

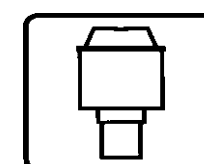
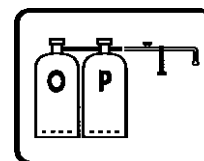
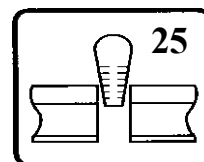
PROCEDURE FOR ALUMINOTHERMIC WELDING OF GROOVED RAILS

SRG

OXY PROPANE

LUTING

ONE-SHOT CRUCIBLE



REVISION N° 0.2

REF MAN/S/SRG/OP/LU/CJ/12.2007/OR

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PREFACE

This notice covers the instructions for carrying out the SRG welding process type RAILTECH , luting moulds and a one-shot crucible.

It is made to help welders and company executives understand welding operations, organization, and the following-up with welding sites.

This manual, however, cannot replace the Railways specifications documents (when available) concerning execution of welding operations and reception of works and determined by the customers. Only these documents must be applicable by the customers.

1 - INTRODUCTION

The micro-metallurgic welding procedure which is the subject of this manual is SRG (limited preheating oxy-propane).

11 - Preheating Oxy-propane

With this procedure, preheating is performed using a blowpipe supplied by cylinders of propane and oxygen adjusted under pressure. This is one of the fastest means of preheating.

Nevertheless, it is necessary to use cylinders of propane and oxygen which are capable of providing the prescribed pressures (see § 2.07). The use of any other gas is strictly forbidden.

For costumers established in regions where is difficult to obtain propane, Railtech can propose other procedures using other preheating techniques. Consult us.

12 - One-shot crucible

This procedure makes use of a crucible used for only one welding operation. This crucible self-decomposes after welding, without, however, completely losing its resistance so that it may be handled, thus its name «One-shot crucible». In this way, the initial shape and temperature of the crucible remain perfectly identical whatever the welding operation.

The crucibles need not be cleaning (and therefore the risks of inclusions because of a poorly cleaned crucible are eliminated). Because of the quality of the materials used to manufacture this crucible, its thermic performance is greatly improved.

With the one-shot crucible, adjustment of the crucible on its frame is unnecessary, as it would be with a conventional crucible, and centring of the casting opening is also simplified. Since it eliminates all unbalanced mass on the rail, the one-shot crucible makes it much easier to obtain precise geometrical tolerances.

13 - Packaging in the Kit

To avoid all errors in the supplying of a site (forgotten items, unadapted melting charges, ...) all of the expendables needed to carry out a welding operation have been packed in a single package called kit.

Each welding kit for the present procedure contains :

- Two half moulds, a bottom briquet and a plug,
- A welding charge packaged in a water tight plastic bag,
- A cartridge of luting paste,

All of these items are packed in a cardboard box shrink wrapped with a plastic film.

IMPORTANT : These moulds are perfectly adapted for the rails if the difference of the sections does not exceed 3 mm. The rails used must be examined to make certain that the wear on both ends remains within this tolerance limit.

2 - PERFORMING THE WELDING OPERATION

2.01 - Before leaving for the site

Make certain that the operator has everything needed for the work to be performed :

- Number of Kits necessary for the quantity of weldings to be done. Kits which correspond to the rails to be welded (see Kit identification § 2.04)
- A sufficient amount of full cylinders propane and oxygen (not less than four cylinders in any case), connections, flexible joints, hoses, manometers, pressure reducers in perfect condition).
- Complete set of welding tools in good condition : press-assembly, mould frames, ...
- Control tools : straight edge, gap gauge, chronometer, ...
- Procedures or possible welding specifications applicable on the network.
- Preparation and finishing materials for the weldings : «A» frame aligners, wedges, grinding machine, with the necessary expendables (petrol, oil, grinding wheels, ...)
- Tool box to carry out minor interventions such as changing a flexible joint, etc...
- Individual equipment (goggles, clothing, ...), safety signs.

It is suggested that a standard list of everything needed on the site remains at hand. This list is established depending on the organization of the work to be done and the number of teams.

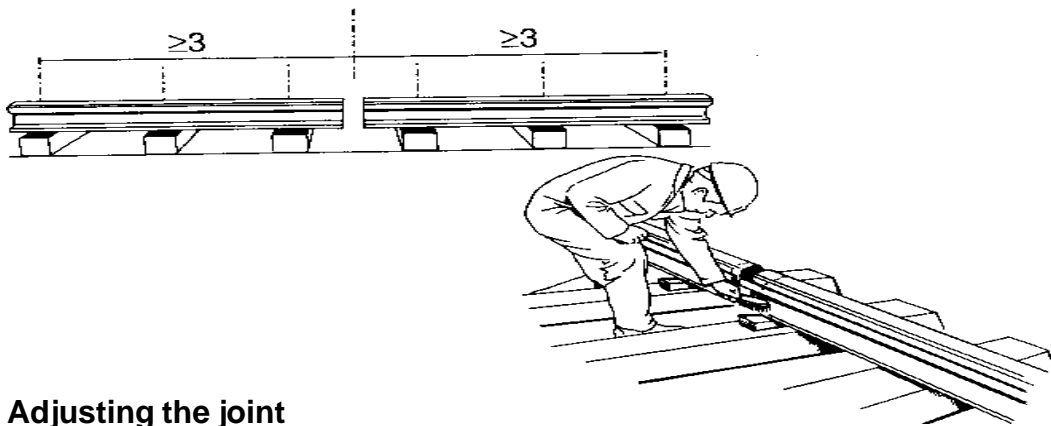
As an example, annexe 4.05 contains a check-list of what is needed for one team of welders (One professional + one assistant) called out for occasional interventions.

Comment : we recommend to make weldings in temperatures > -5 °C

Safety : Whenever possible work within the track

2.02 - Preparing the joint to be welded.

- Remove the fishplates, if necessary,
- Dismount the fastenings on 3 sleepers on each side of the joint to be welded (and more in a curve depending on its radius),
- Clean (degrease) and brush the ends of the rails with the brush and/or the grinder, in order to eliminate all traces of oxydation («rust»). A poorly cleaned rust deposit causes porous areas.
- Check the geometrical quality of the ends to be welded (damaged rail, skidding traces, new rails, drafting tolerances).
- Check that there is no crack in the rails.



2.03 - Adjusting the joint

Four parameters must be considered in adjusting the joint to be welded : the gap, the horizontal alignment, the vertical alignment, and the twist.

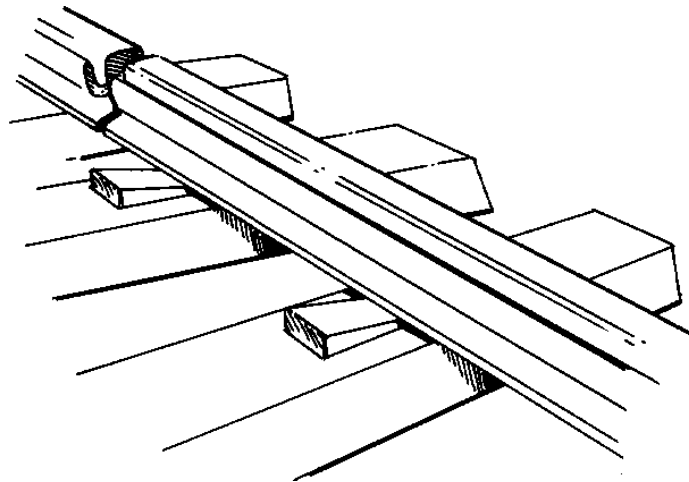
This adjustment is especially important because it determines the dimensional quality of the welding and its lifespan.

If the weld is «low» (negative point), shocks will be generated at each passage. If the weld is «high», the sleepers will move. In each of these two cases, the track will progressively deteriorate and/or the welding shall be damaged.

To adjust the joint, wooden wedges may be used, or any other aligning equipment which shall not damage the rail.

As a general rule, avoid all shocks which may damage the rail during the adjusting operations. Therefore, steel hammers must not be used.

To work more easily, safely, and quickly, use the frame aligners (See illustration below).



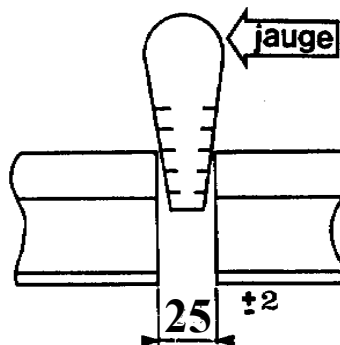
a) The welding gap

This is the space between the two rails to be welded.

This gap is equal to **25 mm +/- 2 mm**

This dimension shall be measured with a graduate gauge or, if not gauge available, with a short measuring tape on both sides of the rail, at the rail head or foot, obtaining four measurements as indicated by the sketch below. The limit values of the four measurements taken must fall within the tolerance span determined above (23 mm to 27 mm).

The **gap** must remain constant during the operation (be careful of rails which «push» or «pull»). If necessary, use **rail stretchers**.

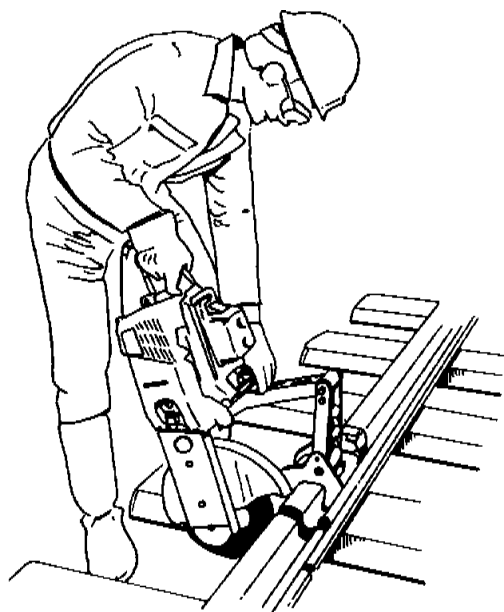


In order to obtain this value (25 mm +/- 2), it may be necessary to cut the rails. In this case, use only a disk rail saw. Use disks with double fabric covering (otherwise there is danger of explosion) adapted to the rotation rate of your equipment.

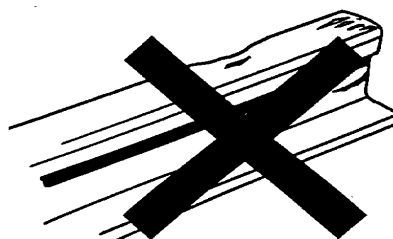
Use equipment in good condition, correctly attached to the rail, so as to obtain perpendicular cuts (if the cuts are not truly perpendicular, the correct tolerance may no be obtained). When the rail is cut in two times, the difference between the two planes which correspond to the two cuts must not exceed 1,5 mm.

It is strictly forbidden to weld directly on cuts made with a blow pipe, for this may cause micro-cracks. If the ends have already been cut by a blow pipe, always cut them again with a saw following the instructions inforced by your network. Claims for faulty weldings which appear on rails cut by a blow pipe shall not be taken into consideration.

Caution!
Strictly follow the safety instructions (manual) concerning the use of your saw. If the manual is not available, inform the operator of these instructions.



Damaged ends (malformations, marks, skidding marks, ...) must be recut after measuring the deflection (arc formed by the rail while it is loosened from the sleeper) with the 1 meter straight edge, if the damage is isolated. If the damage is not isolated (i.e if it extends over a significant length of rail), consult the person in charge of the site.

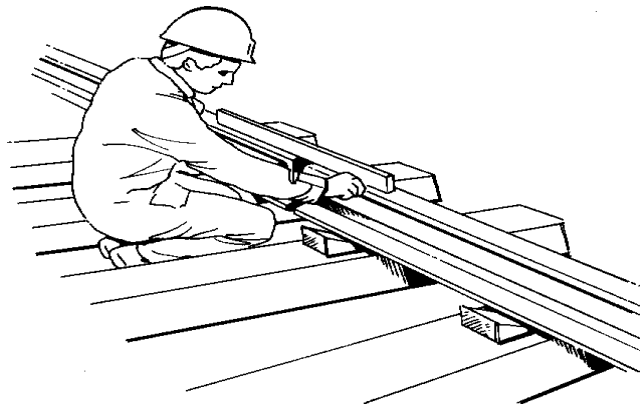


b) Horizontal adjustment

Prior to welding, the rails ends must form a peak (precamber) so that after welding - because of cooling - the rail shall not form a hollow and that an extra thickness shall remain to allow for grinding.

The peak shall be measured as indicated in the sketch below.

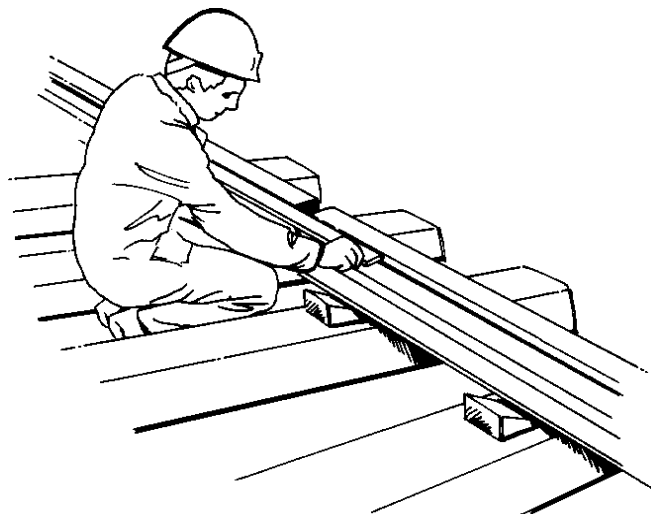
Take measurements approximately 50 mm from the ends of the straight edge.



The tolerances are established by the network.

c) Rail alignment

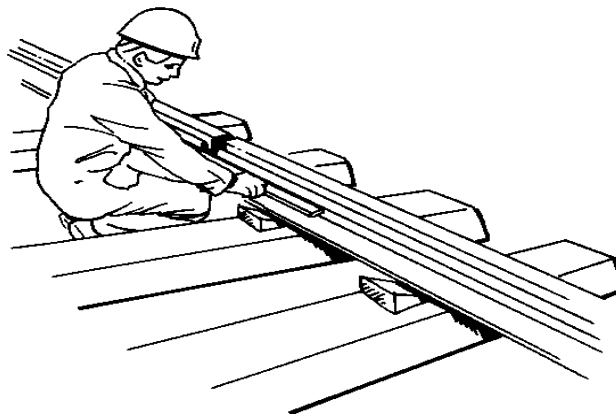
Alignment shall be measured on the internal side (on the inside of the track).



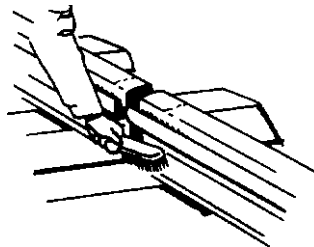
d) The twisting of the rails

Verify that both inclinations of the two rails are carefully checked.

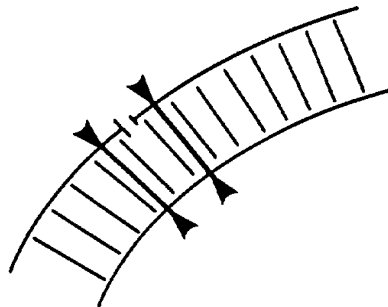
- The inside surface of the railhead ;
- The base of the web of the rail . must be simultaneously aligned.



Nota 1: *The two ends of the gap must remain perfectly dry and clean after being cut.*



Nota 2: *When the curves exceed a certain level, use the «gauge tie rods». For example, the level which is not to be exceeded may be set within a radius < 350 meters. Consult your network's instructions.*



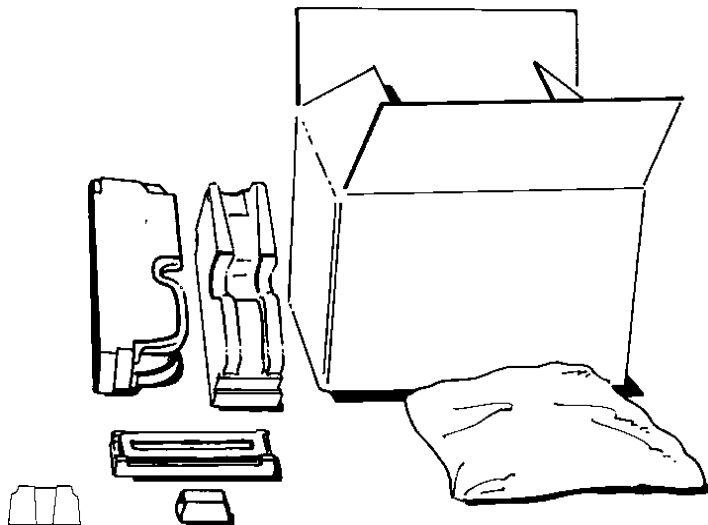
2.04 - Opening the kit

The Kits must be stored in a dry place where they shall not be crushed : do not stack more than 4 Kits, then place a pallet to distribute the weight. When storing with pallets, do not stack more than two.

- The Kit must be conserved in its original packaging, closed and exempt from any distortion or traces of dampness.
- Identification of the procedure and type of rail are indicated on the Kit packaging.
- Make certain that the Kit corresponds to the rails to be welded : sections, grade.
- A label on the plastic bag of the welding charge indicates the date the batch and reference numbers of the charge. This label must be removed from the welding charge bag and place on the recording sheet corresponding to the welding operation. An example of this recording sheet is given in annexe 4.2.

The reference numbers indicated on this label must be maintained (see § 2.17 «Marking and possibility of tracing»). No claim will be taken into consideration without this information.

35 G SRG	Rail and process
D44 SRG 25 G	Welding charge and gap
7B4700	Batch



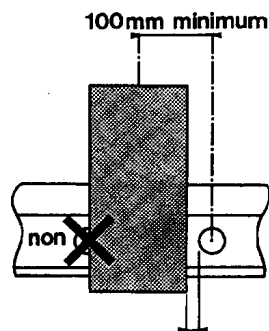
2.05 - Setting the moulds

The moulds must be centred on the axis of the joint.

Any excrescences of the section (burrs...) which may prevent correct installation of the mould, must be eliminated by grinding.

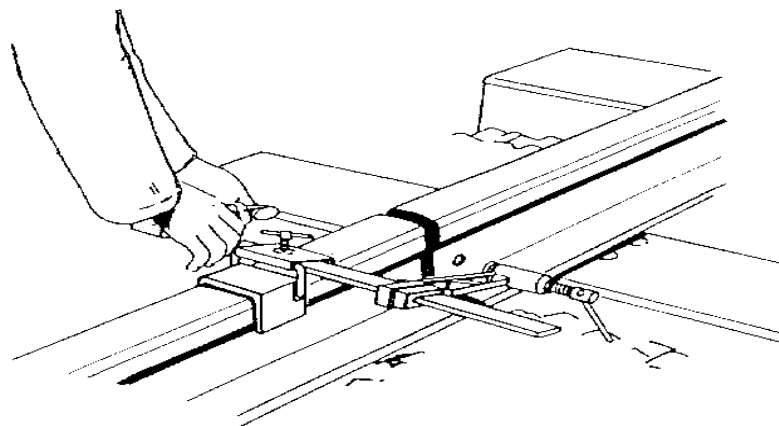
The mould should never be placed near a hole in the web. We suggest that a minimum of 100mm be imposed between the edge of the end to the welded and the center of the hole. Instructions from your network may impose a greater minimum distance : refer to those rules.

If rails were fishplated, 2 cuts might be necessary (Crushing of rail ends).

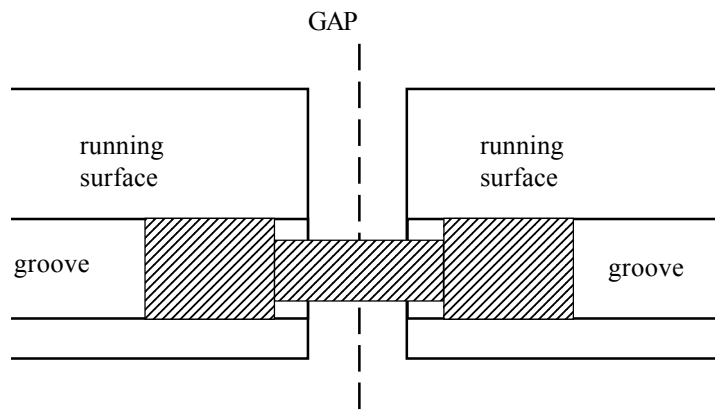


To set the moulds, procede as follows :

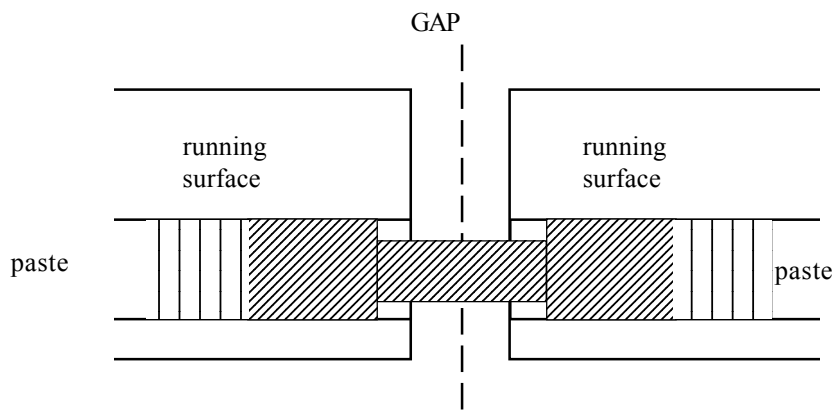
a) Position the clamp assembly.



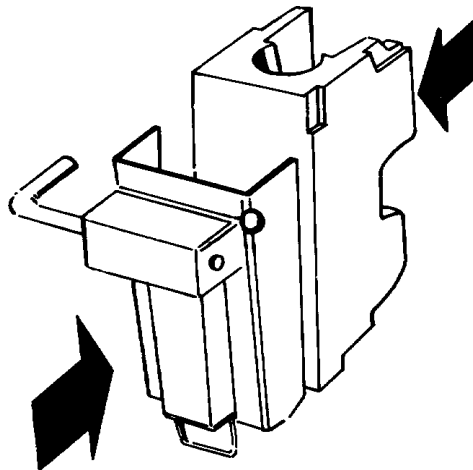
b) Position the groove core by taking care of centering it to the gap.



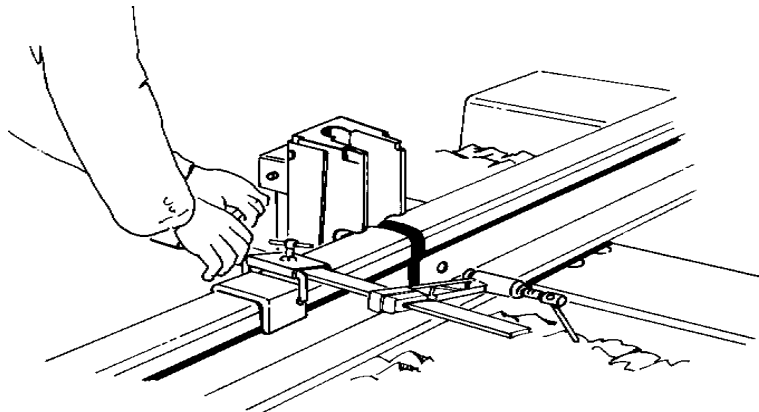
c) Apply luting paste in the groove so as to avoid that the core moves



d) Place each half side mould in its frame.

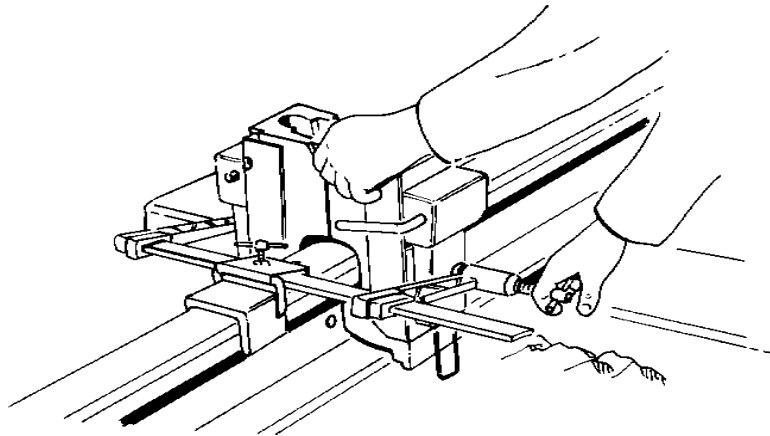


e) Set the half mould over the rail joint. Tighten the screw of the clamp assembly (Centre above and below in relation to the gap axis).

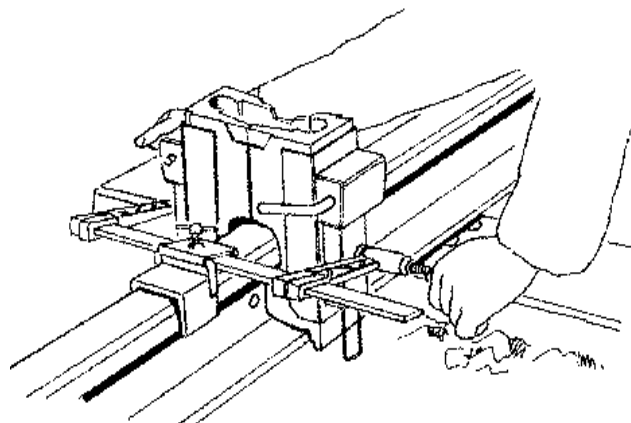


f) Maintain this half mould in position.

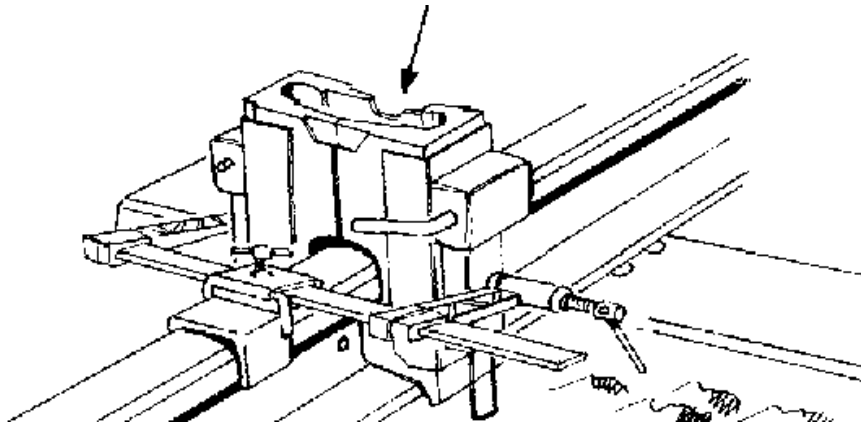
- g)** Position the second half mould. (Centre above and below in relation to the axis of the gap).
The two half moulds must never be offset from one another.



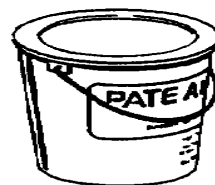
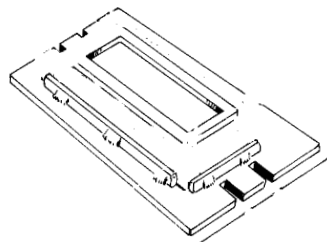
- h)** Finish fitting and adjustment (centering) of both half moulds. Loosen the screw of the clamp then tighten the clamp sufficiently (without breaking the moulds by excessive tightening).



- i)** Verify that no sand has entered into the moulds during the setting operation (erosion of the moulds). If necessary, remove the sand. This operation will no longer be possible once the bottom plate has been positioned (next step).



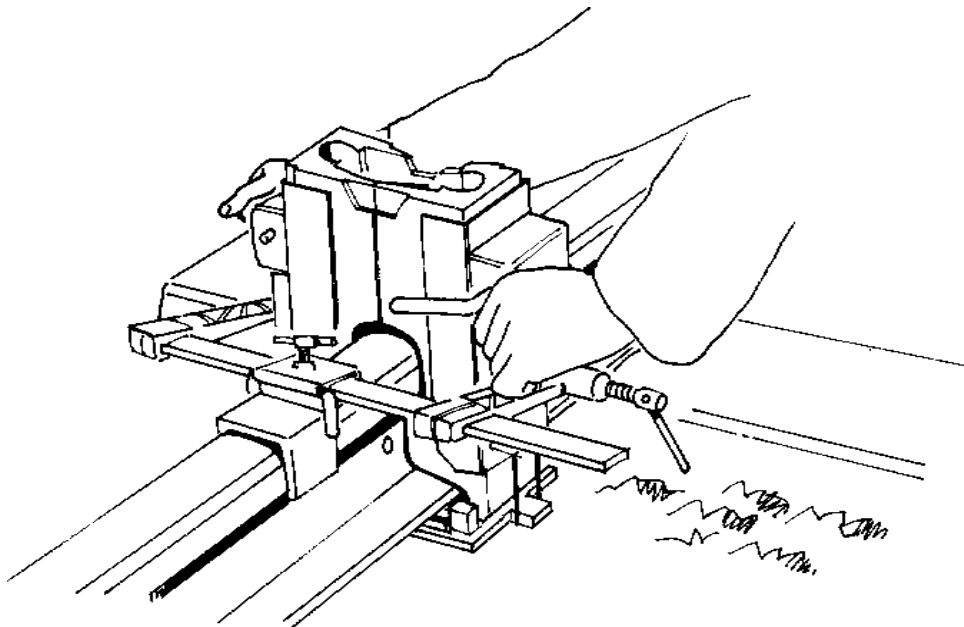
- h)** Place the bottom plate on its base plate. Verify that it rests correctly on the base plate (Does not wobble). Apply a strip of luting paste on the two recesses on either side.



k) Hang the briquet bottom plate on the hangers of the mould frames, check the centring of the plate in relation to the moulds, then take hold a locking handle with each hand.

Turn both hands at the same time.

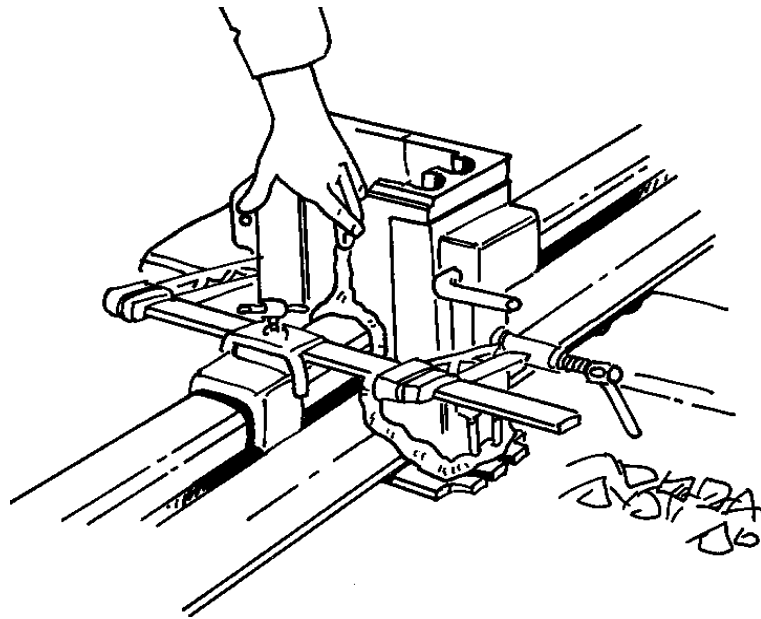
It is advisable to cover the moulds with carboard when the bottom plate has been positioned.



2.06 - Luting

Luting procedure makes it possible to finish up the packing.

Apply a continuous paste strip all around the perimeter.



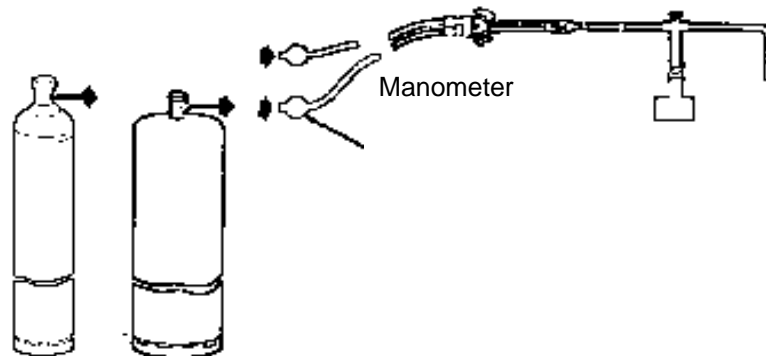
After preheating of the moulds, place the corundum tray and lute the gap between the tray and the moulds by means of a luting paste strip.

2.07 - Preheating

Preheating is an operation of major importance. Its function lies in the elimination of residual humidity from the moulds and in the temperature raising of both rails and moulds.

With the SRG process, it is important to check the propane and oxygen feed pressures and the duration of the preheating operation.

Watch pressure in cold temperature conditions !



We recommended

- a blowpipe equipped with its support
- 1 oxygen pressure reducer
- 1 propane pressure reducer
- 10 m of hose for oxygen \varnothing 10/17 mm norme NFT 47
- 10 m of hose for propane \varnothing 10/17 mm norme NFT 47

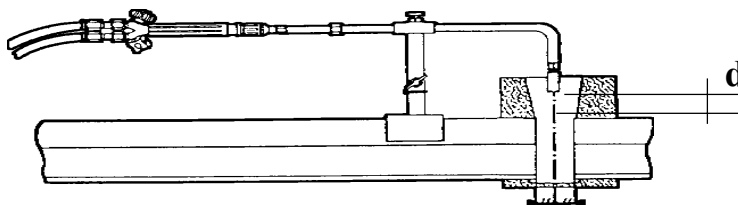
Preheating adjustment

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 blowpipe nozzle and the top of the rail is **50 mm** with Railtech blowpipe :

Pressures **oxygen 0.9 bar**
 propane 0.3 bar

They are preset on the pressure reducers while the taps on the burner are fully opened.



Fit the blowpipe in its support and centre the nozzle in the moulds

Remove the blowpipe from its support

Lighting the blowpipe

Open the propane taps, light the blowpipe at the same time

Open progressively the propane and oxygen inlet.

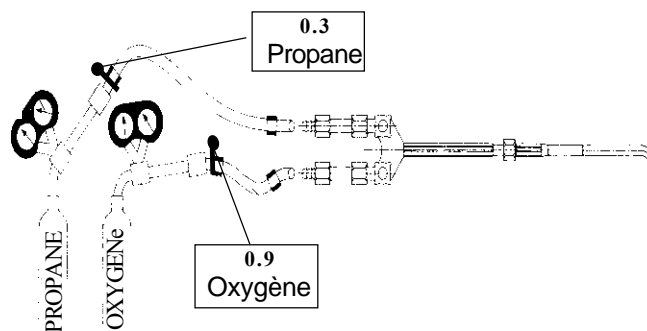
The dart must be between 15 mm and 20 mm. If it is not the case, adjust the length of the dart with increasing the pressure of propane at the cylinder well clamped to the nozzle and should be around 15 mm.

Fit again the blowpipe in its support and centre the nozzle in the moulds. *The two side pipes must release gases in an even and symmetrical way.*

Check the length of the flames (approx. 400 - 500 mm)

Place the plug on the moulds by the exhaust.

Wait for the blowpipe to operate for : **8 minutes**



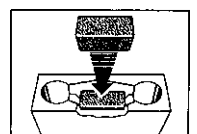
Once the preheating is completed, first turn the propane feed off, then the oxygen feed, taking care not damage the inside walls.

Place the slag tray

Seal the parting line between the slag tray and the moulds.

Place the plug by means of the relevant gripping tools.

Caution! No waste of time shall occur between the end of preheating operation and pouring work (maxi 1 minute). Operations will have to flow one to the other without any interruption.



2.08 - One-shot crucible

The one-shot crucible is made from a refractory compound agglomerated by means of a synthetic resin. The thermic factor being notably better than with conventional crucible, it is mandatory to use the melting charge corresponding to the new thermic balance (as provided in the kit).

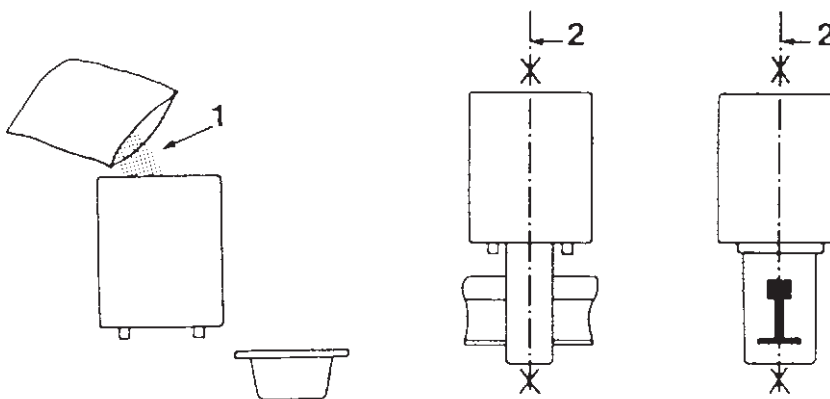
Consequently, use only the welding charge which is provided in the kit. Never mix two components from two different kits (That is to say, never pick up a mould from one kit, the melting charge from an other, etc...)

Never use a welding charge bag that is gutted or uncomplete. Do not add anything. Never mix two welding charges.

2.09 - Casting

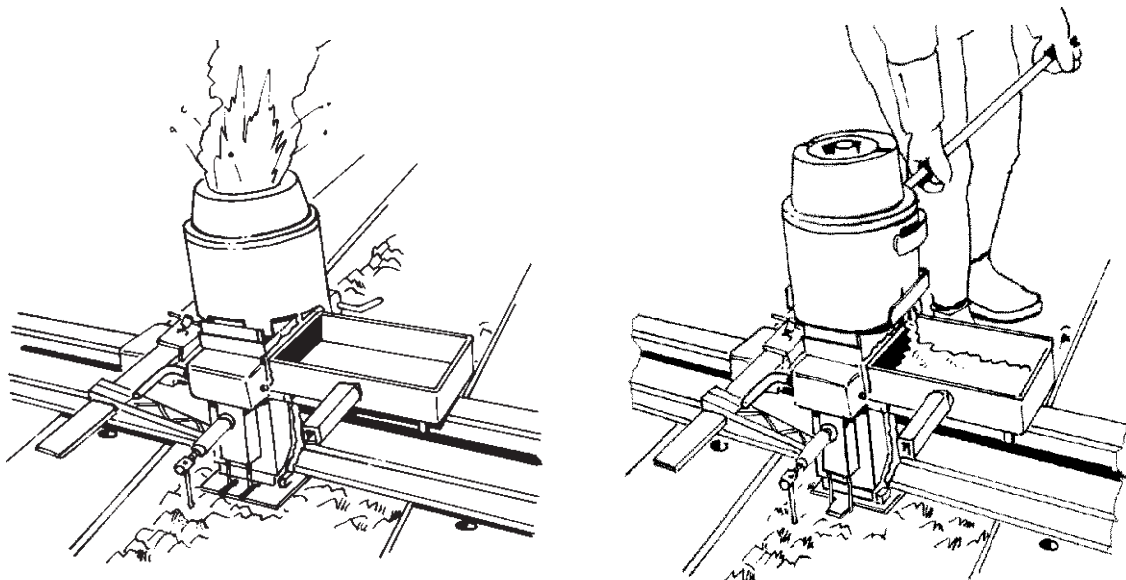
During the preheating :

- Open the bag containing the welding charge,
- Pour the aluminothermic charge into the one-shot crucible,
- Place the one-shot crucible near the working area and get an ignition brand ready,
- Put the one shot crucible fork at hand reach



As soon as preheating is finished:

- The crucible is placed above the moulds, that is to say, just lay on the mould while attention is paid to centering it in such a way that the pouring hole stands just above the plug,
- Ignite the brand by rubbing it (or more simply, before placing the one-shot crucible on the moulds, ignite it by contact with the internal wall of a still red-hot mould, dip the ignited brand in the very middle of the charge, put the lid back on the crucible.
- The reaction develops in a few seconds, and the pouring will automatically take place at the end of the reaction. The corundum flows into in a tray,
- The crucible is then removed by means of a special fork.

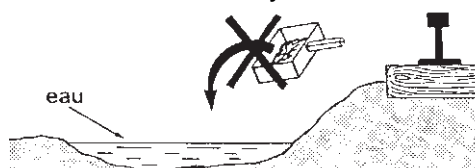


2.10 - Removing the slag tray

Break off the solidified corundum lip located between the moulds and the tray. If such operation is not performed, the lip might cause leakage due to luting paste and sand being both driven away.

The slag tray must be removed only after its content has started to solidify. Never place the tray or pour its content on a wet or frozen floor, nor on a sleeper, nor, even worse, may it be thrown into water. Accordingly, the slag box shall be laid on a metal plate standing by.

To be strictly avoided



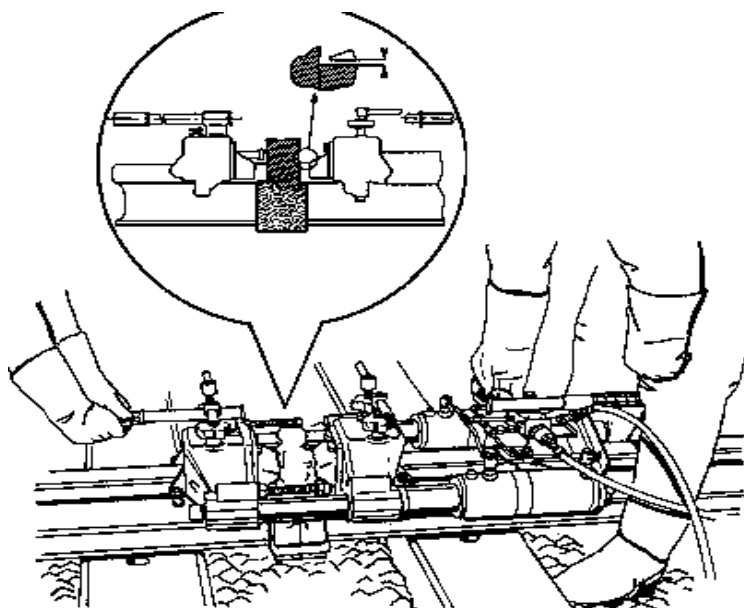
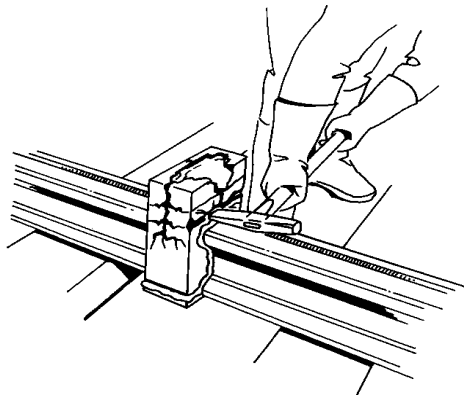
2.11 - Shearing

Shearing with a sledge hammer is to be avoided.

Accordingly, the shearing will be performed 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 set long enough but before it has become cold. For guidance, the shearing operation may be performed at an average time, of approximately **5 minutes** after pouring has been completed.

Shearing preparation.

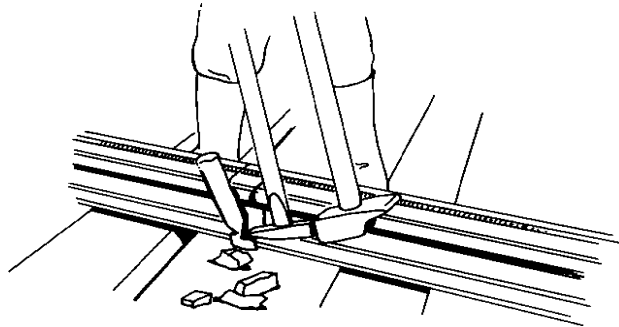


2.12 - Removing the risers

Risers are removed in a two phase operation, with a hot cut chisel and sledge hammer.

- **a)** Begin when the metal is still mild so that an initial gap can be created. This primary operation must be carried out quickly after the shearing, otherwise a too cold metal would make this operation very difficult.
- **b)** Remove of the entire pipe when the metal is cold (the pipe has to be broken off).

This operating procedure may vary according to specific instructions issued by the network authorities. Some Railway Companies require a one phase hot trimming.



2.13 - Rough grinding

Rough grinding is carried out to allow a temporary and limited speed traffic to be restored on a welded railway section. (Refer to 2.14 «Start procedures»).

On main railways, no metal excess thickness above 0.5 mm must remain on the top of the rail head as well as on the lateral surface concerned with the running surface.

Grinding can take place when the weld is cold enough.

2.14 - Opening of the welded track section for traffic

A newly cast welded section can be opened to traffic only if the external temperature of the rail head, in the weld axis, is below 350°C.

In addition to the required lapse of time allowing the weld to cool down (30 minutes minimum, refer to network current instructions) rough grinding must be performed before the welded section can be opened to any traffic (see § 2.13). failing to follow this rule will void the warranty applying to the welded section.

Consequently, no traffic is to be allowed before rough grinding operations and welded seam cooling have been completed.

«Opening» shall be construed as «a low speed traffic on the welded section».

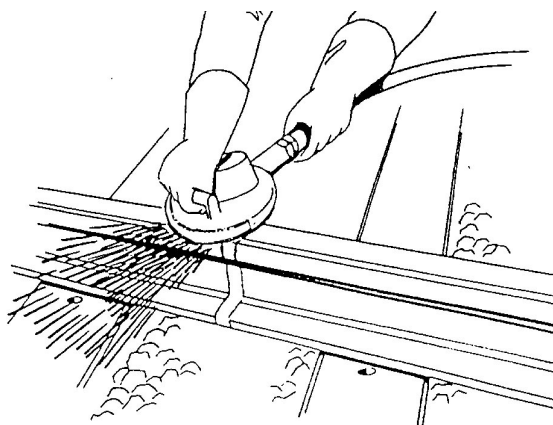
2.15 - Finishing welding

Finishing grinding is meant to get rid of any geometrical discontinuity due to welding. This operation also enables the weld to be checked up (see § 4).

In the planning of works, finishing grinding may only take place **24 hours** after welding has been carried out and, as much as possible, after the welded section has been used several times by traffic.

It is made quite clear that the geometrical qualities depend first and foremost upon the preliminary adjustments before welding (see § 2.02). However, after rough grinding and final grinding have been completed, this adjustment must be verified.

It is strongly recommended to avoid using vertical grinders, rather use lapidary or profile grinding machines.



2.16 - Cleaning

The welder will thoroughly clean the collars so that acceptance operations can be carried out :

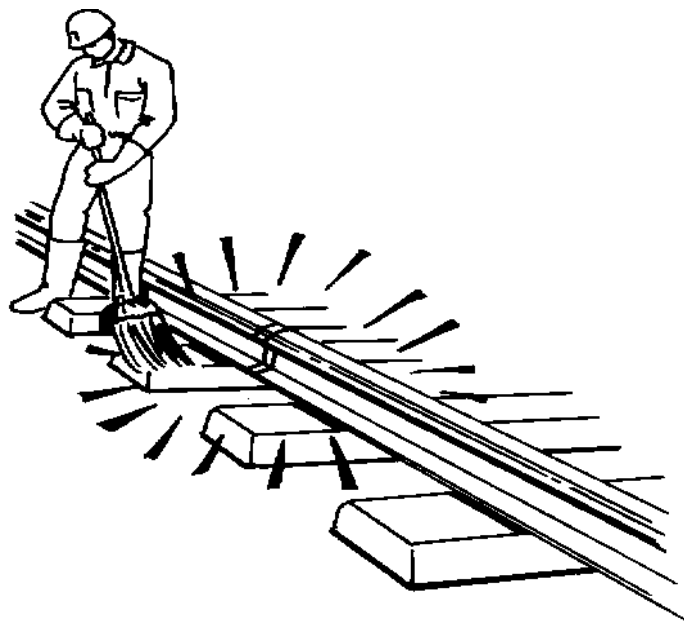
He must in particular :

- All traces of sand or felt,
- Remove all burrs with the help of a grinding wheel,
- Grind down all butts resulting from various parts that have been taken away (risers, etc...)

When such works are over the profile of the weld must show no sharp angle.

The use of sledge hammers, cutters, cutting toches or cutting disks is trictly forbidden for all cleaning works.

Cardboard, mould remains and various waste shall be loaded on the disposal lorry, and the work site shall be left clean.



2.17 - Marking and tracking

To insure « tracking» (i.e. the possibility after a time, to retrieve welding initial conditions), it is compulsory that every weld bears the signature of the welder.

Marking procedures are according to network current instructions.

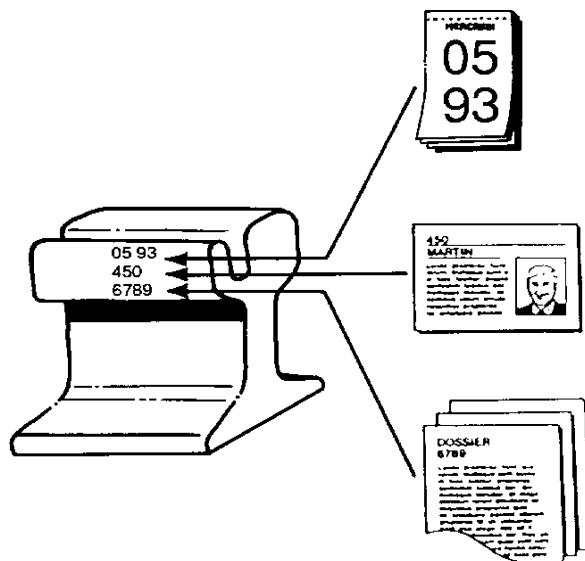
In case of lack of marking procedure, the following method is acceptable :

Marking is performed by punching 8 to 10 mm high digits which will be located on the head flank opposite the tread area and placed vertically on the fusion zone.

This marking will show :

- Number of month when welding was completed (from 01 to 12)
- The two last digits of the year of welding,
- The welder agreement number,
- Eventually, the number of the weld (if such numbering is to be backed up with relevant filing).

Along with such data as well as with the welding location (full PK), a minimum filing system should make it possible to retrieve a record on welding initial conditions (refer to example in appendix 4.02). It is important that such record bears the labels taken off the bag of the corresponding melting charge.



3 - WORK QUALITY CONTROL

Quality is achieved when the operators fulfill all precautionary measures required at each step of the work, from site preparing to work site cleaning. To this end and for guidance purposes, a work self-check form can be found in Appendix 4.01. Any final control after the weld has been completed cannot supersede a quality oriented method.

The set up of a training and certifying cycle for welders is highly recommended.

Nevertheless, the welder must check his end product and may, should the case occur, declare a welded part as «not up to quality requirements».

He will make this decision :

- When he sees that the welding he has just carried out bears a redhibitory defect (lack of metal, cracks, inclusions, damage to parent rails, etc),
- If, while performing work, an accident or a handling mistake (too soon or too late unplugging, leakage, uncorrect gap, corundum tray spilled on rail, etc) leads him to doubt about the final quality of the performed work,
- If the welded part falls beyond geometrical requirements and can not be presented for acceptance.

He must then notify right away the site chief-engineer and give precisions about the nature of incident or anomaly which led him to take this decision.

3.01- Visual inspection

Visual inspection procedures are theoretically set up by the network operating authorities. Refer to applicable instructions.

Should these instructions be lacking, one may adopt the following ones :

The weld must not show a too big displacement of moulds (that is, moulds out of line, offset or not facing properly).

On the rail head, the area which has been ground must not show any damage (cutter prints, accidental grinder marks, metal leak, and so on).

The cast area shall not bear of these foundry redhibitory defects such as :

- porosity
- shrinkage crack,
- sand or corundum inclusion,
- black stain,
- distorsions of the collars,
- etc.

*Warning a «foundry defect» does not necessarily imply a «redhibitory defect». The ability for assessing»'foundry defect» requires reliable **training and trustworthy experience**.*

If these requirements are not be met, the weld shall not be accepted.

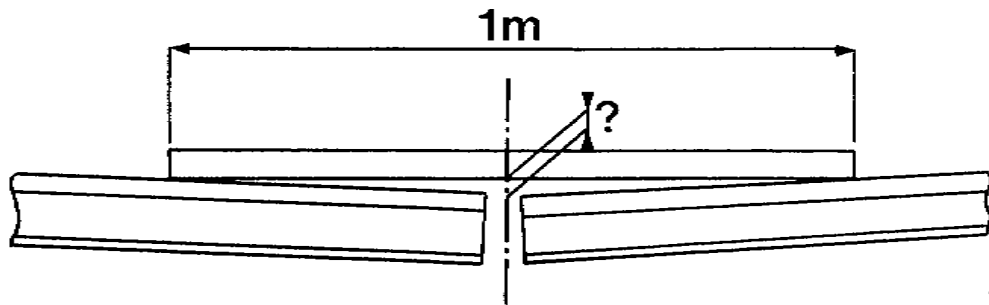
3.02 - Control of the geometry

Geometry control procedures are theoretically set up by the network operating authorities. refer to current instructions.

If should these instructions are lacking, one use the following ones :

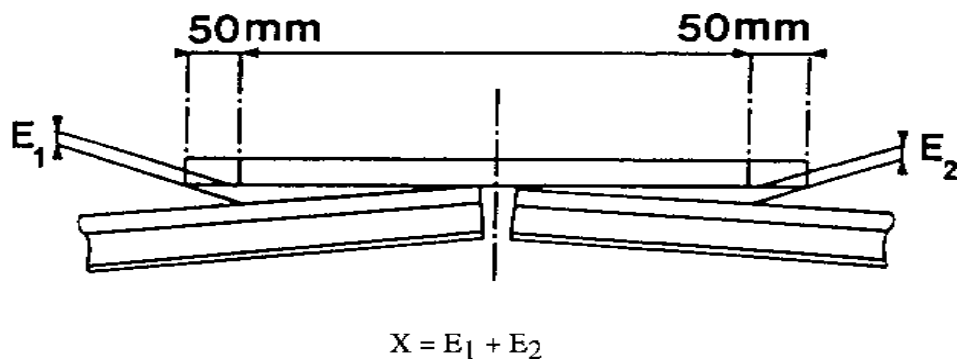
The various measures proposed hereafter are carried out with a bevelled 1 meter long straight edge centered on the axis of the weld, and one set of peel shims.

a) Checking for possible cavities



The presence of a cavity is not recommended and in all case should not exceed a 0.15 mm depth.

b) Checking of the precamber



Look for the thickest gauge blades that can slide under the straight edge at 50 mm away from both ends (refer to above picture).

The sum of E_1 and E_2 values must not exceed $X/10$ mm, where X is the value given by the network authorities and compatible with the normal constraints expected for track welding and compatible with operator's qualifications.

The weld will be refused if the X value is exceeded.

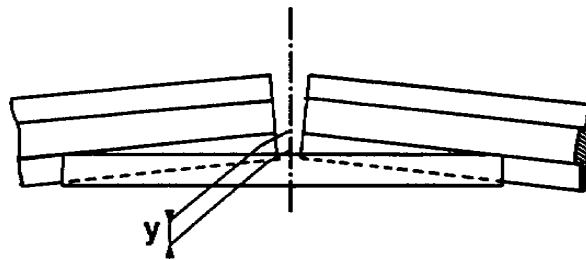
c) Side alignment

With the straight edge placed on the lateral operational face of the rail head and about 15 mm below the running surface, one must not allow :

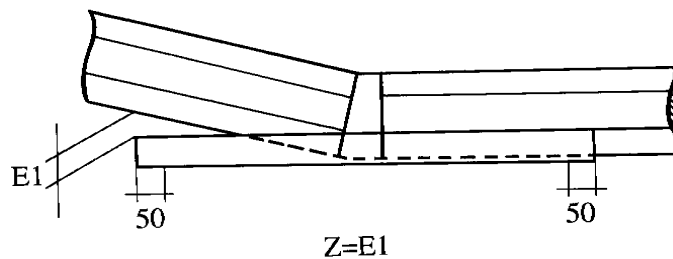
- In the case illustrated in picture 1, that the Y/10 thickness passes through any point of the straight edge.
- In the case illustrated in picture 2, that the sum of dimensions E_1 and E_2 exceeds Z mm at the end of the straight edge.

Y and Z are the values given by the network authorizations and compatible with the normal constraints expected for track welding and compatible with operator's qualifications.

If these conditions are not fulfilled, the weld will be refused.



Picture 1



Picture 2

4 - APPENDICES

4.01 - Self-check manual

4.02 - Recording sheet for the welding operation

4.03 - Safety manual

4.04 - Welding tools

4.05 - Check-list for a welding team

4.01 - AUTO-CHECK AND QUALITY CONTROL CONCERNING THE SECTION IDENTIFIED BELOW

BATCH:	WAY	LINE	WELD IDENT.	PK:	
WELDING OF RAILS				CONFORM TO STANDARD	
PROFILE.....NUANCE.....				YES	NO
<p>-Check rails are clean</p> <p style="padding-left: 20px;">Check gap clearance 25 +/- 2 mm</p> <p>-Check tolerance of abutting ends</p> <p>-Adjustment of rails</p> <p>-Check mould centering</p> <p>-Check suitability of welding charge with rail Type..... Grade</p> <p>- Preheating : check burner positioning</p> <p>-Check preheating time</p> <p>-Check crucible.</p> <p>-Carry out the weld</p> <p>-Respect waiting time before shearing</p> <p>-Trimming : check adjustment of shearing blades</p> <p>-Rough grinding, check before track opening</p> <p>-Check weld is clean</p> <p>-Check finish grinding :</p> <p>a) Angle : in the centre of straight edge-rule below the bearing plane and 50 mm in from the ends of the straight edge : sum of the two readings $\leq X/100$ mm</p> <p>b) Alignment outer : at any point on the straight edge $\leq Y/100$ mm inner : sum of the two reading $\leq Z$ mm.</p> <p>-Check aspect</p> <p style="padding-left: 20px;">Check weld marking.....</p>					
Date of work		Welder's name		Authorisation N	
Remarks					

4.03 - SAFETY NOTICE

OPERATION	RISKS	PROTECTION
Dismantling fishplate	Plate fails on feet	Safety footwear
Adjusting joint	Hammer blows	Leather gloves
Preheating	Sand projection	Goggles - leather gloves
Pouring - Removal	Sand or metal projection	Gloves - goggles (tinted glass)
Crucible	Burns	Gloves
Shearing	Sand projections	Gloves - leggings, plain glass goggles
Grinding	Metal projection	Gloves, leggings, plain glass goggles
Cleaning	Hammer blows - Sand projection	Leather gloves - goggles
Marking	Hammer blows	Leather gloves

This list is given for purposes of informations and is not necessarily complete. Welding includes all the usual risks to be found in on-site work.

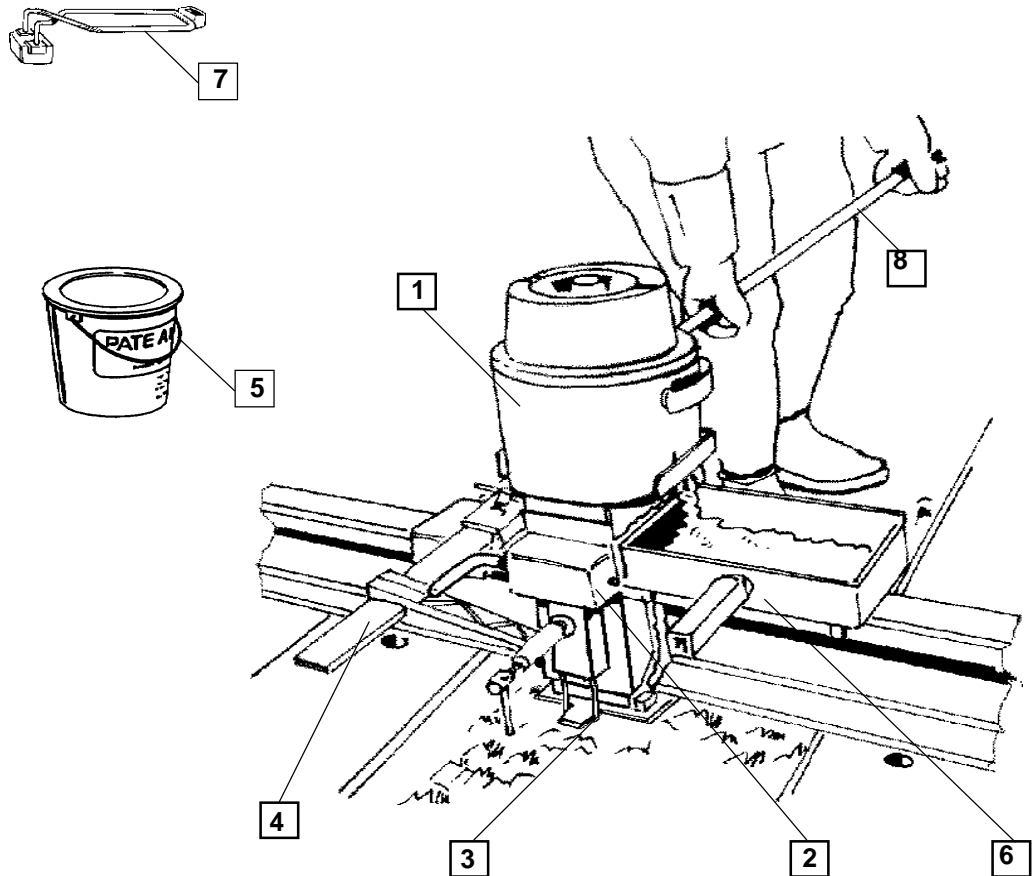
Individual safety equipment.

For information purposes. Consult the safety regulations applied in your network.

- Cotton work clothes. *Prohibit the wear of clothing in your network (nylon, etc...)*
- Leather gloves,
- Fireproof gloves,
- Safety shoes
- Leggings,
- Clear glass safety goggles with side protection (grinding),
- Welding goggles (filter glass),
- Warning bands (fluorescent waistcoat or harness).

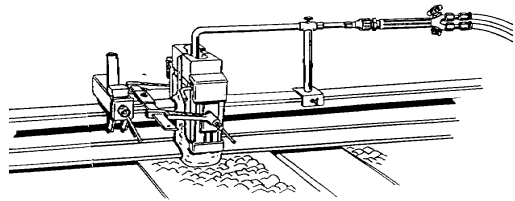
Group equipment : Roll of fluorescent warning tape, first aid kit, instructions for first aid in case of burns, warning device, etc... (see network instructions).

4.04 - Welding Tools

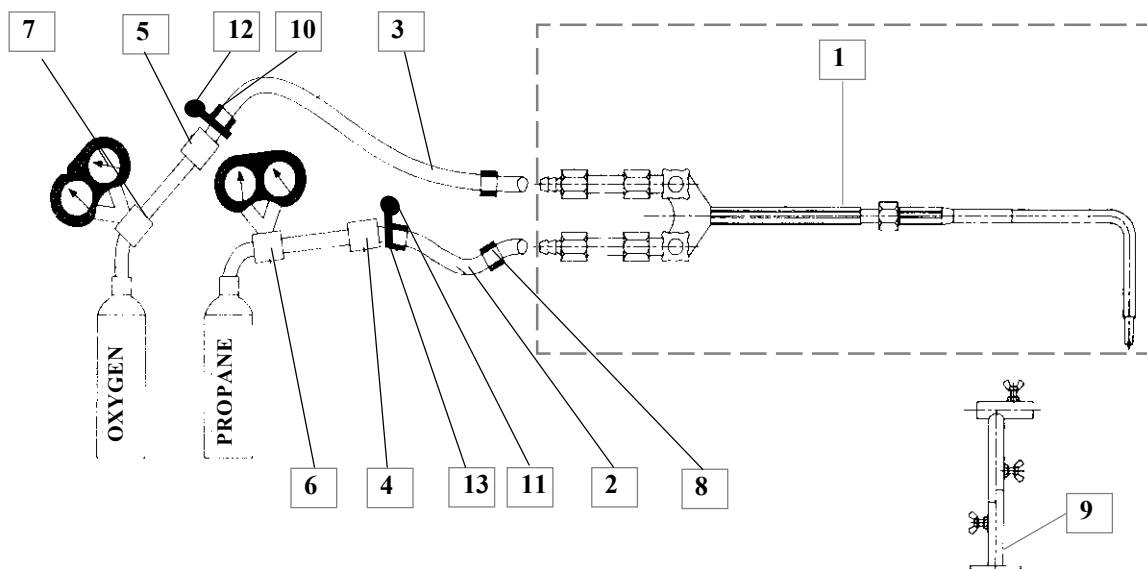


N°	Nature	Réf
1	One-shot crucible	83450127
2	Set of side plates	83200001
3	Base plate	83100004
4	Camp assembly CJ	83250004
5	Luting paste container	83661130
6	Slag tray	81532010
7	Plug tools	83432920
8	Fork CJ	82631411

PREHEATING TOOLS



1	Railtech blowpipe	11231007
2	Propane hose 10 m	39960003
3	Oxygen hose 10 m	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	Tightening collar	48301073
9	Blowpipe support RAG	11234004
10	T-piece Propane	S0000206
11	T-piece Oxygen	S0000205
12	Manometer Gas	48101005
13	Manometer Oxygen	S0000217



Propane and oxygen pressures must be maintained throughout the duration of the preheating :
0.3 bar propane
0.9 bar oxygen

In the other case, two solutions can be considered according to requirement of the building site:

- the welder carries out the welding until his term and declares the welding defective
- the welder takes again completely the implementation of its welding (checking of the gap, setting of new moulds, ...)

4.05 - CHECK-LIST FOR A WELDING TEAM

4.05.1 - CONSUMABLES

KITS:

Types	Quantity	Observations
KITS(S)		Reference:
KITS(S)		Reference:
KITS(S)		Reference:
KITS(S)		Reference:
KITS(S)		Reference:
KITS(S)		Reference:
KITS(S)		Reference:
KITS(S)		Reference:
KITS(S)		Reference:
KITS(S)		Référence:

4.05.2 - HAND TOOLS

Type	Quantity	Remarks
Graduate gauge	1	19123003
Wire brush	1	48401004
Electronic timer	1	48703001
Plug holder	1	83432920
Hot cut chisel with handle	1	11311001
Ballast fork	1	48401050
Cold chisel	1	48401009
Adjustable pliers	1	48401131
Adjustable spanner	1	48401010
Set of screwdrivers	1	48401015
Set of flat spanners	1	48401130
Tool box	1	48401008
Hand-hammer	1	48401013
Set of number-punch	1	48409002
Set of letter-punch	1	48409003
Set of thickness gauges	1	48701005

Type	Quantity	Remarks
Copper hammer	1	11319002
Refuse tray	1	48401014
Metal jerrican 20 litres	2	48401052
Metal jerrican 10 litres	2	48409051
Funnel	2	48409001
Tarpaulin	1	19311001

4.05.3 - WELDING TRACK EQUIPMENTS**Adjustment of rails**

Type	Quantity	Remarks
HC 355 Rail saw machine	2	14221022
Cutting discs 355 x 3,6 x 25,4	6	47901024
Straight edge 1m straight	1	19123001
1 m bevelled straight edge	1	19123002
«A» Frame aligner	1 pair	11111001
Gauge tie rods for curve radius < à 350 m	1 pair	
Wooden wedge	20	11114002

Welding

Type	Quantity	Remarks
Weld shearing machine TYPE RAG	1	11332006
RAG blades	1 pair	

Grinding

Type	Quantity	Remarks
Flexible shaft rail track grinding machine	1	
Or Two-wheel flexible shaft grinding machine For rolling on track	1	
Flexible shaft	1	14341002
Rapid coupling	1	14342002
Grinding lapidary head	1	14343013
Disc guard 115 x 50	1	14343006
Grinding wheel 115 x 50 with countersunk nut	1	47901006
Or Disc guard 150 x 40	1	14343007
Grinding wheel 150 x 40 with countersunk nut	1	47901009
1 m bevelled straight edge	1	19123005

According to the job, and in the case of despatch by waggon provide for a material sufficient for the first three days :

- wooden wedges,
- rail-saw discs,
- petrol
- 2-stroke oil,
- ignition matches,
- etc, ...

Night work

Type	Quantity	Remarks
Generator	1	19412001
Floodlight	1	
Spare bulbs	4	
Electric torch	1	

Transport and locking

Type	Quantity	Remarks
Lorry with brake, usefull load 1,5 T	1	12111003
«T» Spanner for sleeper-screws	1	
Wrench for nut N° 38	1	48101125
Coach screwing machine (Tooling required)	1	13211002

Safety equipment

Type	Quantity	Remarks
Leather gloves	1	48801002
Fireproof gloves	1	48801003
Safety shoes	1	
Leggings	1	48801004
Welding goggles with tinted glass	1 pair	48802001
Safety goggles, clear glass for grinding	1	48802003

This list is given for information purposes and is not necessarily complete. Welding includes the usual risks found on a site work.