

**SPECIFICATION FOR WELDING****Scope:**

This part of documents when defines the comprehensive quality requirements for fusion welding of foot or bridges(FOB) to cross the railway track safety, both in workshops and also at site of (FOB) installation.

**Review of Requirements and Technical Review:**

The the manufacturer shall review the contractual necessities and any other requirements, together with any technical data provided by the purchaser or in-house data when the construction is designed by the manufacturer. The manufacturer shall establish that all information is essential to carry out the manufacturing operations is complete and available prior to the commencement of work. The manufacturer shall affirm its capability to meet all the requirements and shall ensure adequate planning of all quality -related activities.

Minimum requirement: The manufacturer shall be Certified for ISO 3834 2 Quality requirement

**Weld Joint Design:**

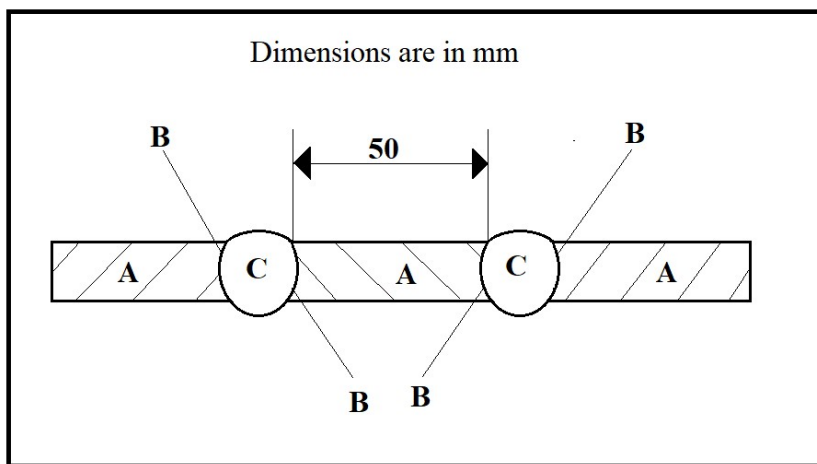
1. Welded joints with sharp edges and abrupt change in cross-section or profile should be avoided. The steep change in lines of stresses should be as an undisturbed as possible.
2. If possible, the centre lines of the welded parts should coincide in one point. Weld seems should be avoided in high stress areas. If this is not possible, higher requirements of inspection shall be planned.
3. If required, to make a decision in the process of development an evidence of the calculated thickness of the weld a can be proved by production weld test with respect to the weld ability of the parent materials and the welding consumables the requirements and recommendations information of their manufacturers shall be observed.,
4. For steel components with stress in thickness direction, suitable design measures and shall be taken and material with the required reduction of material in thickness direction shall be selected.
5. Corrosion protection should be ensured by suitable building design e.g. full penetration weld. Partial penetration welds or intermittent welds should have sufficient corrosion protection.
6. Assemblies: assemblies shall be designed so as to offer the best access possible when welding or inspecting them.
7. The accumulation of joint should be avoided. If necessary forged pieces or casting can be used.
8. Welding secondary parts onto tension flanges by transverse beads should be avoided.
9. In the heat-affected zone of cold deformed Steel alloys the decrease of strength shall be considered in calculation. Designs with mixed assemblies combining welded joints with bolted are riveted joint should be avoided.
10. Minimise the amount of weld metal. Do not over weld.
11. Use intermittent welding in preferences to a continuous weld pass.
12. Place welds above the neutral axis, balance the welding about the middle of the joint by using a double V-joint.
13. Weld depositions sequence shall be at adjusted to minimize the residual stresses and distortion to obtain the desired dimensional stability and mechanical attributes.
14. If possible, welding shall be accomplished in PA or PB positions by using simple tilting or rotating device.
15. The welding shop will be protected against the harmful wind and weather (e.g. wind, rain snow and air-droughts) while welding.
16. Preferably the arc current return cable shall be attached directly to the substrate to enable ample electrical contact with least resistance in a circuit. It is recommended to attach the welding current return cable as close as possible to the arc spots.

17. The substrate or workplace temperature just before the arc strikes shall always be maintained  $15^{\circ}\text{C}$  (Min) and inter-run temperature be  $\leq 180^{\circ}\text{C}$  (Max).
18. If the track welds are merged into the final weld, then those track-welds too will be subjected to the same degree of inspection, as required for the final weld assembly. Track welds becoming the part of final weld shall be accomplished in a manner that they are melted and merge precisely during welding.
19. After removing the notches and ridges caused by the finishing operations, as grinding or cutting the wall thickness shall be maintained at least 98% of that designed nominal thickness. If the nominal wall thickness reduced beyond 2% a repair shall be warranted by welding. Deviation shall only be allowed with the prior agreements between the customer and manufacturer.
20. If the drawings specify notch free surface for the obvious reason of fatigue-strength then that weld surfaces shall be ground flush in that direction of loading.
21. For repairs, only the qualified welding procedure & welder suitable for that type and class of welding shall be used. If the systematic damage or deviations observed from the blue print drawing the prior agreement of the customer shall be inevitable before welding.

### **Proximity of the two weld Joints**

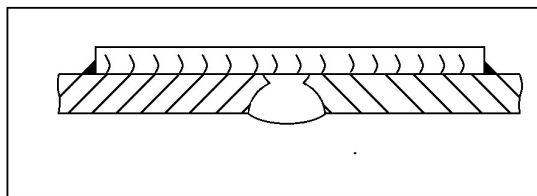
Parallel **weld seam** shall positioned in such a way that the heat affected zones does not overlap. In order to reduce the angular deformation and stress build-up, the minimum distance between the two parallel seams will be determined in accordance with the thickness  $<20\text{mm}$ , it is recommend to maintain the parallel weld seams at least 50 mm apart, see the figure below:

### **Minimum distance between molten areas:**



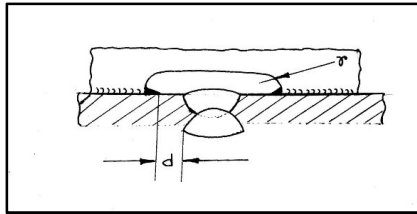
### **Stiffeners welded to a longitudinal weld:**

Openings on component parts while crossing over butt-weld by another fillet/putt-weld shall be avoided. The excess weld material deposited will be ground flush to enable welding without interruption at the weld junctions or crossings.



### **Stiffeners fitted perpendicular to a longitudinal weld:**

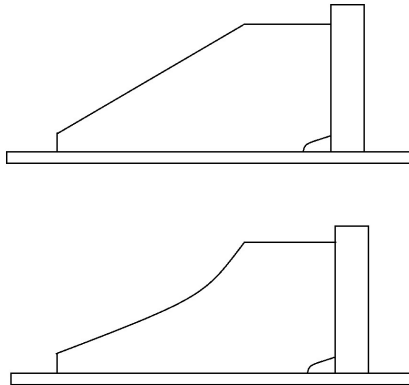
Filler and drain ports: Therefore, drainage cut-outs shall be avoided. If they are absolutely required, such openings shall be large enough to be surrounded by a seal weld without inducing the stress build up in HAZ of connecting welds. Look at the figure ahead:



'r' according to EN 1708-2, but minimum 30 mm  $d \geq 20\text{mm}$ .

### **Gusset shape:**

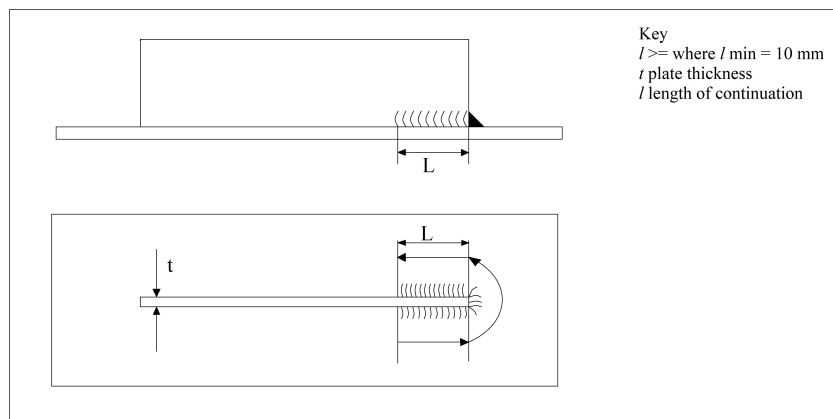
Most failures affecting stressed parts (dynamically loaded) are due to the shape-related problem; which poorly directs the lines of stresses and encourage stress build-ups.



### **Weld return:**

The weld shall run around the ends of the gusset. If possible without interruption over a length which is, at least equal to the thickness of  $2t$ , weld return is to be performed preferably without the interruption.

- a) Generally, to avoid the corrosion at the end of the plate independent of the weld performance class;
- b) At high stressed edges:

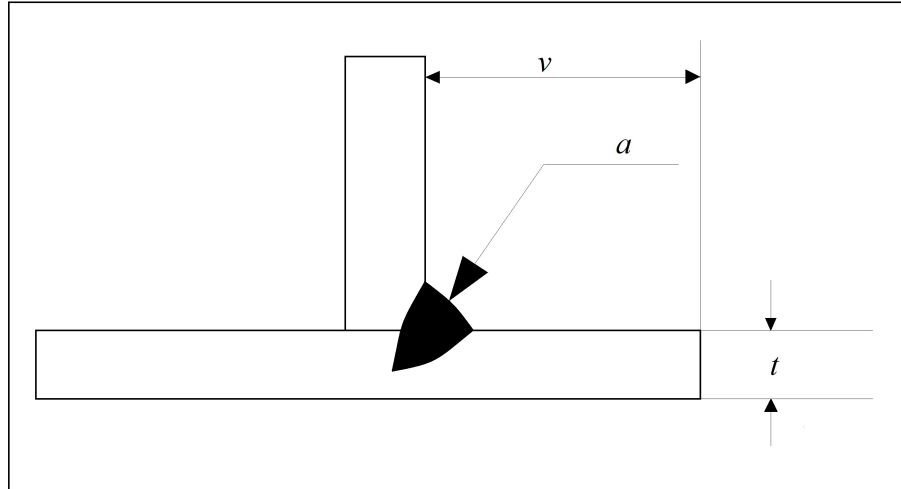


### **Fillet Weld:**

While designing the fillet welds following requirements will be considered:

Fillet welds should normally be isosceles. If there are constructive reasons or if a better force flux is needed, additionally to throat thickness  $a$ , the fillet weld leg length shall also be applied to the drawing.

The throat thickness ' $a$ ' of the fillet welds should not be more than the prescribed calculation. However, this may be increased for technological or welding engineering functions.



The edge distance  $v$  should be  $v \geq 1.5a + t$

### **Butt welds:**

For weld performance, run-on & run-off plates shall be used at the beginning and end of the weld run. For other butt welds, run-on and run-off plates/tabs may be used to prevent an insufficient penetration at the start and end of weld runs. They shall be shown on the drawings.

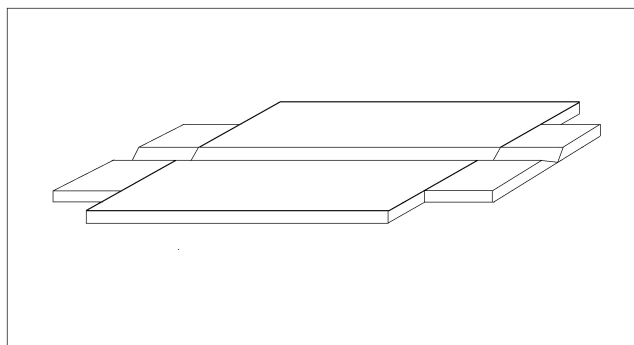
The run-on and run-off plates shall be made so as to enable welding to initiate or end beyond its necessary length. The parts to be assembled and the plates, which are "integrated" into the design or implanted as small plates on the parts to be welded, are homogenous.

The preparation of these plates shall be the same as that used on the joints to be made.

The plates shall be either fixed by mechanical or magnetic means and can be welded.

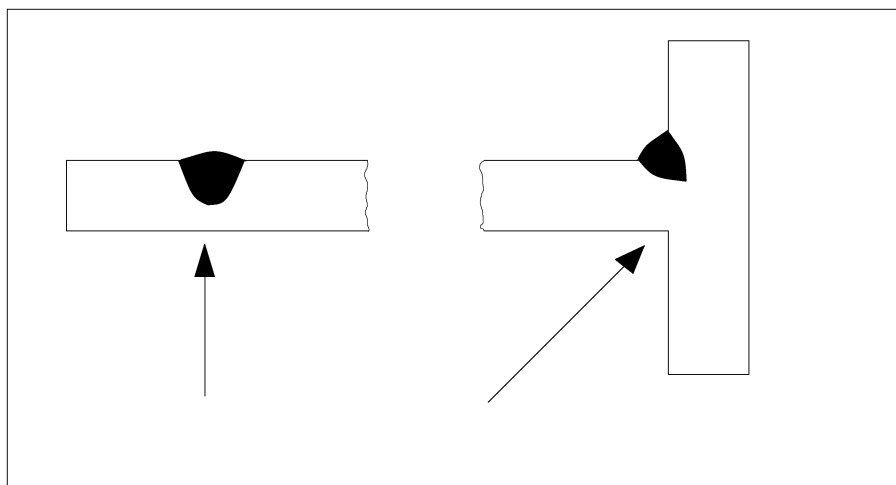
After having completed the joint, the plates can either be mechanically removed or plasma cut. A longitudinal grinding shall be made after the removal of the plates. Any rupture caused by shock is prohibited.

### **Example of run-on and run-off plates for butt welds:**



### **Prevention of corrosion:**

If necessary, in order to prevent corrosion related issue, the designer shall ensure closure at the back of the weld through weld return and/or back welding or the use of a sealing compound.



### **Technical Specification of Stainless Steel for Bridges:**

#### **Base Metal Technical Specification:**

IRSM 44/97(M) similar to RDSO specifications IRS-M44/97 and CK-201 X2CrNi12 suitably modified for the structural application, ASTM A1010/A1010M-01e1 and Indian Standard(IS) 6911- 2077(amendment 2) X02Cr12.

#### **1.1 Chemical Composition**

Element	Percentage
Carbon(C)	0.3 max
Manganese (Mn)	0.8-1.5
Silicon(Si)	1.00 max
Sulphur(S)	0.03 max
Phosphorus(P)	0.03 max
Nickel(Ni)	0.30-1.50
Molybdenum(Mo)	0.1 min
Chromium(Cr)	10.8-12.5
Titanium(Ti)	0.75

#### **1.2 MECHANICAL PROPERTIES:**

1.2.1 When tested according to method Specified in IS-1608, the ultimate tensile strength, 0.2% proof stress, hardness and elongation percentage shall be as follows:

Properties	Value
0.2% proof Stress	350 MPA min
Ultimate tensile strength	500 MPA min
% Elongation	20 min
Hardness(HRB)	97 maxes

**Welding process & consumable:**

<b>Welding Process</b>	<b>Welding consumable class AWS</b>
MMAW/111	E309LMo-16v or 17
MAG /135	ER309LMo
FCAW /136	E309LMo T-X

**Welding personnel:**

The manufacturer shall have at his disposal sufficient and competent personnel for the planning, performing and supervising of the welding production according to specified requirements.

**Welders:**

Welders shall be qualified by an appropriate test as per ISO 9606 -1.

\*\*\*\*\*