



Principle

The rails are aligned with a prescribed gap between rail ends.
Rails are preheated to temperature, measured with temperature indicators.
The joint is made inside shuttering, consisting of copper blocks.
Joints are formed using continuous layers of welded fillets.
Following welding the head of the rail is ground to profile.

Equipment

The basic equipment consists of :

- set up materials: rule, wedges and shims;
- a mould set, comprising of electrolytic copper pieces and shuttering plate;
- a welding transformer of adequate capacity to supply 500 Amp;
- a propane gas burner;
- a rail grinding machine (hand held or trolley mounted).

Consumables comprising :

- low hydrogen electrodes, complying with DIN norm 8555 : E1-UM-250, size 5 or 6 mm;
- a mild steel insert acting as the base of the fillets;
- a thermic insulating plate to protect the rail pad.

Set up

- The technique should be carried out by suitably qualified welders.
- Electrodes must be dry and kept out of any moist atmosphere.
- The amount of electrodes required for each rail weld varies according to the rail and electrode types. For instance, for 450 mm electrodes with a diameter of 5 mm, a typical quantity is :

Rail	Quantity
A 65	15 to 20
A 75	20 to 25
A 100	30 to 40
A 120	50 to 60
GX 42	15 to 20

- Copper mould pieces must be similar to the rail profile. A copper lower plate (± 10 mm) for the base of the weld and pieces of typically ± 20 mm thickness to place at the rail sides to act as shuttering.

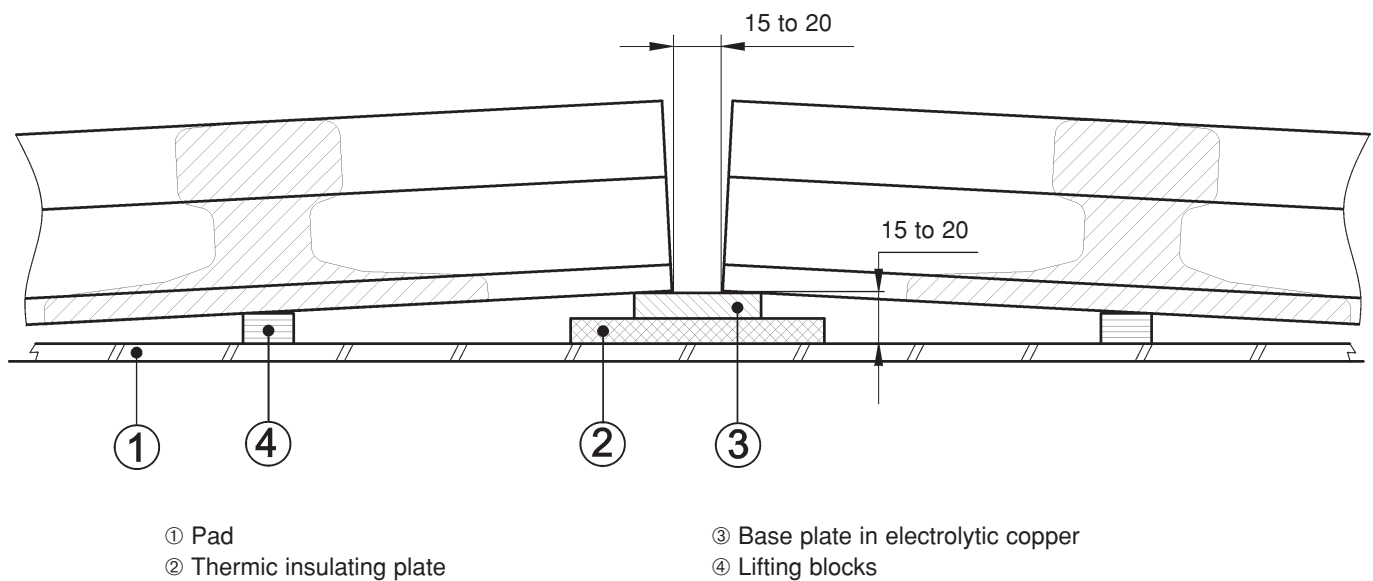
Welding operations

Rail cuts :

- The rail edges must be vertical and square cut, using a commercial saw cut (no flame cutting allowed).
- Ends must be free from rust and carefully cleaned.

Rail installation and set up :

- Each rail length shall be laid on the pad, carefully aligned and tightened on support with the clips. At each end a 3 m length of rail shall be left free in order to allow the rail to be lifted.
The rails shall be placed with a 15-20 mm gap between them.
- Then rail ends will be lifted up of a height equivalent to the gap. This uplift is required to compensate for shrink when cooling.
- The welder will adapt the gap and the uplift, taking into account the result of previous welds.



Pad protection :

- Pad will be protected against heat by a plate of adequate dimensions to ensure correct protection, in a material such as ceramics.
- Recommended materials are Masterclad and Promatech. This plate will be inserted under the copper plate, but above the pad.

Rail preheating :

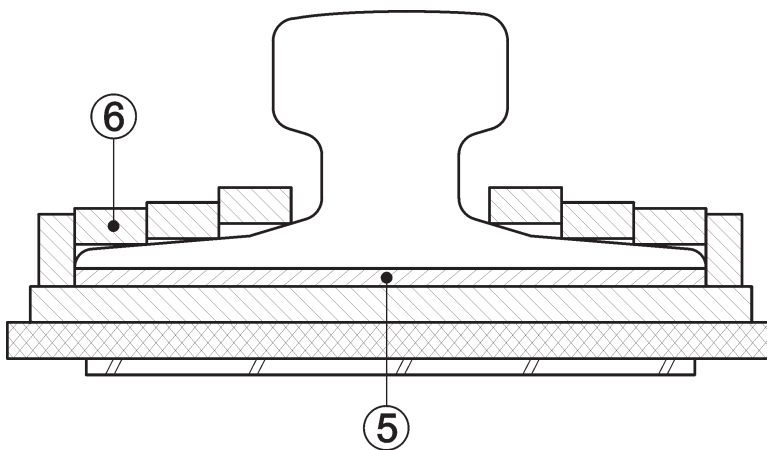
- The ends of the rail shall be preheated prior to welding to a temperature depending on material used, for a distance on at least 150 mm on either sides of the joint. The welder must ensure that the full rail section is heated, and that this temperature is maintained during the welding procedure.

Rail steel grade	Preheating temperature
700 N/mm ²	200-250°C
800 N/mm ²	250-300°C
900 N/mm ²	300-350°C

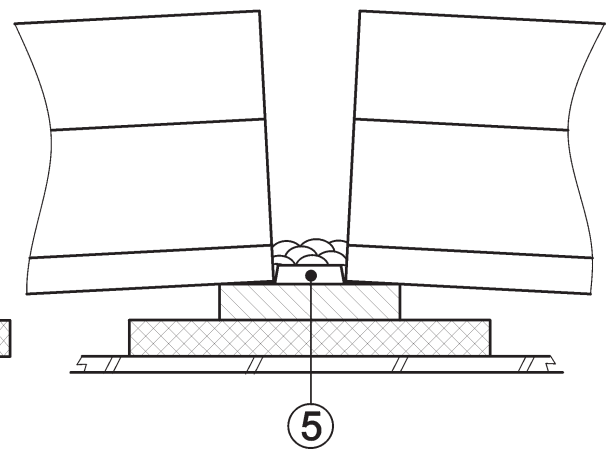
Welding procedure

Rail foot welding :

- The rail is laid on the copper base plate. A mild steel insert is placed in the gap on top of the copper base plate. This insert shall be 12 mm x 3 mm x rail foot width.
- The Welder starts by laying the first run of metal along the mild steel insert. Care must be taken to ensure complete fusion between the insert and the rail ends. The weld shall be carefully de-slugged after the first run.
- The current for the electrode type used is approx 250 to 280 Amp.
- Welding continues up to the completion of rail foot weld. Electrodes have to be changed as quickly as possible in order to prevent the weld bath cooling.



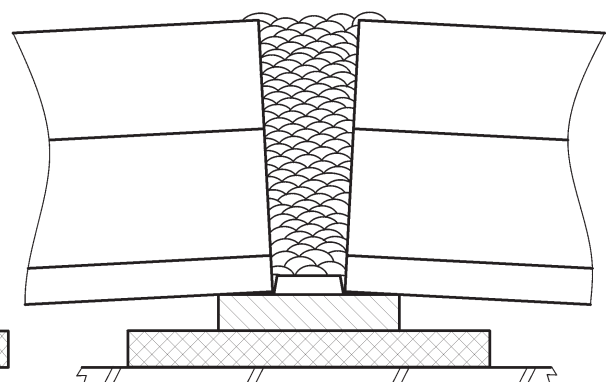
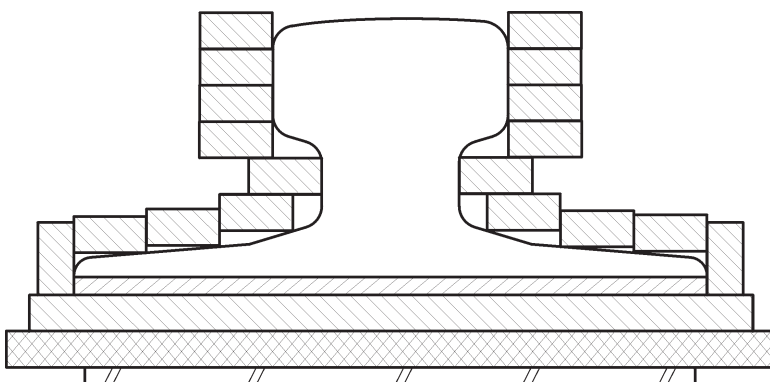
⑤ Steel insert



⑥ Electrolytic copper block

Welding rail web and head :

- Welding of the web and rail head sections is then performed, whilst progressively installing the side copper pieces.
- The weld is continued up to 1-2 mm above the top surface of the rail.





Cooling :

- It is of major importance that the rail cools slowly to prevent weakening of the welded joint.
- After approx. 15 minutes, the copper mould pieces may be removed. They should be carefully cleaned for further use.
- Rail may be laid down, however, the insulating plate **MUST NOT** be removed.
- Allow the rail to cool for at least for 12 hours.
- When weld reaches a temperature of 60°C, the insulating plate may be removed after having checked for smoothness under the rail foot.

Weld finishing

- When weld is completely cooled, it can be finished by removing the excess metal at the periphery of the rail head.
- This grinding has to be performed with an edge grinder either manually or with a running support. Grinding must be performed longitudinally.

Control and tests

For each weld, a visual (general aspect) and dimensional (smoothness, flatness, straightness) check is mandatory.

Upon request, other test may be carried out.

Remarques

Safety requirements and adequate personal protections must be used for the welding operations.

We reserve the right to discontinue or change specifications or design at any time without prior notice and without incurring any obligation whatsoever.



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