING SHALL BE ENSURED

5) THE HALVES SHALL BE MATCH DRILLED

6) PROPER TIGHTENING SHALL BE ENSURED BEFORE MACHINING

7) MISMATCHING OF HALVES SHALL BE AVOIDED.

8) WT OF THE STEEL COMPENSATING WEIGHT SHALL BE AS CALLED FOR IN THE DRAWING.



M/S BHEL:BAP RANIPET 632 406 TAMIL NADU	STANDARD QUALITY PLAN FOR **AP FAN LEVER**	NAME OF CONTRACT PACKAGE **STANDARD**	QP NO : FAN:358 RE :00 DATE : 05 12 2000 PAGE 01 OF 02

SL NO	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE STANDARD	FORMAT OF RECORDS	AGENCY		REMARKS
									M	C	
1	2	3	4	5	6	7	8	9			11
1.0	**MATERIAL**										
1.1	FORGING/CASTING	CHEMICALS& MECHANICAL PROPERITIES	MAJOR	VERIFICATION OF TCs	100%	RESPECTIVE MATL SPEC.	RESPECTIVE MATL SPEC	T C	P	V	
2.0	**INPROCESS INSPECTION**										
2.1	LEVER M/CING	HOLE CENTRE TO PIN DIA CENTRE DISTANCE,BORE DIA,KEY WAY WIDTH, OFFESET HEIGHT	MAJOR	-DO-	100%	DRAWING	DRAWING	DR	P	W	
			MAJOR	-DO-	100%	DRAWING NOTE A	DRAWING NOTE A	DR	P	W	

LEGEND
P :PERFORMED BY,V : VERIFIED BY, W : WITNESSED BY
M: MANUFACTURER/SUBCONTRACTOR
C: BHEL/AUTHORISED INSPECTION AGENCY

PREPARED BY (k Rajadurai)	QA	
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P Rajasekaran	QC-OLT	

APPROVED BY
(H ANANTHANARAYANAN)

MANUFACTURER'S NAME & ADDRESS: M/S BHEL:BAP RANIPET 632 406 TAMIL NADU	STANDARD QUALITY PLAN FOR AP FAN LEVER	NAME OF CONTRACT PACKAGE STANDARD	QP NO: FAN:358 RE :00 DATE : 05 12 2000 PAGE 02 OF 02

SL NO	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE STANDARD	FORMAT OF RECORDS	AGENCY		REMARKS
									M	C	
1	2	3	4	5	6	7	8	9	10 **		11
3.0	FINAL INSPECTION										
3.1	PANTING, IDENTICATION& PRESERVATION	VERIFICATION OF IDENTIFICATION OF WO.NO,DU NO PAINTING & PRESERVATION	MAJOR	VISUAL	100%	GMS& RP 0674199	GMS& RP 0674199	DR	P	W	

NOTE . A

1 MACHINING FIXTURE SHALL BE USED FOR MACHINING THE LEVER.

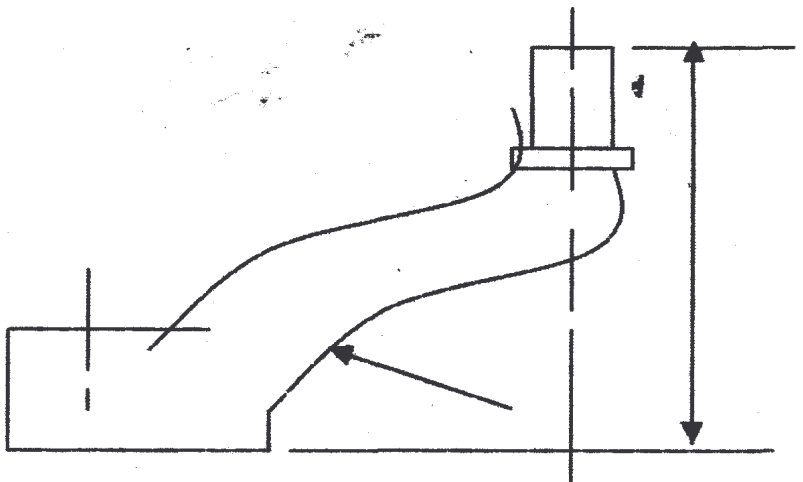
2 THE LEVER SHALL BE PLACED ON THE FIXTURE .THE PROFILE OF THE LEVER SHALL MATCH WITH FIXTURE PROFILE.

3. AFTER PRE DRILLING THE LEVER BORE , THE CENTRE OF PIN W.R. T BORE SHALL BE ENSURED IN FIRST OFF PIECE.

4. PROPER CLAMPING SHALL BE ENSURED.

5. THE LEVER SHALL BE CHECKED WITH GAUGE MADE FOR LOCATING THE BORE, PIN AND KEYWAY.

6. THE HEIGHT OF PIN TOP TO BORE BOTTOM SHALL ALSO BE ENSURED.



QUALITY DEPARTMENT		
Amendment to Quality work Instruction		
QWI No: QCP: 2:4:258	REV: 00 : A1	DT. 01 03 1981
Amendment No: A2	Date. 05 02 03	

Description:	**QCP for Cleaning devise assembly.**	
Details of Amendment		
CLAUSE NO	AMENDED AS	BASIS FOR AMENDMENT
7.1	Painting as per PR: QA: 590 /latest rev	Document revised.

Prepared by	**Reviewed & Approved by**
	B. Srinivasa Rao

Control copy No	
Issued to Shri	

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QUALITY DEPARTMENT

Amendment to Quality Work Instructions

QWI NO: QCP:2:4:258 REV:00 DT.01-03-1981
Amendment no: A 1 DT. 13 01 2002

Description: QCP for cleaning devices of air heaters

Details of Amendment

CLAUSE NO	AMENDED AS	BASIS FOR AMENDMENT
7.1	**Painting as per plant standard RP 067 4199 instead of BPS 027601-7601.**	**Document revised.**

Reviewed by	Approved by
B. Srinivasa Rao	
(B.Srinivasa Rao)	**(H.Ananthanarayanan)**

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BHARAT HEAVY ELECTRICALS LTD.,
TIRUCHIRAPALLI - 14
QUALITY ASSURANCE

QCP: 2:4:258
Page 1 of 4

QUALITY CONTROL PROCEDURE FOR	CLEANING DEVICES OF AIRHEATERS.
EFFECTIVE DATE	1st March 1981

Accepted by	Department	Date
	ENGINEERING & DEVPT. CENTRE	
	OPERATION, PLANNING & CONTROL	
	BOILER PRODUCTION	
	QUALITY CONTROL	
	QUALITY ASSURANCE	

ISSUED BY: QUALITY ENGINEERING	REVISION NO. :	NIL
	DATE :	--

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QUALITY CONTROL PROCEDURE FOR CLEANING DEVICE OF AIRHEATERS.

1.0 SCOPE

1.1 This procedure specifies the requirements for manufacture of cleaning device of Airheater.

2.0 MATERIALS

2.1 Any material alteration shall be approved by Methods, Product Engineering prior to effecting change.

3.0 GENERAL REQUIREMENTS

3.1 The manufacture of the cleaning device shall be carried out as per the relevant production drawing.

3.2 Dimensional tolerances shall be as per the drg. wherever specified.

3.3 For untoleranced dimension, the tolerance shall be as per Table-1.

3.4 All components shall be carefully handled so that the dimensions or profile are not disturbed.

4.0 GAS CUTTING AND FORMING

4.1 Carbon Steel material shall be gas cut or sheared to shape. Alloy steel shall be gas cut and ground or machined to the required shape. Preheating for gas cutting and welding shall be as given below:

Material	Thickness	Temperatures	
		Gas Cutting.	Welding
Carbon Steel	25mm & less	Nil	Nil
	Over 25mm to 50mm	Nil	120°C
	Over 50mm	100°C	150°C
Alloy Steel	All	--	200°C

4.2 All gas cut edges shall be free from deep serrations. The edges shall be free from cracks and laminations and gas cut edges shall be ground.

4.3 Care shall be exercised during forming to maintain the profile as called for in the drawing.

5.0 WELDING

5.1 Surfaces to be welded must be free from grease, paint and any other foreign material.

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5.2 Edge preparation shall be made either by mechanical means or by flame cutting. All slag and loose scales must be removed before welding. All edge-s must be smooth and free from blows or indentation.

5.3 Before welding over previously deposited weld metal, all traces of slag will be removed by chipping and adjoining base metal will be wire brush cleaned.

5.4 All welds shall be smooth andmerged into adjacent base metal in gradual smooth curves.

5.5 The welding consumable shall be dried in an oven at 350°C for 1 hour and baked at 150°C for 30 minutes before using them. Also they shall be free from paint, grease, rust etc.

5.6 Sequence of welding shall be adopted to minimise distortion.

5.7 All finished welds shall be cleaned to remove slag and spatter before final inspection or painting.

5.8 All defects shall be repaired if any in each layer before depositing further layer.

6.0 MANUFACTURE

6.1 Conduct hydraulic test on swivel joint to the pressure of 21 Kg/c m^2 after machining and before assembly.

6.2 Ensure the module of the worm gear used.

6.3 Ensure for smooth running of the worm gear assembly.

6.4 Ensure the name plate details of the motor and speed reducer.

6.5 Ensure the swivelling angle of the swivel block as given in the drawing.

6.6 Ensure click sound of the limit switch arrangement at extreme limits of the swivelling angle after connecting to he motor.

6.7 Ensure the swivelling arm alignment by water level.

6.8 Ensure the dimension of the swivel arm from centre of swivel to the erection joint and after welding.

7.0 CLEANING AND PAINTING

7.1 The cleaning device assembly shall be cleaned to remove the dust and painted as per the painting schedule (BPS No.027601-7601)

7.2 The completed assembly shall have the following details painted/stencilled:

7 i) Work Order No.
ii) DU No.
iii) Heater No.

8.0 HANDLING AND STORAGE

8.1 During handling and storage, care shall be exercised to avoid damage.

TABLE 1

Nominal size	Tolerance on Linear Dimension		Angular dimensic	
	Machining	Fabrication	Length of shorter side	Variation
Upto 6 mm	± 0.1	± 0.2	Upto 10mm	± 1°
Over 6mm upto 30mm	± 0.2	± 0.5	Over 10mm upto 50mm	± 30'
Over 30mm upto 100mm	± 0.3	± 0.8		
Over 100mm upto 300mm	± 0.5	± 1.2	Over 50mm upto 100mm	± 20'
Over 300mm upto 1000mm	± 0.8	± 2.0		
Over 1000mm upto 2000mm	± 1.2	± 3.0		
Over 2000mm upto 4000mm	± 2.0	± 4.0		
Over 4000mm	± 3.0	± 5.0		

QUALITY DEPARTMENT
Amendment to Quality Work Instructions meant for SQP for Tubular Air pre heater
SQP APH 104 Rev 01 DT 27 01 03 **Amendment A1 DT 04 02 08**
SQP for Tubular Air pre heater

Clause Number and reference.	Amended as	Basis for Amendment
Note **Clause 4.9**	Calculate percentage of tube thickness using the following formula: - % age of expansion $K = 1 - \left\{ \frac{Dh-d}{2} \right\} \times 100$ Dh = Tube sheet hole ID in mm d = ID of the expanded tube in mm T = Thickness of tube in mm K = %age of tube thinning	Based on feed back from QC

Prepared by	**Reviewed & approved by**

Ranipet	MANUFACTURER'S NAME& ADDRESS M/S BHEL / BAP / RANIPET TAMIL NADU-632 406	STANDARD QUALITY PLAN ITEM/SUB SYSTEM: Tubular Air pre heater	Doc. No	SQP APH 104
			Rev. No	01
			Date	27 01 03
			Page No	01 of 05

Sl no 1	Component & operation 2	Characteristics 3	Type Of Check 4	Quantum of Check 5	Reference Documents 6	Acceptance Norms 7	Format Of Records 8	Agency 9		Remarks 10
								M	B	
1.0	**MATERIAL ***									
1.1	Plates, Sheets, Tubes,	Chemistry, Tensile Properties	Chemical Tensile test	Each Heat	Respective Material Spec.		**TC**	P	V	
2.0	**In-process control**									
2.1	Welding	**Welders are to be qualified to AWS D1.1&Procedures are pre qualified.**								
2.1.1	Weld Quality	All Fillet welds	LPI	10 %	AS PER ASME SEC VIII DIV 1		NDT Report	P	V	
3.0	Tube Sheet preparation	Dimensional check	Measurement	100%	Drawing/ Ref note 1.0, 2.0		Records	P	W	
3.1	Tube Block Assy. (Skeleton)	Dimensional check	Measurement	100%	Drawing/ Ref note 3		Records	P	W	
4.0	**Tube Expansion**									
4.1	**Mock up test for tube expansion**	Soundness of Expansion	Hammer test & 4.9.3	100%	Refer Note 4.0		Records	P	W	

LEGENDS:			
M – Manufacturer,(BHEL Shop / Subcontractor,)	**Prepared by**		**APPROVED BY :**
B - BHEL QC/ Authorised Inspection agency	**Reviewed by**	**QA**	
P - Performed By, V - Verification Of Reports/Records		**QC**	**(Head/QA)**
W - Witness T C - Test Certificate R- report.			

Record of revision	Rev No	Date	Changes made
	00	**27 01 03**	**The requirements of QCP A 018 and PRQA 415 are merged and this SQP is formed.**

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Ranipet	MANUFACTURER'S NAME& ADDRESS M/S BHEL / BAP / RANIPET TAMIL NADU-632 406	STANDARD QUALITY PLAN ITEM/SUB SYSTEM: Tubular Air pre heater	Doc. No	SQP APH 104
			Rev. No	01
			Date	27 01 03
			Page No	02 of 05

Sl no 1	Component & operation 2	Characteristics 3	Type Of Check 4	Quantum of Check 5	Reference Documents 6	Acceptance Norms 7	Format Of Records 8	Agency 9		Remarks 10
								M	B	
4.2	Tube Expansion (In actual)	Soundness of Expansion	Hammer test	100 %	Drawing /Ref Note 4.9.3& 5.0		Records	P	W	
5.0	Final Inspection	Over All Dimension	Measurement	100 %	Drawing/ Note 6.0		DR	P	W	
5.1	Painting and Preservation	Proper Preservation	Visual	100 %	Ref PRQA 590 Rev 00 & Note 8.0		--	P	W	

Note : For Notes referred in column 6 & 7 ,refer the page No 03 ,04, 05 of SQP

1.0 Tube Plate preparation

1.1 Plates are to be sheared or gas cut . The gas cut edges shall be free from cutting notches and finish should be of 50 microns .The tolerance on length and width shall be ±1 mm. the diagonals shall be within 2 mm .

1.2 The square ness shall be maintained precisely. Minimum two perpendicular sides shall be taken for tube hole marking reference.

1.3 The stock preparation shall be as per the drawing subject to coaxial drilling of top, middle and bottom plate together for the same block with match marks. Match marking shall be carried out. Both top, middle and bottom plates have to be marked for identification.

2.0 Marking for drilling

2.1 Drilling shall be done on a batch of plates as a stack. Mark the holes as per the drawing. Check the extreme holes for the diagonal and it should be within 1 mm. Drill the stack with proper support. Check the stack with water level of 1mm before drilling.

2.2 The tolerance for the holes shall be as per the drawing and finish shall be 12.5 microns. The pitch variations shall be within 1 mm subject to a cumulative variation of 2 mm maximum.

2.3 Dismantle the stack. De burr the holes.

2.4 Check the hole sizes using 'Go' and 'No Go' plug gauges which should be checked and approved by BHEL inspector.

3.0 Tube Block Skeleton Assembly

3.1 Layout the plates for bottom, middle (where applicable) and top assembly as per the drawing separately as given in the assembly drawing.

3.2 Identify the top, middle and end plates with proper match mark. Check the diagonals the variation shall not be more than 3 mm

3.3 Fit the tube plates and lifting eye pieces as per the drawing. For proper matching of the plate use eye piece by welding on to the plates at two or three places and using bolts and nuts for fastening. And Weld the lifting lug. Conduct root LPI and final MPI and then paint as per PRQA 590/LATEST.

3.4 Do the skeleton assembly with the stay tubes and tack weld, Ensure the tube projection from tube plate as per drawing.

3.5 Check water level & Plumb out with reference to the extreme row of hole & also at edge of the plate and Correct Within 1 mm Mark the water level reference & Plumb out with metal punch and bordered with paint.

3.6 Check the top diagonals X1,X2 and front and back diagonals F1, F2 & B1, B2 respectively and side diagonals SD1, SD2, SD3 and SD4 . Record the diagonal dimensions on the history card .The tolerance on diagonal shall be 3 mm.

3.7 Weld all stay tubes as per drawing.

3.8 Dismantle the skeleton from trial assembly if weight of each block with all tubes inserted weights more than 25 MT.

3.9 Inspect the tubes for defects such as rust, pitting, bends. The tubes shall be applied with rust preventive oil before inserting it into the holes. Insert the good ones in the tube holes and also ensure the tube length tolerance with in 2mm before tube Insertion.

4.0 Mock Up test for tube Expansion

4.1 The mock up for the tube expansion shall be carried out in the presence of QC personnel separately. Expand both ends of the tubes into the tube sheet using an Electronically torque controlled tube expander ensuring the projection of the tubes as per drawing.

4.2 Prepare a tube plate cut bit of size approximately 300 x 300 mm and thickness equivalent to that of actual Tubular air pre heater.

4.3 Drill holes of size covering the min and max limits of tolerance and in between size chosen suitably. The max number of holes drilled can be restricted to 8. Mark the holes as A,B,C, etc., as per the details of TAPH drawing. Also mark the corresponding tubes to be inserted as a,b,c etc., Measures the internal dia and pitch of these holes and record.

4.4 Select a tube with max and min sizes (thickness) meant for the actual job and cut it to 8 pieces each measuring not less than 250 mm. Measure tube OD/ID and thickness and record.

4.5 Set the electronic tube expander to minimum current for tube expansion.

4.6 Insert tube in hole A. Expand the ID using electronic tube expander. Electronic tube expander should break on reaching the preset torque and should not break on preset timer. Note current setting and ID of tube after expansion.

4.7 Perform Hammer test by giving a blow using a half pound hammer at free end of the expanded tube. There should not be any shake/displacement of tube.

4.8 Perform kerosene leak test and confirm that it does not leak from one side to other side of tube plate through the area between tube plate hole and tube OD.

4.9 Calculate percentage of tube thickness using the following formula:-

$$\% \text{ age of Expansion(K)} = \left[\frac{Dh - d}{2t} - 1 \right] \times 100$$

Dh = Tube sheet hole ID in mm
d = ID of the expanded tube
t = Thickness of tube in mm
K = %age of tube thinning

4.9.1 Repeat 4.5 to 4.9 for different current setting to ensure kerosene leak test and hammer test for tube holes B to H.

4.9.2 Record the values as follows:-

Hole No.	Current setting	Tube sheet Hole ID (Dh)	Tube OD	Tube Thickness (t)	Tube ID before expansion	Tube ID after expansion (d)	%age of thinning (k)

4.9.3 Choose the current setting, which gives a thinning %age within 8% for the actual tube thickness. And in any case tube expansion beyond the tube sheet thickness is not acceptable.

4.9.4 Complete the expansion of tubes in each split block and offer for inspection.

5.0 Hammer Test

5.1 Check the tube expansion at both free ends by Hammer test. With half pound hammer, check for any shaking of tubes. If the joint fails to meet hammer test, repeat the expansion up until it passes hammer test.

5.2 After two or three expansions if still hammer test fails, seal welding can be resorted on that particular tube-to-tube sheet joint subject to a maximum of two percent of the tubes per block.

5.3 Weld the expansion piece and do kerosene leak test for the joint especially in the corners.

5.4 Fix the side walls and weld as given in the drawing.

6.0 Final inspection

6.1 Check overall dimension and water level & Plumb out with reference to the already marked reference and record the readings

6.2 Ensure the match mark by punching and bordering with yellow paint.

****-****-****

Ranipet	Bharat Heavy Electricals Limited Boiler Auxiliaries Plant Ranipet – 632 406 Vellore Dist., (TN)

QUALITY ASSURANCE DEPARTMENT

Amendment to Quality Work Instruction (QWI) – Standard Quality Plan (SQP)

Amendment No: A1 **Date:22.07.2014**

Refer: QWI NO: SQP:APH:107 Rev.02 Dtd.15.02.2010

Description: Heating Element Basket Assembly

Details of Amendment		
Clause No	**Amended As**	**Basis for Amendment**
Refer Note Clause no. 10.0	Clause no. 10.0 is amended as follows: Wt of Basket Assembly shall be -4.0% to + 8% of the GMS weight (or) As per Spare P.O Specification.	Feedback from QC-Shop/Prdn/OP&C/ENGG **MOM dt 15/07/14**

Prepared By (QA)	Reviewed By		Approved By
	QC	(M S.RAVI KUMAR) MGR / QC	
	QA	(R.ARUNACHALAM) SR MANAGER / QA	22/07/14
(S.DAMODARAN) DY.MANAGER / QA			(J.RAVISHANKAR) SDGM / QA QC-Proc & BE

Ranipet	QUALITY ASSURANCE M/S BHEL / BAP / RANIPET TAMIL NADU-632 406	STANDARD QUALITY PLAN		
		ITEM/SUBSYSTEM: **Heating Element Basket Assembly**	Doc. No	SQP: APH: 107
			Rev No	02
			Date	15 02 2010
			Page No	01 of 04

SL NO 1	COMPONENT & OPERATION 2	CHARACTERISTICS 3	TYPE OF CHECK 4	QUANTUM OF CHECK 5	REFERENCE DOCUMENTS 6	ACCEPTANCE NORMS 7	FORMAT OF RECORDS 8	AGENCY M	AGENCY B	REMARKS 10
1.0	**RAW MATERIAL** Sheets /Coils IS 513GrDD CORTEN A (or) EQUIVALENT Flats, plates & Rods to IS 2062 or CORTEN A	Chemical and Mechanical Properties	Chemical & Mechanical	As per TDC/ melt wise	Respective Material specification		TC	P	V	Material are taken to stock after verification of TC
2.0	**In Process Control** Basket Fabrication. (with out elements)	WELDERS ARE QUALIFIED TO AWS D1.1 and PROCEDURES ARE PRE QUALIFIED,								
2.1	Welding									
2.1.1	Weld Quality	Weld finish & size	Visual	100%	Refer note 1.0 to 1.4		Records	P	W	10 % Random surveillance check by QC and 100 % by Task Performer (Sub Contractor)
2.2	Basket Dimension	Measurement	Go/No go check	10%	Refer note 2.0 to 2.3.3		Records	P	W	
2.3	Identification & preservation	Proper Preservation & Identification	Visual	100%	Refer note 3.0 to 6.0		-----	P	W	

LEGENDS: M – MANUFACTURER / SUBCONTRACTOR, B - BHEL /BHEL AUTHORISED INSPECTION ,P - PERFORM, V - VERIFICATION, W - WITNESS, T C - TEST CERTIFICATE, DR –DIMENSIONAL REPORT.	Prepared By		APPROVED BY:
	Reviewed By		

Ranipet	**QUALITY ASSURANCE** **M/S BHEL / BAP / RANIPET** **TAMIL NADU-632 406**	**STANDARD QUALITY PLAN**	
		ITEM/SUBSYSTEM: **Heating Element Basket Assembly**	**Doc. No** / **SQP: APH: 107** **Rev No** / **02** **Date** / **15 02 2010** **Page No** / **02 of 04**

SL NO 1	COMPONENT & OPERATION 2	CHARACTERISTICS 3	TYPE OF CHECK 4	QUANTUM OF CHECK 5	REFERENCE DOCUMENTS 6	ACCEPTANCE NORMS 7	FORMAT OF RECORDS 8	AGENCY M / B 9	REMARKS 10
3.0	Basket Assembly (With Elements)								
3.1	Elements	No. of pairs	Verification of No. of Pairs	100% (See Remarks)	As per drawing / contract / PO Ref. Note 7.0 & 8.0		Record	P W	10% Random surveillance check by QC and 100% by task performers.
4.0	Basket assembly	1 Dimensional Measurement	Go gauge / Visual	100%	As per drawing / contract / & Note 9 & 10		Record	P W	
		2 Weight	Measurement	Random	-Do-		Record	P W	
		3 weld Quality	Visual	100 %	Ref. Note 1.1, & 1.2		--	P W	
5.0	Final inspection								
5.1	Identification & preservation	Proper preservation & identification	Visual	100 %	(Ref. Note 5.0, 6.0 & 11.0 12.0)		--	P W	

Record of revision	Rev 00 / DTD 18 10 02	Original Issue
	Rev 01 / DTD 11 02 10	Revised based on Shop and Quality feed back.
	Rev 02/ DTD 15 02 10	Revised due to typographical in clause 2.3.1.

LEGENDS: M – MANUFACTURER / SUBCONTRACTOR, B - BHEL /BHEL AUTHORISED INSPECTION ,P - PERFORM, V - VERIFICATION, W - WITNESS, T C - TEST CERTIFICATE, DR –DIMENSIONAL REPORT.	Prepared By		APPROVED BY:
	Reviewed By		

1.0 Welding

1.1 All welds shall be examined visually for defects like cracks, crater, and fillet size shall be checked with fillet gauges.

1.2 For Carbon steels E6013 electrodes can be used for all welding in baskets where thickness of the items is < = 20 mm and for thickness above 20 mm E7018 electrodes only shall be used. For other material respective WPS to be followed for selection of electrode.

1.3 Fabricator shall use suitable fixture for assembly and welding to ensure dimensional stability of baskets. Proper welding sequence to be adopted to avoid / to minimize distortion. Distortion if any is to be corrected to meet drawing requirement

1.4 All the bends in the sheet metal are to be free from cracks on the line of bend at the ends to avoid cracking .Bending shall be done perpendicular to the rolling direction (rolling direction is along the length of the sheet).

2.0 Inspection Tolerance for Empty basket

2.1 Inside gap between holding bars shall be with in –0 to +1 mm of inside dimension given in drawing.

2.2 Dimensions are to be checked by gauge and recorded at top, middle & bottom.

2.3 Full fabricated baskets are to be checked with go and no go gauges. The dimensions of gauge are as follows:

2.3.1 For '**GO GAUGE'**' the inside dimension of the go gauge shall be -2 mm to nominal dimensions of the baskets.

2.3.2 For '**NO GO GAUGE'** the inside dimension of the no go gauge shall be -4 mm to nominal dimensions of the baskets.

2.3.3 Go and No go gauges shall be identified by punching / paint stenciling of the drawing number of the corresponding basket.

3.0 Cleaning

3.1 All baskets shall be thoroughly cleaned of weld slag, spatters, and rust before painting.

4.0 Painting

4.1 The cleaned basket shall be painted as per PRQA: 590 latest revision.

5.0 Identification

Stenciling shall be carried out outside of the basket face and outside of the cover so that the identification is visible even after filing the element. The baskets are to be identified with following details:

a) WO No.
b) Drawing No.
c) Type of baskets (to be punched (punch size 12) & stenciled)
d) Sub-contractor code : as applicable
e) IR No.: as applicable

6.0 Transportation to BHEL

6.1 Finished baskets shall be transported to BHEL carefully to avoid any damages.

7.0 ELEMENTS shall be made from coils of the specified width and thickness.

8.0 No. of pairs of the elements shall be in line with the drawing / PO requirements.

9.0 The finished basket shall be inspected with **TEMPLATE,** the tolerance for the template shall be – 0 to + 1 mm of nominal size of the baskets. Baskets do not answer to the template shall not be accepted.

9.1 Template shall be inserted to the baskets at both ends to a length of 50 mm.

10.0 Wt of Basket Assembly shall be -2% to +8% of the GMS weight (or)As per P O Specification

11.0 Preservation

11.1 The basket assembly shall be dipped in rust preventive fluid. Refer PRQA 522 Latest. It shall be ensured that heating elements are completely coated with rust preventive oil. Take out the baskets and allow sufficient drain time.

11.2 Visually check to see rust preventive coating in all heating element area.

12.0 Packing (for heating elements which are sent to site as separate DU)

12.1 The basket assembly shall be packed in wood / steel crates as per packing plan.

12.2 If wooden box are used for packing, ensure the following:

- The box shall be made without any gap in any side and shall be lined on the inside with polythene bonded Hessian cloth.
- Silica gel packets shall be placed inside in the every container.
- After nailing down the top cover, the corner shall be closed by polythene bonded Hessian cloth.
- The baskets shall be placed inside the wooden box and supported from all sides to avoid movement by providing wooden logs.

12.3 Steel crates are used for packing, the above points are not applicable except silica gel packets inside the every container.

SPLICING NORMS FOR PLATES AND SHEETS OF APH COMPONENTS

PREPARED BY

DEPARTMENT	NAME & DESIGNATION S/Shri	SIGNATURE
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REVIEWED BY

DEPARTMENT	NAME & DESIGNATION S/Shri	SIGNATURE
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QC (PROCUREMENT)	ZEESHAN ALI	
QC (SHOP)	K. RAJADURAI Dgm/QC-SHOP&B.E	
QA	K.C. GANDHI PARIMALAM Sr. Dgm/QA	
OP&C	R. SOUNDARARAJAN	R. Soun
QC (OLI)	SENTHIL PRAKASH.T	

APPROVED AND ISSUED BY

DEPARTMENT	NAME & DESIGNATION S/Shri	SIGNATURE
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1.0 SCOPE

1.1 This procedure details out the splicing norms for Diaphragm plates, Housing Panels and Pedestals, Sector plate, Connecting plate assembly, Cleaning device assembly of Air Preheater.

2.0 GENERAL REQUIREMENTS

2.1 Check for the material specifications of plates/sheets, which are to be joined to avoid mix up of material. TCN to be obtained for any change of material from engineering specification

2.2 Electrode selection shall be as per respective WPS (E 7018 shall only be used for carbon steel).

2.3 Welding shall be followed with suitable methods and controls to minimize the distortion.

2.4 Stiffeners parallel to joint (splice) shall be in such a way that welds over joint is avoided and a minimum distance between stiffeners parallel to weld joint shall be maintained as Two times the thickness of thicker plate.

2.5 Whenever back grinding is not feasible due to location of the plate /sheet, root welding to be carried out with 3.15 mm electrode and LPI to be carried out after thorough cleaning and repeat LPI after final welding.

2.6 Plus joint shall not be permitted when building up of plate to drawing size. However minimum offset of 100 mm is to be maintained.

2.7 Cut out on welds shall be avoided. In case any such opening on the joint the same shall be strengthened with pad plate of 50mm width all round on one side with the thickness equal to the parent material.

2.8 Unless otherwise mentioned against specific requirement minimum joint piece shall not be less than 500 mm. For hot end center section (tub plate) end joint piece shall be min 500 mm however for other joint piece shall be of max available sizes in order to reduce the number of joints.

2.9 Following are the guidelines if Edge Preparation (EP) is not specified in drawing/ OP&C Sketch.

a) **Plates and sheets up to 5mm**: No EP is required. Provide 2 to 3 mm root gap, weld on both sides.
b) **Plates of 6mm:** No EP is required. Welds shall be with square butt with 2 to 3 mm gap. Weld from first side and turn the plate for back grind and conduct LPI. Complete the weld.

c) **Plates above 6mm and up to 8 mm** Single 'V', 60° EP. Weld from V side and turn the plate, back grind and conduct LPI, complete the weld.

d) **Plates above 8mm**: Double 'V', 60° EP. Weld one side. Carry out back chipping/ Grinding, conduct LPI to ensure sound metal and weld from other side.

2.10 Wherever cross members are fouling on the weld, Flush grind weld metal and ensure flatness. There shall not be any depression at weld zone. Thickness at weld zone shall not go below the actual thickness of the plate. Check 100 % visual inspection.

2.11 Cleaning device support channel plate: One joint is permitted up to 4 meters length and 2 joints for more than 4 meters (perpendicular to the bend line.) and the minimum joint piece shall be 500 mm.

3.0 SPECIFIC REQUIREMENTS FOR DIAPHRAGM PLATE

3.1 One joint only allowed perpendicular to axis of the Rotor post (along the length of the plate).

3.2 Joint shall be made at least 650 mm from the edge where cold end element depth is 300mm. This is to avoid weld over weld distance of 100mm from the joint. For other cases OP&C has to raise TCN for joint approval. While fabricating the module, it is to be ensured that, the joint shall be in the cold end (Lower Lug side).

3.3 Place the plates to-be-welded together. Check for straightness of minimum two sides & right angle of the plate. Check the mismatch of joint edge. The mismatch shall be within 1 mm. Check for length, width and diagonal as per OP&C Sketch. Length and width tolerance shall be as per OP&C sketch, Maximum allowed diagonal difference is 2 mm and record the readings.

3.4 Weld one side and reverse & back grind. Conduct LPI. Ensure defect free joint and weld the other side. Butt welds shall be ground flush. Conduct final LPI.

3.5 Identify the Right angle corner of the each plate with Paint and hard punch the specification, size, firm code by punching and border with white paint.

3.6 Load all the plates in such a way that the identified right angle corners are in one corner with details visible from top.

3.7 Tack welds the stack as per OP&C Sketch.

4.0 SPECIFIC REQUIREMENTS FOR PEDESTALS

4.1 One joint only allowed parallel to flange bend. (90°) in addition to site joints envisaged in drawing.

4.2 Joint shall be made at least 500 mm away from any side.

5.0 SPECIFIC REQUIREMENTS FOR HOUSING PANELS

5.1 One joint only permitted in either Horizontal or Vertical direction of each panel plate.

5.2 Minimum Joint shall be 500 mm from any edge

6.0 Specific Requirements for bottom plate and side Plates and plate formed channels of Sector plates

6.1 No joint is permitted on bottom plate.

6.2 One joint is permitted up to 4 meters length and 2 joints for more than 4 meters (across the bend line.) in side Plates and plate formed channels. Minimum joint piece shall be 500 mm.

6.3 EP and other requirement shall be as per clause 2.9 and 100% LPI shall be carried out on final weld in the joint area.

7.0 Splicing of stay plate and shell plate.

7.1 Splicing of stay plate and shell plate is permitted if both dimension (length and width) is more than 1 meter. Joint shall be perpendicular to the axis of the rotor post. Minimum joint piece shall be 500 mm. Weld one side and reverse & back grind. Conduct LPI. Ensure defect free joint and weld the other side. Butt welds shall be ground flush. Conduct final LPI.

8.0 Splicing of duct wall is permitted if both dimension length and width is more than 1 meter. Minimum joint piece shall be 500 mm.

9.0 Specific Requirements for Wash / Deluge Pipe.

9.1 Pipe length up to 6 meter - No joint is permitted.

9.2 Pipe length more than 6 meter - One joint is permitted.

9.3 Joint shall be made at least 500 mm away from free edge.

RECORD OF REVISIONS

Rev No	Date	QP Clause	Revision Details
00	13.05.1996	-	Original Issue
01	31.05.1996	2.10	Clause 2.10 deleted.
02	04.12.2002	-	Requirements are reviewed and updated
03	01.09.2004	-	Revised to include splicing norms for pedestals and housing panels
04	20.09.2006	3.0	Clause 6 added in sub section – 3 based on shop feedback.
05	21.06.2008	-	Requirements completely reviewed and updated based on the discussion with WRI/Trichy. Amendment A1 details merged.
06	09.09.2014	9.0	Clause 9.0 added, based on outcome of APH-RCA meeting (ref: RCA-MOM dated 19.08.2014) to reduce no. of TCN's
07	07.10.2021	3.2	Clause no. 3.2 modified bringing more clarity based on discussion with Engineering, QC, OP&C and QA.

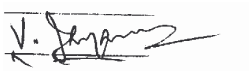
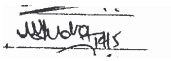
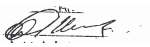
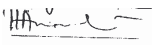
BHEL : BAP : RANIPET

QUALITY DEPARTMENT

QCP : D : 001
REV : 00
DT : 15 05 97

QUALITY CONTROL PROCEDURE FOR

FABRICATION AND ASSEMBLY CHECKS ON DESALINATION PLANTS

PREPARED BY	V JAYARAMAN , MGR/QA	
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	M RAVINDRA , MGR/MSA	
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APPROVED BY	H ANANTHANARAYANAN ,DGM/QA	

ISSUED BY DGM/QA

CONTROLLED COPY TO : V. JAYRAMAN, MSR/QA.

CONTROLLED COPY NO : AB10

RECORD OF REVISION

REV .NO	DATE	CLAUSE REVISED	REASON
00	15 03 97	FRESH ISSUE	----------

QUALITY CONTROL PROCEDURE FOR

FABRICATION AND ASSEMBLY CHECKS ON DESALINATION PLANTS

1 . 0 SCOPE :

This Quality control procedure specifies visual inspection , fabrication checks , assembly cheeks and testing of Desalination plants.

2. 0 MATERIALS:

All materials shall be procured from sources given in the approved vendor directory , all material shall be procured as per relevant standards/TDCs applicable and shall be taken into stock after verfication of material test certificates.

Any change of material shall have the approval of EDC - Desalination.

3.0 WELDING:

3.1 Only qualified welding procedures shall be used for used for fabrication and welders with adequate experience and qualification in welding on the material combination Shall only be engaged for welding.

3.2 E7018 electrodes shall be used for welding of carbon steel material .

3.3 Where the WPS calls for low hydrogen electrodes these shall be baked and dried thoroughly as per shop procedures.

3.4 For stainless steel welding , root weld shall be done with TIG welding and other layers may be finished with MMAW (above 5mm thickness) / MAG(upto 5mm thickness) .

3.5 As the weld combinations are mostly AISI 3161. material all welding electrodes shall be preferably AWS A5.22 E- 316 L16 or A-317 LT3, alternatively the electrodes may be AWS AWS A5.22 E- 309 MO - 16.

3.6 Post weld heat treatment is not required for any of the Welds .

4.0 FABRICATION CHECKS:

4.1 All dimensions and tolerances shall be an per drawings. All untoleranced dimensions shall be as per PR : QA : 500 .

4.2 R.O Stack frame Assembly

The marking of the position of all the stack angles drilling and slotting , slot pitches and sizes , shall be checked thoroughly . The foot holes sizes , pitches perpendicularity to the channel , all shall be thoroughly checked .

4.3 Ensure that the slotted face is facing top side on the slotted angles in every stack.

4.4 Ensure the soundness of weld and fillet sizes and LPI checks are done to ascertain the Quality of all the welds on the R.O Stack frame assembly.

4.5 Ensure that the bottom of support feet of the frame are on the same level and exactly on the same plane.

4.6 Check the diagonals of all the four sides of the frames and top and bottom diagonals are not varying beyond + or - 1.0mm .

4.7 Ensure that additional transport stiffeners are fitted on the top and bottom of the frame , to avoid distortion during transportation on the trailer/wagon.

4.8 All the welds of R.O stack frame shall be LPI tested after root welding and grinding and then final LPI testing shall be done before surface preparation and painting .

4.9 Thoroughly sand blast the frame to Sa 2 1/2 finish and cleanliness before applying one coat of marine epoxy paint at 50p per coat .

4.10 All pipe supports shall be appropriately edge trimmed before welding to the slack frame as per drawing. These shall be welded at site as per drawing.

4.11 Ensure that all pipe supports are checked with pin gauges or templates, to verify the correct position of the slots as per drawing.

4.12 These pipe supports also shall be sand blasted painted as per clause 4.8.

5.0 FEED PIPING AND BRINE PIPING

5.1 All stainless steel half couplings shall be checked with threaded plug gauges before fitting on to the headers. Mockup welding shall be carried out to check the distortion of threads. Suitable matching plugs shall be fitted before welding to control distortion. after welding all threads must be checked & corrected if required.

5.2 Weld all the piping as per drawing , checking layout , spatial orientation and lengths as per drawing.

5.3 Assemble the entire feed piping & brine piping as per orientation given in the drawing and match mark all the joint locations where pipes are to be dismantled for transportation. Please see Annexure I, II & III .

5.4 Do 100% LPI on the welds and 10% RT on the welds at random to ensure the soundness of the welded joints.

5.5 Using dummy plus at the pipe ends subject the feed piping assembly & brine piping assembly to hydro test pressure of 100 bars for not mire than half an hour. For hydro test. the flanged valves may be removed and only welded valves may be retained in the piping.

5.6 Use the torque values , to tighten the fasteners on flanges of flanged joints as per drawing.

6.0 BRINE MANIFOLD IPE , FEED MANIFOLD PIPE , SS PIPING AT MEMBRANE INLET AND SS BEND .

6.1 Check for the quality of the butt joints by root LPI and 10% random RT and final 100% LPI , after flesh grinding of the weld reinforcement .

6.2 Check for the socket groove size for all the socket welded T joints and weld nipples .

6.3 Ensure that on the brine manifold on the feed manifold T branch axes are on the same plane , deviation from planarity can be + or – 1 degree

6.4 Check the dimensions of the SS bend (inter) are as per drawing , the weld shall be as per clause 3.4 & 3.5 .

6.5 To prove the correct orientation and to do hydro test as an assembly , connect the SS feed piping and membrane in the .SS piping and do the hydro test as an assembly at 100 bar pressure for half an hour .

6.6 After welding , all threads shall be checked & corrected if required .

7.0 PACKING OF SS PIPING :

7.1 All SS pipe assembly after dimensional checks , weld checks and position / orientation checks shall be dismantled after match marking and placed inside wooden boxes with adequate spacer supports to avoid any bend or transport distortion .

7.2 PAINT SUPPLIER LIST :

Marine Epoxy Paint shall be bought from any one of the following paint suppliers .

(a) M/S ASIAN PAINTS , MADRAS

(b) M/S BERGER PAINTS , CALCUTTA

(c) M/S BOMBAY PAINTS , BOMBAY

(d) M/S JENSON & NICKHOLSON , CALCUTTA

(e) M/S SHALIMAR PAINTS , CULCUTTA

(d) M/S WESTERN INDIA PAINT & COLOUR CO . , MADRAS .

ANNEXURE - I

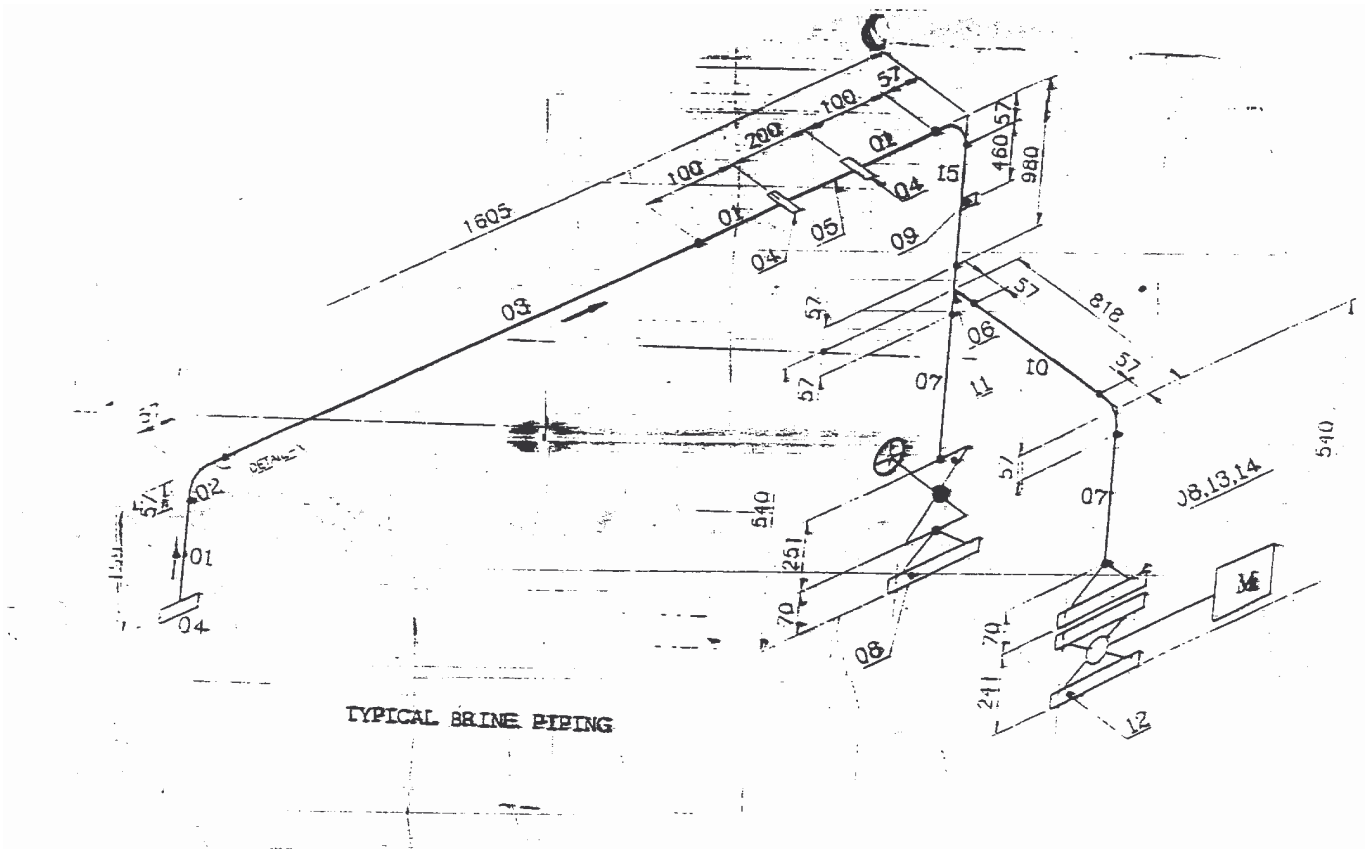
TYPICAL R.O DESALINATION PLANT

(COMPLETE ASSEMBLY)

QCP : D : 001 / 00
DT : 15 05 97

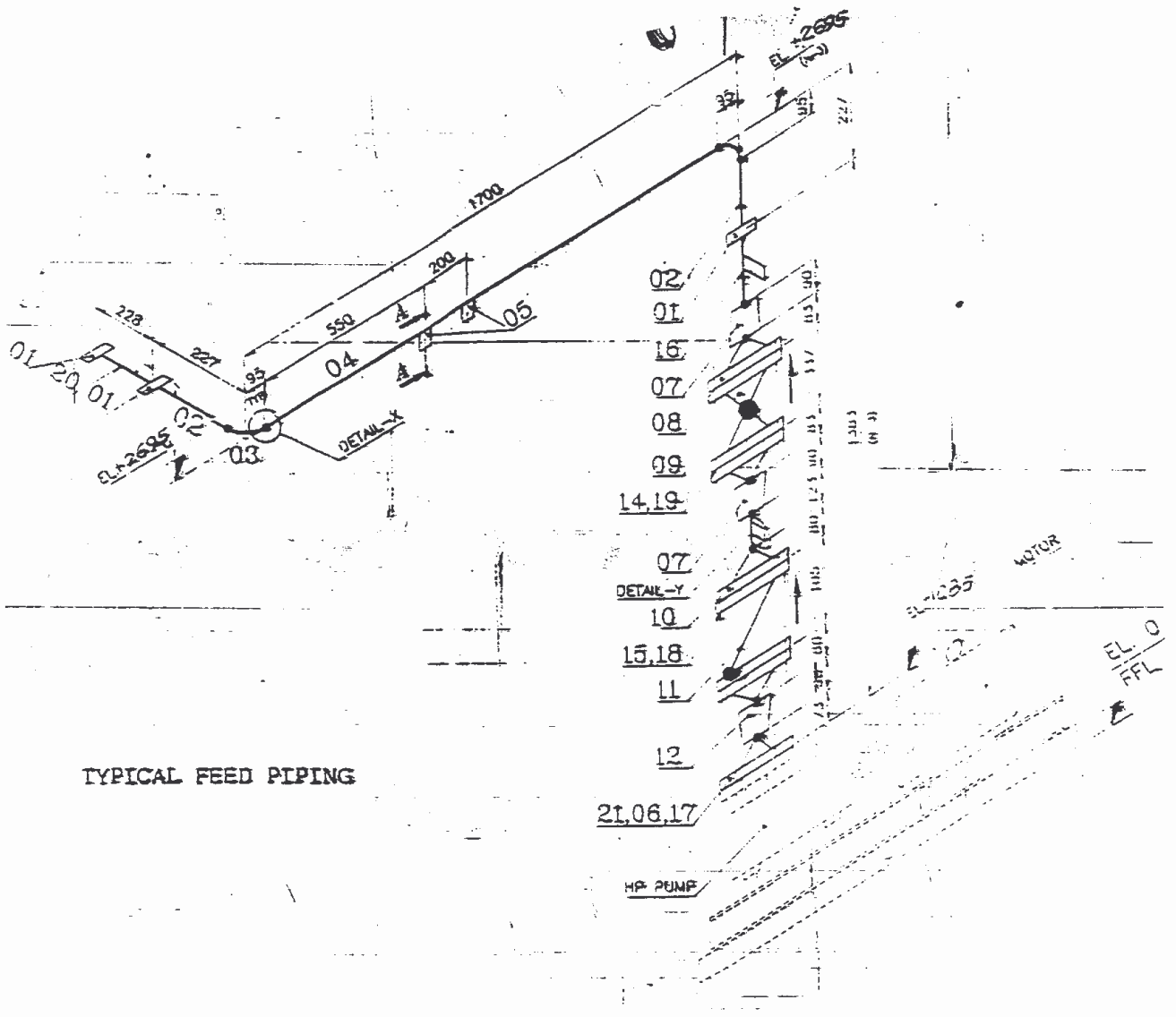
ANNEXURE - II

QCP : D : 001 / 00
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ANNEXURE - III

QCP : D : 001 / 00
DT : 15 05 97



TYPICAL FEED PIPING

RANIPET	**QUALITY ASSURANCE** **SURFACE PREPARATION AND PAINTING PROCEDURE FOR DESALINATION COMPONENTS**	**PRQA: 526** **REVISION: 01** **DATE: 14.08.01** **PAGE: 1 OF 5**

PROCEDURE FOR		***SURFACE PREPARATION AND PAINTING OF COMPONENTS OF DESALINATION PLANTS***	
EFFECTIVE DATE		**14.08.2001**	
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RECORD OF REVISIONS

REVISION NO.	DETAILS OF ISSUE	DATE OF ISSUE
00	ORIGINAL ISSUE	09.05.96
01	EDITORIAL CORRECTION	14.08.01

PROCEDURE FOR SURFACE PREPARATION AND PAINTING OF COMPONENTS OF DESALINATION PLANTS

1.0 SCOPE:

This procedure gives guidelines for surface preparation and painting of components of Desalination Plants.

2.0 The following are not under the purview of this procedure.

2.1 Masonry structures, PVC tubes, pipes & fittings, FRP vessels, pipes components and glass.

3.0 PROCEDURE:

3.1 The following components of Desalination Plants are under the purview of this procedure.

(a) Membrane Racks
(b) Valve supports and clamps, Pipe supports and clamps
(c) Supporting Structures
(d) Carbon steel filters, hand rails, platforms
(e) Shed Structures
(f) Handling Equipment
(g) Cranes
(h) Electric motors, base frame
(i) Any other component specified in the drawings.

4.0 SURFACE PREPARATION SCHEME:

4.1 Except stainless steel pipes and fittings (and Aluminium if any) all other steel surfaces shall be sand / shot blasted to SA 2½ finish as per Swedish Standard SIS 055900 before painting.

5.0 PAINTING SCHEME:

See Table – 1 below.

TABLE – 1

Scheme	Paint Type
PS 1	Epoxy Zinc Phosphate Primer Paint
PS 2	Epoxy finish Paint

5.1 The probable paint supplier can be as follows:

a. Asian Paint (India) Ltd.
b. Bombay Paints
c. Berger paints India Ltd.
d. Goodlass Nerolac paints Ltd.
e. Garware Paints
f. Jenson & Nicholson
g. Shalimar paints

Sl. No	Component	Surface Preparation	Primer	No. of Coats	DFT Total Microns	Finish Paint	No. of Coats	DFT Total Microns
01	Membrane Racks	SA 2 ½	PS 1	2	100	PS 2	2	100
02	Valve Supports and Clamps	SA 2 ½	PS 1	2	100	PS 2	2	100
03	Supporting Structures	SA 2 ½	PS 1	2	100	PS 2	2	100
04	Carbon steel filters (outer surfaces)	SA 2 ½	PS 1	2	100	PS 2	2	100
05	Hand Rails & Platforms	SA 2 ½	PS 1	2	100	PS 2	2	100
06	Shed Structures & Clamps	SA 2 ½	PS 1	2	100	PS 2	2	100
07	Handling Equipment	Leave greased/oiled surfaces free (for other follow scheme)	PS 1	2	100	PS 2	2	100
08	Cranes	- do -	PS 1	2	100	PS 2	2	100

6.0 GENERAL PRECAUTIONS:

6.1 Do not delay painting after Sand / Shot blasting. Maximum delay permitted is only half an hour.

6.2 Do not paint when the weather is rainy or the temperature is below 20^0 C.

6.3 The epoxy primer and finished paints are two component paints. The components must be mixed in the proportions given by the manufacturer only. The application of epoxy paints shall be completed with in 2 hours of mixing.

6.4 The etch/wash primers are also two component paints, which must be mixed in proportions given by the manufacturer.

7.0 IMPORTANT:

If the components are to be painted at site one coat of EPOXY FINISH PAINT of DFT 50 Microns SHALL BE GIVEN.