

### Specification for Cast Manganese Steel Crossings

EN 15689:2009(E) Standard for Cast Manganese Steel for fixed Crossings and Cradles for Crossings with moveable parts designed to be bolted to rails.

Rail ends of the Cast Manganese Steel Crossings shall be suitable for mechanical joints.

#### Materials

Element	Percentage Weight Components Weight %
Carbon	0.95 to 1.3 <sup>a</sup>
Silicon	0.65 max.
Manganese	11.5 to 14.0 <sup>a</sup>
Phosphorus	0.050 max.
Sulphur	0.030 max.
Nickel	1.75 max.
Molybdenum	0.75 max.
Chromium	0.50 max.
Copper	0.30 max.
Aluminium	0.045 max.

#### **Microstructure**

Crossing shall have an austenitic microstructure and be free of detrimental carbide precipitation. To prove the as-cast carbide structure has changed to an acceptable austenitic structure this shall be demonstrated by metallographic examination or mechanical testing.

#### **Surface Conditions**

##### 1. Un-machined and heat treated surfaces

- I. Surface finished
- II. Surface inclusions
- III. Gas porosity
- IV. Laps and cold chutes
- V. Scabs

##### 2. Machined surfaces

The maximum level of arithmetical roughness are

- I. Wheel contact area : Ra 6,3  $\mu\text{m}$
- II. Surfaces without wheel contact : Ra 12,5  $\mu\text{m}$
- III. Fish plate areas : Ra 6,3  $\mu\text{m}$

### 3. Tolerances

Dimension of non machined areas of the casting areas shall comply with tolerances given by ISO 8062-CT 11.

Dimensional tolerances for machined casting shall be referenced on detail drawings for the crossing component.

#### Internal Soundness

Check all zones on sample casting over the full length, using radiography

Acceptance levels according to ASTM E 446, ASTM E 280 and ASTM E 186.

#### Locations Zone of inspection

1. Running surface and rail weldable end pieces
2. Under running surface on the nose up to 60 mm width
3. Wing rail by a distance of 400mm from theoretical point towards wing front rear wards up to the end of the running surface.
4. Below the running surface and rail weldable end pieces
5. Web of the leg ends of fish plated crossing for the whole length of the fish plate.
6. All other zones of the crossings.

#### Frequency for radiography examination

Each pattern type shall be checked by radiography in the following locations

1. The nose
2. The wheel transfer area
3. Leg ends
4. Change of sections

#### Acceptance Tests

1. Chemical analysis  
Shall be checked from each cast of liquid steel
2. Impact bend  
The efficiency of the heat treatment shall be checked for each melt and heat treatment charge.
3. Metallographic examination  
Shall be done with a magnification of 100X shall be undertaken.



4. Visual inspection  
The inspection shall be done according to EN 1370.
5. Dye penetrant testing  
Shall be checked in accordance with EN 571 - 1. Acceptance shall be in accordance with EN 1371 - 1 quality level SP 1. Testing shall be undertaken in the finished condition.
6. Radiography  
Shall be undertaken in accordance with the requirements of EN 444:1994, class A, verified in accordance with EN 462-3:1996 by the use of wire type Image Quality Indicators. Staff undertaking radiography shall be qualified to EN 473.

#### **Additional Requirements for Pre-hardened Crossings**

The process shall be approved by manufacturing a Cast Manganese Crossing with pre-hardened running surface.

##### **1. Dye Penetration Test**

The acceptance criteria are the same as specified in 7.5. To demonstrate that the pre-hardening process has no detrimental effects on the casting, the Cast Manganese Crossing shall be dye penetration tested after pre-hardening. All the pre-hardened surfaces shall be tested.

##### **2. Hardness Requirements**

Minimum surface hardness on the running surface, down to 10 mm on the gauge corner as shown in Figure 7 shall be 321 HBW. Other hardness testing equipment with a ball indenter, which allows a conversion into Brinell, may be used.

The sub-surface hardness at a depth of 5 mm shall be a minimum 280 HBW.

Sub-surface hardness testing shall be tested at the frequency specified in 8.3.

Depth of hardening profiles shall be measured on transverse sections according to Figure 8.

The depth hardness profile shall be measured with Vickers HV30 down to depth of 20 mm. The distance between hardness indentations shall be 1 mm. Additional hardness tests at 5mm from the running surface shall be done.

#### **Production Tests**

Surface hardness shall be tested on every pre-hardened crossing.







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