

Bharat Heavy Electricals Ltd., Piping Centre, Chennai – 600 017		
Packaging Instructions for Piping Components	Doc. No PC: PKG:01	
	Rev No: 00 Date : 28 /05/ 2014	No of Sheets : 24

PACKAGING INSTRUCTIONS FOR PIPING COMPONENTS

PC: PKG: 01

Revision summary

Rev No	Revision Details	Issued on
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Prepared by	Reviewed & Approved by
	
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1. SCOPE

This procedure elicits the general requirements to be complied with for packaging of piping components. The packaging is intended to preserve and protect the contents.

The handling, storage, cleaning, packaging, and preservation of items shall be controlled to prevent damage or loss and to minimize deterioration.

2. PACKAGING

This procedure contains requirements for packaging of items for protection against corrosion, contamination, physical damage, or any effect that would lower the quality or cause the components to deteriorate during the time they are shipped and stored at sites.

Items shall be inspected for cleanliness immediately before packaging. Dirt, oil, residue, metal chips or other forms of contamination shall be removed.

Adequate protection shall be provided against mechanical damage and atmospheric corrosion in transit and, for equipment suitable for outside storage, for prolonged storage at the site prior to installation.

Water proof barrier material – high density polythene shall be used as a resistant to grease and water; it shall protect items from airborne and windblown soils.

Desiccants like silica gel to be used inside pipe components. Silica gel shall conform to IS 3401. The gel is to be packed in sachets placed at different positions inside the components for absorbing moisture. The quantity of silica gel shall be adequate for storage period of one year.

Components to be placed in such a way that metal to metal contact is avoided.

For mechanical components, (1) all openings shall be covered or plugged with substantial (1/2 inch minimum thick) one piece plywood or metal closures, securely fastened and suitable for prolonged exposure prior to final installation; (2) all tapped openings in equipment shall be plugged with plastic plugs to protect internal threads; and (3) all welding end connections shall be provided with adequate weld bevel protectors to protect from corrosion and physical damage.

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Austenitic stainless steel and nickel-based alloy materials shall be handled in such a manner that they are not in direct contact with carbon steel materials or with materials containing halogen, sulphur, zinc and lead.

Each components/item of stainless steel materials should be wrapped with high density polythene.

All equipment shall be packed, securely anchored (skid mounted when required) and weather protected for the shipment method adopted.

Temporary bracing or supports, marked and tagged for removal after equipment installation, shall be provided to prevent damage during shipment and shall be painted bright, fluorescent yellow.

3. Criteria for Selection of Packaging:

Packages are to be made according to categories listed in Table-6 (see page – 24), depending on the type of materials and size.

4. TYPES OF PACKAGING:

4.1 CRATES

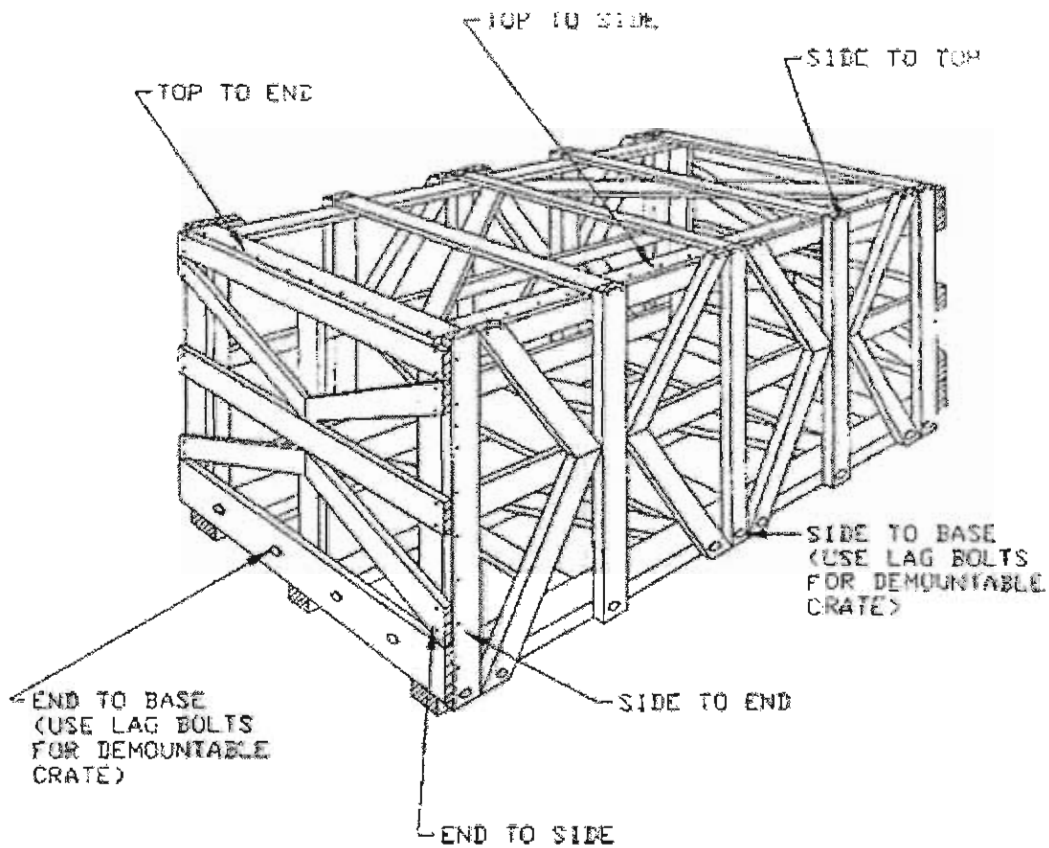
- These are to be made of seasoned wood and are intended for packaging heavy materials Viz., straight pipes and pipes with attachments.
- The crates are to be lined with hi-density polythene, to prevent entry of moisture.
- The dimensions of the crates are to be restricted to 20 x5x5 feet.
- Pipes up to OD 350mm are to be crated.
- Pipes are to be stacked inside the crate so that the weight of the pipe does not rest on branch stubs or carrier plates.
- Contents of the crate should not come in contact with each other or with the crating, and should be adequately cushioned to preserve the painting.
- The gross weight of the crate should not exceed 2 Tons.
- For further instructions refer ASTM D6039 Standard Specification for Open and Covered wood Crates.

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WOODEN CRATE



Max Net Load (KGS)	Length (mm)	Width (mm)	Height (mm)
2000	6096	1524	1524

All the dimensions shown in the above table are maximum inside dimensions.

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4.3 SADDLES

- Saddles are defined as profiled supports made of wood, and are used to cradle and support Tanks, pipe bends and pressure vessels.
- Ensure that the end chamfering of the bends are duly protected for the transit.
- Tanks are to be completely drained and dried.
- Adequate amount of the specified desiccant is to be placed inside the tank/ vessel.
- Ensure that all openings are covered and /or plugged.

4.4 CASES

- Other components such as fittings and Mitres are to be packed inside wooden cases.
- The insides of the cases are to be lined with hi-density polythene.
- Air vents to be provided in the cases for ventilation.
- Components to be placed in such a way that metal to metal contact is avoided.
- Small components like Fasteners, gaskets are to be packed in high density polythene covers and placed inside the wooden cases.
- Holes to be provided in the case floor to act as drains.

4.5 BUNDLES

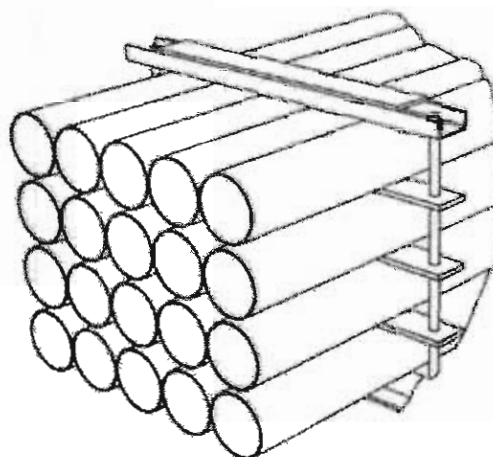
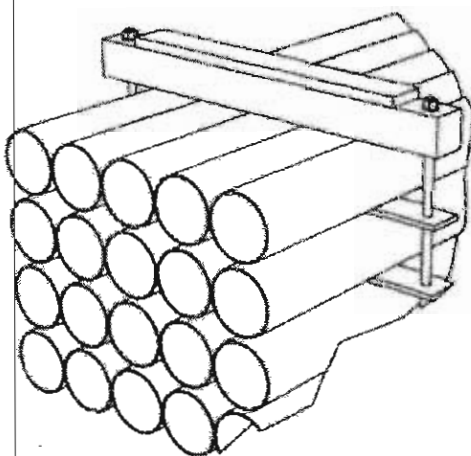
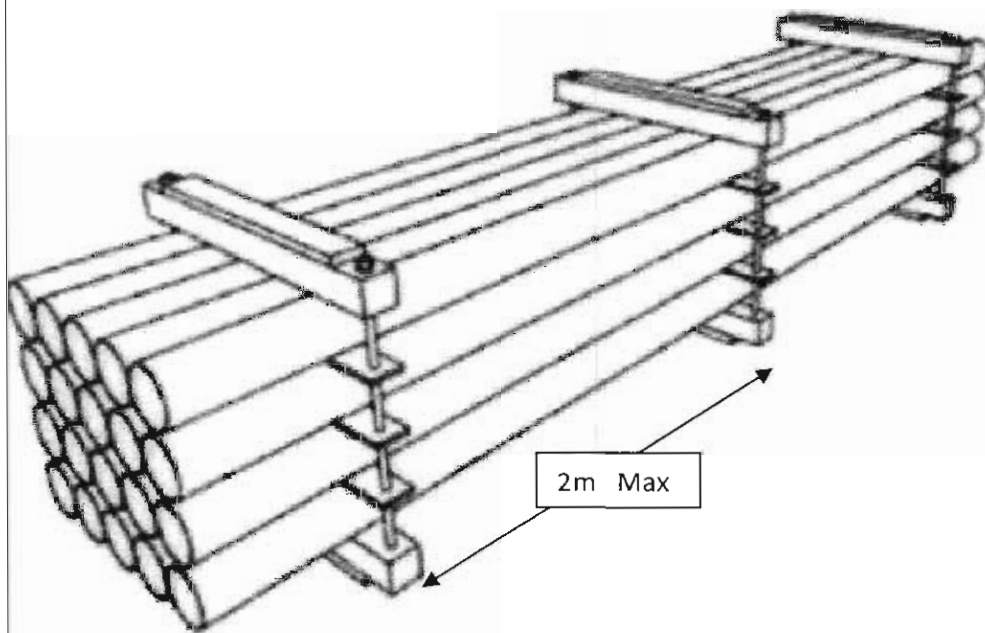
- Bundles are transportable units where a large number of straight pipes of the same diameter and even lengths are arranged securely and are fit to be lifted by cranes and also stacked.
- Pipe ends should be covered fully with plastic end caps.
- Pipes can be bundled only when they can bear the stack compression load without additional support.
- Clamps made of wood or steel clamps with wooden inserts are to be used.
- Clamps must be locked firmly so that the pipes cannot slide out of bundle.
- Bundle must be held together by at least three sets of clamps as indicated in the diagram.

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5. SLING PROTECTIONS

The lifting points of the case or crate or bundle must be equipped with sling protections suitable to the respective package gross weight.

6. MARKING AND LABELLING

Components and their containers shall be identified by marking. Shipping marks shall be on all sides of package. The shipping marks shall be at least 3 inches high where space permits. Markings are to be in black paint or ink depending on shade of the package surface.

Cautionary symbols to be stencilled in red waterproof paint or ink.

7. PACKING LIST

One complete packing list inside a watertight envelope must be affixed outside of each package and be covered by sheet metal. One more copy of the packing slip wrapped in polyethylene bag is to be kept inside the box at the pertinent place.

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8. General Instructions for packaging

- The quantity of Slides / Runners is 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 and cross sections of the Slides to be provided with their carrying capacity.
- The construction of bottom frame is as shown in the Figure-2.
- The construction of the top frame is, as shown in the figure -3.
- Thickness of the boards, used for sheathing for the top, sides and end panels, shall be 25 mm.
- The top of the Box consist of Beam supported on top traverse bar and sheathing, as shown in the figure- 3.
- The dimension of items 1, 2 f figure -3 shall be as table -3.
- Diagonal braces shall be used in packing cases with height, exceeding 600 mm as shown in the figure- 4.
- The angle between the lower (or) upper horizontal supports and diagonal braces, shall be in the range of 20° to 60° and if possible, this angle preferably be kept at 45°.
- If the height of the box exceeds more than 1400 mm the diagonal braces, shall cross each other and when this dimension exceeds 1800mm additional horizontal supports shall be provided as shown in figure-5 and figure- 6.
- Size of upper and lower horizontal supports and vertical supports, shall be as per Table 4 refer figure 7, 8, 9 & 10 for the arrangement.
- The cross section of end traverses bar (item -1) and thickness of bottom boards (item-2), shall be used as per table -5.
- All boxes measuring more than 600 mm height shall be constructed by assembling end, side and top shook's on a bottom, forming a complete enclosed Box (refer figure-11).
- Angle iron cleats shall be used for strengthening the joints, as indicated in figure -12.
- Boxes will be strengthened by steel bands to withstand transit damages.

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9. Reference drawings

1. SLIDE
2. LONGITUDINAL UNDER
SLIDE BOARD.
3. BOTTOM BOARD
4. CARRIER TRAVERSE BAR
5. INTERMEDIATE VERTICAL SUPPO
6. HORIZONTAL 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 SHEETING 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.

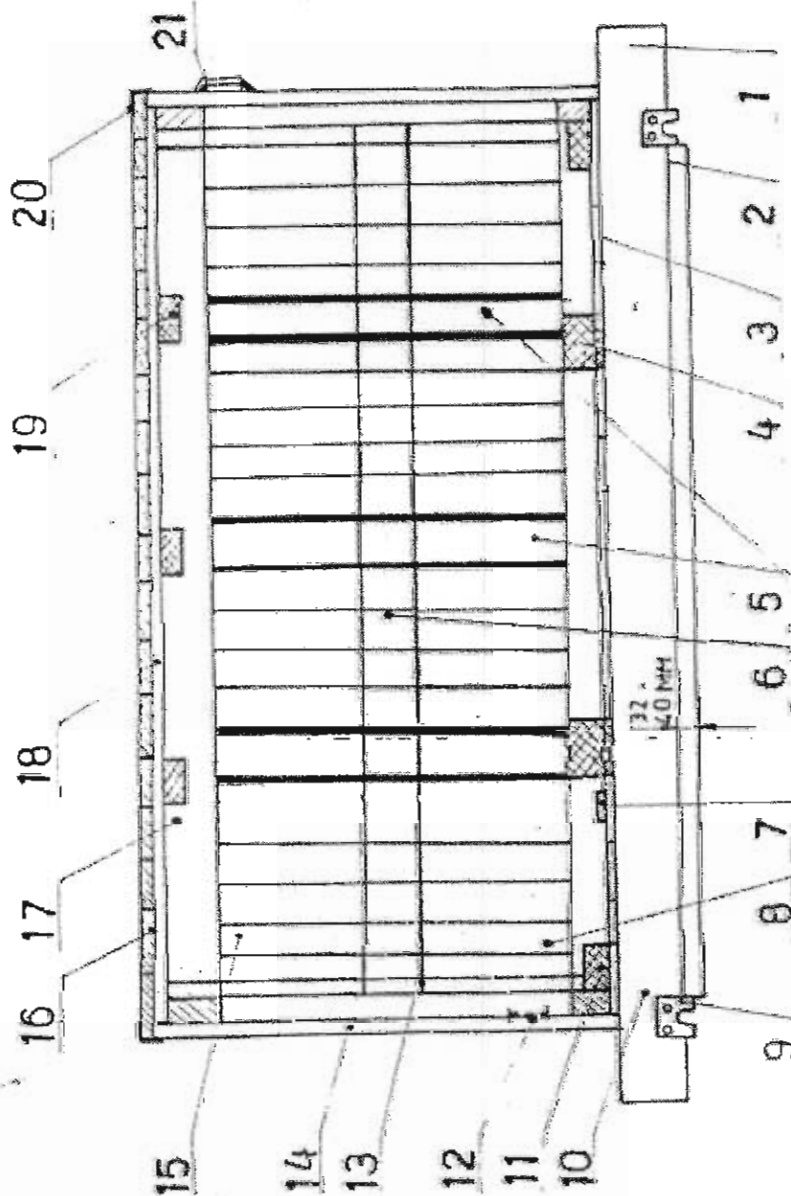


Fig. 1

NOMENCLATURE OF PARTS OF PACKING

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BOTTOM FRAME ARRANGEMENTS FOR TYPES
633, 654, 966, 1296, 1122, 1144, 1399, 1577

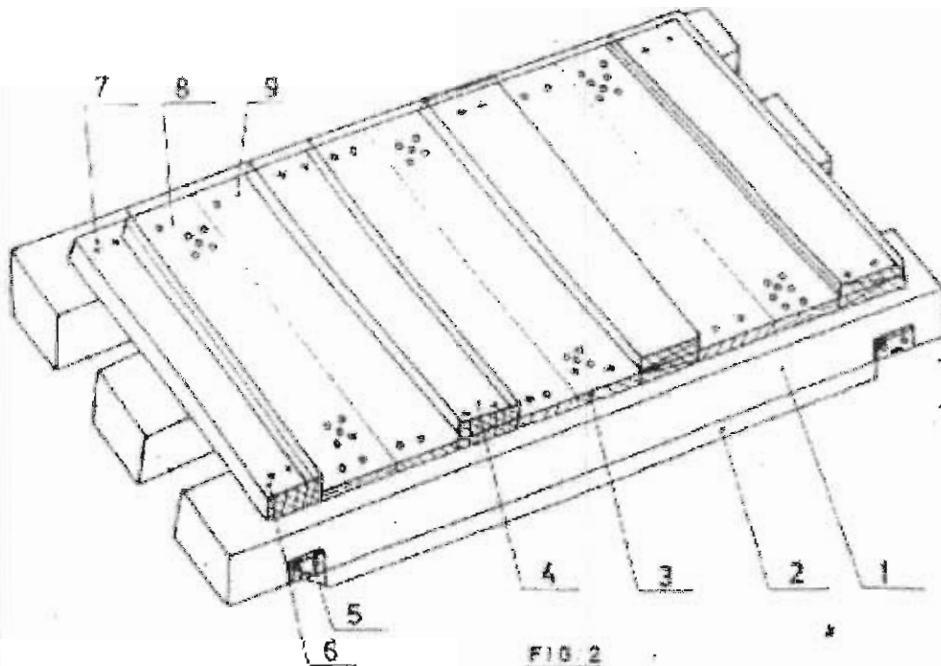


FIG. 2

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

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TOP FRAME ARRANGEMENT FOR TYPES
633, 654, 966, 1296, 1122, 1144, 1399 & 1577

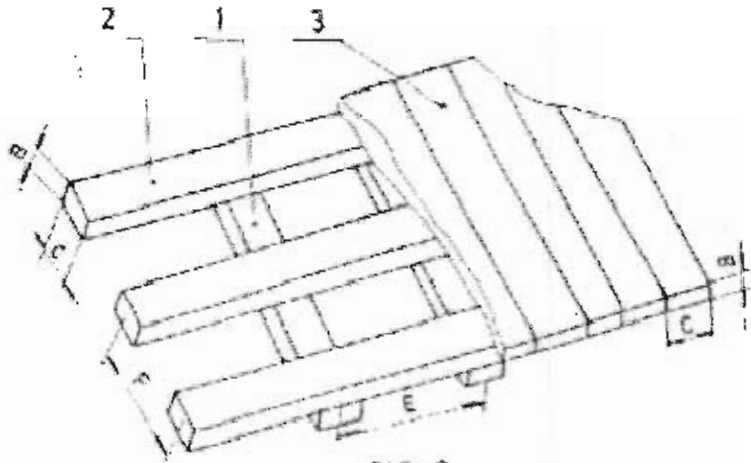


FIG-3

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

PROVISION OF DIAGONAL BRACING ARRANGEMENT

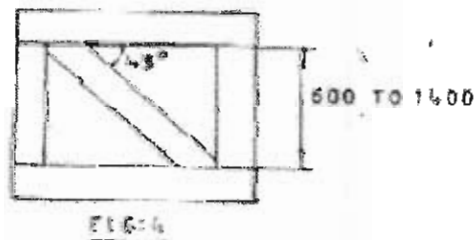


FIG-4

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ARRANGEMENT OF DIAGONAL BRACING &
HORIZONTAL SUPPORT

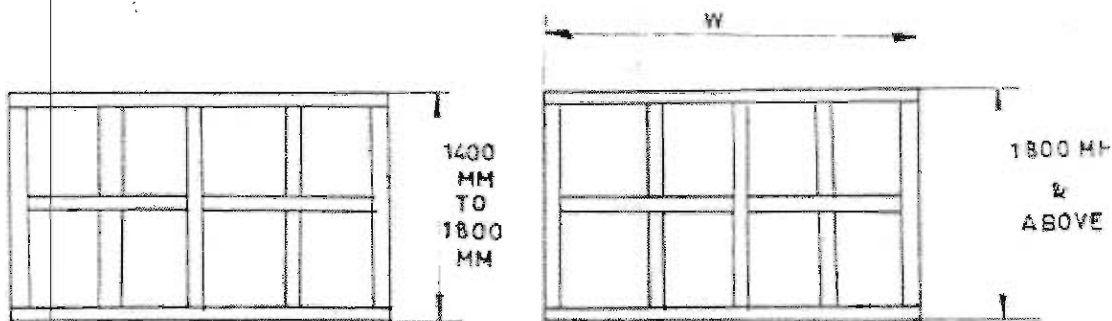


FIG. 5

FIG. 6

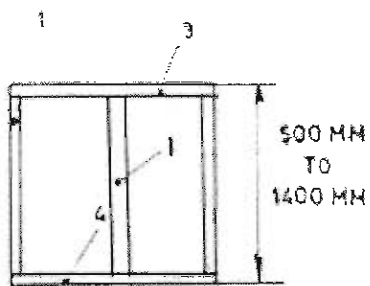


FIG. 7

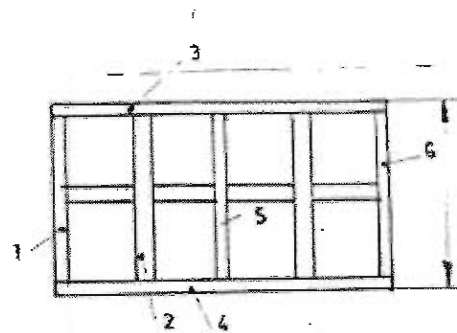


FIG. 8

1. VERTICAL SUPPORT

1, 2, 5, 6 - VERTICAL SUPPORT

3. UPPER HORIZONTAL SUPPORT

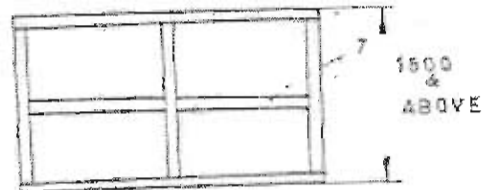
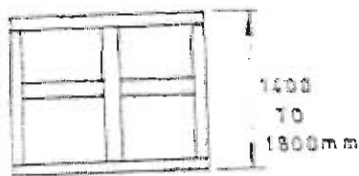
3 - UPPER HORIZONTAL SUPPORT

4. LOWER HORIZONTAL SUPPORT

4 - LOWER HORIZONTAL SUPPORT

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ARRANGEMENT OF DIAGONAL BRACING AND HORIZONTAL SUPPORT



7 – MIDDLE HORIZONTAL SUPPORT

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ARRANGEMENT OF PACKING CASE

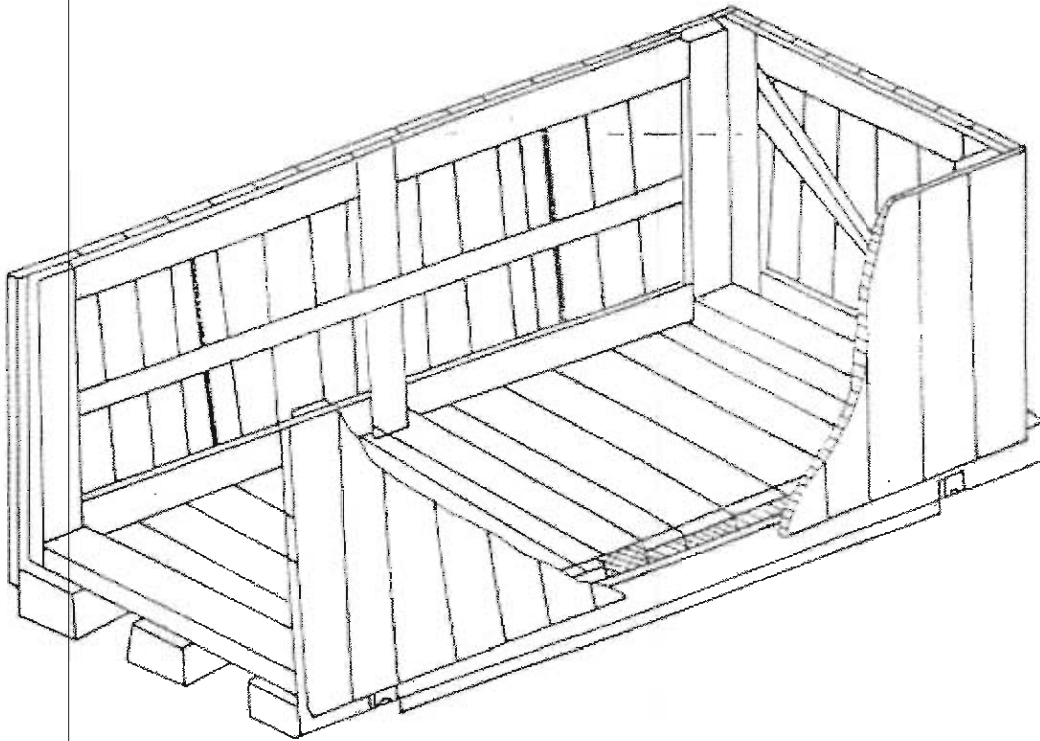


FIG : 11

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ARRANGEMENT OF ANGLE IRON CLEATS

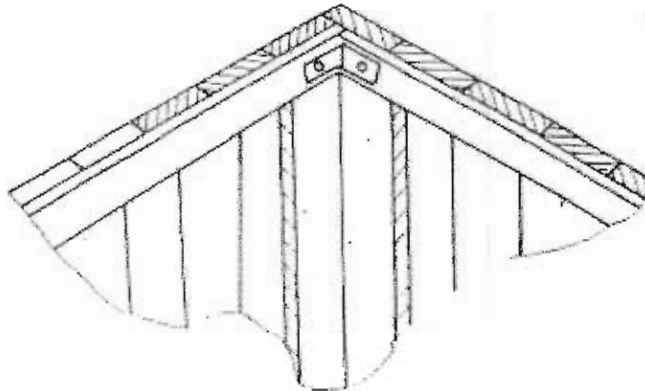


FIG:12

ARRANGEMENT OF C-CLAMPS AROUND CASES

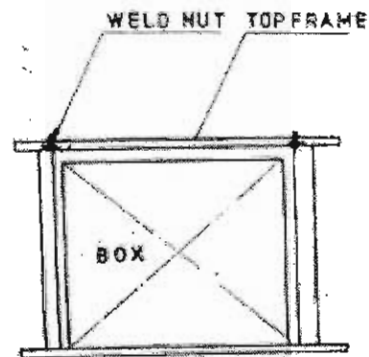
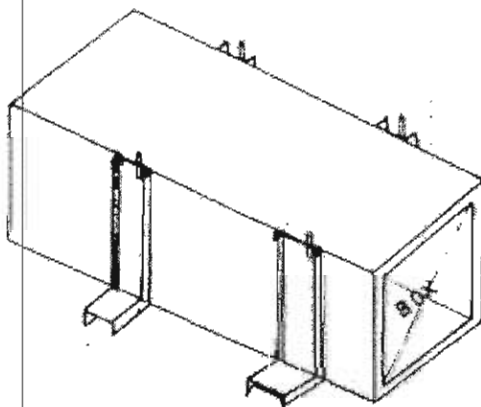


FIG:13

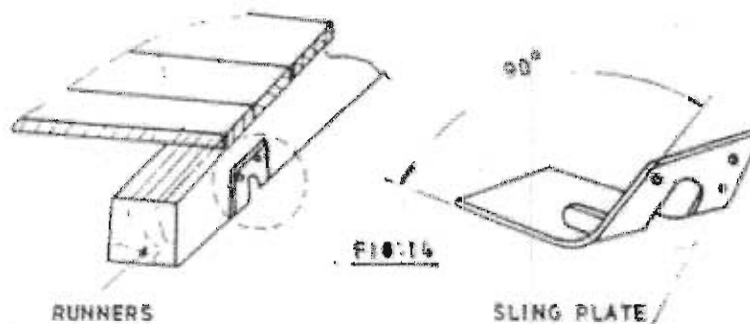
**Packaging Instructions for Piping
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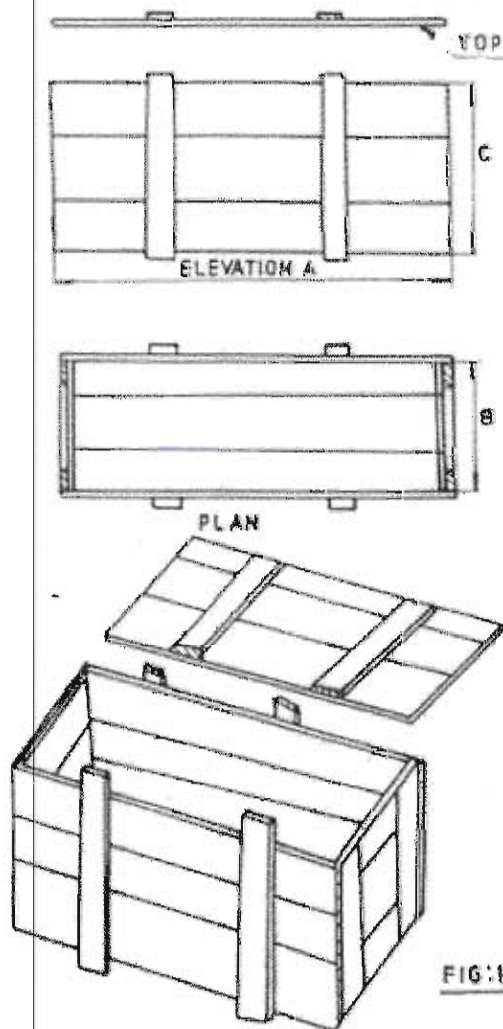
**ARRANGEMENT OF SLING - PLATE ON
CASES**



RUNNERS

SLING PLATE

ARRANGEMENT OF SMALL CASES



TYPE 654, 633

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

IN MM ONLY

1. BOTTOM BOARD
 2. CROSS TRAVERS BOARD
- A. UNIFORMLY DISTRIBUTED
B. CONCENTRATED LOAD

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The sizes of boxes given below are indicative. Actual sizes may vary according to size and positioning of component inside.

ANNEXURE – A
WOODEN BOXES

TYPE	L X B X H (MM)	CARRYING CAPACITY IN KGS
633	600x300x300	200
654	600x500x400	500
966	900x600x600	1000
1296	1200x900x600	2000
1122	100x200x200	300
1144	110x400x400	300
1399	1300x900x900	2500
1577	1500 X 700 X 700	1500

TABLE - 1

No. of slides	Length of slides	Weight in (kgs)	Types of loading
2	600 - 1800 mm	0 - 1000	Two slides for central loading near the ends or uniformly distributes load.
3	1801 - 2500 mm	1001 - 5000	Three slides with load concentrates near the end or uniformly distributed load.

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TABLE - 2

LOAD	Length of slides						
	600	800	1000	1200	1300	1500	2000
	CROSS SECTION						
	B x C		c				
			b				
500	30 x 100	30 x 100	30 x 100	30 x 100	30 x 100	30 x 100	30 x 100
800	30 x 100	30 x 100	100 x 100	100 x 100	100 x 100	100 x 100	100 x 100
1000	30 x 100	100 x 100	100 x 100	100 x 100	100 x 100	100 x 100	100 x 100
1500	100 x 100	100 x 100	100 x 100	100 x 100	100 x 100	100 x 100	100 x 100
2000	100 x 100	100 x 100	100 x 100	100 x 100	100 x 100	100 x 100	100 x 100
2500	100 x 100	100 x 100	100 x 100	100 x 100	100 x 100	120 x 150	120 x 150
3000	100 x 100	120 x 150	120 x 150	120 x 150	120 x 150		

TABLE – 3

Distance between top horizontal scans dim 'f'	Distance between the axis of the traverse bar dimension 'E' in fig -3				
	500	600	700	800	900
	Size b x c				
700 – 1000 mm	30 x 100	30 x 100	30 x 100	30 x 100	30 x 100

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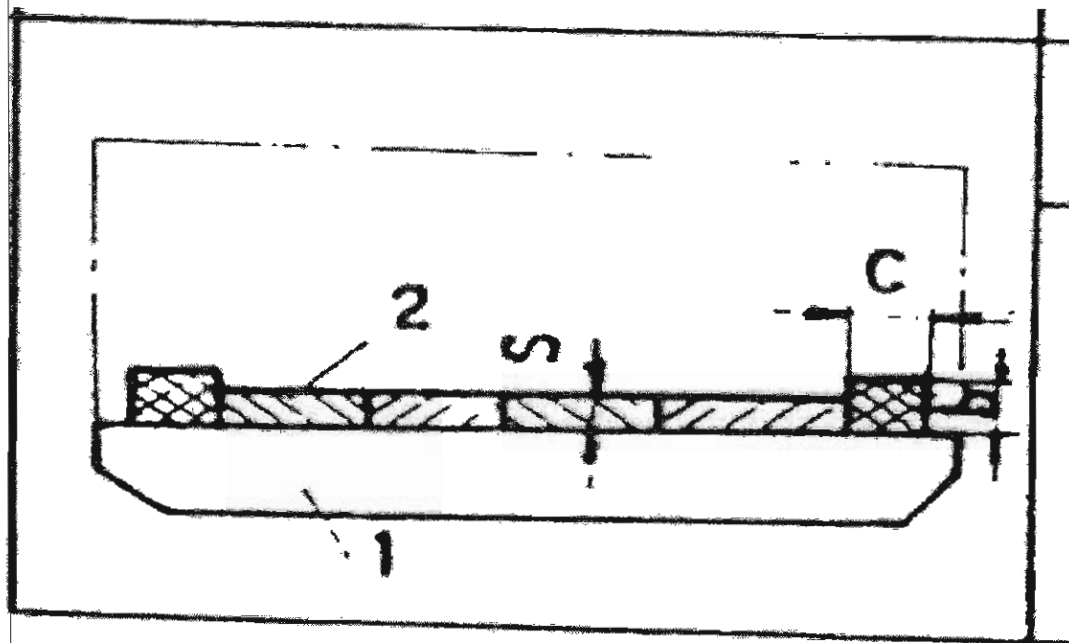
TABLE-4

End and side panels	Width of the panels	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

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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 the box	Cross section	S
Up to 3000	Above 1000 mm	100 x 100	25

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10. Cautionary symbols



FRAGILE, HANDLE WITH CARE



PROTECT FROM HEAT AND RADIOACTIVE SOURCES



USE NO HOOKS

NOTE: The design of heavy goods packages cannot always resist top lifting by grabhooks.



KEEP DRY

NOTE: Not all cases have waterproof internal liners; plywood used in the construction may not have a waterproof gluing.



THIS WAY UP

NOTE: Certain designs of small cases make it difficult to distinguish top from bottom.



CENTRE OF GRAVITY

NOTE: This should be stencilled as a minimum on the two longest case sides (this information will normally be supplied by the manufacturer of the item(s) packed).



KEEP AWAY FROM HEAT

... kg max.



STACKING LIMITATION

NOTE: The maximum load in kilograms should be marked above the arrow.



International 'slings here' symbol



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11. Packing Reference Table

TABLE-6

No	Packing Method ->	Wooden Crates	Bundles	Saddle supports	HD Polythene Sheet Wrapping	Wooden boxes (Cases)	Spider	Remarks
	Description							
1	Straight Pipes	✓	✓					Crates for random length
2	Pipes with attachments	✓						
3	Pipes with Fittings	✓						
4	Tanks			✓				
5	Mitre bends			✓		✓		Saddle or cases to be used
6	Fasteners					✓		
7	Hanger components					✓		
8	Clamps					✓		
9	Fittings >nb200/ Flanges					✓		Fittings <200 shall be packed in boxes
10	Plates(Cut to size)					✓		
11	SS Pipes		✓		✓			Wrap SS pipes before bundling
12	SS fittings / Flanges	✓				✓		Fittings <200 shall be packed in boxes
15	SS Fasteners					✓		
16	CW piping(>900mm)						✓	To maintain circularity of pipes
17	CW fittings(>900mm)						✓	
18	CW fittings(<900mm)							
19	Structurals(<200mm)		✓					

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12. CHECK LIST

S No	VENDOR TO PROVIDE DETAILS	
1	On despatch of components/items , vendor has to provide the following information for each package of despatched items: 1. Contents of package (Packing list) 2. Corrosion Prevention: Rust-preventive coating /protective painting/Silica gel/ other corrosion inhibitors (please mention) 3. Lifting Instructions: Crane using slings/Fork lift/any other means (please mention) 4. Dimensions (LxBxH) mm: 5. Gross Weight (Kgs): 6. Net Weight (kgs):	
S No	VENDOR TO CONFIRM	
1	Where ever items are despatched as a bundle, they should be clamped together with bolted timber block clamps or bolted steel section clamps with timber block inserts. Adequate number of clamps should be provided along the length of the bundle with sufficient projection of the clamps beyond the width and height of the bundle.	
2	Only such materials which can withstand corrosion and environmental conditions are allowed to be packed in wooden crates or bundles.	
3	In case of wooden packing, planks of 20-25 mm thick and 100-150mm wide needs to be suitably placed at close intervals for giving rigidity to packing appropriately.	
4	Wood used for packing should be seasoned & shall be free of termites.	
5	Damages, if any, resulting due to improper/inadequate packing will be to vendors account. It will be the responsibility of the vendor to identify suitable and adequate packing for his supplies to protect it from damage and/or deterioration during storage, stacking, transport and handling.	
6	All packing should be suitable for loading/unloading by cranes/forklifts & suitable for transport by road. Suitable marking should be made on the packing indicating the lifting positions.	



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List of raw material sources for SA182 F91 & F92
(Indigenous & Foreign)

QCP:18
Rev:02
Date:05.05.2018

Sl	Vendor Name	Material Grade	Location
AA)	Indigenous		
1	Kalyani Carpenter Special Steels Ltd, Pune	F91 & F92	INDIA
2	Remi Metals, Baruch	F91	INDIA
3	Star Wire, Faridabad	F91	INDIA
4	UP Steels, Muzafarnagar	F91	INDIA
5	Alloy Steel Plant, Durgapur	F91	INDIA
6	Mishra Datu Nigam Ltd- Midhani, Hyderabad	F91	INDIA
BB)	Foreign		
7	A.C.P. S.r.l	F91 & F92	ITALY
8	Abs Spa	F91 & F92	ITALY
9	Acciaieria Bertoli Safau S.p.A	F91 & F92	ITALY
10	Acciaieria Fonderia Cividale S.p.A	F91 & F92	ITALY
11	Acciaieria Valbruna S.p.A	F91 & F92	ITALY
12	Afar spa	F91 & F92	ITALY
13	Ascometal (Asco Industries)	F91 & F92	ITALY
14	Aso Siderurgica S.r.l	F91 & F92	ITALY
15	Aubert & Duval	F91 & F92	ITALY
16	Baosteel Special Metals Co Ltd, Shanghai	F91 & F92	CHINA
17	Bohler Uddeholm	F91 & F92	ITALY
18	Breitenfeld Edelstahl AG	F91 & F92	AUSTRIA
19	Celsa Huta Ostrowiec SP. Z O. O.	F91 & F92	ITALY
20	Cogne Acciai Special S.p.A,	F91 & F92	ITALY
21	Coprosider ISF spa	F91 & F92	ITALY
22	Deutsche Edelstahlwerke GMBH	F91 & F92	GERMANY
23	Esia Fucine	F91 & F92	ITALY
24	Foc Ciscato	F91 & F92	ITALY
25	Forge Fedriga	F91 & F92	ITALY
26	Forge Monchieri spa	F91 & F92	ITALY
27	Forge Nicromo SRL	F91 & F92	ITALY
28	Forgiatura Marcora	F91 & F92	ITALY
29	Forgiatura Moderna Arese	F91 & F92	ITALY
30	Forgiatura Morandini	F91 & F92	ITALY
31	Forgiatura Vienna	F91 & F92	ITALY
32	Friulforgia Srl	F91 & F92	ITALY
33	Gloria Material Technology Corp	F91 & F92	TAIWAN
34	Gruppo Cividale	F91 & F92	ITALY
35	Industeel	F91 & F92	FRANCE
36	Inosmann	F91 & F92	ITALY
37	Inox Fucine	F91 & F92	ITALY


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	Bharat Heavy Electricals Limited, Piping Centre, Chennai. List of raw material sources for SA182 F91 & F92 (Indigenous & Foreign)	QCP:18 Rev:02 Date:05.05.2018	
SI	Vendor Name	Material Grade	Location
BB)	Foreign		
38	Italfond S.p.A	F91 & F92	ITALY
39	La Forgia Di Bollate	F91 & F92	ITALY
40	Lucchini RS S.p.A, Foroni S.p.A	F91 & F92	ITALY
41	Metalcam spa	F91 & F92	ITALY
42	MT Acciai S.r.L	F91 & F92	ITALY
43	NLMK Verona S.p.A	F91 & F92	ITALY
44	Olifer ACP spa	F91 & F92	ITALY
45	Olifer, Cogne	F91 & F92	ITALY
46	Pilsen Steel	F91 & F92	ITALY
47	Rubiera Special Steel S.p.A	F91 & F92	ITALY
48	Sider Plating Scaiigera	F91 & F92	ITALY
49	Società ED Indirizzo	F91 & F92	ITALY
50	Special Flanges SRL	F91 & F92	ITALY
51	Stahlwerk Bous GmbH	F91 & F92	GERMANY
52	Valforge SRL	F91 & F92	ITALY
53	Veronal steel	F91 & F92	ITALY
54	Vitkovice Heavy Machinery	F91 & F92	ITALY
55	Xincheng Special Steel Co Ltd, Jiangsu	F91 & F92	CHINA

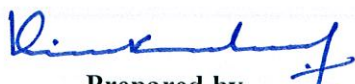
Record of Revision

Rev 00: 01/12/2013: Fresh Issue

Rev 01: 21/09/2017: Heading Modified, Sources added based on MOM between BHEL, Trichy & NTPC - May 2014, NTPC approval letter for Chinese pipe makers

Rev 02: 25/04/2018: Heading Modified, Sources added based on Enq.4101700030 dt:24.07.2017 vendor responses for F92 raw material sources.

Note: The raw material TC's shall be procured to meet IBR requirements and shall be in English only.


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**BHARAT HEAVY
ELECTRICALS LIMITED**
PIPING CENTRE, MADRAS - 17
QUALITY ASSURANCE & CONTROL DEPT.

**STANDARD QUALITY ASSURANCE PLAN FOR FORGED FITTINGS
CONFORMING TO ASME SA105 & SA182**

QP NO : QPG: 87
REV.NO: 01
DATE : 05-05-2018

REF: BHEL TDC No. : TDG:104 (latest revision)

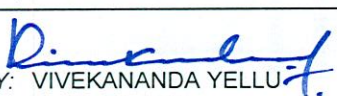
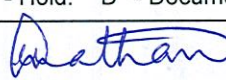
SL . NO.	COMPONENT OR OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE STANDARD	TYPE OF RECORD		AGENCY			REMARKS
									D*	M	B		
1	2	3	4	5	6	7	8	9	10	11	12	13	
2.6	Test Piece Marking (TPM)	Selection of Test coupons	Major	Measurement & Marking	One Sample / Heat / Size/ HT Batch	As per ASTM A370		Internal report	X	P	V/ W*	Refer Note : 1	
3.0	TESTS												
3.1	Finished product	YS, UTS, % Elongation (Mandatory)	Major	Tensile Strength,	One Sample / Heat / Size/ HT Batch	Material Specn. & BHEL TDG:104		Test Report	X	P	V		
3.2		Product Analysis	Major	Chemical Composition	One Sample / Heat / Size	Material Specn. & BHEL TDG:104		Test Report	X	P	V/ W*		
3.3		Hardness	Major	Hardness test	100% / 10%	Material Specn. & BHEL TDG:104		Test Report	X	P	W	100% for F91/92 ; 10% for others	
3.4		Surface Defect	Critical	NDE - LPT	100%	Material Specn. & BHEL TDG:104 Only for SS & Duplex SS items		Test Report	X	P	W		
3.5		Sub-surface Defect	Critical	NDE - MPT	100%	ASTM E709	ASME B31.1 Cl. 136.4.3	Test Report	X	P	W	Wet MPT for F91/92; Dry MPT for others	
3.6		Volumetric Defect##	Major	NDE - UT##	100%	ASME SA388	ASME Sev-VIII, Div.2 Cl.3.3.4	Test Report	X	P	W	##: Bars/Rounds: OD = 40mm and above; Others: OD >= 200mm or Thickness >= 6mm	
3.7		Microstructure (Applicable for F91/92 Fittings)	Major	Metallo- graphic test	One Sample / Heat / Size/ HT Batch	No micro fissures. Microstructure shall show tempered martensite. Grain growth if any has to be examined further.		Test Report (Magnification at 500x)	X	P	W	F92: Delta Ferrite shall be 3% max as per VD TUV 1272 & Refer Note :8	
3.8	PMI for AS fittings	Chemical	Major	PMI	100%	Material Specn. & BHEL TDG:104		Test Report	X	P	W		

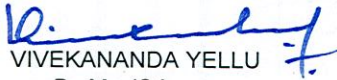
LEGEND: M:- Manufacturer; B:- BHEL/ BHEL Nominated Agency; P - Perform; V - Verification; R-Review; W - Witness; H - Hold. D* - Documents required if marked "X"

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PAGE : 2 of 4

 BHARAT HEAVY ELECTRICALS LIMITED PIPING CENTRE, MADRAS - 17 QUALITY ASSURANCE & CONTROL DEPT.		STANDARD QUALITY ASSURANCE PLAN FOR FORGED FITTINGS CONFORMING TO ASME SA105 & SA182							QP NO : QPG: 87 REV.NO: 01 DATE : 05-05-2018				
REF: BHEL TDC No. : TDG:104 (latest revision)													
SL. NO.	COMPONENT OR OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE STANDARD	TYPE OF RECORD		AGENCY			REMARKS
									D*	M	B		
1	2	3	4	5	6	7	8	9	10	11	12	13	
1.0	Raw material sources for F-91&92 shall be as per QCP:18(Latest Revision); Any other source proposed by the vendor shall be subjected to BHEL approval.. The Test Certificate for all material specifications received from RM manufacturer shall meet IBR requirements.												
1.1	Raw Materials	Chemical Composition, Mechanical Properties & NDT	Major	Verification of MTC & Ladle Analysis Report	100%	As per Required Material (ASME) Specification	MTC	X	P	V/R	F92 : Si: 0.10-0.50%; Ni: 0.30 max and Cu: 0.25 max. MTC - Mill Test Certificate		
1.2		Surface defect	Major	Visual	100%	As per Required Material (ASME) Specification	Report	X	P	V			
1.3		Dimensions Outer Dia.,Thk.etc	Major	Measurement	100%	As per Spec	Report	X	P	V			
1.4		Chemical Check for Semi-Finished Components	Major	PMI	100%	As per Required Material (ASME) Specification	Report	X	P	R/W*	W*For F91/92 material		
1.5		Hardness Test for Semi-Finished Components	Major	Measurement	100%	As per Specification	Report	X	P	R/W*			
		Forging ratio shall be 1:4 minimum & shall be reported in Mill test certificate incase of semi-finished forging otherwise manufacturer test certificate.											
2.0	IN PROCESS INSPECTION												
2.1	Fitting Forming Procedure	Procedure qualification	Major	Review	100%	Material Specn. & BHEL TDG:104	Appd. Procedure	X	P	V	Forming Procedure shall be approved by BHEL.		
2.2	LPT Procedure	Procedure Review	Major	Review	100%	Material Specn. & BHEL TDG:104 Only for SS & Duplex SS items	Appd. Procedure	X	P	V	LPT - Liquid Penetrant Test		
2.3	MPT Procedure	Procedure Review	Major	Review	100%	Material Specn. & BHEL TDG:104	Appd. Procedure	X	P	V	MPT - Magnetic Particle Test		
2.4	UT Procedure	Procedure Review	Major	Review	100%	Material Specn. & BHEL TDG:104	Appd. Procedure	X	P	V	UT - Ultrasonic Test		
2.5	Heat Treatment	Rate of Heating, Rate of Cooling & Soaking time	Critical	Temp & Time graph	100%	Material Specn. & BHEL TDG:104 Refer Note : 2	HT Chart	X	P	V/ W\$	W\$: For 1st off trial / at random		
LEGEND: M:- Manufacturer; B:- BHEL/ BHEL Nominated Agency; P - Perform; V - Verification; R-Review; W - Witness; H - Hold. D* - Documents required if marked "X"													
PREPARED & REVIEWED BY:  Dy.Mgr/QA										APPROVED BY:  AGM/QA			
PAGE : 1 of 4													

 BHARAT HEAVY ELECTRICALS LIMITED PIPING CENTRE, MADRAS - 17 QUALITY ASSURANCE & CONTROL DEPT.			STANDARD QUALITY ASSURANCE PLAN FOR FORGED FITTINGS CONFORMING TO ASME SA105 & SA182						QP NO : QPG: 87 REV.NO: 01 DATE : 05-05-2018				
REF: BHEL TDC No. : TDG:104 (latest revision)													
SL. NO.	COMPONENT OR OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE STANDARD	TYPE OF RECORD		AGENCY			REMARKS
									D*	M	B		
1	2	3	4	5	6	7	8	9	10	11	12	13	
4.0	FINAL INSPECTION												
4.1		Surface check, Bend angle, Radius, End-to-end dimn, Ovality, Thickness, Wrinkles, d1 at ends, Edge preparation & other dimensions as per Drg.	Major	Visual & Measurement	100%	ASME B16.9/B16.11 / BHEL Drg. & P.O.	Report	X	P	W			
4.2		IBR Certification	Major	all tests as per IBR	100%	IBR	FORM-IIIG	X	P	IBR	Refer Note : 11		
4.3		Marking / Color coding	Critical	Visual	100%	BHEL TDG:104 & P.O.	Report	X	P	V	Refer Note : 13		
4.4		Surface Protection, Preservation & Packing	Critical	Visual	100%	BHEL TDG:104 & P.O.	Report	X	P	V	Refer Note : 9 & 12		
5.0	Inspection clearance	Documentation	Critical	Verification	100%	All reports as required in this QAP	Report	X	P	H			
NOTES :-													
1.0	Seal tranfer on pieces to be cut shall be done by BHEL inspector & IBR for F91/92 materials and only IBR for other than F91/92 materials.												
2.0	POST FORMING HEAT TREATMENT (AFTER FORGING & BEFORE MACHINING):-												
	For F91/92 materials : Normalise at 1050 - 1080 deg.C & Temper at 750-780 deg.C; Soaking shall be 30 minutes minimum for thickness upto 50mm and 1Hr minimum for thickness 51-100mm												
	Normalising and Tempering shall be carried out within 72 hours after completion of forming. The items shall be kept dry and stress free. The temperature shall be brought down to room temperature after hot forming before normalizing and also after normalizing before tempering. Normalising and tempering of Gr91/92 shall be done encompassing the entire component.												
	SA105 : Normalised; SA182 F11/F12/F22 : Normalised & Tempered.; SS & Duplex SS : Solution Annealead.												
3.0	Finished SS & Duplex SS fittings shall be checked for radioactive contamination and reported in raw material(Ingot/Blooms/Billets) manufacturer TC / Mill TC. Survey meter shall be used to measure at 5cm near the surface. Acceptance limits: Shall be less than 0.1 milli Rontgen (MR) per hr or 1 micro Sievert per hr.												
4.0	Chemical & Mechanical tests shall be performed at NABL approved laboratories(in-house/outside).												
LEGEND: M:- Manufacturer; B:- BHEL/ BHEL Nominated Agency; P - Perform; V - Verification; R-Review; W - Witness; H - Hold. D* - Documents required if marked "X"													
PREPARED & REVIEWED BY:  VIVEKANANDA YELLU Dy.Mgr/QA										APPROVED BY:  C VAITHIANATHAN AGM/QA			PAGE : 3 of 4



**BHARAT HEAVY
ELECTRICALS LIMITED**
PIPING CENTRE, MADRAS - 17
QUALITY ASSURANCE & CONTROL DEPT.

**STANDARD QUALITY ASSURANCE PLAN FOR FORGED FITTINGS
CONFORMING TO ASME SA105 & SA182**

QP NO : QPG: 87
REV.NO: 01
DATE : 05-05-2018

REF: BHEL TDC No. : TDG:104 (latest revision)

SL . NO.	COMPONENT OR OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE STANDARD	TYPE OF RECORD		AGENCY			REMARKS
									D*	M	B		
1	2	3	4	5	6	7	8	9	10	11	12	13	
5.0	All NDE procedures with Level-III authorised shall be submitted to BHEL for review. NDE shall be performed by qualified personnel. All NDE shall be done before proof machining.												
6.0	Items shall be visually checked. No hard scales shall be present on inside & outside surfaces.												
7.0	Gas cutting & Plasma cutting are prohibited for F91/92 material.												
8.0	1 replica for the size Nb 80 & below per Heat Treatment batch. 3 replicas in one fitting per Heat Treatment batch. Actual magnification shall be indicated in the photomicrograph. Photomicrographs shall be provided as records for review & acceptance and future in-service reference.												
9.0	All fittings shall be Painted as below when not specified in the P.O./Drawing:- a) Fittings supplied to BHEL's Stores: All items except SS & Duplex SS to be applied with resin type rust preventive coating with visibility to punched and stenciled details on outside. b) Fittings supplied directly to BHEL's Sites(DTS): Surface preparation by Blast cleaning (SSPC-SP10); Primer : 1 coat of 60 microns of In-Organic Ethyl Zinc Silicate primer; Finish : 2 coats of 20 microns each of Heat Resistance Aluminium paint to IS13183 Gr-1; Total DFT : 100microns minimum; Shade: Aluminium The internal surface shall be protected with rust preventive coating or rust inhibitor. Stainless steel and Duplex SS (UNS32205) fittings need not be painted. Pickled & Passivated as per ASTM A380.												
10.0	All items shall be inspected and cleared by BHEL / BHEL authorised Inspection agency & IBR authorities.												
11.0	Necessary IBR Requirements shall be fulfilled and IBR documents to be submitted. a) Well-Known Forger: - (i) Finished Fittings: No further fabrication like Machining/Cutting at shop: Form IIIC. (ii) Semi-Finished Fittings: Form IIIG signed by Forger. b) Not Well-Known Forger: - (i) Finished Fittings: No further fabrication like Machining/Cutting at shop: Form IIIC. (ii) Semi-Finished Fittings: Form IIIG – counter signed by IBR authorities.												
12.0	Machined ends shall be well protected using end caps and suitably packed to avoid transit & other damages. Tack welding is prohibited on F91/92 material.												
13.0	Marking :- a) Items dispatched to Stores : The finished components shall be punched & paint stencilled with Material code, Heat number, material specification, maker's emblem, Inspectors seal and Statutory authorities seal (as applicable) b) DTS (Direct to Project Site) Items :- DTS shall be hard punched and paint stencilled with DU code (14 digit work order du detail) as given by purchase in addition to marking done as per 13 (a). Colour coding : SA105 - Blue ; SA182 F11 - Green & White; F12 - Black & Red; F22 - Blue & Red; F91 - Brown & Red; F92 - Brown & Blue; F316 - Black & Blue; F316L - Blue, Brown & Yellow; Duplex SS - Red, White & Green												

LEGEND: M:- Manufacturer; B:- BHEL/ BHEL Nominated Agency; P - Perform; V - Verification; R-Review; W - Witness; H - Hold. D* - Documents required if marked "X"

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Cancellation / Termination of contract, Default / Breach of contract and Risk Purchase

In case of abnormal delays (beyond the maximum late delivery period as per Penalty clause) in supplies / defective supplies or non-fulfilment of any other terms and conditions given in Purchase Order as enumerated subsequently in this clause, Purchaser shall be entitled to cancel the Order / Contract either in whole or portion thereof without compensation to Seller / Contractor and if the Purchaser so desires, may procure upon such terms and in such manner as deemed appropriate, stores not so delivered or others of similar description where stores exactly complying with particulars are not, in the opinion of the Purchaser, which shall be final, readily procurable, at the risk and cost of the Seller / Contractor and the Seller / Contractor shall be liable to the Purchaser for any excess costs provided that the Seller / Contractor shall continue the performance of the Order / Contract to the extent not cancelled under the provisions of this clause. The Seller / Contractor shall on no account be entitled to any gain on such repurchases. If bidder does not agree to the above Risk Purchase Clause, BHEL reserves the right to reject the offer.

Risk & Cost Clause, in line with Conditions of Contract may be invoked in any of the following cases:

- i. Contractor / supplier's poor progress of the work vis-à-vis execution timeline as stipulated in the Contract, backlog attributable to contractor/ supplier including unexecuted portion of work / supply does not appear to be executable within balance available period (#) considering its performance of execution.
- ii. Withdrawal from or abandonment of the work by contractor before completion of the work as per contract.
- iii. Non completion of work / Non-supply by the Contractor / supplier within scheduled completion / delivery period as per Contract or as extended from time to time, for the reasons attributable to the contractor / supplier.
- iv. Termination of Contract on account of any other reason (s) attributable to Contractor / Supplier.
- v. Assignment, transfer, subletting of Contract without BHEL's written permission resulting in termination of Contract or part thereof by BHEL.
- vi. Non-compliance to any contractual condition or any other default attributable to Contractor / Supplier.

Risk and Cost amount against Balance Work:

$$\text{Risk \& Cost Amount} = [(A-B) + (A \times H/100)]$$

Where,

A= Value of Balance scope of Work / Supply (*) as per rates of new contract

B= Value of Balance scope of Work / Supply (*) as per rates of old contract being paid to the contractor / supplier at the time of termination of contract i.e. inclusive of PVC & ORC, if any.

H= Overhead Factor to be taken as 5

In case (A-B) is less than 0 (zero), value of (A-B) shall be taken as 0 (zero).

***(Balance scope of work / supply)**

Difference of Contract Quantities and Executed Quantities as on the date of issue of Letter for 'Termination of Contract', shall be taken as balance scope of Work / Supply for calculating risk & cost amount.

Contract quantities are the quantities as per original contract. If, Contract has been amended, quantities as per amended Contract shall be considered as Contract Quantities.

Items for which total quantities to be executed have exceeded the Contract Quantities based on drawings issued to contractor from time to time till issue of Termination letter, then for these items total Quantities as per issued drawings would be deemed to be contract quantities.

Substitute / extra items whose rates have already been approved would form part of contract quantities for this purpose. Substitute / extra items which have been executed but rates have not been approved, would also form part of contract quantities for this purpose and rates of such items shall be determined in line with contractual provisions.

Cancellation / Termination of contract, Default / Breach of contract and Risk Purchase

However, increase in quantities on account of additional scope in new tender shall not be considered for this purpose.

Note: In case portion of work is being withdrawn, contract quantities pertaining to portion of work withdrawn shall be considered as 'Balance scope of work / supply' for calculating Risk & Cost amount.

LD against delay in executed work / supply in case of Termination of Contract in case of Risk and Cost Option

LD against delay in executed work / supply shall be calculated in line with LD clause of the contract for the delay attributable to contractor / supplier. For limiting maximum LD value, contract value shall be taken as Executed Value of work / supply.

Method for calculation of "LD against delay in executed work / supply" is given below.

- i. Let the time period from scheduled date of start of work till termination of contract excluding the period of Hold (if any) not attributable to contractor / supplier= T1
- ii. Let the value of executed work / supply till the time of termination of contract= X
- iii. Let the Total Executable Value of work / supply for which inputs / fronts were made available to contractor / supplier and were planned for execution till termination of contract= Y
- iv. Delay in executed work / supply attributable to contractor/supplier i.e. $T2 = (1 - X/Y) * T1$
- v. LD shall be calculated in line with LD clause of the Contract for the delay attributable to contractor / supplier taking "X" as Contract Value and "T2" as delay attributable to contractor / supplier.

Note: In case portion of work / supply is withdrawn, no LD shall be applicable for portion of work / supply withdrawn.

Recovery from Supplier

Recoveries from contractor / supplier on whom risk & cost has been invoked shall be made from the following:

- i. Dues available in the form of Bills payable to contractor / supplier, SD, BG's against the same contract.
- ii. Dues payable to contractor / supplier against other contracts in the same Region / Unit / Division of BHEL.
- iii. Dues payable to contractor / supplier against other contracts in the different Region / Unit / division of BHEL.

Legal Options for recovery of dues payable by the supplier / contractor.



1.0 GENERAL

Materials shall meet Indian Boiler Regulations, (IBR) in addition to the latest version of SA105, SA 182 & Code Case 2179 (for SA182 F92) as on date specified in the Purchase Order (PO).

2.0 RAW MATERIAL

- The raw material used shall meet the respective specification and the test certificate shall be furnished.
- Raw material Steel for IBR forging items to be inspected at Mill & test certificate countersigned by IBR approved Authority, if the mill is not approved under IBR as well known steel maker.
- For SA 182 F91 & F92 (Code Case 2179): The raw material shall be procured from the Mills listed in document ref.QCP:18(latest revision). For raw material sources not listed in QCP:18, credentials shall be submitted by the vendor along with offer for BHEL review and approval. Indigenous vendors shall procure the raw material for other than SA182 F91 & F92 (code case 2179) from IBR approved sources.
- For SA 105: Carbon: 0.25% max.
For SA182 F92: Si: 0.10-0.50%; Ni: 0.30 max and Cu: 0.25 max.
- SS & Duplex SS: All raw materials used in steel making including incoming scrap shall be checked by supplier to ensure freedom from radioactivity.

3.0 PROCESS

- Process of manufacture shall conform to applicable standards.
- Unless otherwise specified in the P.O, SA182 F11/12 items shall be supplied as per class 2 and SA182 F22 shall be of Class 3 only.
- For SA 182 F91 & F92 (Code Case 2179): Steel for forging shall be check tested for product analysis at vendor's works and shall be witnessed by IBR / IBR authorised agency. The check test report along with Mill-TC shall be certified by IBR / IBR authorised agency.
- Forging:** to ensure uniformity of structure & strength with reduction ratio in area 4: 1 min from ingot to final forging, close to final size & shape. Flow lines to be parallel to axis of openings. Forged items order to this TDC shall be forged to the nearest shape before machining to final dimensions as per respective drawing.
- Blooms / Billets** used for forgings (Side Length, Dia $\geq$ 50mm) shall be UT tested & for acceptance norm refer sl.5(j). For finished bars this can be done at Final stage.
- Dimensions shall be as per drawings indicated in Purchase Order.

4.0 HEAT TREATMENT

4.1 All items shall be heat treated as below:

SA 105	- Normalised
SA 182 F11/ F12/ F22	- Normalised & Tempered

Stainless Steel & Duplex Stainless Steel ----- Solution Annealed

4.2 SA182 F91 & F92 :-

Normalising Temp. : 1050°C - 1080°C (for wall thickness larger than 75 mm, accelerated cooling may be done to obtain a fully martensitic structure).

Tempering Temp. : 750°C - 780°C Soaking time: 2.5min/mm of thickness (1 hr min.), still air cooling.

5.0 TESTING

- Product analysis:-** Product analysis shall be carried out on One piece / Heat / HT lot / Size.

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Prepared by		Reviewed by	Approved by



- (b) **Corrosion test:-** Corrosion test (IGC) shall be carried out on one piece / Heat / HT lot / Size for SS & Duplex SS items.
- (c) **MPI (After Heat Treatment) :** 100%: As per ASTM E 709. Linear Indications like cracks, folds & other injurious defects are unacceptable.
Dry MPI : CS, AS (other than F91, F92) : all sizes.
Wet MPI : SA182 F91, F92 : all sizes.
- (d) **LPI (After Heat Treatment) :** 100% for SS & Duplex SS as per ASTM E165, No linear indications acceptable.
- (e) **SS & Duplex SS:** Finished forgings shall be checked for radioactive contamination and reported. Survey meter shall be used to measure at 5cm near the surface. Acceptance limits: Shall be less than 0.1 milli Rontgen (MR) per hr or 1 micro Sievert per hr.
- (f) **Tension test:-** Tension test shall be carried out on one Test piece for each specification, heat, heat treatment lot and size.
- (g) **Bend test:-** (a) Bend test for CS (SA 105) : One sample of 19 mm thick and 25mm width to be bent 180 deg around mandrel of radius 6.35mm.
(b) Bend test for AS (SA182): One Sample of 25.4 mm width and thickness = t to be bent 180 deg around mandrel of radius = 1.5 t. Test on representative sample is also acceptable.
- (h) **Photomicrograph test for F91 & F92 :-** Photomicrograph test shall be carried from a specimen of forging in the as finished condition for each individual size (OD & Thickness) from each heat per heat treatment batch. Acceptance norms - The Material shall be free from any micro fissures. Microstructure shall show tempered martensite and also to be examined for any grain growth. Photomicrograph with 500x (min) magnification along with Photomicrograph report to be provided. The actual magnification shall be indicated.
- (i) **Hardness test:** - (i) For SA 182 F91 :- 100% of items; Value: 191-250 BHN
(ii) For SA 182 F92 :- 100% of items; Value: 196-250 BHN
(iii) For Duplex SS :- 100% of items; Value - 290 HBW max.
(iv) For other specn :- 10% of items; Value - As per specn
The hardness test values shall be indicated in the Test certificate.
- (j) **Ultrasonic Test:** - All items shall be ultrasonically tested as per SA388 and acceptance norms shall be as per ASME Sec VIII Div .2 Cl. 3.3.4.

UT Qualification: - For Forged Bars/Rounds: OD = 40mm and above.
For others: OD $\geq$ 200mm or Thickness $\geq$ 6mm

6.0 POSITIVE MATERIAL IDENTIFICATION (PMI) FOR ALLOY STEEL FITTINGS.

Each alloy steel item shall be checked for the correctness of the material by using X-ray fluorescence principle or spark emission spectrography.

7.0 WORKMANSHIP, FINISH AND REPAIR

All items shall have smooth, workman like finish, and to be free from scale & defects like laps, seams, folds, cracks, etc. Pickled & Passivated as per ASTM A380 for SS & Duplex SS items. Surface defects can be removed by mechanical means and defective areas smoothly dressed up with the adjacent surface. Minimum dimension after repair shall meet drawing / Specification. Repairs by fusion welding are prohibited.

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8.0 PAINTING, COLOUR CODING, MARKING, PACKING & END PROTECTION

8.1 PAINTING: -

Fittings supplied to BHEL's Stores: All items except SS & Duplex SS to be applied with resin type rust preventive coating with visibility to punched and stenciled details on outside.

Fittings supplied directly to BHEL's Sites(DTS):

- a) **Surface preparation:** Blast cleaning
- b) **Primer coat:** One coat of 60 microns of In-Organic Ethyl Zinc Silicate primer.
- c) **Finish coat:** Two coats of 20 microns each of Heat Resistance Aluminium paint to IS13183 Gr-1.
- d) **Total DFT:** 100 microns minimum.
- e) **Shade:** Aluminium -- for all fittings.

The internal surface shall be protected with rust preventive coating or rust inhibitor.

SS & Duplex SS items to be surface treated as per ASTM A380 both inside and outside.

8.2 COLOUR CODING: All items shall be colour coded circumferentially at ends as given below.

SA105	=	Blue
SA182 F11	=	Green & White
SA182 F12	=	Black & Red
SA182 F22	=	Blue & Red
SA182 F91	=	Brown & Red
SA182 F92	=	Brown & Blue
SA182 F316	=	Black & Blue
SA182 F316L	=	Blue, Brown & Yellow
SA182 UNS32205 (Duplex Stainless Steel)	=	Red, White & Green

8.3 MARKING (In English only) :-

8.3.1 The items dispatched to **BHEL Stores** shall be hard punched / etched with Material code, Heat number, material specification, maker's emblem, Inspectors seal and Statutory authorities seal (as applicable).
In addition, the above details along with size shall be paint stencilled on the fittings.

8.3.2 The items dispatched directly to project site as **DTS** shall be hard punched and paint stencilled with DU code (14-digit work order du detail) as given by purchase in addition to marking done as per para 8.3.1.

8.4 **PACKING AND END PROTECTION:** Machined ends of the items shall be well protected using end caps and shall be suitably packed in box / crate to avoid transit & other damages.

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9.0 INSPECTION & CERTIFICATION (In English only): -

9.1 All items are to be Inspected at the manufacturer's works by the Inspection agencies / authorities as per IBR and as indicated in the P.O. IBR Forms shall be submitted as indicated below.

A) Well-Known Forger: -

- (i) Finished Fittings: No further fabrication like Machining/Cutting at shop: Form IIIC.
- (ii) Semi-Finished Fittings: Form IIIG signed by Forger.

B) Not Well-Known Forger: -

- (i) Finished Fittings: No further fabrication like Machining/Cutting at shop: Form IIIC.
- (ii) Semi-Finished Fittings: Form IIIG – counter signed by IBR authorities.

The above IBR forms shall be submitted as applicable along with the Work Test Certificate and shall include the following.

1. Test Certificate Number, Manufacturer Name & date.
2. BHEL P.O Number & Amendment Number (if any)
3. BHEL P.O. Serial Number
4. BHEL TDC Number
5. Size-wise Quantity
6. Specification, Grade & Year of code.
7. Heat/Melt Number
8. Steel making / forming process
9. Ladle and product Analysis of Raw Material.
10. IBR approved certificate for manufacturing creep resistance steel in case of indigenous steel makers.
- *11. Product analysis report.
- *12. Tensile Test report
- *13. Bend Test report.
- *14. Intergranular corrosion test report for SS & Duplex SS
- *15. Measured radioactivity levels shall be reported in the Mill test certificate (Not to be recorded in IBR Form).
- *16. Repair details if any, certified copy of TC for starting material.
- *17. Guarantee of HTP shall be given in the test certificate as follows if hydro test is not carried out: - "Forgings are capable of with standing without failure, breakage or impairment of their serviceability a hydrostatic test pressure equal to that prescribed for the specified matching pipe of equivalent material".

*Details furnished in the Test certificate in lieu of chart/report is acceptable.

9.2 The following reports shall be **furnished separately** along with the Form III C/G & MTC indicated in para 9.1 above.

- i. NDE reports for VT, LPI, MPI, UT (Reports in soft copy + hard copy).
- ii. Positive Material identification (PMI) report for Alloy steel.
- iii. Heat Treatment Chart.
- iv. Hardness Test report.
- v. Photomicrograph test report along with photomicrograph with minimum 500 x magnifications.
- vi. Dimensional report (as built drawing with dimensions)

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10.0 AUDIT CHECKS AT BHEL

BHEL reserves the right to carry out audit checks for chemistry, HT condition, mechanical test and NDT on representative test bars or job.

Supplies found defective during check or subsequent processing at BHEL are liable for rejection.

11.0 Records of Revisions:-

Revision 02 : Material specification SA 182 F316 added.

Revision 03 : (i) Para 4.0, 6.0 included.

(ii) Para 5.0 (b),(c),(h),(j), 8.0 and 9.0 (17) are revised.

Revision 04 : (i) New material specification SA 182 F92 added.

(ii) Para 1.0, 3.0, 4.2, 5 (f), (g) & 8.2 are revised.

(iii) Para 5 (a) to (h) are modified for better clarity.

Revision 05 : (i) Para 10.0 added.

(ii) Para 2 (c), 3.0, 8.2, 8.3.2 & 9.0 are revised.

(iii) Para 5 (c), 5 (d) & 5 (i) are modified for better clarity.

Revision 06 : (i) Para 2 (b), 3 (e),(g) & 9.0 are revised.

(ii) Para 4.1, 4.2, 5(h), 6.0, 8.1, 8.2, 8.3 & 8.4 are modified for better clarity.

Revision 07 : (i) Para 3 (e) deleted-(Creep Test (Type Test) requirement), further clauses renumbered.

(ii) Para 9.0 revised.

Revision 08 : (i) Para 2.0(b), 3.0(d) & 5.0(g) are revised.

(ii) Para 4.2 modified for better clarity.

Revision 09 : (i) Items : Forged Y-Piece & Forged-Tee are added.

(ii) Para 2.0(b)(e), 5.0(e) & 9.2 are added.

(iii) Para 3.0(e) & 9.0 modified for better clarity.

Revision 10 : (i) Duplex Stainless Steel (UNS32205) added and relevant technical requirements 2(e), 4.1, 5.0(b)(d)(e)&(i), 7.0,8.1 & 9.1(14) are indicated.

(ii) Para 5.0(j) & 8.1 revised.

(iii) Para 9.1 modified w.r.t. IBR form requirements for forgings.

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