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GUIDELINES FOR PREPARATION OF QUALITY ASSURANCE PLAN FOR JIB/BOOM OF 140T CRANE (New design)

DEC'2016

CRANE ORGANISATION

EASTERN RAILWAY, LOCOMOTIVE WORKS

JAMALPUR - 811214

SECTION “A” : ORGANIZATION CHART

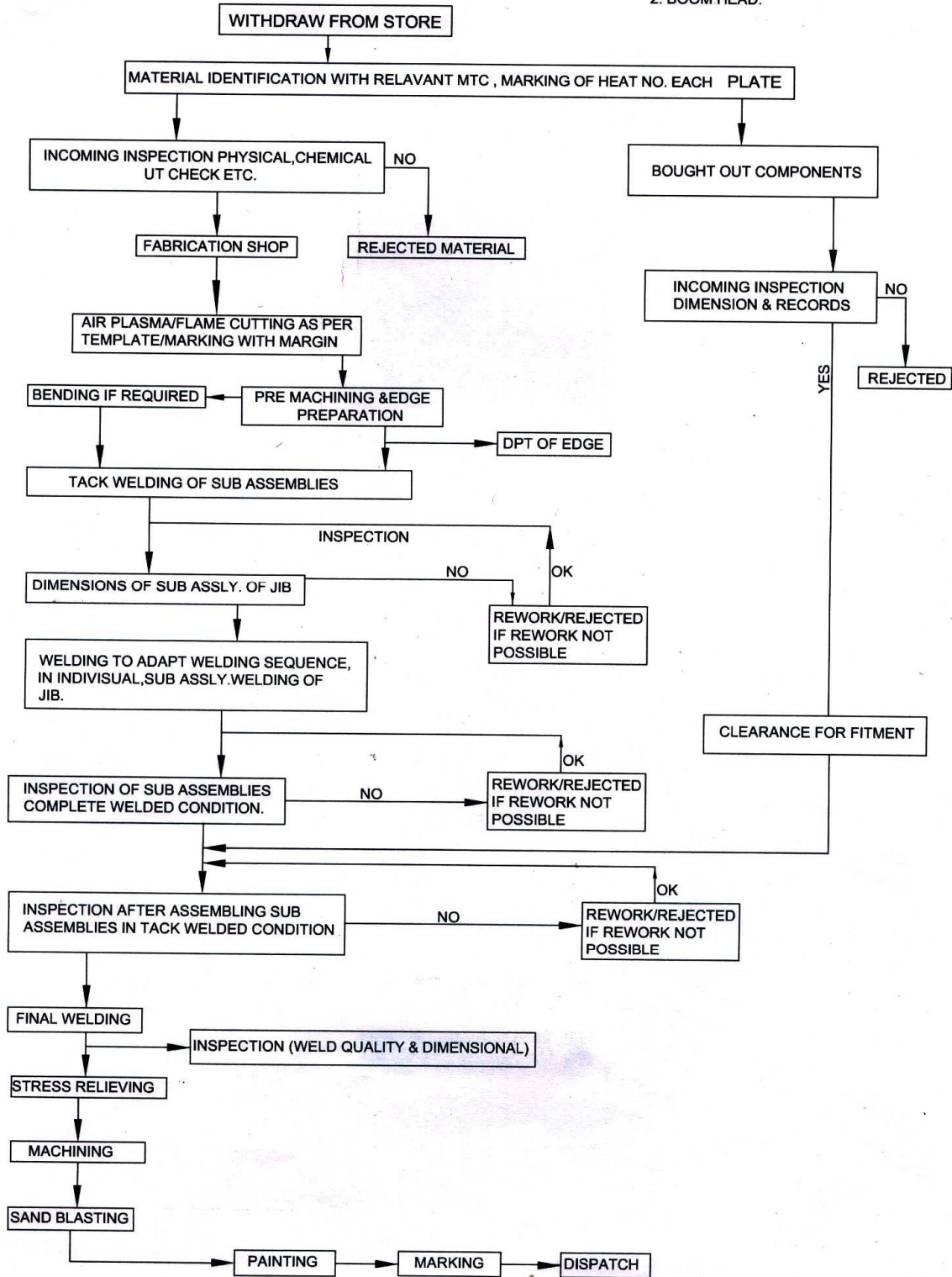
Organization chart should be prepared by firm.

SECTION “B” : QUALIFICATION/EXPERIENCE OF QUALITY CONTROL PERSONNEL

Key personnel of firm should be enlisted.

PROCESS FLOW CHART**MAJOR SUB ASSEMBLIES**

1. BOOM.
2. BOOM HEAD.



SECTION “C” : Part II (a)

- 1. SCOPE :** This quality assurance plan (QAP) is based on GOTTWALD Quality Assurance Schedule and is applicable for fabrication assembly and supply of Jib assembly for New design crane of Eastern Railway Locomotive Workshop, Jamalpur as per JMP Specn. No. and drawings.
- 2. (a) REFERENCE DRAWING :** A list of approved drawings including Main Drawing and sub assembly drawings which are to be followed by manufacturer for fabrication and machining of the above Jib assembly for 140T New Design crane is given below. The fabricated Jib shall be supplied conforming in all respects to the relevant Jamalpur Railway workshop drawings as indicated below.

REFERENCE DRGS. FOR JIB ASSLY (140T NEW DESIGN CRANE)

SN	STRUCTURE CODE	MDC-ID	DESCRIPTION	Drawing No.	Qty /Cr.
1	1.3.1	82729340	BOOM	3 WDH140CR-5.5.4600.0059-O, ALT-1	1
2	1.3.2	82756940	BOOM FULCRUM POINT	3 WDH140CR-5.2.4852.0106-O, ALT-1	1
3	1.3.3	82682740	BOOM HEAD PULLEY SET FOR DERRICK GEAR (except item 1)	3 WDH140CR-5.2.5401.1846-2, ALT-1	2
4	1.3.4	82667840	BOOM HEAD PULLEY SET FOR HOIST 1 (except item 1)	3 WDH140CR-5.2.5401.1845-2, ALT-1	1
5	1.3.5	82669240	BOOM HEAD PULLEY SET FOR HOIST 2 (except item 1)	3 WDH140CR-5.2.5401.1844-2, ALT-1	1
6	1.3.6	82670240	ON BOOM HEAD DEFLECTOR ROLLER (except item 1 & 2)	3 WDH140CR-5.2.5401.1843-2, ALT-1	1
7	1.3.7	82675940	SUPPORT ROLLER COMPLETE	3 WDH140CR-5.2.5404.0175-1, ALT-1	1
8	1.3.8	82775340	FLOOD LIGHT BRACKET	3 WDH140CR-5.2.4758.0026-1, ALT-1	2
9	1.3.9	82741440	BOOM STAIRWAY	3 WDH140CR-5.2.5610.0694-0, ALT-1	1
10	1.3.10	82725040	ROPE GUARD	3 WDH140CR-5.2.7901.3224-3, ALT-1	1
11	1.3.11	82724940	ROPE GUARD	3 WDH140CR-5.2.7901.3223-3, ALT-1	2
12	1.3.12	82731540	ROPE LAYBOY	3 WDH140CR-5.2.7257.0047-2, ALT-1	5
13	1.3.13.2	82685040	ROPE FIXED POINT HOIST 1 (except item 4)	3 WDH140CR-5.2.4853.0031-3, ALT-1	1
14	1.3.14.2	82681240	ROPE FIXED POINT HOIST 2 (except item 6)	3 WDH140CR-5.2.4853.0032-2, ALT-1	1
15	1.3.15.2	82874640	ROPE SUSPENSION COMPLETE (except item 14,15 & 16)	3 WDH140CR-5.2.8156.2198-1, ALT-1	1
16	1.3.17	82699540	BOOM HEAD	3 WDH140CR-5.5.5401.0002-1, ALT-2	1
17	1.3.18	82854940	ROPE GUARD COMPLETE	3 WDH140CR-5.2.7901.3226-3, ALT-1	4
18	1.3.19	82904040	HOOK SECURING ROPE	3 WDH140CR-5.2.5613.0700-0, ALT-1	1

2(b) List of DIN/ EN/IS and other Specifications to be available with the Manufacturer:

Sl. No.	Specification	Description
1	IS:2062/2011	Hot rolled medium and high tensile structural steel-Specification
2	IS:2074/1992	Ready mixed paint, Air drying, Red oxide zinc chrome, Priming-Specification
3	IS:7215/1974	Tolerances for fabrication of Steel Structure
4	IS: 2102/1993 (Part-I)	General Tolerances for tolerances for linear and angular dimensions without individual tolerances indications
5	IS:2102/1993 (Part.II)	General Tolerances for Geometrical tolerances for features without individual tolerances indications
6	IS: 7310 (Part-I)	Welder's qualification
7	IS: 9595	Root edge or root faces of butt joints shall be kept within tolerance
8	IS: 5334	Procedure and acceptance standard of Magnetic particles test
9	IS: 3658	Procedure and acceptance standard for Dye Penetrate test
10	IS: 813	Welding symbols
11	DIN 55928(Part-IV)	Surface quality SA 21/2
12	DIN 8570/1974 (Part-I)	General Tolerances for Welded Structures(Linear/ angular dimension)
13	DIN 8570/1974 (Part-III)	General Tolerances for Welded Structures (geometrical tolerance)
14	DIN 933	Hex head bolt M24 X 120
15	DIN 125	Washer B25, Washer A21
16	DIN 980/1987	Special metal prevailing to required type Hexagon nuts.
17	DIN/EN 25817/1992	Arc welded joints in steel, guidance on quality levels for imperfections
18	Article 23,SA-435/SA-435M	Standard Specification for Straight Beam UT Examination of steel plates
19	Article 23,SA-578/SA-578M	Standard Specification for Straight Beam UT Examination of rolled steel plates for special application
20	Article 23,SA-388/SA-388M	Standard Practice of UT Examination of steel forging identical with ASTM Specification
21	ASTM E-112	Grain size finer
22	ASTM E-45	Inclusion rating shall be better than 1.5 thick and thin series of A, B, C, D types of inclusions
23	ASTM 578 Level- C	Ultrasonic Test to be done at the perimeter of the plate at 25 mm from the edge for lamination in case the plates are certified
24	ASTM E390	For radiography of BUTT weld joint
25	ASNT Level-II	Welding defects detail report duly signed by Non-destructive Test personnel shall be issued in the standard formats
26	ASTM-A388M	Ultrasonic Test acceptance for forgings
27	ASTM E-164	Fillet welding of run on-runoff tabs
28	DIN-1543/1981	Flat products of steel, hot rolled plates with thickness of 03 to 150mm. tolerance on dimensions mass & shape

29	DIN-01013/1976	Steel bars, hot tolled round for general purpose.
30	DIN-07991/1986	Hexagon socket counter sunk head cup screw.
31	DIN-00980/1987	Spl. Metal prevailing to required type hexagon nuts.
32	DIN-6912/1985	Hexagon sockets this head cap screw with pilot recess for wrenches.
33	DIN-07527	Steel forging machining allowances and permissible variations.
34	DIN-02448/1991	Seamless steel pipes & tubes dimension conventional mass of per unit length.
35	DIN-0671/1981	Bright round steel.
36	DIN-02093/1978	Disc spring dimensions, material properties.
37	DIN-01481/1978	Spring type straight + Pins (roll pins) Heavy type.
38	DIN-936/1985	Hexagon thin nut, metric threads 8 to M52 and M8 x 1 to M52 x 3 product grade A&B.
39	DIN-01017	Hot rolled flat steels.
40	DIN-00934/1982	Hexagon nuts, metric threads, product grades A&B.
41	DIN-00472/1981	Circlips (retaining ring) for bores, Normal type & Heavy type.
42	DIN-10029	Hot rolled plate.
43	DIN-00094/1983	Split pin
44	DIN-01029/1978	Steel bars, hot rolled unequal leg angles with round edges dimensions, weights, tolerance sectional properties.
45	RDSO/LKO Specn. No. MC/04 Nov 1994 (Version-REV-May'2005)	For UT of BUTT Welded joint

3. **DEVIATIONS** : If deviations from original design, material specification, dimensions or any other changes are desired by manufacturer, specific proposals with reason shall be submitted for approval. Only after approval of JMPW deviation will be implemented.

4. **INSPECTING AGENCY** :

INTERNAL : By the QA personnel & Inspection department of manufacturer.

EXTERNAL : By inspection team nominated by Dy.CME/Crane/JMP – At manufacturers premises as under :

- (i) Raw material – steel plate testing – Chemical composition and Mechanical (micro & macro) Examination should be carried out and UT for plate.
- (ii) Stage and final inspection including welding quality etc. will be done at firm premises as per Inspection Plan, Check Sheet.

5. RAW MATERIAL TESTING PARAMETERS

(a) PLATES:

- (i) The chemical composition & mechanical properties of steel shall be as specified in the drawings for the Jib assembly of 140T crane. The original material specifications mentioned in the drawings are in DIN Standard. However, materials to other equivalent International standards or to indigenous Equivalent IS Specifications corresponding to relevant DIN/ EN Standard may be used (A list of Equivalent IS Specifications corresponding to relevant DIN Standard is given as Annexure III for guidance of the manufacturer, but in cases where the exact Equivalent IS Specification material is not available, the DIN Standard has to be followed).
- (ii) Steel plates shall either be imported as per relevant DIN Standard or other corresponding International standards against MTC of foreign supplier along with documents in support of import, OR procured along with Mill test certificates from SAIL/JINDAL or other Rly. Board approved sources. These test certificates shall be correlated with the stamping on the plates (Heat No, Plate Nos, Specification & grade) to be taken up for manufacture prior to commencement of fabrication and records maintained by the firm.
- (iii) All test certificates shall be submitted to Inspecting Agency for scrutiny by the firm.
- (iv) Any deviation in material specification may lead to rejection of material.
- (v) The plates procured should have a minimum width of 2.5 meter (max. required width) manufactured through EAF – VAD – CC route.
- (vi) Micro and Macro examination of the steel plates to be done for samples taken from the center portion at both ends of the plate for inclusion streaks and dendrites. The average grain size should be of ASTM Grain size No.6 or finer as per ASTM E-112. The inclusion rating shall be better than 1.5 thick and thin series of A, B, C, D types of inclusions as per ASTM E-45.
- (vii) UT to be done at the perimeter of the plate at 25mm from the edge for lamination in case the plates are certified with ASTM 578 level C, otherwise UT of full plates may be done as per ASTM 578 level C (For Plates above 12mm to 50mm thickness).
- (viii) DPT to be done on the machined face of plates for surface cracks. No surface or sub surface cracks if revealed through DPT or Magna-flux testing will be acceptable.
- (ix) All test reports must be preserved to be produced on demand.

(b) Forgings:– UT acceptance as per ASTM A388M.

(c) Other items:– As per relevant specification.

6. MANUFACTURING PROCESS:

6.1 Inspection of Steel plates

Manufacture shall ensure cleaning of all plates for freedom from dust and scale. The plates will then be examined visually for surface defects such as cracks, dents pitting bend etc. There should not be any harmful surface defects as stated above.

6.2 Straightness:

Required plates can be straightened on straightening machine or by hydraulic press (governing specification IS: 7215/Latest).

6.3 Bending of Plates:

Bending of plates shall be done by suitable bending machine or hydraulic press.

6.4 Cleaning of Plates: All plates shall be cleaned and shall be free from dust oil and scales etc.

6.5 Marking of Plates: All plates shall be marked properly to achieve the specified dimensions as per drawing keeping in view the required allowance for welding and machining. As such the job should conform to the actual assembly dimensions.

6.6 Cutting preparation and machine of Plates:

- (i) Ensure marking of the sections avoiding centre line weakness.
- (ii) The straightness of surfaces of the machined plates must be true to 0.5 mm in one meter length or as per IS : 2102 (Part-2)/1993 Gr-K.
- (iii) The radius as detailed in the drawings must be ensured while profile cutting of plate. Building up of plates through welding must strictly be avoided.
- (iv) Plate shall be cut either by plasma or Oxy-acetylene gas.
- (v) The plate should be cut in 08 mm margin for machining to eliminate the heat affected zone.
- (vi) DPT to be done on the machined plates for surface cracks. No surface or sub. Surface cracks if revealed through DPT or Magna flux testing, will be acceptable.

6.7 Edge preparation

- (i) Edge preparation shall be done by suitable machining followed by grinding in accordance with drawing requirement.
- (ii) Weld joint dimensions/edge preparation shall be as per relevant drawing.
- (iii) To ensure intimate contact, fusion faces shall be ground smooth and uniform and shall be free from cracks, under cut, gouges, oil, rust, dust grease etc. Occasional gouges of depth greater than 3.0 mm deep shall be filled up by welding & grinding.

6.8 Welding

Welding shall be done as per WPS. Appropriate welding electrodes, recommended for different types of welding shall be used as applicable

7.0 INSPECTION:

7.1 Dimensional Inspection:

Dimension of main assemblies shall be inspected as per Drawings/Dimension control chart approved by E.Rly. Workshop, Jamalpur Linear/angular and geometrical tolerance of welded structure shall be followed as per DIN 8570 Part-I Class-B & Part-3, Class-F respectively.

7.2 Testing of welded joints:

- i) All butt weld and bevel weld joints shall be subjected to 100% ultrasonic testing.
- ii) Welded joints of size 12mm & above shall be subjected to Radiographic testing at sub assembly stage. Only where joints are inaccessible, UT may be done.
- iii) All fillet joints of size 12mm & below shall be subjected to D.P test only. Bigger joints shall subject to U.T/M.P.T as applicable.

7.3 Repair & Report:

(a) Repair

Defects like incomplete penetration, lack of fusion, cracks, slag inclusions, porosity, blow holes, sub surface defects are to be repaired and re-examined as per acceptance standard mentioned below.

(b) Report

The detail report duly signed by NDT Personnel (ASNT-Level-II) shall be issued in the standard formats. Valid certificate of NDT personnel shall be produced before inspecting agency for inspection.

7.4 WELDING QUALITY:

7.4.1 Quality of Weld Joints

- (i) Weld joints shall have uniform beading and smooth change over from weld deposit to parent metal and thorough fusion between adjacent layers of weld metal and between weld metal and parent metal.
- (ii) Weld joints shall be free from cracks, craters, undercuts, overlaps, porosity, inclusions, blow-holes etc.
- (iii) In butt welded area, one extra run of welding shall be applied; excess metal shall then be ground off to eliminate stress raisers and normalize the welded metal.
- (iv) The fillet weld profile shall be made concave by grinding so that smooth transition occurs at the toe of weld maintaining correct size of the welds. Welds shall be ground to eliminate stress raisers and to improve fatigue life.
- (v) Adequate measures shall be taken by the manufacturer to avoid distortion during welding. Minor distortion, if any, shall be corrected preferably in the cold (by mechanical method). In exceptional cases, any correction to be done by flame heating of members shall be carried out only in presence of Inspecting Agency or his representative; temperature of heated part shall not exceed 500° C. Generally heating is not acceptable.
- (vi) Any linear discontinuity shall be unacceptable and shall be repaired by chipping or grinding and subsequent welding. After rectification of defects in welding, the area shall be re-examined by the same method to ensure defect free weld joint.

7.4.2 Inspection of Weld Quality

The quality of entire weld length shall be checked by Dye Penetrate test by the Inspecting Agency. However, weld quality of critical areas shall be checked by magnetic particle test and quality of welding of butt joints shall be checked by radiographic / ultrasonic test as indicated in the diagram. Details of tests and their acceptance standards are given below:

7.4.2.1 Dye Penetrate Test

Dye penetrate test shall be conducted to ensure absence of cracks, under cuts, blowholes, porosity etc. The procedure and acceptance standard shall be as per IS: 3658 or ASME Sec-viii Div-I.

7.4.2.2 Radiographic / Ultrasonic Testing

Butt weld joints shall be subjected to Radiographic tests. Butt weld joints not accessible to radiography shall be checked by Ultrasonic testing. The manufacturer shall submit method of test of all butt joints to Inspecting Agency indicating acceptance test for each joint. Proper record of Radiographic / Ultrasonic testing shall be maintained. Acceptance standard shall be as per Blue Standard of IIW for Radiography and DIN EN 25817 quality level C for Ultrasonic test.

7.4.2.3 Magnetic Particle Test (MPT)

(a) All weld joints on critical areas shall be checked by Magnetic Particle Test. These areas shall be cleaned and made smooth by grinding before checking of weld quality by magnetic particle test. These areas shall then be checked by loop / yoke method for weld flaws. The procedure and acceptance standard shall be as per IS: 5334.

(b) Evaluation for MPT

Each discontinuity and defect indicated by retention of magnetic particles shall be explored to determine if linear discontinuities are present or defect is due to excessive surface roughness, heat affected zones etc. If the indication is suspected due to excessive surface roughness, heat affected zones etc., it shall be confirmed by re-checking the area by MPT after making the area smooth by grinding.

7.4.3 Rectification of Weld Defects

- (i) Any linear discontinuity shall be un-acceptable and shall be removed and repaired by chipping / grinding and subsequent welding and the area re-examined by the same method to verify complete rectification of observed defect.
- (ii) Further rectifications shall not be allowed if linear discontinuity is observed again during checking after rectification.
- (iv) All test reports of Magnetic particle inspection shall be submitted to Inspecting Agency for review.

7.4.3.1 Inspection of Run-on and Run-off tabs:

Any two randomly selected run-on and run-off tabs welded with structures shall be detached after welding in presence of Inspecting Authority and subjected to magnetic particle test to assess the quality of welding of centre section, side section and end section. These tabs shall be free from any weld defect like lack of root fusion, slag inclusion, porosity etc.

7.4.3.2 Evaluation for Run-on and Run-off tabs:

In case any one of the welds fails to meet the requirement of a good fillet joint, the whole fillet welding of the sections shall be subjected to ultrasonic test as per ASTM E-164.

7.5 Inspection of Jib:

Inspection should be carried out by inspecting agency as per the sample inspection plan for the fabricated Jib assly of 140T new design crane. Raw materials inspection & testing will be carried out by authorized inspector/JMP as per clause (5) above. The total inspection will be conducted in four stages.

Stage I :-

- i) Raw Material Inspection.
- ii) Review/Witness of Welding Qualification Test.
- iii) Review/Witness of WPS.
- iv) Review/Witness of PQR.
- v) Review of Welding Consumables, Machines & its accessories.
- vi) Review of testing certificates of Welding Machines & its accessories.

Stage II:-

- i) Inspection of sub assemblies in tack welded condition.
- ii) Inspection after final welding of sub assemblies.
- iii) N.D.T inspection of weld joints as applicable.

Stage III:-

- i) Inspections in Tack weld condition of Jib assembly complete.
- ii) Dimensional checking.

Stage IV:-

- i) Dimensional inspection after complete welding of Jib assembly.
- ii) N.D.T examination of weld joints as applicable.
- iii) Stress relieving to be done in presence of inspecting agency.
- iv) Random verification of hardness at weld & heat affected zone.
- v) Inspection after machining of Jib assly for :-
 - (a) Visual inspection & Workmanship
 - (b) Inspection of slew ring stud holes.
 - (c) Checking of painting & paint thickness by Elcometer/DFT gauge.
 - (d) Verification of all the relevant documents.
- vi) Inspection of all accessories of Jib assembly.

8. Quality control Requirement:

Dimensions shall be recorded in accordance with inspection plan approved by E.Rly/JMP and the same shall be submitted to the inspecting agency for verification during inspection at different stages.

- (i) Dimension and tolerance shall be as per drawing. Dimensions without tolerance shall comply with IS: 2102 Part- (medium) for machined parts. For other parts DIN 8570 Part-1 as per tolerance class B and DIN 8570 Part 3 as per tolerance class F for linear and geometrical dimensions respectively shall be followed.
- (ii) Gauges, fixtures, templates and accurate measuring instruments duly calibrated shall be used for measuring dimensions.

9. Calibration:

Gauges, fixtures, templates welding machines and measuring instruments shall be calibrated at regular intervals by the manufacturer.

10. RECOMMENDED STRESS RELIEVING PROCEDURE:

- i) The heat treatment furnace should be of suitable size.
The thermocouples should be connected with associated recording equipment for effective monitoring of temperature.
- ii) To avoid distortion during stress relieving operation, suitable tie-bars shall be provided.
- iii) The Jib assembly shall be kept in furnace, bottom side up (inverted position).
- iv) The assembly shall be suitably supported while loading in furnace to avoid any permanent deformation.
- v) The temperature of furnace shall not be exceed 315°C at the initial stage when the Jib is kept in furnace.
- vi) Above 315°C, the rate of heating shall not exceed 100°C/hour. During the heating period, variation in temperature throughout the portion of the part heating shall not be greater than 50°C.
- vii) Soaking temperature shall be between 600°C and 650°C. On reaching soaking temperature, the assembly shall be held within specified limit for a time not less than four hours (one hour per 25 mm thickness of plates).
- viii) For determining soaking time, the thickness part of assembly shall also be considered. During the soaking period, difference between highest and lowest temperature at different point of the assembly shall not be greater than 20°C.
- ix) The job shall then be allowed to cool down to 300°C in close furnace at a rate not exceeding 100°C/hour. Below 300°C, the assembly may be cooled in still air. Recording of stress relieving chart (Time-Temperature graph) shall be a part of inspection record to be submitted.

11. Machining:

After stress relieving Jib shall be machined properly by appropriate machine.

- 12. Sand Blasting:**
After machining items shall be cleaned by sand blasting to achieve a surface finish of SA 2.5.
- 13. Identification Marking:**
The job shall be provided with identification at an easily visible location. The identification plate shall contain the following:-
Manufacturer's Monogram, Sl. No. , Month & Year of manufacture & P.O. No.
- 14. Painting & Packing:**
- (i) Rust preventive coating shall be applied on machined surfaces before packing.
 - (ii) Fabricated parts shall be coated with two coats of lead based Primer to IS2074. Paint coating shall be 80 micron DFT.
 - (iii) While packing due care shall be taken to protect all machined surfaces, drilled & tapped holes against rubbing/impact/scratches. All small accessories should be packed in wooden/metal box. All such boxes must contain a packing list.
 - (iv) All documents including dimensional check sheets, test certificate etc shall be furnished along with Jib assly and same shall be property of purchaser (Locomotive Workshop/JMP).
- 15. Review of quality assurance plan:**
The quality assurance plan may be reviewed during inspection to check its effectiveness and, if necessary any changes may be incorporated in QAP in order to improve quality, but only after taking approval of Dy.CME (Crane)/JMP.

Section C Part-II (b): Brief description of different manufacturing process mentioned in flow chart.

Details of the manufacturing & testing process:

Sl. No.	Requirement of manufacturing/ testing process in proper sequence.	Details of the process being installed/ follows
1.	Raw material	As per specification
2.	Plate cutting	As per drawing
3.	Sand Blasting	As per specification
4.	Primer painting	As per specification
5.	Machining of plates for edge preparation	By using suitable machine & instruments
6.	Flange and round forging machining	By using suitable machine & instruments
7.	Fit up of sub-assemblies	Dismantle suitability by using suitable measuring instruments
8.	Welding	Visual welding gauge, UT/ MPT/ DPT
9.	Fit up of assemblies	Dismantle suitability by using suitable measuring instruments
10.	Complete welding	Visual welding gauge, UT/ MPT/ DPT
11.	Machining	By using suitable machine & instruments
12.	Bought out items	As per specification & only suitable instruments

Section C- Part-III - Brief Description of ancillaries & additional units (if any):

Sl. No.	Location	Address	Whether unit is under factory licensee	Whether unit is ISO Certified	Manufacturing process Details.
1.					
2.					

Section D - Part-I - Details of sub assembly/components manufactured in house.

Sl.No.	Drg.No./Specification	Description	Source

Section D -Part-II - Details of outsourced sub assemblies/components :

Sl.No.	ITEM/DESCRIPTION	DRAWING NO./SPECIFICATION	SOURCE
1	Forging item	As per material list.	Open market.
2	Fasteners	As per material list given on relevant drawings.	As per vendor directory.
3	Nylon items	As per material list given on relevant drawings.	As per vendor directory.

Section E: - Incoming Raw material & in Process/Final Inspection

Stage inspection & detailing inspection procedure, inspection parameters, method of testing/test procedure including sample sizes for destructive and non destructive testing etc. areas follows.

Part I : Incoming raw materials/Parts/Sub- assemblies

SN	Incoming product/assembly	Sample size & its frequency of inspection	Parameters' for inspection	Mode of inspection/ equipment used	Acceptance limit/Criteria/ Specified value	Rejection & Disposal Reprocessed/ Scrapped	Traceability registers no. if any.
1.	Plate of different thickness, 12,14,15,20,25,30,35,45,50 mm	Each heat	as per standard specified	Lab testing UT of Plates above 12 mm thickness	as per standard specified	Report, if rejected returned to supplier	
2.	Forging/Round Section	Each heat	as per drg. and specification	Lab testing	as per standard specified ASTM A-388M	If rejected returned to supplier	
3.	Bought Out Components	10%	as per standard specified	As required	As specified in the relevant drgs./Spec.		

Part-II - In process inspection (of the product):

Sl. No.	Name of the Process	Sample size & its frequency of inspection	Parameters for inspection	Mode of inspection/ equipment used	Acceptance limits/criteria/specified value	Rejection & Disposal	Corrective & preventive action	Traceability registers no. if any.
1.	Raw material	Each heat	Specified value	Lab	As per specification	Repair or Reject	.....	.....
2.	Marking	Each component	Specified drawings	Dimensionally	As per drawing	.....	.....	.....
3.	Cutting of plate	Each component	Specified drawings	Dimensionally	As per drawing	Report	.....	.....
4.	Sand blasting	Each component	.....	.....	As per specification	.....	.....	.....
5.	Primer Painting	Each component	.....	.....	As per specification	.....	.....	.....
6.	Edge preparation	Each component	Specified drawings	Dimensional control chart	Specified	Report	.....	.....
7.	Fit up (Sub-assembly)	100%	Dimensional suitability	Bevel gauge vernier caliper, Laser distance meter (beyond 02 Mtrs) & others measuring instruments	Drawing	Report	Prepare report for each deviation	.....
8.	Welding	100%	Welding quality	Test	As per WPS	Report	Prepare report for each deviation	.....
9.	Fit up assembly	100%	Dimensional suitability	Bevel gauge vernier caliper, Laser distance meter (beyond 02 Mtrs) & others measuring instruments	Drawing	Report	Prepare report for each deviation	.....
10.	Complete welding	100%	Welding quality	Test	As per WPS	Report	Prepare report for each deviation	.....
11.	Machining	100%	As per drawing	Suitable machines & measuring instruments	As per drawing	Report	Prepare report for each deviation	.....
12.	Final painting	Each component	.....	.....	As per specification	.....	.....	.....
13.	Final inspection	100%	Dimension		Drawing	Report	Report	Report

Part-III - Final internal inspection of the product by the firm:

S N	Name of the test/ Process	Sample size & its frequency of inspection	Parameters for inspection	Mode of inspection/ equipment used	Acceptance limits/ criteria/ specified value	Rejection & Disposal Reprocessed /scrapped	Traceability registers no. if any.
1	Dimension	Major dimension	Controlled dimension	After Machining	As specified in inspection plan check sheets.	Report	Report
2	Welding Quality	Joints	Internal defects	UT,DP,MPT	As per section "C" part II (a) para 7.4	Report	Report

Section –F : Calibration of Testing measuring equipment.

Part-I - In house testing facilities available for calibration with the firm.

Sl. No.	Name of master	Make	Range	Frequency of calibration	Traceability to national standard
1.	Vernier caliper	Mitutoyo	Different range	Yearly	
2.	Measuring tap, Laser distance meter	Freeman	5,10 & 30 mtr Beyond 02 mtr.	Yearly	
3.	Micro meter	Mitutoyo	50 to 1000 mm	Yearly	
4.	Welding gauge	Indian	04 to 40	Yearly	
5.	Other instruments like laser distance meter	-	2 mtrs above	As specified	

Part-II - Personnel trained for in house calibration

Sl. No.	Name	Qualification	Experience
1.			
2.			
3.			

Part-III- Calibration plan for the items identified for specified calibration.

Sl. No.	Measuring equipment	Ref. ISO Standard	Range/Accuracy	In-house/Out sourced	Name of agency if out sourced
1.					

Part-IV -Calibration plan for other measuring equipment in ISO Standard.

Sl. No.	Measuring Equipment	Ref. of ISO standard	Range/Accuracy	Frequency	In-house/out sourced	Name of calibration agency
1.						
2.						

Section G: System of maintaining the date of customer complaints/warranty failures /In-service failures reported from customers.

S N	Date of report of complaint	Letter No.	Complaint received from	Brief details of complaint	Classification of failure- Warranty failure/in service failure/call for joint inspection/Consignee end rejection/ General complaints	Whether any person deputed for collecting field sample	Date of joint inspection	Failure analysis & cause of failure	Date of compliance in case of warranty	C & P action taken
1										

Section H: Any other information Firms like to submit

WELDING PROCEDURE SPECIFICATION
(Ref:- WPS for BOXN HL provided by RDSO)

LOCOMOTIVE WORKSHOP/ E.Rly./ JAMALPUR

Welding Procedure No. JMP/140T/Jib/ New Design/01

1.0 GENERAL:

- 1.1 **SCOPE:** - This welding procedure is intended to cover the general requirement for the Gas Metal Arc Welding (GMAW) and Manual Metal Arc Welding (MMAW) of all related materials as applicable to the fabrication of 140T Crane Jib (New Design). This WPS is only for guidance of the manufacturer who shall prepare detailed WPS covering all the components and their parts in accordance with the drawings submit the same along with QAP for approval of Dy.CME(Crane)/JMP (in triplicate).
- 1.2 **WELDING SYMBOLS:** The welding symbols are as specified in Specification No. IS:813 (Symbols for welding).
- 1.3 **WELDER'S QUALIFICATION:** Welding procedure and welding performance shall be conducted as is laid down in IS: 7310 (Part-I) or, AWS welding code – D.1.1.2010/ASME Sec IX 2013.
- 1.4 **WELDING PROCESS:** Gas Metal Arc Welding (GMAW) and Manual Metal Arc Welding (MMAW).
- 1.5 **SHIELDING GAS:** CO₂

SN	Materials	Process	AWS	IS
1 *	E450 BR / SAILMA 450HI + E450 BR	GMAW	AWS/SFA5.29 E110T5-K4	--
		MMAW	AWS/SFA5.5 E10018 M	I S:1395 E68BM229Fe
2 *	E450 BR + E350 BR	GMAW	AWS/SFA5.29 E110TS-K4	--
		MMAW	AWS/SFA5.5 E10018M	IS:1395 E68BM229Fe
3 *	E350 BR + E350 BR	GMAW	AWS/SFA5.29 E80TS-G	
		MMAW	AWS/SFA5.5 E9018-G	IS: 1395E63 BG129Fe
4 *	E450 BR +E250 BR or Others	GMAW	AWS/SFA5.29E80TS-G	--
		MMAW	AWS/SFA5.5 E9018-G	IS : 1395E63BG129Fe

* Impact should be according to mutual agreement.

2.0 MATERIALS:

- 2.1 E450 BR/SAILMA450 HI AND E350 BR/SAILMA 350HI
- 2.2 **WELDING CONSUMABLES:**
- 2.3 **CARE OF ELECTRODES:** All electrodes/MAG wire will be stored properly and away from weather effects. Electrodes having past of their coating damaged shall be discarded.
- 2.4 **DRYING OF ELECTRODES:** Low hydrogen electrodes to be dried at 200° C to 250° C for two hours before use.

3. WELDING TECHNIQUES :

- 3.1 **EDGE PREPARATION:** Edges shall be prepared for welding by Beveling cutting machine joint configuration should comply with requirement of design. Edge preparation shall be as per relevant drawing. Fusion faces shall be ground smooth and uniform and shall be free from cracks, under cut, gouges, oil, rust and dust, grease etc.
- 3.2 **ALIGNMENT:** The root edge or root faces of Butt joints shall be kept within tolerance as per IS: 9595 for a specified material thickness as far as practicable.
- 3.3 CLEANING OF WELDING ZONES :**
Welding zone should be absolutely free from Grease, Oil, and Paint, rust, scales and oxide. Weld portion should be clean by wire brush each run of weld layer.
Each run of weld layer should be thoroughly cleaned to remove particles of slag, Flux, spatters etc before the subsequent layer or weld visible defects such as cracks, cavities, blow holes, pin holes and other deposition fault if any shall be removed by gouging/grinding to sound metal before deposition subsequent layer of weld.
- 3.4 **CURRENT/OCV –** OCV limits of various types of welding is as follows: GMAW-80V max & MMAW – 70V max.
- 3.5 **WELDING POSITION:** All welding shall be done in down hand position as far as practicable and the welders should be weld in comfortable position. Overhead and vertical upward position welds shall be used only when unavoidable and with the prior qualification of the welders in that position.
- 3.6 **TACK WELDING OF ASSEMBLIES:** All the welding member shall be brought into correct alignment and held in position by clamp, wedge, strong backs, fixture etc till welding is completed. Tack welding shall be done using the same electrodes for continuous welding. Any defects in this must be removed prior to depositing the first layer.
- 3.7 Length of Tack weld and distance between consecutive tack shall be suitably selected by the manufacturer to avoid defects like distortion, warping etc.
- 3.8 Welding shall be confirmed by Inspecting agency during tack welding for the fitment details against drawing requirements.
- 3.9 Inspection of major sub-assemblies on tack weld condition.
- 3.10 **DIMENSIONAL INSPECTION:** Dimension of main assemblies shall be inspected by inspecting Agency.
- 3.11 **BUTT WELDS :** Details of all Butt weld shall be arranged to permit the use of satisfactory welding procedure and combination of welding details and welding procedure shall be such that the resultant joint complies with the requirement of the design a per IS: 813.
- 3.12 MISCELLANEOUS :**
(a) **FILLET /BEVEL WELD CONTOUR:** Fillet weld contour shall be slightly concave or convex. Excessive convexity shall be avoided. Tolerance of fillet weld size shall be within the limits required.

- (b) **SEALING RUN:** All Butt welds to be back gouged up to gouged metal and a sealing run is deposited where backing plate is used.
- (c) **WELD BEAD:** Slag shall be removed after each pass. Defects in any run must be rectified before depositing subsequent runs. The final run shall be free from defects and tolerance must be within the limits required.

3.13 ON WELDING:

- (a) **WELDING TECHNIQUE:** Welding shall not be done on wet surface, at high wind areas. Welding current shall be in accordance to recommendation of the manufacturer of welding consumables. It should ensure proper fusion of filler metal and parent plates. Over lapping must be avoided. Under cutting does not occur and avoid slag inclusion. Welding bead should be smooth and uniform. Welding sequence shall be adopted to avoid distortion. The electrode angle should be such to obtain proper slag control, avoidance of undercuts and proper fusion of both members and uniform arc length.
- (b) **FINISHING OF WELDS:** In order to avoid crater formation, porosity and crack formation in the crater at the end of welding. The travel speed should be reduced and the arc length should be gradually increased and move back to fill up the crater before the arc is extinguished.
- (c) **PREHEAT & INTER PASS TEMPERATURE:** Electrode shall be preheated in backing oven to a temperature of 150 ° C to 250 ° C for 2 hours before use.
Inter pass temperature of 150 ° C- 250 ° C shall be maintained throughout the welding.
- (d) **AFTER WELDING:** All surfaces shall be smooth and regular and shall satisfy strength requirements and be free from defects such as cracks, blow holes, pin holes, porosity, under cutting etc.

3.14 QUALITY OF WELDS:

- (a) Welding joint should have uniform beading and smooth over the weld deposits to parent metal and thorough fusion between adjacent layers at weld metal and parent metal.
- (b) Weld shall be free from cracks, craters, undercuts, overlaps, porosity, slag inclusion, blow holes etc.
- (c) The fillet or Butt weld should be checked with AWS gauge.
- (d) Weld shall be slightly ground to eliminate stress raisers and to improve fatigue life.

3.15 INSPECTION AFTER WELDING:

- (a) Size of fillet or Butt weld to be checked by AWS Gauge.
- (b) Reinforcement and welding finish & contour.
- (c) Dye penetration inspection for defects if any.
- (d) **WELDING MACHINE:** Manufacturer to check whether the welding machine is giving proper current. As indicated on its dial indicator and whether it has OCV proper voltage for the electrode to be used. Synergic welding plants for MIG/MAG should be preferred.
- (e) **WELDING TOOLS:** Welding screen, electrodes, hand Glove, Chipping hammers, welding holders and wire brush should be checked by manufacturer for their quality.

4.0 INSPECTION AND DEFECTS RECTIFICATION:

4.1 **VISUAL INSPECTION:** All fusion faces shall be free from irregularities which would interfere with the deposition of the metal. The preparation of fusion faces, angles, root radius and root faces in limits can be maintained for manual metal arc welding. The tolerance of limits of gap and root face as per drawing.

4.2 **RECTIFICATION OF DEFECTS:** Rectification of defects shall be done in compliance with acceptable standards. Defects, if any, shall be chipped out and grounded if necessary and welding will be done in the same sequence and procedure as required in original welding. Slag shall be removed after each pass.

4.3 STEPS TO CONTROL DISTORTION AND RESIDUAL STRESS:

- (i) Welding sequence shall be such to minimize welding distortion and residual shrinkage stresses.
- (ii) Weld in always so as to distribute heat input uniformly and in a balanced manner. Back step method, skip welding etc. is some of the method.
- (iii) Long parallel runs to be deposited concurrently.
- (iv) The use of high deposition electrode, high welding currents tends to reduce the possibility of distortion.
- (v) The heat amount of weld metal deposited with as few passes as possible is desirable.
- (vi) On multi pass double 'V' welds balance welds on both sides.
- (vii) Joints that may have the greatest contraction on cooling should be welded first.

4.4 CONTROL OF SHRINKAGE:

- (i) Over welding shall be avoided.
- (ii) Intermittent welding shall be used.
- (iii) Use as few weld passes as possible.
- (iv) Place weld near neutral axis.
- (v) Use back step welding.

4.5 **CORRECTION OF DISTORTION:** Any distortion which is unavoidable may be corrected by:-

- (i) Cold (Mechanical Process)
- (ii) Peening (Excess peening not recommended).
- (iii) Combination of heating and mechanical working.
- (iv) Remove shrinkage forces arising from welding by stress relieving (Heat treatment).
- (v) Welding time shall be minimized.
- (vi) Maximum utilization of fixtures, clamps, strong back etc.

PRECAUTIONS FOR WELDING OF JIB:

- (i) Surface to be welded must be clean, dry and free from dirt oxides, film, oil and grease etc.
- (ii) Electrode should be re-dried before use.
- (iii) Maximum amount of welding work by MIG/MAG preferred.
- (iv) Avoid weaving and make stringer beads.
- (v) Always maintain short arc length to minimize the loss of alloying elements.
- (vi) After finishing welding, left electrodes/MAG wire slowly and fill the crater before breaking the arc. This will avoid crater cracks.
- (vii) Use hard wire brush for cleaning welds.
- (viii) Every bead should be properly cleaned, before further welding on it.
- (ix) Welding should be carried in flat position (preferably)
- (x) Correct electrode/MAG wire size, recommended current arc length, travel speed and electrode angle must be followed.
- (xi) Any defect like crack, blow holes etc must be properly gouged out and re-welded.
- (xii) Do not strike arc adjacent to the weld.
- (xiii) Proper welding sequence must be followed to reduce internal stress.

WELD MAP

SECTION - 'A-A' OF BOOM

DRG.No.- 5.4600.0059-0

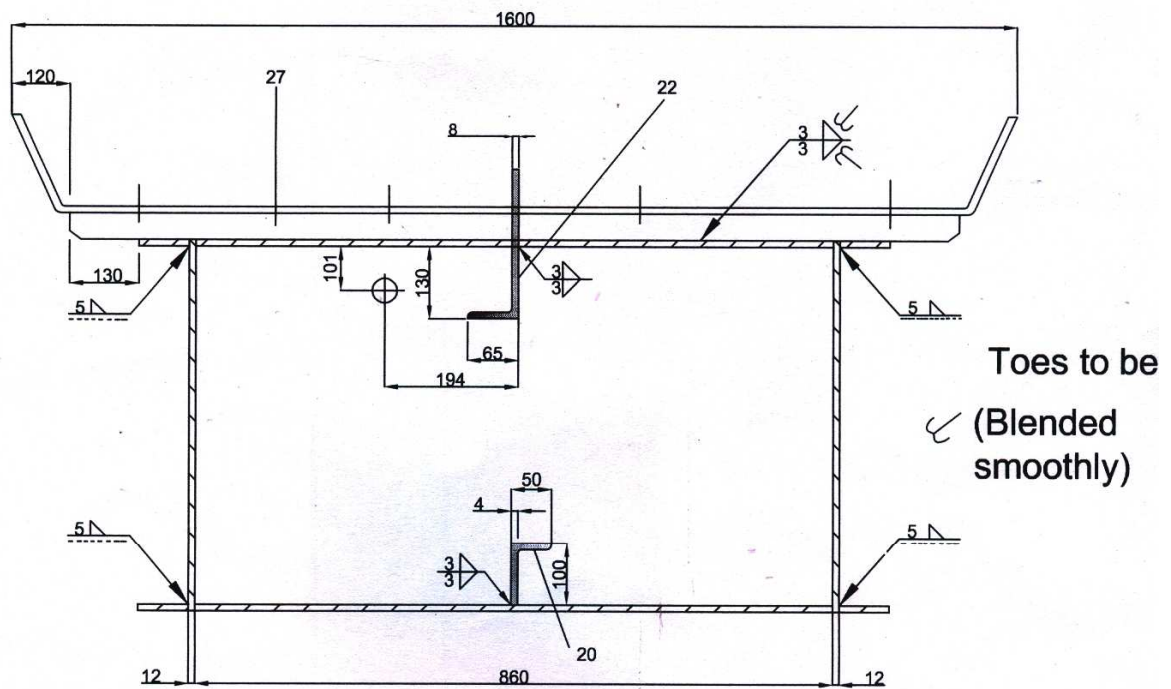
1. Fillet weld

Joint item no. 27

Sheet Metal - (Size- 15x120x1775)
With

Item No.- 22
Sheet Metal (Size- Angle sheet)
130x65x8

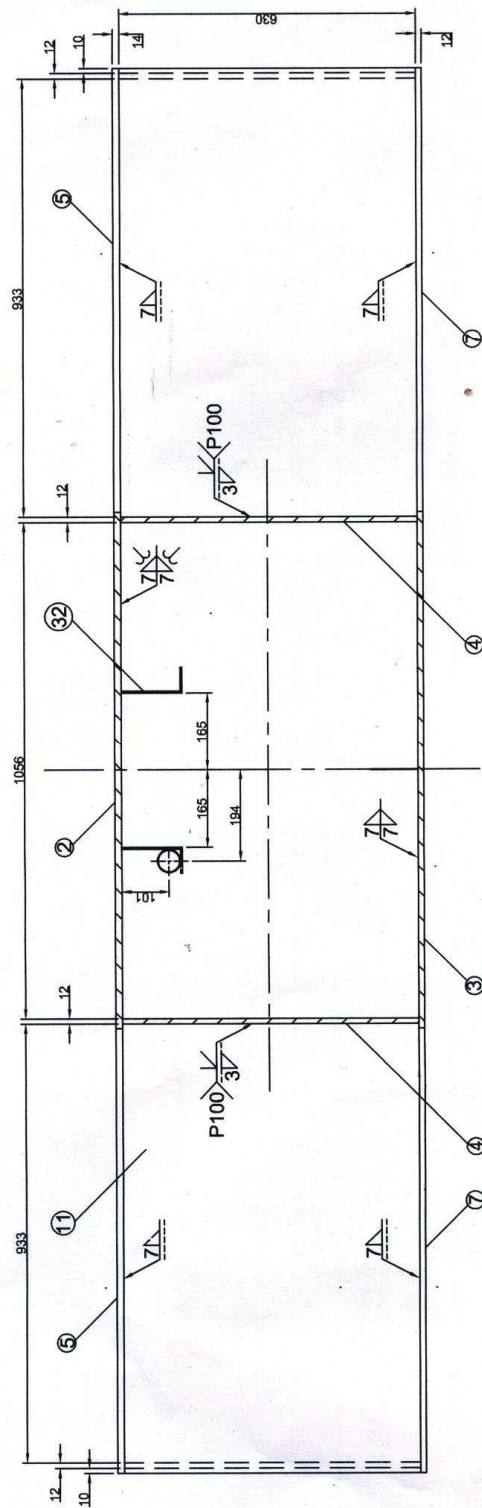
A-A



signature of firms Representative

Inspecting Authority

DRG. NO.-3WDH 140 CR-5.4600.0059-0



Weld joint toes to be blended smoothly

- ① Fillet weld joint item no. 11-12x630x2990 with item no. 5-14x1444x2990 & item no. 7-12x1444x2990.
- ② Double fillet weld joint item no. 3-12x1100x13020 with item no. 4-12x630x13630.
- ③ Double fillet weld joint toes to be blended smoothly with item no. 2-14x1100x13520 & item no. 32-130x65x8 angle steel.
- ④ One side bevel & one side fillet joint item no. 4-12x630x13630 with item no. 5-14x1444x2990 & item no. 7-12x1444x2990.
- ⑤ One side bevel & one side fillet joint item no. 4-12x630x13630 with item no. 2-14x1100x13520 & item no. 3-12x1100x13020.

Inspecting Authority

DRG. NO.-3WDH 140 CR-5.4600.0059-0

Technical drawing of a mechanical part, likely a shaft or rod, showing a cross-section and a side view. The cross-section is a circle with a diameter of 12. The side view shows a shaft with a diameter of 122 and a shoulder with a radius of 7. The drawing is labeled with circled numbers 2, 21, and 26.

Page 25

Section' V' of View F-F of Boom
DRG No- 3 WDH140 CR-5. 5.4600.0059-0

Technical drawing of a boom head assembly. The drawing includes the following components and dimensions:

- Item no.-04 of Boom Head:** Points to the vertical structural member.
- Item no-02:** Points to the horizontal structural member.
- Item no-22:** Points to a curved section with a radius of $R15$.
- Item no-26:** Points to a vertical structural member at the bottom.
- Dimensions:**
 - 14 (vertical dimension at the top left)
 - 30 (horizontal dimension at the top left)
 - 35 (angle dimension at the top left)
 - 40 (horizontal dimension at the top right)
 - 40 (horizontal dimension at the top right)
 - 29 (vertical dimension at the bottom left)
 - R042X2 (curved dimension at the bottom left)
- Other features:** The drawing shows various lines, including solid, dashed, and hatched areas, representing different parts and materials of the assembly.

Inspecting Authority

WELD MAP

SECTION-" W" OF VIEW -FF OF (BOOM)

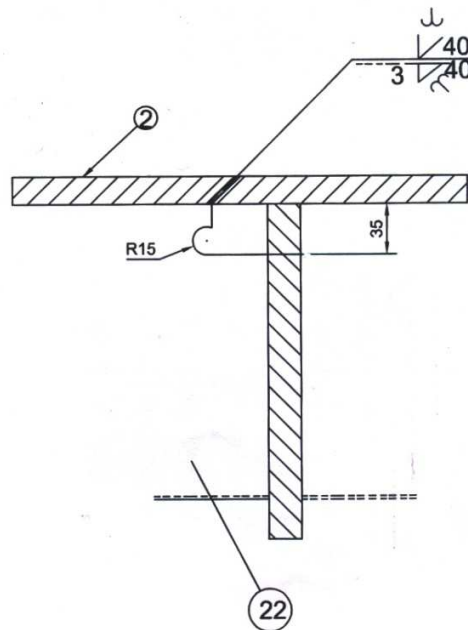
DRG. NO.-5.4600.0059-0

SINGLE BEVEL & FILLET JOINT(both side toes to be blended)

item 2 of Drg.No.-5.4600.0059-0
sheet metal 14x1100X13520.

with

item no. 22 of (Drg.No.-5.4600.0059-0)
sheet metal (ANGLE STEEL 130X65X8)



Signature of Firm Representative

Inspecting Authority

WELD MAP

SECTION-" X" OF VIEW -"FF" (BOOM)

DRG. NO.-5.4600.0059-0

SINGLE BEVEL BUTT JOINT

item 4 of boom head (Drg.No.- 5.5401.0001-0)
sheet metal 14x858x1100.

with

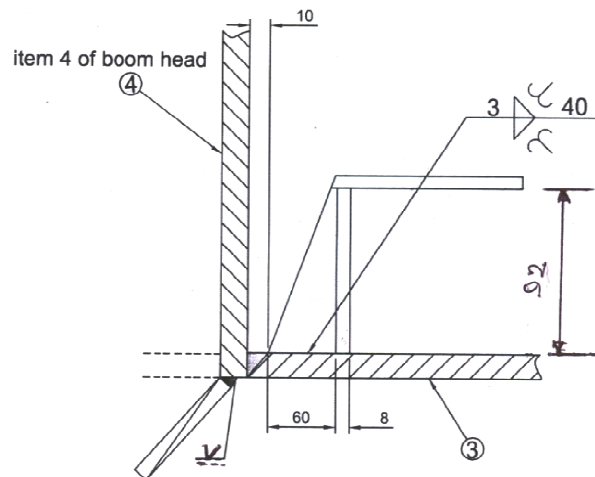
item no. 2 of (Drg.No.-5.4600.0059-0)
sheet metal 14x1100x13520.

&

item no. 3 of (Drg.No. 5.4600.0059-0)
sheet metal 12x1100x13020

&

item no.4 of (Drg.No. 5.4600.0059-0)
sheet metal 12x630x13630.



Signature of Firm Representative

Inspecting Authority

WELD MAP

Detail -'Y' of View "F-F" of Boom
Drg. No.-5.4600.0059-0

Fillet Joint

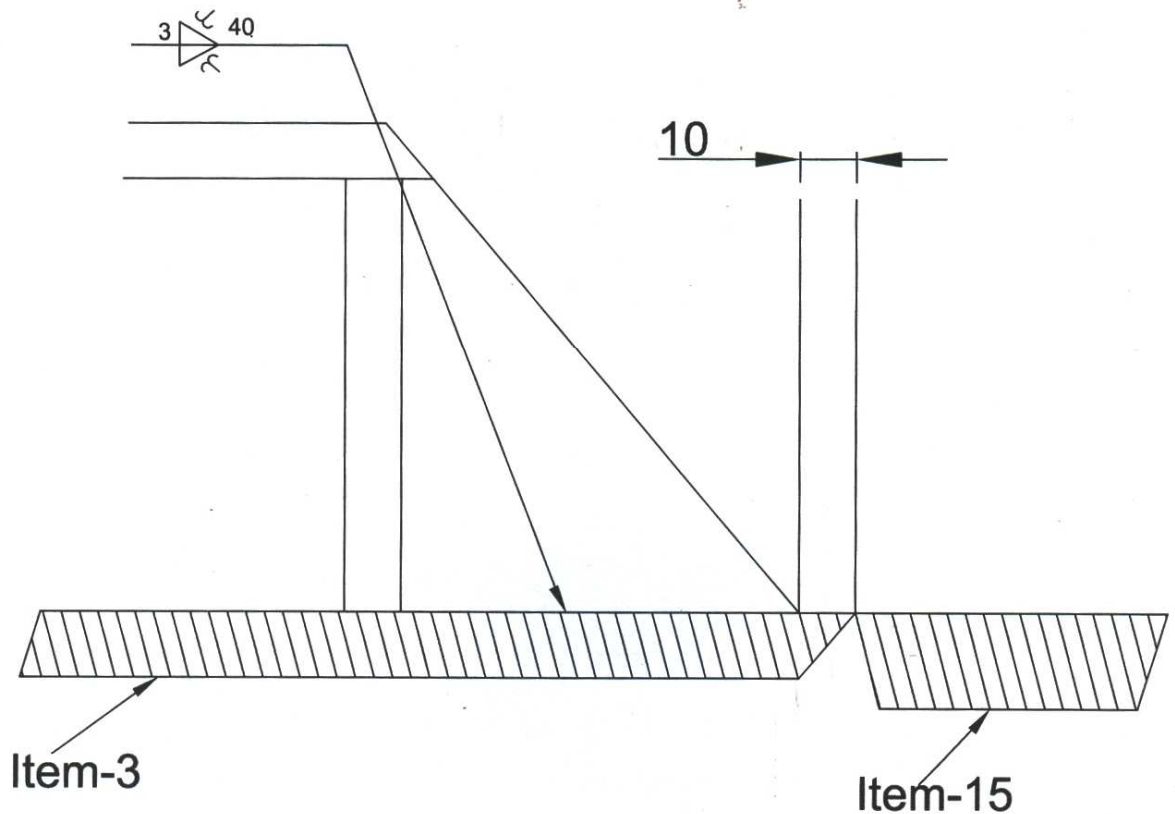
Item No.- 03

sheet metal - 12x1100x13020mm

with

Item No.- 15

sheet metal - 20x500x1100mm



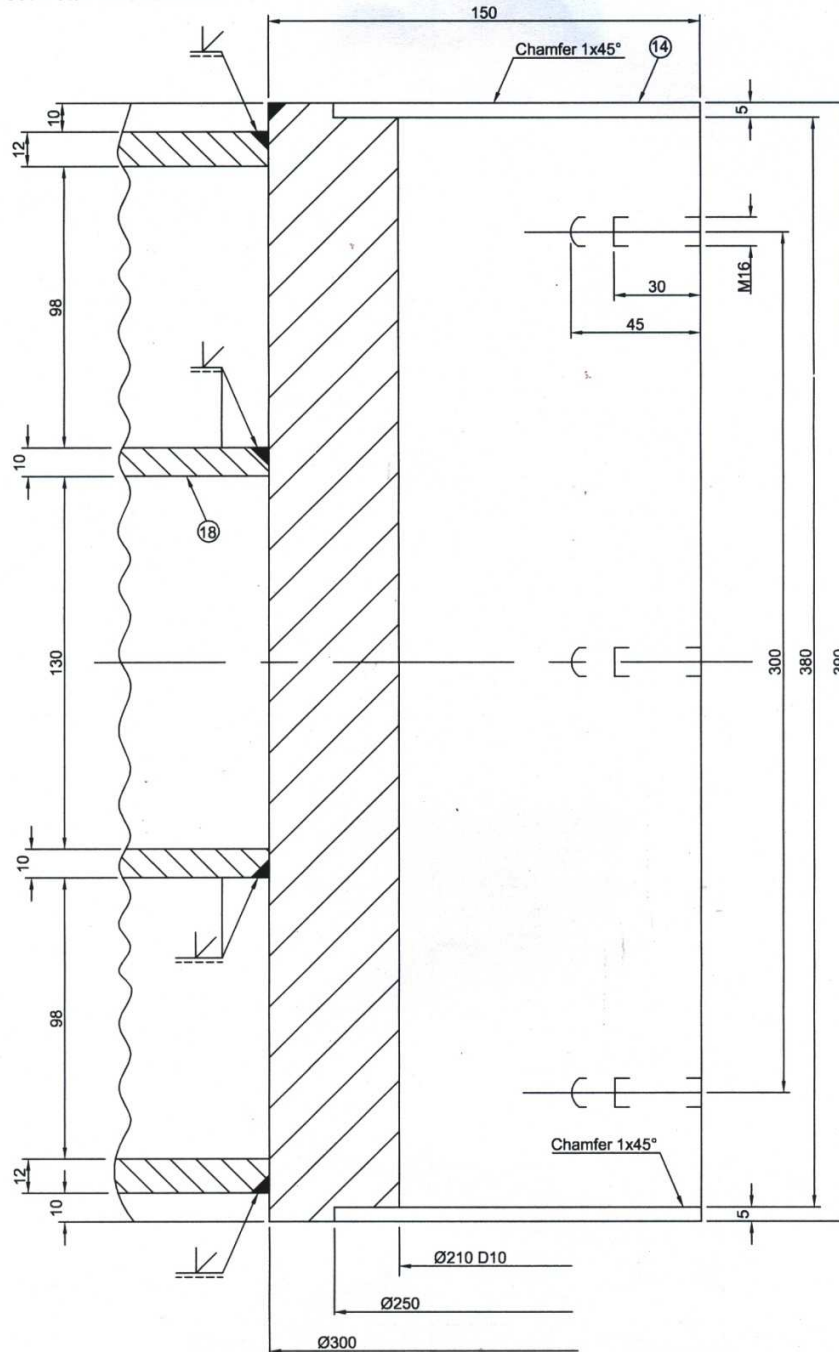
Signature of Firm Representative

Inspecting Authority

WELD MAP
SECTION 'Z' OF BOOM

DRG. NO.-3WDH 140 CR-5.4600.0059-0

Single bevel butt weld joint
 Item No.-18
 Sheet Metal-10x278x304
 with
 Item No.-14
 Sheet Metal-12x578.5x600



Signature of Firm Representative

Inspecting Authority

Inspection Plan(Check Sheet)

Item : Fabricated Jib/Boom for 140T HBD Crane
Specn. : JMP/CR/140T/03
Amd. :
Drg. No. & Alt :

-
1. Name of Component :
 2. Firm's Name :
 3. Date (Period) of Inspection :
 4. Contract Details :
 - a) Purchase Order No. & Date :
 - b) Order placing Authority :
 - c) Specification No. as P.O. :
 - d) Drawing No. as per P.O. :
 5. Quantity on Order :
 6. Quantity offered for Inspection :
 7. Consignee :
 8. Validity of D.P. of P.O. :
 9. Remarks on adherence to Firm's QAP :
 10. Remarks on calibration of Measuring Instruments & Testing Facilities :
 11. Remarks on availability of latest copies of Specification & Standards referred. :

Signature of firms Representative

Inspecting Authority

CHECKS ON MANUFACTURING QUALITY

1. Raw Material		
Remarks of Inspector on quality of raw material to be checked from internal inspection records.		
i	Whether the firm has procured the steel plates in accordance with para-5(a) of QAP	
ii	Whether the firm has correlated the test certificates with the stamping on steel plates.	
iii	Whether the chemical composition and mechanical properties of steel plates used for fabrication of Jib as given in these certificates conform to the material specified in the drawings or their alternatives, as applicable.	
iv	Whether the internal tests have been carried out by the firm from the steel plates for conformity to the prescribed material specification, to ensure quality.	
v	Whether all plates have been checked visually for surface defects such as cracks, dents, pitting, bent, rust, scales and records have been maintained.	
vi	Whether the plates have been subjected to ultrasonic test on the entire surface for detection of sub-surface defects and ultrasonic testing is carried out as per ASTM A: 578 III using angular / normal probes.	
vii	Remarks of the Inspector on check of the test certificates & internal test records of steel plates.	
viii	Remarks of the Inspector on check of the visual inspection record of steel plates for defects such as dents, pitting & straightness of steel plates.	
ix	Remarks of the Inspector on check of the ultrasonic testing record of steel plates for sub-surface defects.	
x	Remarks of the Inspector on check of raw material and deviation in material specification of raw material, if any.	
2. Welders' Qualification		
i	Remarks of the Inspector on qualification of welders employed for welding of Jib.	
3. Quality of Weld Joints		
Remarks of inspector on quality of weld joints to be checked from internal inspection records		
i	Whether welding of Jib done by MIG welding.	
ii	Whether consumables used for welding conform to JMP approved brands/make.	
iii	Remarks on Dye Penetrant Test on all weld lengths.	
iv	Remarks on Magnetic Particle Test of critical areas.	
v	Remarks on Radiography / Ultrasonic test of butt welds.	

Signature of firms Representative

Inspecting Authority

4. Stress Relieving		
Remarks of Inspector on check of the internal inspection records of the firm on stress relieving of Jib.		
i	Whether all rework including rectification welding and straightening operations has been completed before stress relieving.	
ii	Whether stress relieving has been carried out in oil fired / electric furnace equipped with thermocouples and graphical recorders.	
iii	Whether distortion of Jib was observed after stress relieving to be checked from dimension check sheets	
iv	Whether stress relieving procedure / cycle conforms to the recommended stress relieving procedure placed at Annexure-1 as checked by the graphical record and certificate of stress relieving	
5. Dimensional Checks to be conducted by the Inspector "After Machining of Jib"		
i	Whether detailed dimension check sheets have been prepared by the firm for stage inspection during manufacturing of Jib.	
ii	Check dimensions and geometry of Jib after machining as per attached dimension check sheets.	
ii	Whether all the dimensions of Jib are within the specified limits.	
6. Trammeling of Jib to be checked by the Inspector		
i	The Inspector shall check the trammeling of Jib for alignment and squareness on the marking table and record dimensions in the attached dimensional check sheets.	
ii	Remarks on trammeling of Jib.	
7. Identification Marking		
i	Whether identification marking conforms to specification as per Sec-C ,Part-II (a),para-13 of QAP.	
8. Painting of Jib		
i	Remarks on painting of Jib. Whether painting conforms to Sec-C, Part-II (a), para -14 of QAP.	
09. Recommendation / Remarks of Inspector		

Signature of firms Representative

Inspecting Authority

STANDARD TEST CERTIFICATE FORMAT FOR INDUSTRIAL RADIOGRAPHY

Inspection/Visit Note No.		Stage of Manufacturing	
Description of Job		Base Material	
Details of Related Drawing No.		Approximate Size of the Job (LxWxH)	
Items/Parts No. Assigned		Items/Parts No. Completed	
Details of Industrial Radiography			
Name of the Firm doing Industrial Radiography			
Date(s) of Radiography		Type of Radiography Source Used	
Type of Machine/Unit/Camera Used		Sr. No. of Source Used	
Strength of the Source Used		Details of Exposure Taken	
Penetrating Thickness in mm		Technique(s) Used	
Type of Image Quality Indicator Used		Source to Film Distance in cm (SFD/FFD)	
Type of the Film Used		Size of the FSC Used	
Sensitivity Obtained in %		Optical Density Obtained	
Details of Raw Materials Used			
Recommended Standard Reference Code: IIW Standard; Acceptance Criteria as per RDSO/LKO IIW-Blue Standard OR			
Recommended Standard Reference Code: ASTM Specification E390; Acceptance Criteria Severity Level II			

The observations with all relevant details regarding the job and respective advice(s) are enumerated below:

Sl. No.	Joint Identification No.	Segment No.	Status (Fresh/ Rectified)	Defect(s) Definition	Defect(s) Gradation	Concluding Remarks

Summary:

Total No. of Exposures Taken:

Total No. of Length Covered:

Signature of the Firms Representative

Signature of the Inspecting Authority

Note: To be printed on letter head of the Firm.

STANDARD TEST CERTIFICATE FORMAT FOR ULTRASONIC SCANNING

Inspection/Visit Note No.		Stage of Manufacturing	
Description of Job		Base Material	
Details of Related Drawing No.		Approximate Size of the Job (LxWxH)	
Items/Parts No. Assigned		Items/Parts No. Completed	
Details of Ultrasonic Scanning			
Name of the Firm doing Ultrasonic Scanning			
Date(s) of Ultrasonic Scanning		Date of Commissioning of UFD Unit	
Details of UFD Unit Used		Sr. No. of UFD Used	
Performance Checking Parameters as per IS-12666-2006			
Details of Calibrated Bars in m		Details of Calibrated IIW V1 & V2 Block	
Description of Probe Used (Angle/ Frequency/ Dimension)		Length of BNC Cable Used	
Sensitivity of the UFD		Range Decided in mm	
Velocity in m/s		Rejection in %	
Energy/Gain Utilized in dB		Details of Gate(s), if any	
Surface condition of the Job offered		details Couplant Used	
Recommended Standard Reference Code: IS 4260 OR			
Recommended Standard Reference Code:ASTM-A435/A435M-90(R2007) for Plates thickness up to 63.00 mm			
Recommended Standard Reference Code:ASTM-A578/A578M-96(R2001) for Plates thickness above 63.00 mm			
Recommended Standard Reference Code:ASTM-A609/A578M-91(R2007) for Castings of Low Alloy Steel			
Recommended Standard Reference Code:ASTM-A609/A578M-91(R2007) for Forgings Articles			
Recommended Standard Reference Code: RDSO-MC-04/2005 for Butt-Welded Joints			

The observations with all relevant details regarding the job and respective advice(s) are enumerated below:

Sl. No.	Joint Identification No. or Location of Scanning	Segment No.	Status (Fresh/ Rectified)	Defect(s) Definition	Defect(s) Gradation	Concluding Remarks

Signature of the Firms Representative

Signature of the Inspecting Authority

Note: To be printed on letter head of the Firm.

STANDARD TEST CERTIFICATE FORMAT FOR MAGNETIC PARTICLES TEST

Inspection/Visit Note No.		Stage of Manufacturing	
Description of Job		Base Material	
Details of Related Drawing No.		Approximate Size of the Job (LxWxH)	
Items/Parts No. Assigned		Items/Parts No. Completed	
Details of Magnetic Particles Test			
Name of the Firm doing Magnetic Particles Test			
Date(s) of MPT		Date of Commissioning of MPT Unit	
Type of Magnetic Powder Used		Sieve Size of the Magnetic Powder Used	
Details of MPT Unit Used		Sr. No. of MPT Used	
Sensitivity of MPT Unit		Test Method	
Type of Magnetization Used		Magnetizing Current Used	
Surface Condition of the Components (Smooth/Rough etc.)		Particulars of Demagnetization Process Adopted after Testing	
Recommended Standard IS: 5334			

The observations with all relevant details regarding the job and respective advice(s) are enumerated below:

Sl. No.	Joint Identification No. or Location of Testing (Sensitive Area)	Segment No.	Status (Fresh/ Rectified)	Defect(s) Definition, If any	Concluding Remarks

Signature of the Firms Representative

Signature of the Inspecting Authority

Note: To be printed on letter head of the Firm.

STANDARD TEST CERTIFICATE FORMAT FOR DYE-PENETRATION TEST

Inspection/Visit Note No.		Stage of Manufacturing	
Description of Job		Base Material	
Details of Related Drawing No.		Approximate Size of the Job (LxWxH)	
Items/Parts No. Assigned		Items/Parts No. Completed	
Details of Dye-Penetration Test			
Name of the Firm doing Dye-Penetration Test			
Details of DP Kit Used (i.e Make, Mfg. Date & Supply)			
Sensitivity of the Penetrant Used		Date(s) of DPT	
Surface Condition of Weld Geometry		Temperature of the Job	
Penetrant Dwelling Time			
Recommended Standard IS: 3658			

The observations with all relevant details regarding the job and respective advice(s) are enumerated below:

Sl. No.	Joint Identification No. or Location of Testing (Sensitive Area)	Segment No.	Status (Fresh/ Rectified)	Defect(s) Definition, If any	Concluding Remarks

Signature of the Firms Representative

Signature of the Inspecting Authority

Note: To be printed on letter head of the Firm.

Material Marking & Cutting Clearance Report										
VENDOR NAME:						P.O. NO.:				
RAW MATERIAL CLEARANCE REPORT:						CUSTOMER:				
PROJECT:						DESCRIPTION:				
W.O. NO.:						DATE:				
SL. No.	PLATE SIZE	SPECIFICATION & GRADE	HEAT NO.	PLATE NO.	MTC NO.	SIZE	DRAWING NO.	ITEM NO.	QTY	T.C. REVIEWED DATE
<p>The material specification, grade, heat No. & plate No. to be transferred to the cut plates & off cut piece & stamped by MANUFACTURER Quality Control after verifying the original marking on the plate & Co-relating with MTC before cutting plate.</p>										
FIRM/QC										

STAGE INSPECTION REPORT

P.O. No.Date
Description Client
Equipment No./ Item No. W.O. No.
Drawing No.
Inspection Authority

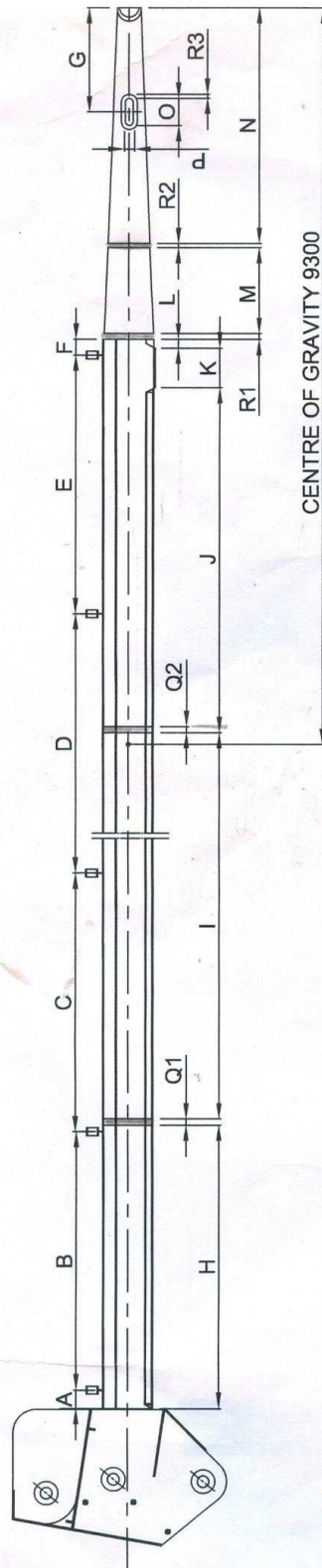
Date of Inspection	Description	Qty.	Stage Vendor	Stage Inspection Agency	Remark, if any

DIMENSIONAL REPORT

Authority		Report No.		Date	
P.O. No. - Customer – W.O. No. -			Description – Drawing No. Quantity -		
Sl. No.	Specified Dimension (mm)	Location	ACTUAL DIMENSION		
			Sl. No.	Sl. No.	Sl. No.
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					
13.					
14.					
15.					
16.					
17.					
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General Observation:					
					Inspected by

DRG. NO. 3WDH140 CR-5.5.4600.0059-0

BOOM



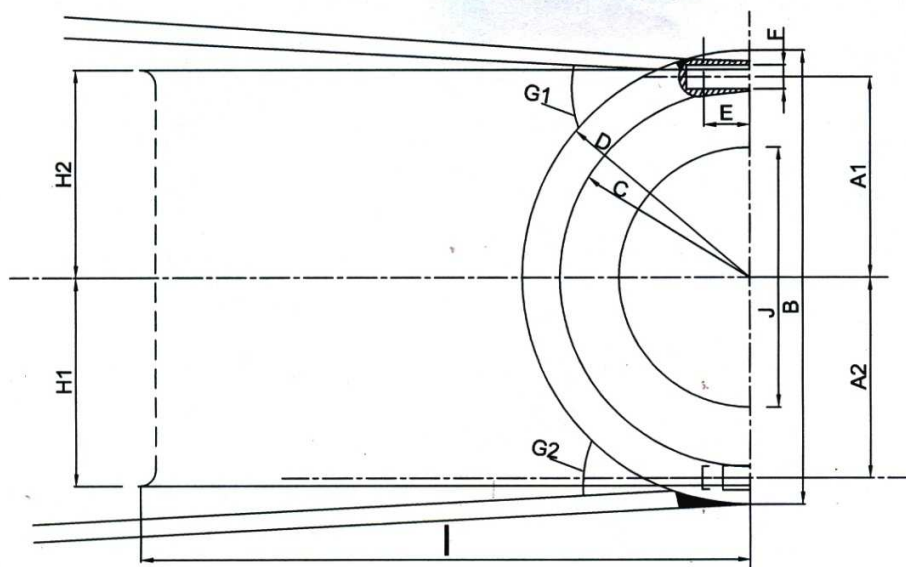
SL. NO.	NOTATION	DRG. DIMENSIONS	OBTAINED DIMENSIONS	REMARKS
1	A	0230		
2	B	3300		
3	C	3300		
4	D	3300		
5	E	3300		
6	F	0200		
7	G	1325		
8	H	3614		
9	I	5000		

SL. NO.	NOTATION	DRG. DIMENSIONS	OBTAINED DIMENSIONS	REMARKS
10	J	4390		
11	K	500		
12	L	110		
13	M	1200		
14	N	3000		
15	O	350		
16	P	120		
17	Q1,Q2	8		
18	R1,R2,R3	12		

Signature of the Firms Representative

Signature of the Inspecting Authority

FOR BOOM FORK END

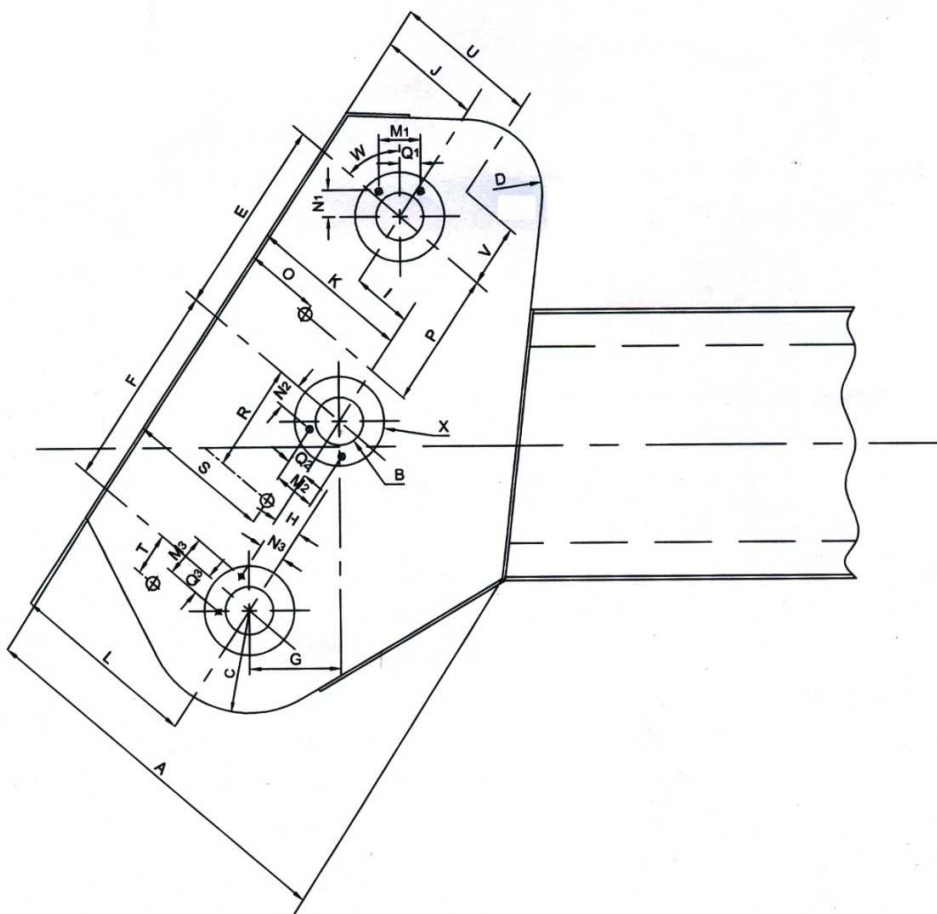


SL NO.	NOTATION	DRG.DIMENSION	OBT.DIMENSION	REMARKS
1	A1/A2	132.5 \pm 0.2		
2	B	300		
3	C	R125		
4	D	R150		
5	E	30		
6	F	M16		
7	G1/G2	R80/R80		
8	H1/H2	137.5/137.5		
9	I	400		
10	J	210		

Signature of the Inspecting Authority

BOOM HEAD (LEFT)

DRG. NO.-3 WDH 140 CR-5.5.4600.0059-0 & 5.5401.001-0

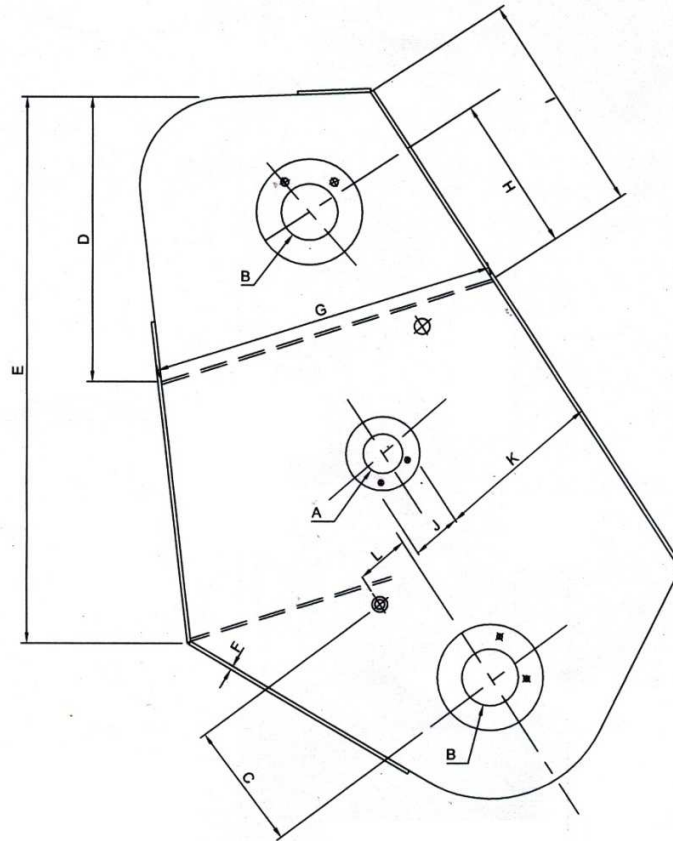


SL. NO.	NOTATION	DRG. DIMENSIONS	OBTAINED DIMENSIONS	REMARKS
1	A	1276.5		
2	B	Ø160H7		
3	C	R345		
4	D	R250		
5	E	655		
6	F	680		
7	G	253.66		
8	H	90		
9	I	200		
10	J	340±1		
11	K	540		
12	L	630±1		
13	M1,M2,M3	140		
14	N1,N2,N3	85		
15	O	250		
16	P	455		
17	Q1,Q2,Q3	70		
18	R	360		
19	S	480		
20	T	140		
21	U	491		
22	V	208		
23	W	49°		
24	X	Ø280		

Signature of the Firms Representative

Signature of the Inspecting Authority

BOOM HEAD (RIGHT)
DRG. NO.-3 WDH 140 CR-5.5.4600.0059-0 & 5.5401.001-0

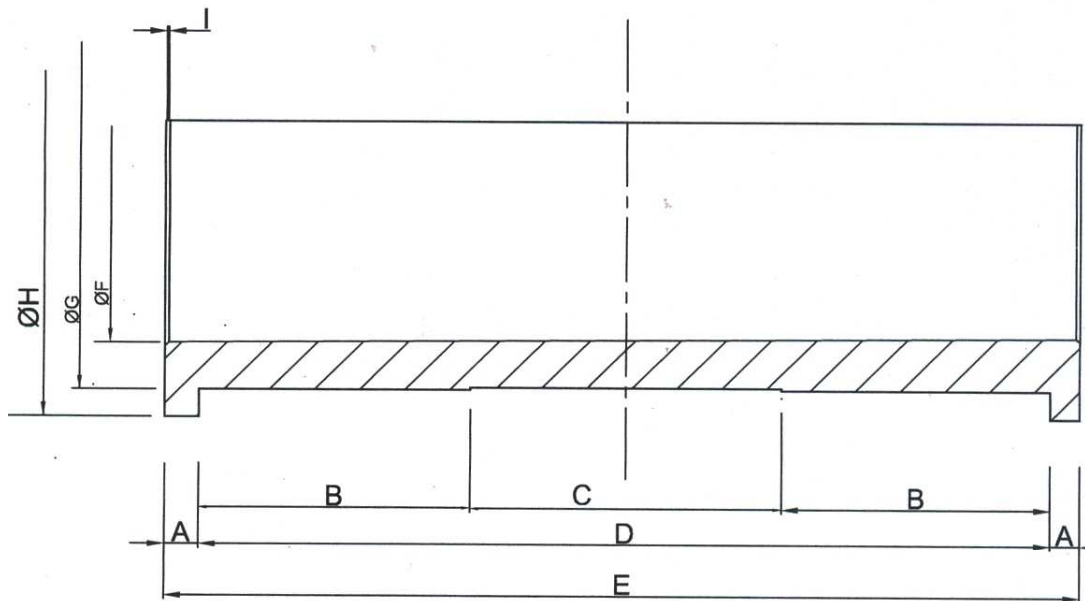


SL. NO.	NOTATION	DRG. DIMENSIONS	OBTAINED DIMENSIONS	REMARKS
1	A	Ø120H7		
2	B	Ø160H7		
3	C	350		
4	D	776		
5	E	1432		
6	F	14		
7	G	1017		
8	H	477		
9	I	702		
10	J	140		
11	K	470		
12	L	150		

Signature of the Firms Representative

Signature of the Inspecting Authority

BEARING SHELL
DRG NO.-3WDH140CR-5 2.7653.0066-3



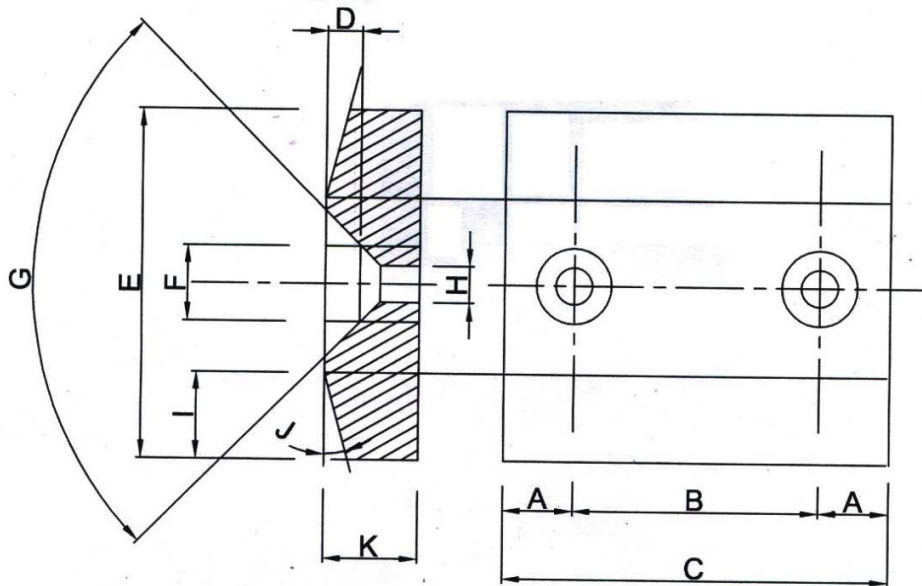
SL	NOTATION	DRG. DIMENSION	OBTAINED DIMENSION	REMARKS
1	A	10		
2	B	130		
3	C	120		
4	D	$380^{+0.1}_0$		
5	E	$400^{+0.3}_0$		
6	ØF	$\text{Ø}160\text{-D}10^{+0.305}_{+0.145}$		
7	ØG	$\text{Ø}210\text{-h}8^{+0}_{-0.072}$		
8	ØH	$\text{Ø}240$		
9	I	$1.2 \times 45^\circ$		

Signature of the Firms Representative

Signature of the Inspecting Authority

SLIDING PLATE

DRG. NO.-3WDH140CR-5 2.7655.0600-3



SL	NOTATION	DRG. DIMENSION	OBTAINED DIM.	REMARKS
1	A	20		
2	B	70		
3	C	110		
4	D	10		
5	E	100		
6	F	Ø21.5		
7	G	90°		
8	H	Ø10.5		
9	I	25		
10	J	15°		
11	K	27		

Signature of the Firms Representative

Signature of the Inspecting Authority

DIMENSIONAL CHECK SHEET

S.NO	DESCRIPTION	SPECIFICATION	ACCEPTABLE OR NOT	REMARKS
1	Straightness of Plates	Grade-K, IS: 2102 (Pt-II)		
2	Flatness to Horizontal Plane	Grade-K, IS: 2102 (Pt-II)		
3	Flatness to Vertical Plane	Grade-K, IS: 2102 (Pt-II)		
4	Visual Finishing	-		
5	Primer Coating	80 μ		
6	Metal Finish Painting	-		

Note: 1.Roundness /Radius should be checked by Gauge.
2. There shall not be any weld deposit in the critical zone of Jib/Boom.

Firm's representative

Inspecting Authority

ANNEXURE

A List of equivalent IS specifications corresponding to relevant DIN standard is given below.

Sl.No.	Material type	DIN/EN	Equivalent Indian/British material
1	ST-33	DIN 17100	ASTM A 106 Gr.B/IS : 1161 Yst 210
2	UST 37-2	DIN 17100	IS : 2062 Gr.B/E 410 C/2011
3	ST 52-3	DIN 17100	SAILMA 350 HI/IS :2062, E-350C
4	ST 50-2K	DIN 17100	E350 C/IS : 2062/11
5	RST 37-2	DIN 17100	IS : 2062 Gr.B/E 410 C
6	ST 37-2	DIN 17100	IS : 2062 Gr.B
7	ST 33-2	DIN 17100	IS : 1161 Yst 210
8	STE-460	DIN 17102	SAILMA 450/450HI/E450 BR IS : 2062
9	C45	DIN 17200	IS : 5517 45 C8
10	30 Cr4	DIN 17200	IS : 5517 40 Cr4
11	42 Cr Mo4V	DIN 17200	EN-19 BS : 970 (709M40)
12	UST 1203 ST 12	DIN 01623	IS : 513 Gr.D
13	ST-52	DIN 01629	E 350 C/ IS : 2062/11
14	ST-37	DIN 01652	IS : 2062 Gr.B/E 410 C
15	30CrNiMo8V	DIN 17200	EN-24 BS 970 (817 M 40)
16	C45 K	DIN 01652	IS : 5517 - 45C8
17	L415 MB	DIN 10208	SAILMA 450HI/ IS : 2062,E450 BR

The above specification should also be available with the manufacturers.