

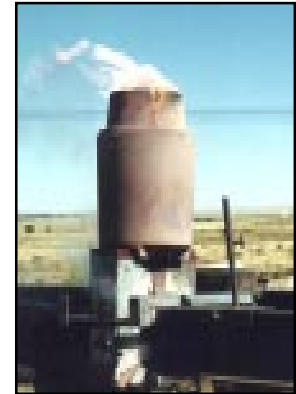
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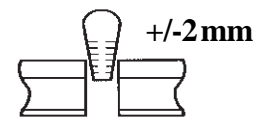
PROCESS MANUAL

FOR ALUMINOTHERMIC RAIL WELDING
SAR30 - SAR 40 - SAR 48 / SAR 40
SAR 48 - SAR 57 - SAR 60 - SAR 57/SAR 48



QP PROCESS

GAP 25 mm



LUTING PASTE



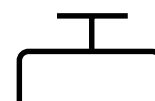
ONE-SHOT CRUCIBLE



OXY - PROPANE



CONTROLLED COOLING



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PREFACE

This manual is made to help welders and supervisors of welding operations, organizations, and follow-up inspections.

However it does not replace the Railways specification documents concerning thermite welding and inspections.

SAFETY

Whenever possible work within the track
Wear gloves, goggles, leggings, safety shoes.

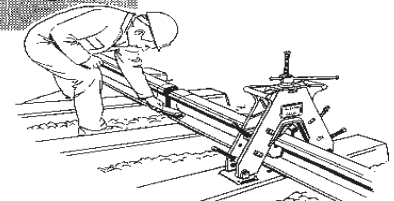
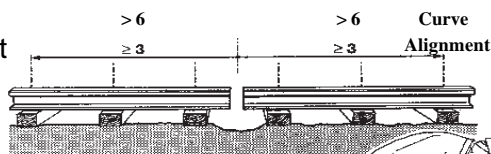
1 - PREPARING THE JOINT TO BE WELDED

- Undo fasteners on either side of the joint to be welded

- on 3 sleepers in straight track
- on 6 sleepers in curve

- Clean and brush the ends of the rail in order to eliminate all traces of grease or oxydation.

- Check the dimensional quality and note the discrepancies.



2 - AJUSTING THE JOINT

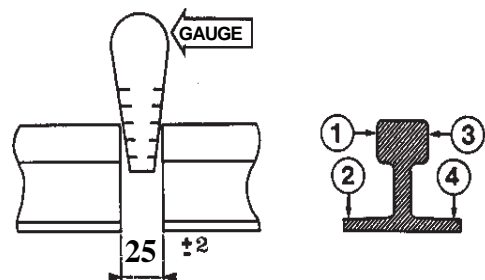
2.1 - Welding gap

- Welding gap : **25 +/- 2 mm**

The four measurements 1-2-3-4 taken must fall within the tolerance span of 23 to 27 mm.

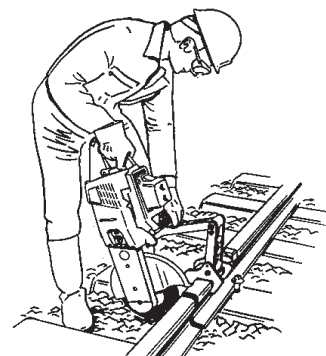
Rail cuts are to be perpendicular and within the above tolerance range.

It is recommended to use a rail saw to cut rail.



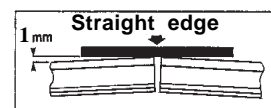
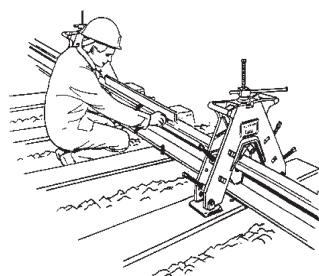
Caution !

Strictly follow the safety instructions (manual) concerning the use of your saw.



2.2 - Vertical Alignment

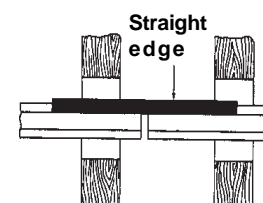
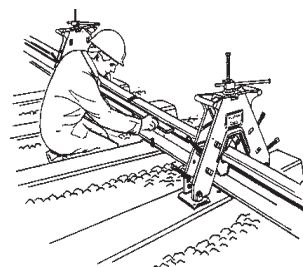
- Prior to welding, the rails must be vertically adjusted in order to form a peak, measurement between straight edge ends and rail is to be 1 mm.



2.3 - Horizontal alignment

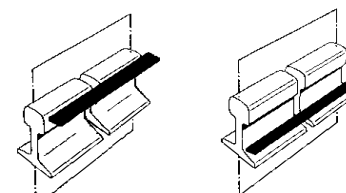
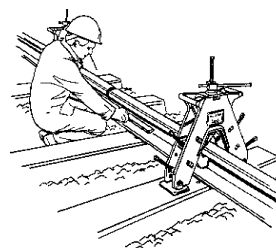
- Line rail, gage side to match head, web and base over the length of the entire straight edge length.

Nota : in curves with a radius < 500 m use gauge tie rods



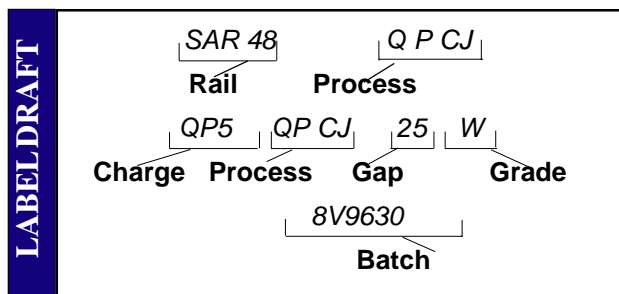
2.4 - Twisting of the rails

- Inclination of the two rails must be carefully checked in order to eliminate rail twist (match head, web and base)



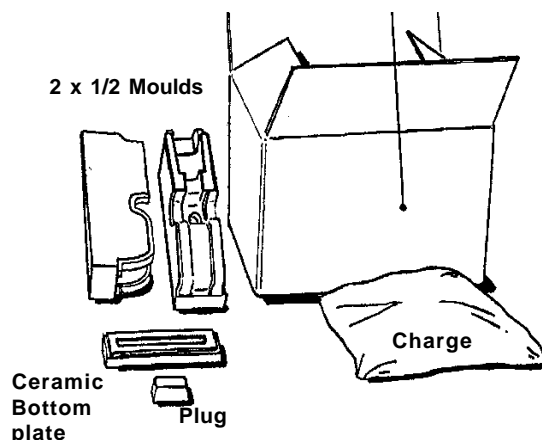
3 - WELDING KIT

The reference numbers indicated on this label must be recorded. No inquiries shall be taken into consideration without this information.



Welding portion grades

- W = Z80
- 320 Cr = Z110
- HH = Z120



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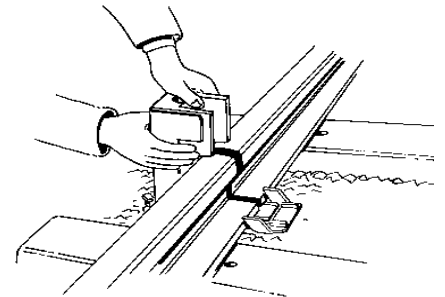
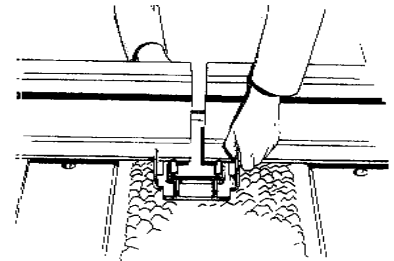
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4 - SETTING THE MOULDS AND LUTING

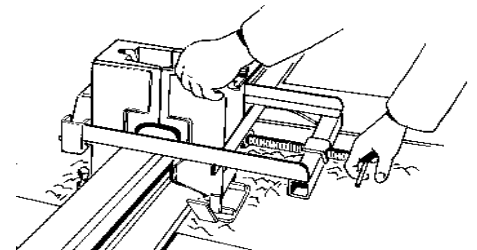
4.1 - Preparing and luting the sand base plate

- Place the base briquet in the base plate. Make sure that it sits in the plate correctly (*no wobbling*).
- In the recesses on either side of the briquet, apply a strip of clay cement. *Not thicker than a pencil*
- Engage the base plate assembly on both rail ends.
- Verify that the base plate is perfectly centered. Then tighten the bolts by hand.

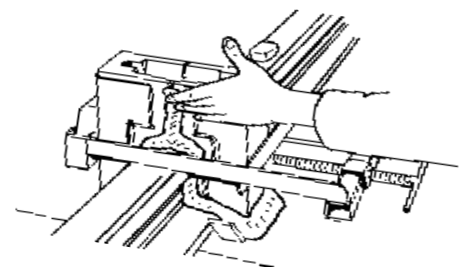


4.2 - Setting the moulds

- Place each mould jacket on respective half mould.
- Place half mould (*Centering to the gap and base briquet*).
- Place second half mould and apply mould clamp.
- Make final adjustment so two half moulds are perfectly centred.

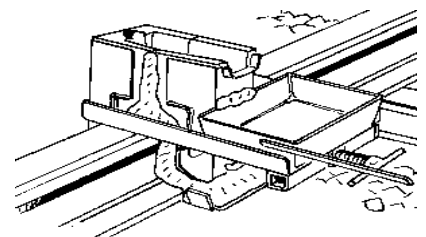


Be carefull not to break the mould by over tightening the clamp. We recommend to cover the top of mould with cardboard while luting.



4.3- Luting the moulds :

- Seal crevices between mould and rail, and back it up with larger bead starting at the heel of the mould.
- After luting, place the slag tray and seal the part between tray and mould.
- Protect the spout and thread of the mould clamp with paste.



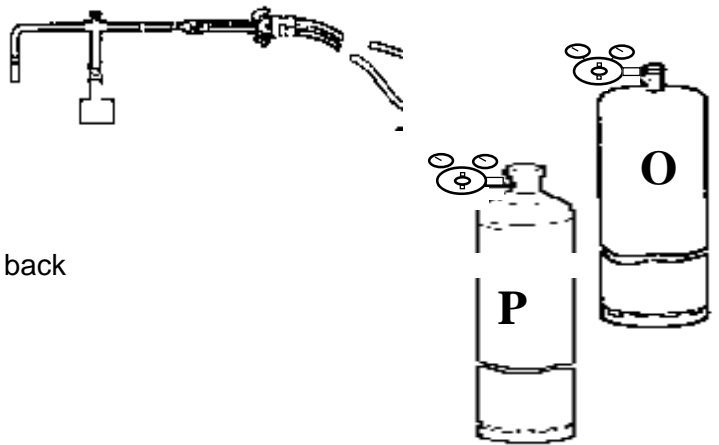
5 - PREHEATING

The good execution of preheating is essential for the life span of the weld. It is thus compulsory to respect carefully the specifications described below.

Preheating is an operation of major importance. Its function lies in the elimination of moisture from the moulds and to raise the temperature of the rail ends.

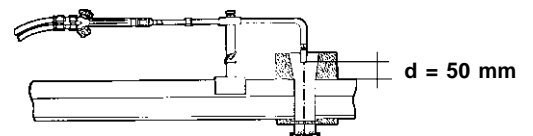
5.1 - Equipment (Page 11 - § 15 Preheating tools)

- It is specified :
 - 1 oxygen cylinder
 - 1 propane cylinder
- We recommend
 - 1 burner equipped with its support and flash back arrestors
 - 1 oxygen regulator
 - 1 propane regulator
 - 25 m hose assembly \varnothing 8 mm
 - Flow gauge

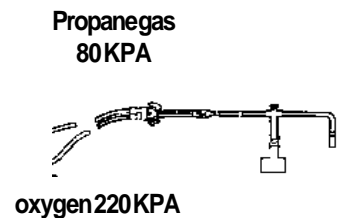


5.2 - Preheating adjustment

- Make sure that the propane and oxygen cylinders are full enough for the duration of the operation
- The distance (d) between the end of the burner nozzle and the top of the rail is **50 mm**.
- Fit the burner in its support and centre the nozzle in the moulds
- Remove the burner from its support



SPOORNET flow gage settings
oxygen **220 KPA** propane **80 KPA**



Propane tap fully open, oxygen tap open to reach 27 mm flame. To adjust the flame reduce oxygen until verge of on the popping

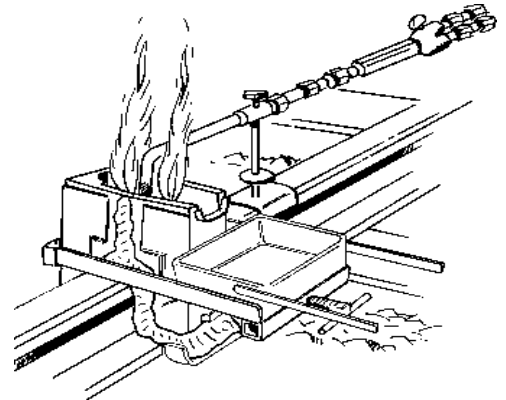
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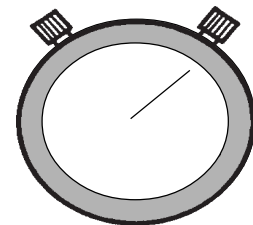
5.3 - Lighting the burner

- Light the burner and check the length of the flame cone (27 mm blue flame).
- Place the burner in its support into the moulds,
- Reduce the oxygen flow until the flame is on the verge of popping and increase slightly until popping is eliminated. Repeat this procedure several times during pre-heat
- With the burner inserted into the moulds, the flames must be symmetrical.
- Place the plug by the exhaust with the upper side against the flame, so the plug can be warmed up. (In doing so, take care not to block the exhaust).



5.4 - Preheating times :

- SAR 30	5 minutes approx.
- SAR 40	5 minutes approx.
- SAR 48 / SAR 40	6 minutes approx.
- SAR 48	6 minutes approx.
- SAR 57	7 minutes approx.
- SAR 60	7 minutes approx.

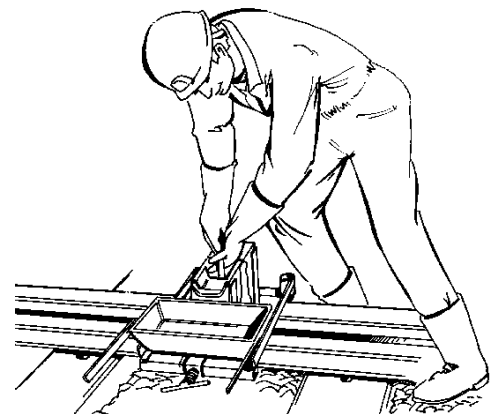
*USE STOPWATCH*

5.5 - Once the preheating is completed

- First turn the propane feed off, then the oxygen feed.
- Insert the plug by hand.

Caution !

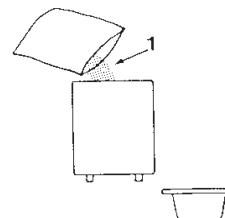
No waste of time shall occur between the end of preheating operation and igniting.



6 - ONE-SHOT CRUCIBLE

Preparing the one-shot crucible while preheating.

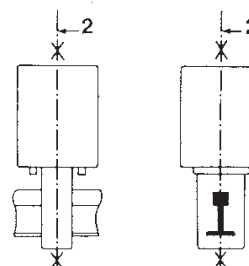
- Open the bag containing the welding charge,
- Pour the relevant aluminothermic charge into the one-shot crucible,
- Place the one-shot crucible near the rail ends and get an ignitor,



7 - CASTING

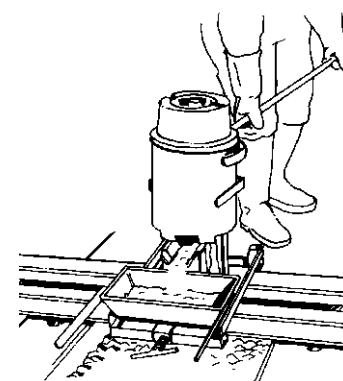
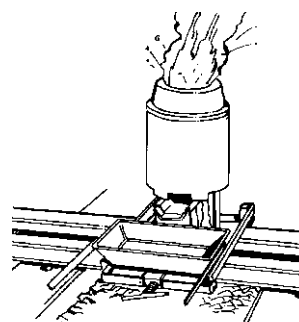
7.1 - As soon as preheating is over

- Place the crucible on top of the moulds. Make sure the crucible spout is centred in both directions.



7.2 - Reaction

- Ignite the ignitor by inserting it in a hot riser holes,
- Insert the ignitor a maximum of 25 mm into the charge mound,
- Put the lid on the crucible,
- The reaction develops in a few seconds, and the pouring will automatically take place at the end of the reaction.

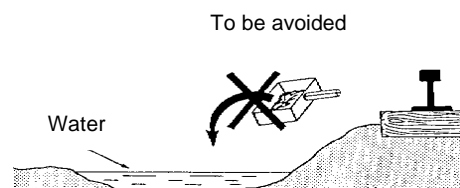


8 - REMOVAL OF THE SLAG TRAY

- The crucible is then removed by means of a special fork after 3 minutes of completion of pouring.
- Break the solidified slag on slag tray and mould jacket (3 minutes after the pour) and then remove the slag tray.

Caution !

The slag tray must be removed only after its content has fully solidified. Place slag tray with hot content on a dry spot (not on sleepers). Do not place or throw slag tray with hot content on wet surface or into water.



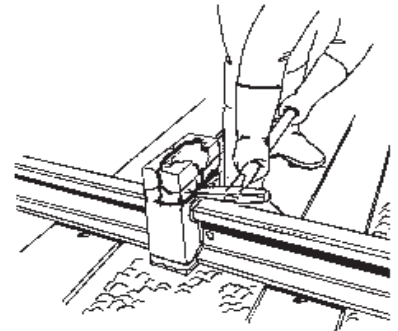
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9 - SHEARING PREPARATION

- After crucible and slag tray have been removed the base plate, mould clamp and mould jacket can be taken off.



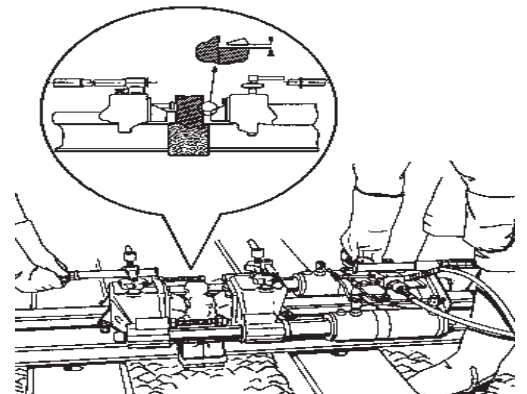
10 - SHEARING

Shearing with a sledge hammer and hot cut chisel is to be avoided

It is proposed to shear with a shearing machine. This method insures a better profile of the weld. Blades must be adjusted in height, at a minimum of 3 mm over the running surface.

This operation may take place when the weld has solidified a minimum of 6 **minutes** after pouring.

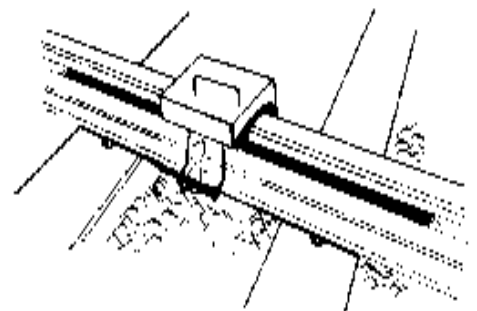
- Clean the sand around the excess metal using a metallic brush
- Place the shear machine on the rail
- Activate the lever for shearing
- Remove the shearing machine rapidly after use
- Bend inside risers to allow for grinding



Controlled cooling

The weld for 350LHT(HH grade 1200) and 320CR (Cr - Mn grade 1100) requires controlled cooling :

- Put the thermal blanket on immediately after shearing,
- Keep it on for **8 minutes**.



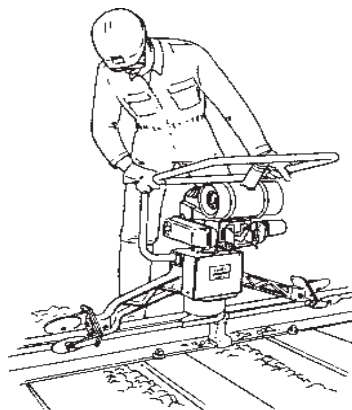
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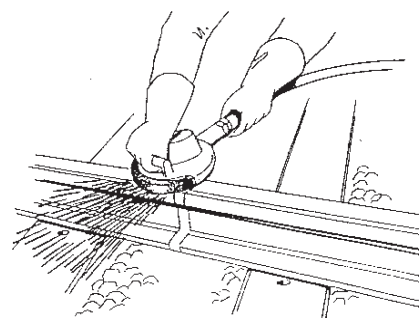
11 - HOT GRINDING

- Grind the running surface and leave to 1 mm. Grind the sides flush.



12 - COLD GRINDING

- After weld has cooled, grind running surface flush,



13 - FINISHING WELD

- Remove rail raisers, trackjacks or wedges after weld has cooled to 370°C,
- Clean weld from mould debris,
- Grind riser stumps and check for defects.

14 - MARKING

- Mark and record data according to Spoornet specifications

15 - PREHEATING TOOLS

1	Railtech burner (22 holes)	11231007
2	Propane hose	39960003
3	Oxygen hose	39960006
4	Flash back arrestor gas	48302028
5	Flash back arrestor oxygen	48302029
6	Manometer propane equipped with connector cylinder and protection	48102016
7	Manometer oxygen equipped with connector cylinder and protection	48102015
8	Manometer protection oxygen or propane	48101009
9	Tightening collar	48301073
10	Burner support	11234003

