PANDROL

TECHNICAL MANUAL

ALUMINOTHERMIC WELDING

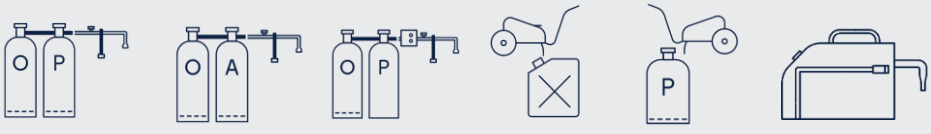
PROCESS

PLA

WELDING GAPS

LUTING

PREHEATING



PLA CJ EN
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Partners in excellence

Update history

Version	Date	Written by	Comments
V1	24/03/2021	S.BARON	ATI traduction
V2	30/03/2021	S.BARON	Text improvement
V3	26/04/2021	S.BARON	UK modification + Metal bucket
V4	08/09/2021	S.BARON	AutoSeal® moulds
V5	04/10/2021	S.BARON	PL + Pdf 68mm
V6	16/11/2021	S.BARON	3H pressure
V7	20/09/2022	S.BARON	HFP insertion – AO configuration
V8	15/02/2023	S.BARON	Modification according to UK revision
V9	15/01/2024	M.BRUN	HFP modification

Summary

Foreword

This quick-reference guide for welding teams and company managers is essential for implementing the Pandrol welding process:

PLA with a One-Shot Crucible

There are several types of preheating:

- Oxy-propane 22 H Version A
- Oxy-propane 22 H Version B
- Oxy-propane 3 H Version A
- Oxy-propane Gasbox 22 H Version A
- Oxy-propane Gasbox 3H Version A
- Oxy-acetylene 8 H Version A
- GP40 air petrol
- GP40 Air Propane
- HFP (check that you have the correct configuration of the HFP (Torch and Support), refer to Appendix E - Preheating Line) **HFP → Yellow support or universal support – Height 90mm – rectangular nozzle** .

The **PLA** process can be done with two types of welding gaps:

- 25mm welding gap (25 +/- 2 mm)
- 68mm welding gap (68 +/- 3 mm)

Follow the general instructions and, whenever stipulated, apply the specific instructions given for each type of welding gap.

PLA welding can be done with:

- Felted moulds
- Luting moulds
- AutoSeal® moulds

The aluminothermic portion can be ignited using:

- The STARTWEL®
- An igniter

NOTE

Pandrol Connect is a mobile app designed to help welders throughout the welding procedure. In addition to recording all the data on the welding process, it saves time and improves the traceability of the welds for companies and railway network managers.

Depending on the chosen PLA variant and items delivered in the kit, refer to the relevant sections.

However, under no circumstances can this manual replace the applicable documents in the customer networks, when the latter provide for special conditions.

This document is intended for staff that are already familiar with and have been trained in aluminothermic welding. It sets out the conditions needed to perform the process in accordance with the criteria of the manufacturer, Pandrol.

This manual is non-exhaustive and the data provided are subject to change without notice. The latest version is available from your Pandrol contact.

1. Safety

1.1 Hazards

1.1.1 Burns

Burns may be sustained during the welding operation from a number of sources:

- Rail end preparation
- Hot rails, tools and materials used throughout the welding operation
- Preheating
- Ignition and reaction of the portion
- Weld cleaning
- Airborne hot sparks and particles
- Etc.

1.1.2 Fire

Fire may occur through accident or negligence due to the following:

- Sparks from cutting and grinding
- Molten metal spillage and splashes
- Flammable material too close to the welding operation
- Incorrect disposal of hot slag
- Etc.

WARNING

It is strictly forbidden to use water to extinguish a metal fire

1.1.3 Explosion

Explosion may occur through accident or negligence due to the following:

- Use of compressed gases
- Molten metal coming in contact with water
- Molten metal coming in contact with wet, snow-covered or frozen ballast
- Hot slag or hot slag bowls coming into contact with wet or frozen ballast
- Etc.

1.2 Hazard prevention

1.2.1 Safety equipment

Welders must be given personal protective equipment (PPE) and they must wear it correctly at all times.

The equipment required for welding includes the following, for example:

- Flame retardant overalls
- Leather gloves, heat-resistant gloves
- Safety shoes
- Clear safety goggles
- Tinted welding goggles
- Gaiters
- Hard hat
- Disposable type FFP3 dust mask, respirator system, etc.
- Etc.

Non-exhaustive list - Consult the safety rules in force in the country or network.

1.2.2 Safety data sheet

SDS safety data sheets are available from your Pandrol contact.

1.3 Materiel storage

Refer to the appendix.

1.4 Weather conditions

1.4.1 Wet weather

Welding can be done in rainy weather provided adequate protection is used *(e.g. welding tent)*.

All the consumables should be kept dry and the wet rails dried before welding.

1.4.2 Cold weather

It is advisable to perform the welding operation at an ambient temperature of more than **-5°C.**

Below this temperature, the properties of the gas *(flow rate/pressure)* are incompatible with the quality expected from the weld. A heating blanket placed around the gas cylinder can be used to maintain the properties of the gas at the appropriate level.

2. Preliminary information

2.1 General information

2.1.1 Knowledge

Before any welding operation, it is necessary to know and control the following:

- Size of the welding gap, specified with its tolerance interval
- Rail profile and steel grade of the rail to be welded
- Product reference of the kit to be used: mould profiles, portion grade, etc.
- Inspection of the rail ends
- Alignment of the rails
- Implementation of the welding process: mould type, mould centring and bottom briquette, luting, etc.
- Preheating conditions: material, time, pressures, etc.
- Use of the crucible, its condition, its centring on the mould, etc.
- Tapping time
- Stripping and shearing time
- Adjusting the blades of the shearing machine
- Post-pour parameters: cooling time, grinding, tolerances, etc.
- Etc.

2.1.2 Precautions

Make sure that the operator has everything they need to perform the work:

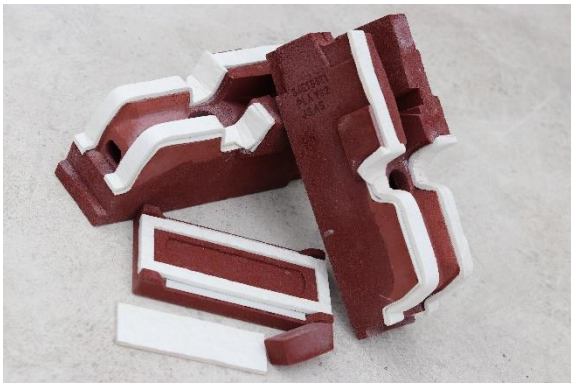
- Enough kits and crucibles for the quantity of welds to be completed. Kits corresponding to the rail profiles and the steel grades of the rails to be welded as well as the types of welds to be completed
- General condition of the STARTWEL® electric trigger, correct battery level and enough thermal igniters to complete the work
- Enough full gas cylinders, fittings, hoses, pipes, pressure gauges, regulators in perfect condition, charged batteries, etc.
- Complete set of welding tools in good condition: bottom plate, side plates, etc.
- Control tools: straightedge, steel rule, stopwatch, mechanic's support blocks, gap gauges, etc.
- Any welding procedures or standards in force on the network
- Welding preparation and finishing materials: alignment A-frame, grinder, consumables (petrol, oil, grinding discs, etc.)
- Toolbox for minor interventions
- Personal protection equipment
- Etc.

3. Identification of consumables

- To avoid any errors in the delivery to the site, the moulds and the portion are packed in a single package, called a kit, covered with a plastic film to ensure that it is sealed
- The one-shot crucible is delivered in a cardboard box which can be covered with plastic film on request
- When opening the kit and box containing the one-shot crucible, it is important to check that they have been kept in their original packaging, were closed, are not deformed in any way and there are no signs of moisture

One-shot crucible

Kit and portion



Moulds

Non contractual photos, data given by way of example to represent the products.

3.1 Consumables

3.1.1 Felted mould kit – 25 mm

NOTE

The felted moulds are used to weld rails with a difference in the amount of wear of no more than 3 mm.

The felted mould kit includes the following:

- 2 felted moulds
- 1 felted bottom briquette
- 1 plug

- 1 portion in a waterproof (plastic) bag

3.1.2 Luting mould kit – 25 mm

NOTE

With luting moulds, there can be a difference in wear between the rails to be welded of **6 mm maximum.**

In the event of a difference in wear, the moulds must be modified before installation.

The luting kit includes:

- 2 luting moulds
- 1 luting bottom briquette
- 1 plug

- 1 portion in a waterproof (plastic) bag

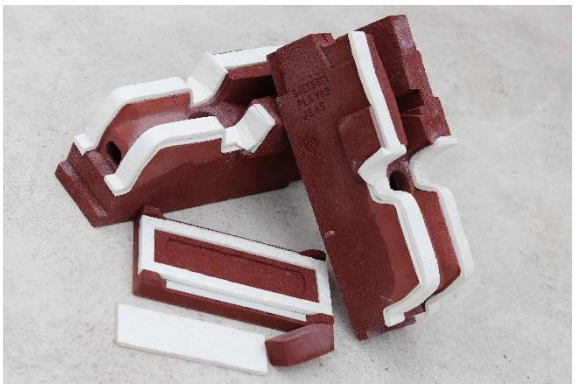
3.1.3 AutoSeal®mould kit – 25 mm

NOTE

The AutoSeal®moulds are used to weld rails with a difference in the amount of wear of no more than **3 mm.**

The AutoSeal® mould kit includes the following:

- 2 AutoSeal® moulds
- 1 AutoSeal® bottom briquette
- 1 plug
- Part of felt (for slag bowl)



- 1 portion in a waterproof (plastic) bag

WARNING

The AutoSeal® moulds does not require luting.

The AutoSeal® moulds are equipped with an expansive strip that inflates during the preheating and automatically ensures the tightness.

When opening the kit, carefully check the good condition of the different elements

3.1.4 Hybrid felted mould kit – 25mm HY B, HY C

NOTE

The hybrid moulds are designed for welding rails with high wear or a difference in wear between the two rail ends to be welded.

The hybrid kit includes:

- 2 hybrid moulds (HY B or HY C)
- 1 inclined felted bottom briquette in the case of the HY B
- 1 standard bottom briquette in the case of the HY C
- 1 plug

- 1 portion in a waterproof (plastic) bag

Pandrol offers a matrix to define the hybrid PLA kit (hybrid HY B or hybrid HY C) to be used according to the difference in wear between the two rail ends to be welded.

- Hybrid B (**HY B**) welding kit:

To be used when the difference in wear is **greater than 3 mm and less than or equal to 7 mm**

- Hybrid C (**HY C**) welding kit:

To be used when the difference in wear is **less than or equal to 3 mm**

PANDROL MATRIX FOR THE HYBRID PLA MOULD

RAIL WEAR B (in mm) \ RAIL WEAR A (in mm)	0	1	2	3	4	5	6	7	8	9	10	11
0	Felted/Luting Auto Seal HY C	Felted/Luting Auto Seal HY C	Felted/Luting Auto Seal HY C	Felted/Luting Auto Seal HY C	HY B	HY B	HY B	HY B	N/A	N/A	N/A	N/A
1	Felted/Luting Auto Seal HY C	Felted/Luting Auto Seal HY C	Felted/Luting Auto Seal HY C	Felted/Luting Auto Seal HY C	HY B HY C	HY B	HY B	HY B	HY B	N/A	N/A	N/A
2	Felted/Luting Auto Seal HY C	Felted/Luting Auto Seal HY C	Felted/Luting Auto Seal HY C	Felted/Luting Auto Seal HY C	HY C	HY B HY C	HY B	HY B	HY B	HY B	N/A	N/A
3	Felted/Luting Auto Seal HY C	Felted/Luting Auto Seal HY C	Felted/Luting Auto Seal HY C	Felted/Luting Auto Seal HY C	HY C	HY C	HY B HY C	HY B	HY B	HY B	HY B	N/A
4	HY B	HY C HY B	HY C	HY C	HY C	HY C	HY C	HY B HY C	HY B	HY B	HY B	N/A
5	HY B	HY B	HY C HY B	HY C	HY C	HY C	HY C	HY C	HY B HY C	HY B	HY B	N/A
6	HY B	HY B	HY B	HY C HY B	HY C	HY C	HY C	HY C	HY C	HY B HY C	HY B	N/A
7	HY B	HY B	HY B	HY B	HY C HY B	HY C	HY C	HY C	HY C	HY C	HY B HY C	N/A
8	N/A	HYB B	HY B	HYB B	HY B	HY C HY B	HY C	HY C	HY C	HY C	HY C	N/A
9	N/A	N/A	HY B	HYB B	HY B	HY B	HY C HY B	HY C	HY C	HY C	HY C	N/A
10	N/A	N/A	N/A	HYB B	HY B	HY B	HY B	HY C HY B	HY C	HY C	HY C	N/A
11	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

0 to 3mm: Use **Felted** moulds or **Luting** moulds or **Auto Seal** moulds or PLA hybrid C type **HY C** moulds

HY B: Use only PLA hybrid B type moulds

HY C: Use only PLA hybrid C type moulds

HY B or **HY C**: Use PLA hybrid B or hybrid C type moulds

N/A: Use of hybrid moulds not applicable

3.2 Markings

3.2.1 Marking of the kit

- The marking of the kit includes the information below

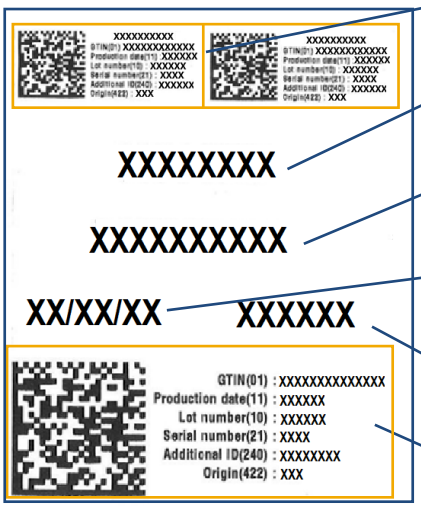
QR Code and name of the kit

Kit reference

Batch no. and date of manufacture

3.2.2 Marking of the portion

- The marking of the portion bag includes the information below
- The detachable adhesive labels are used to trace the portion



Detachable labels

Portion code

Designation of the portion

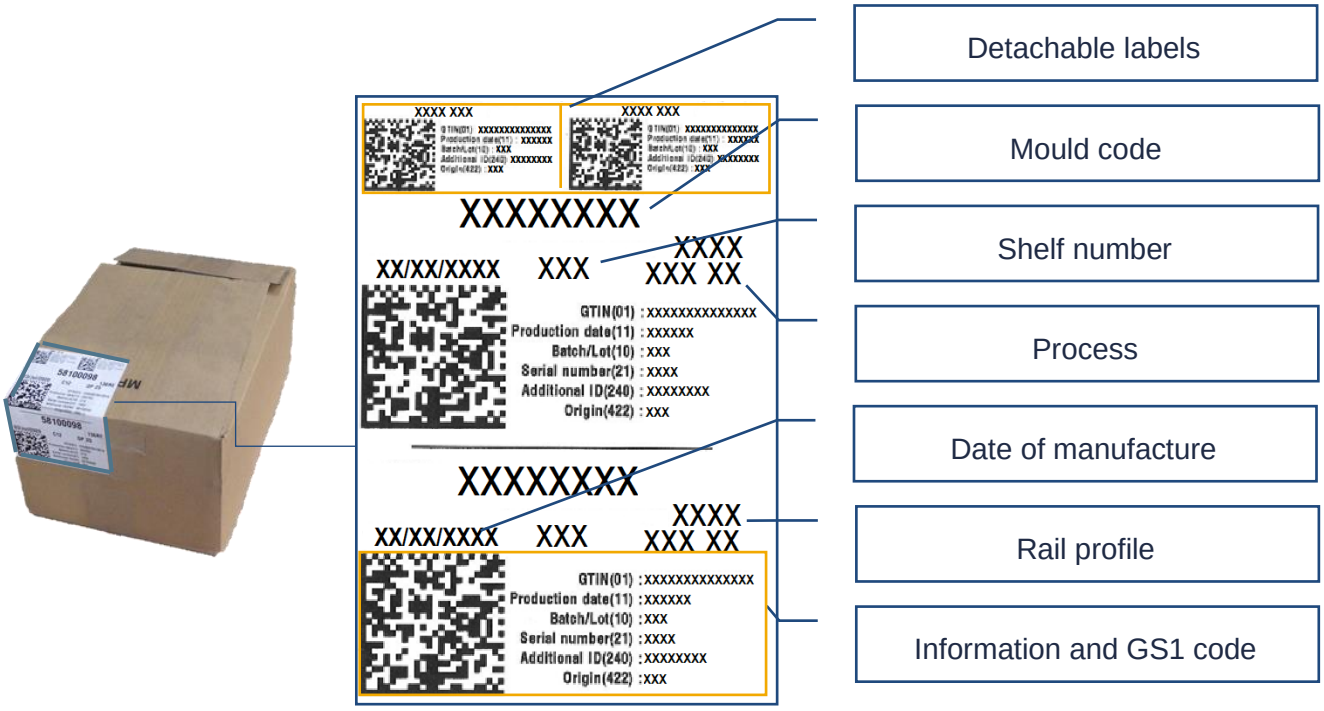
Manufacture date

Batch number

Information and GS1 code

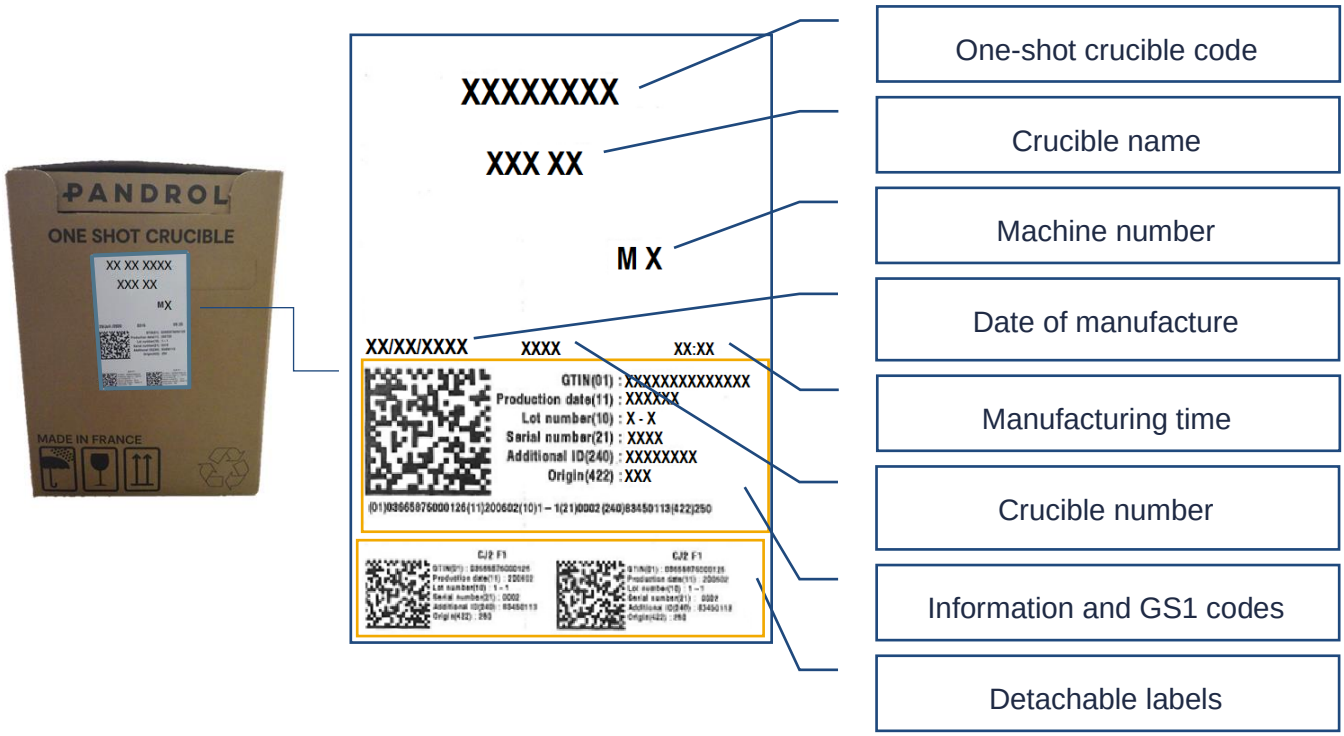
3.2.3 Marking of the mould

- The markings on the mould include the information below
- Detachable adhesive labels are used to trace the moulds



3.2.4 Marking of the one-shot crucible

- The marking of the one-shot crucible includes the information below
- The detachable adhesive labels are used to trace the one-shot crucible



4. Verification before welding

4.1 Consumables

The moulds, one-shot crucible and portion are usable straight out of their packaging and do not require any preparation.

To keep the operator safe and ensure the quality of the weld, the following checks must be made:

- The consumables have been kept in their original packaging
- The moulds and the crucible are not damaged (broken, cracked, unobstructed tap hole of the crucible, etc.)
- There are no holes in the portion bag
- The consumables are free of moisture

SAFETY

Never modify a portion: do not mix them together, do not add external elements, etc.

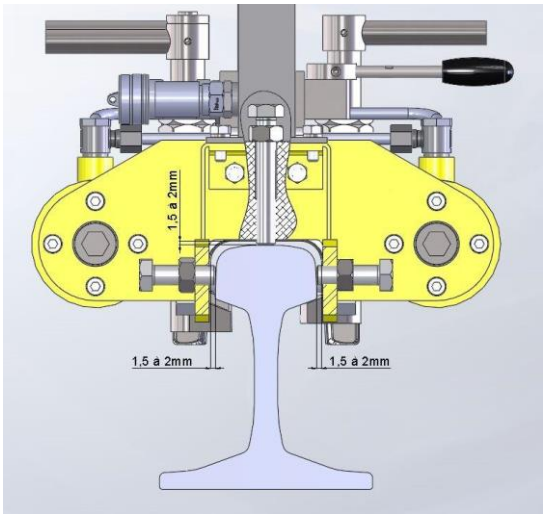
4.2 Adjustment of shearing tools

A set of shearing blades is provided for each rail profile (see Appendix).

Adjusting the shearing blades

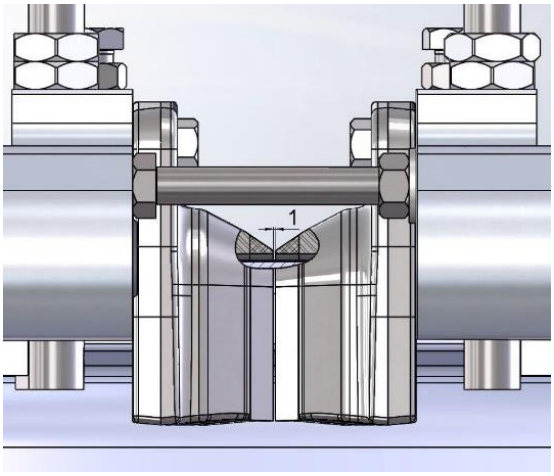
To optimise shearing, the blades must be systematically adjusted after the blades have been resharpened or replaced.

- Leave a distance of blades of at least **1,5mm** between the cutting edge of the blades and the sides of the rail head
- Adjust the blades to leave a distance between **1,5mm and 2mm** in height between the cutting edge of the blades and the rail surface



Adjusting the limit stops

- In order to avoid damaging the edges of the blades, adjust the adjustment screws in order to leave **1mm** of play between the blades



4.1 Checking the preheating equipment

4.1.1 Oxy-gas preheating

Preheating is done using a preheater, supplied with gas and oxygen through pressurised hoses.

Precautions before operating the equipment

- Check that the gas and oxygen cylinders are full enough to complete the work
- Check that the preheater is in good condition
- Check that the pressure gauges are in good condition by checking the length of the flame cone
- Check that the hoses are in good condition
- Check that the cylinders are vertical

4.1.2 GP40 Air petrol

Preheating is done using a petrol air burner and a preheating unit.

The engine of the preheater drives an air supercharger using a belt.

This pressurises the petrol tank and supplies the air needed for the forced draught-petrol mixture of the burner.

The burner fits on a hose that slots onto an outlet of the preheating unit.

Precautions before operating the petrol preheating unit

- Check the quality and quantity of oil according to the instructions in the manufacturer's manual
- Check the tension of the belt
- Check that the preheater is in good condition
- Check that the air and petrol hoses between the tank and the supercharger are in good condition
- Adjust the air pressure to **0.30bar** as it appears on the pressure gauge

Checking the burner and its holder

- In use, the inside of the nozzles has a tendency to get coked up. These carbon deposits must be regularly removed
- The oxidation caused by the preheating of the rail joints damages the burner nozzle with a tendency for the base of the holes to become oval shaped. As a result, the jet of the air-fuel mixture is dispersed rather than being directed towards the inside of the mould. If preheating is deficient, the burner must be replaced
- Check that the burner holder is in good condition (tightening and height adjustment)

4.1.3 GP40 Air propane

Preheating is done using a propane air burner and a preheating unit.

The engine of the preheater drives an air supercharger using a belt.

This delivers the air needed to create the air-propane mix of the forced draught burner.

The burner fits on a hose that slots onto an outlet of the preheating unit.

Precautions before operating the propane preheating unit

- Check the quality and quantity of oil according to the instructions in the manufacturer's manual
- Check the tension of the belt
- Check that the preheater is in good condition
- Check that the air and propane hoses between the cylinder and preheating unit are in good condition
- Adjust the air pressure to **0.30bar** as it appears on the pressure gauge

Checking the burner and its holder

- In use, the inside of the nozzles has a tendency to get coked up. These carbon deposits must be regularly removed
- The oxidation caused by the preheating of the rail joints damages the burner nozzle with a tendency for the base of the holes to become oval shaped. As a result, the jet of the air-fuel mixture is dispersed rather than being directed towards the inside of the mould. If preheating is deficient, the burner must be replaced
- Check that the burner holder is in good condition (tightening and height adjustment)

4.1.4 HFP preheating

Precautions before operating the HFP equipment

Examine the apparent condition of each element of the HFP:

- Check that the gas cylinder is full enough to complete the work
- The pressure gauge must be in good condition, windows not broken, and boxes not deformed
- The gas pipe must not be cracked, cracked, or cut
- Fittings at both ends of the pipe must be apparently in good condition and apparently tightly tightened
- The body of the HFP Preheater must be clean, not show any trace of blow
- The output nozzle of the HFP must not be calaminated or deteriorated by oxidation

If any of these conditions are not met, the HFP must be immediately removed from service.

5. Welding

5.1 Preparation of the joint to be welded

5.1.1 Condition of the rail ends to be welded

- Cleaning (degreasing) and brushing of the rail ends to remove all signs of oxidation ("rust"). Poorly cleaned rust deposits cause defects
- Check the geometry of the rail ends to be welded (rail profile, running edge, wear, etc.)
- Check that there are no cracks (to be removed by cutting the rail). This check can be carried out using penetrant testing or a magnetic-particle inspection
- Remove burrs
- Check the position of any holes in the web. These must be completely removed from the mould
- Etc.

The gap measurement must be between:

- **23mm and 27mm** for the **PLA 25** (25 +/- 2mm)
- **65mm and 71mm** for the **PLA 68** (68 +/- 3mm)

To obtain this gap it may be necessary to cut the rails using a rail cutting machine.

Welding directly on rail ends, which have been cut with a torch, is strictly prohibited.

*The rail joints must not be out of square by more than **1.5mm** in relation to the gap measured in the permitted interval.*

SAFETY

Strictly comply with the safety instructions for using the equipment

WARNING

The cut must be carefully cleaned to remove all signs of oxidation, which can lead to impurities in the weld

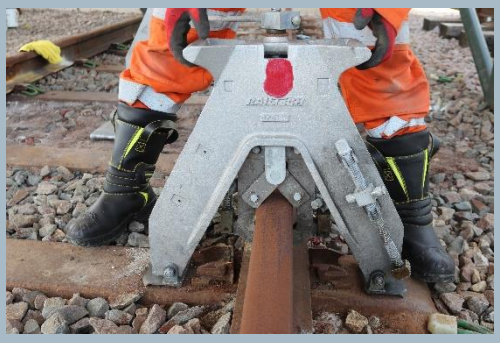
5.1.2 Preparation of the joint

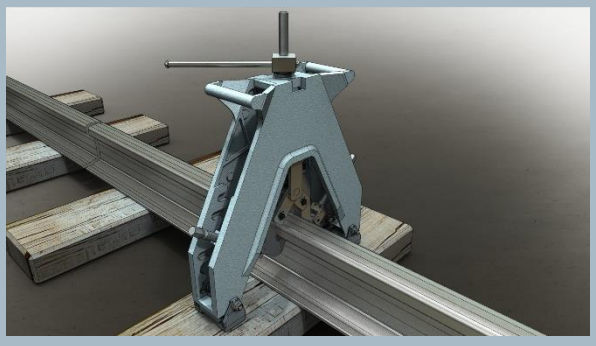
- Remove the fasteners of at least three sleepers to either side of the joint (or more in a curve depending on the radius)
- Remove the rubber pads and any other non-metallic element surrounding the joint to be welded
- If necessary, remove any ballast that may be obstructing the positioning of the moulds
- Check the compliance of the rail ends to be welded

5.2 Aligning the joint to be welded

RECOMMENDATION

To make the alignment operations easier, faster and more reliable, use the A-frame aligners.





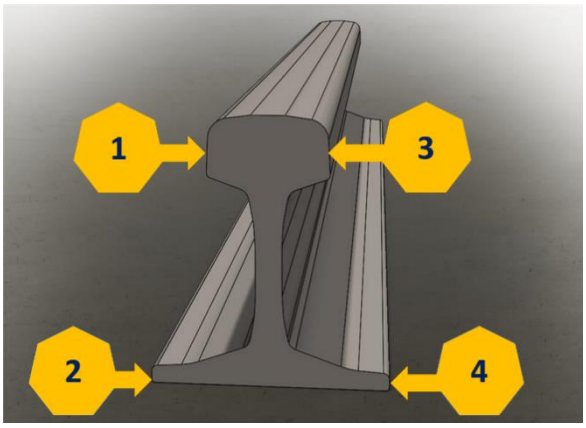
This alignment is very important because it will determine the geometric quality of the weld and its service life. The settings (peak, twist, alignment) are made using an approved 1-metre straightedge.

5.2.1 Adjusting the welding gap

The welding gap is the space between the two rails to be welded.

- **23mm and 27mm** for the **PLA 25** (25 +/- 2mm)
- **65mm and 71mm** for the **PLA 68** (68 +/- 3mm)
- Measure the gap at the head and foot, according to the diagram below

The 4 measurements obtained must be within the welding range defined above.



5.2.2 Peak adjustment (profile)

Prior to welding, the rails must form a peak. This is necessary to compensate for the contraction of the weld when it cools down.

- Adjust and fine-tune the peak, according to the condition of the track, so that the final geometry is within the tolerances of the network

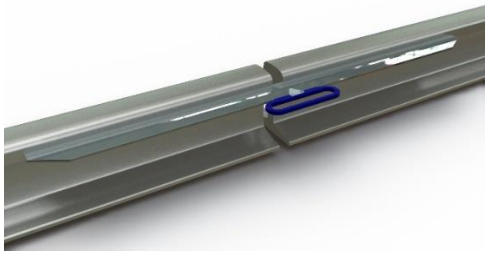
1-meter nibbed straightedge

The final geometry will be checked after finishing grinding and must be within the tolerances of the network (peak and dip).

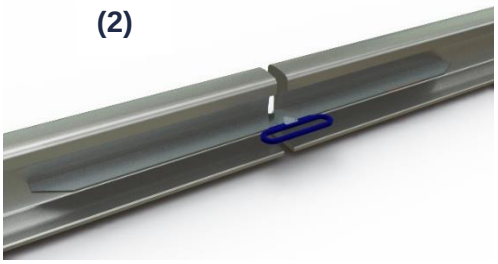
5.2.3 Tilt adjustment

- Make sure that the tilt of the two rail ends on the inner side of the heads (1) and at the base of the web (2) is the same

(1)

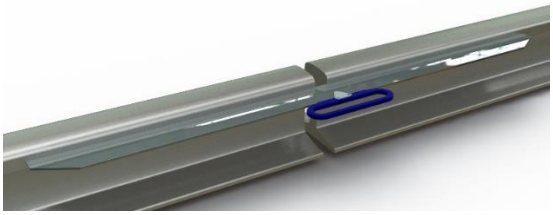


(2)



5.2.4 Alignment adjustment (running edge)

- Align the inner face of the two rails, on the inner side of the track



5.2.5 Checking the gap

- After completing the previous operations, check that the gap has not changed
- It must remain within the following values:
- **23mm and 27mm** for the **PLA 25** (25 +/- 2mm)
- **65mm and 71mm** for the **PLA 68** (68 +/- 3mm)

5.3 Fitting the moulds

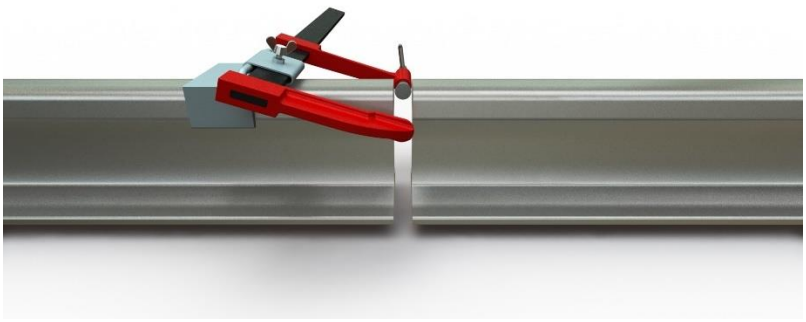
5.3.1 Fitting the first mould

COMMENT REGARDING LUTING MOULDS

Before positioning the moulds, fit the first mould onto the ends of the rails to be welded and hold it in place.

- **Fit the second mould against the first mould and the ends of the rails to be welded.**
- **Check that the two moulds fit the rail profiles of the two rail ends.**

- The mould clamp assembly must be positioned so that the axis of the jaws aligns with the axis of the gap and is level with the middle of the rail head
- Fit each mould into its side mould shoe
- Position the levers inwards, in the open position



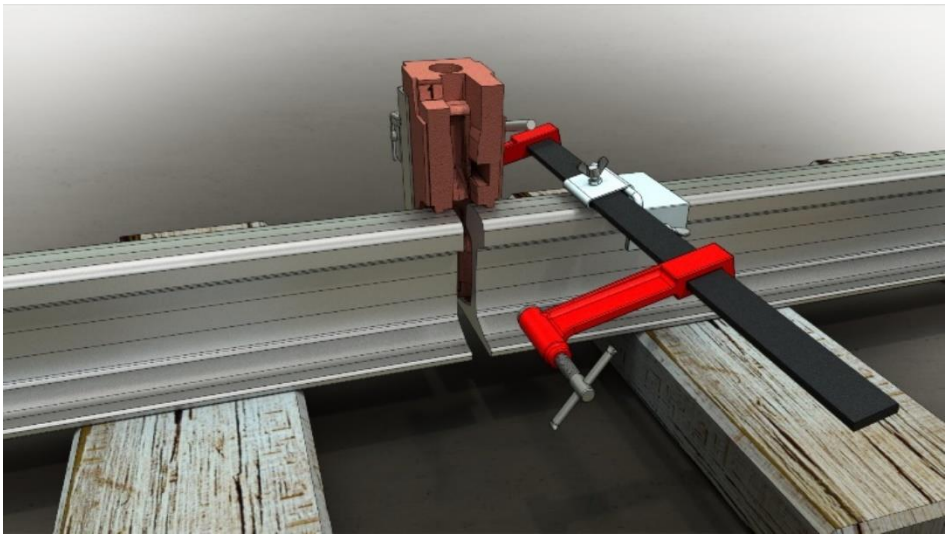
Check the correct positioning of the side mould shoe on the mould by looking through the aperture at the corner of the side mould shoe (1).

In some cases, given the available space, the special mould shoe for switches and turnouts and crossings is required (2).

(1)

(2)

- Fit one mould to the rail making sure that it is centred on the axis of the welding gap
- Hold the mould in place by tightening the wing screw positioned on the mould clamp



NOTE – GASBOX PREHEATER HEIGHT ADJUSTMENT

- After fitting the first mould, put the setting gauge on the running surface and adjust the height of the preheater according to the gap

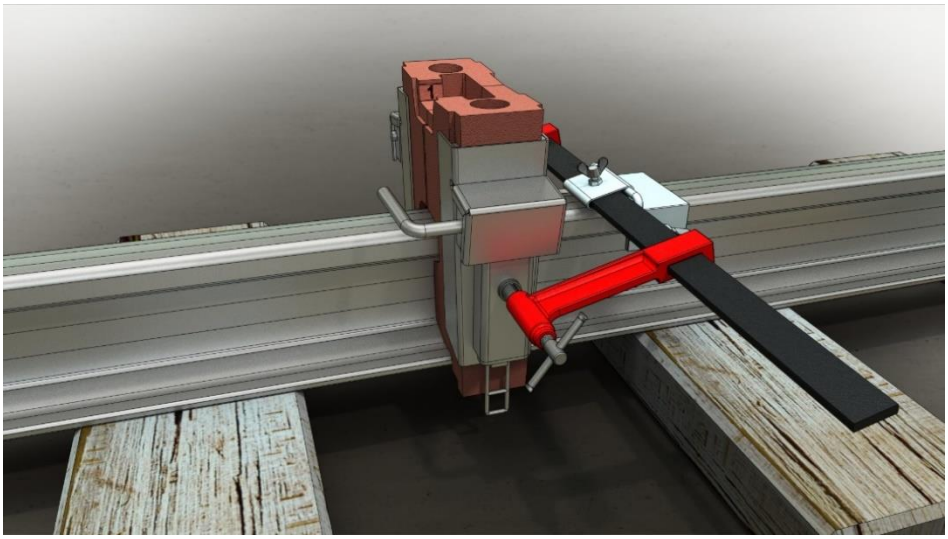
  - Place the preheater on the mould and adjust the height
  - The height is correct when the preheater touches the setting gauge
  - Tighten the preheater screw and check that the preheater height is correct
  - Remove the preheater and the gauge and continue fitting the moulds

	25mm welding gap	**68mm welding gap**
GASBOX 22H Version A	Height 50mm	Height 70mm
GASBOX 3H Version A	Height 40mm	Height 60mm

5.3.2 Fitting the second mould

- Fit the second mould, making sure that it is centred at the top and bottom in relation to the axis of the welding gap

- Loosen the wing screw used to fit the first mould



The clamping force of the mould clamp must be level with the middle of the rail head so that the parting line of the two moulds is even.

- Tighten the mould clamp sufficiently (without however breaking the moulds through excessive tightening)

- Make sure there are no foreign bodies inside the mould

AUTOSEAL® MOULDS

In the case of AutoSeal moulds, check the moulds are correctly positioned and verify there is no gap between the moulds and the rail.

IMPORTANT

When welding rails with a difference in wear, check that the moulds are perpendicular to the rails:

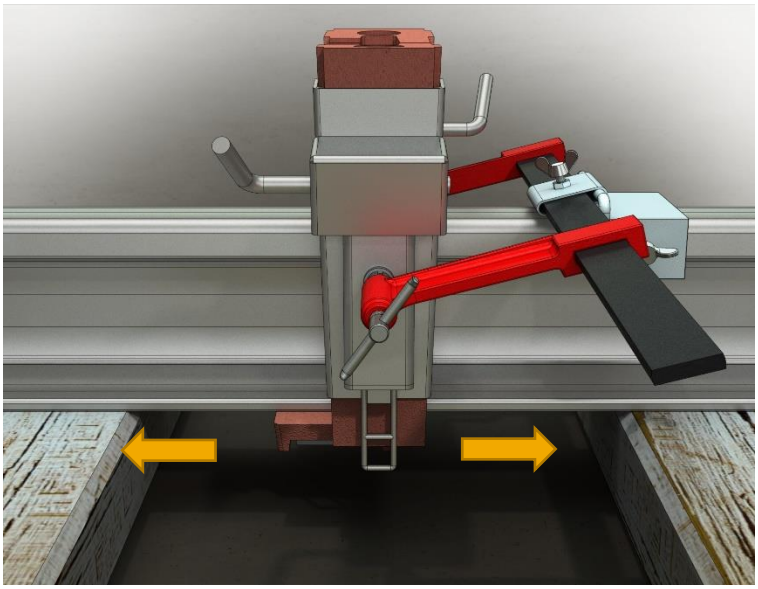
- ➔ **Loosen the mould clamp**
- ➔ **Straighten the moulds**
- ➔ **Tighten the mould clamp**

5.3.3 Fitting the bottom briquette

AUTOSEAL® MOULDS

In case of AutoSeal® moulds, no adjustment of the briquette is necessary (no scratching). Place the briquette directly into the bottom plate.

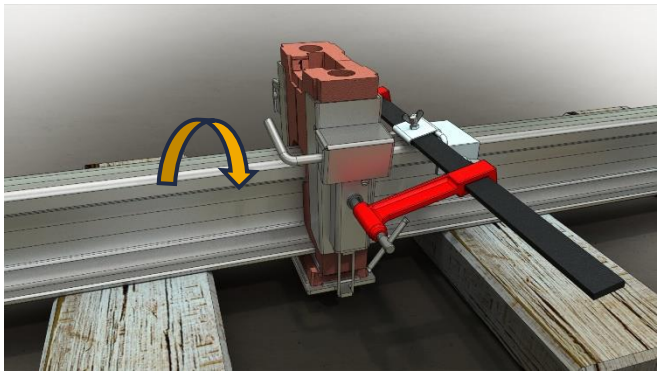
- Hold the bottom briquette **upside down** (with the flat part on top) and position it under the rail to check that it fits correctly between the lower sections of the side moulds

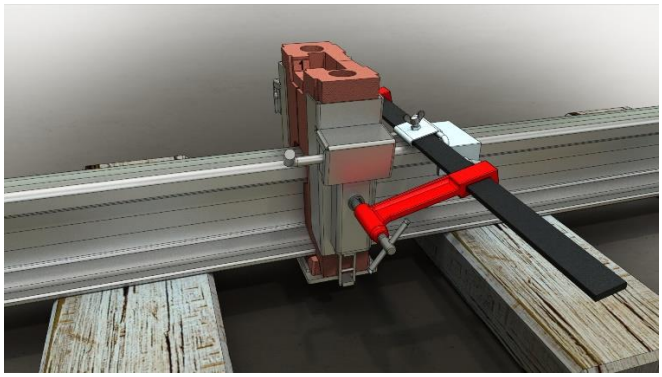


- Lay the bottom briquette in the bottom plate and make sure that it fits properly on this plate (no rocking)

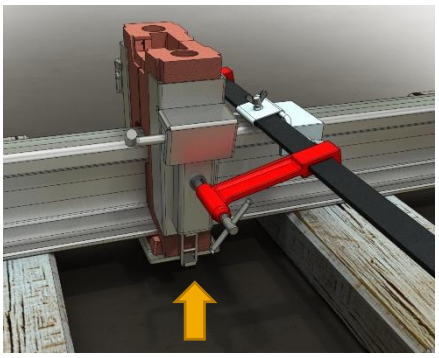
5.3.4 Luting the luting bottom briquette – 68mm

- Place a bead of paste on the two lengths of the base plate and along the bottom briquette, in the space provided
- Using a sharp object, carefully level the paste protruding above the upper level of the bottom briquette
- Position the bottom briquette-base plate assembly under the moulds
- Engage the fasteners on both sides
- Hold the 2 locking handles and turn them at the same time





- After tightening, tap the underside of the base plate to make sure it is properly supported



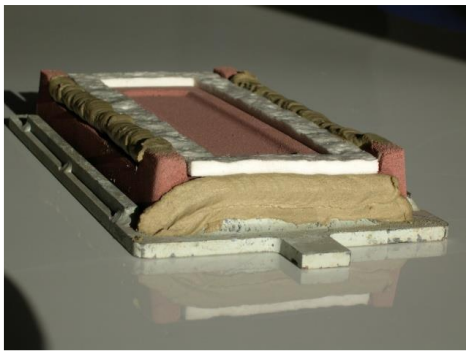
NOTE – 68 mm

When raising the bottom briquette using the two handles, visually check that the centring is correct.

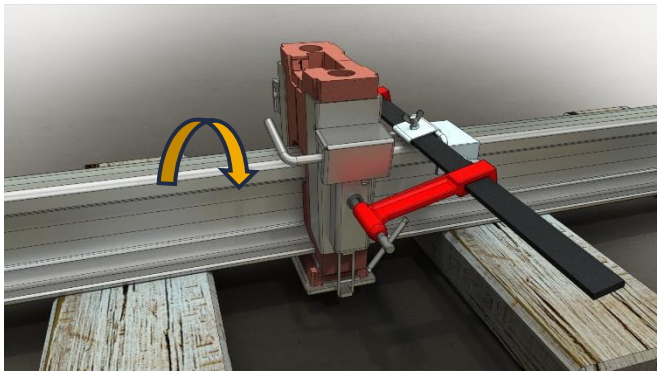
Once the moulds have been fitted, cover them (with a piece cardboard) to avoid any risk of foreign bodies falling inside the moulds.

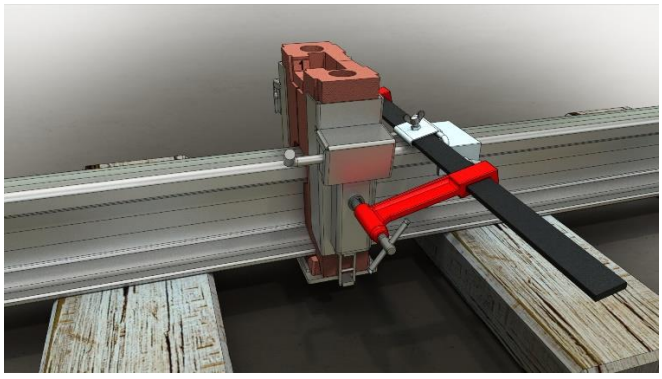
5.3.5 Luting and fitting the felted bottom briquette – 25mm

- Using the cartridge gun, place a bead along the two lengths of the bottom briquette, outside the felt
- Place a bead across the width of the base plate, on the 6mm-wide guides at the ends of the plate, without going above half the thickness of the bottom briquette

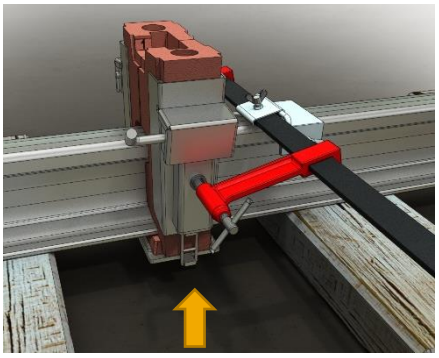


- Be careful not to put paste on the felt
- Position the bottom briquette-base plate assembly under the moulds
- Engage the fasteners on both sides
- Hold the 2 locking handles and turn them at the same time





- After tightening, tap the underside of the base plate to make sure it is properly supported

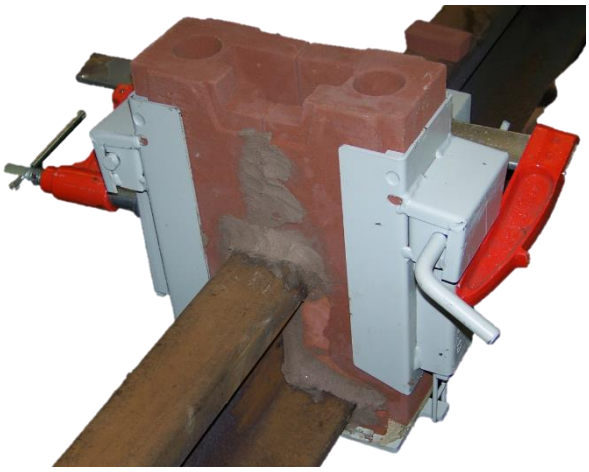


Once the moulds have been fitted, cover them (with a piece cardboard) to avoid any risk of foreign bodies falling inside the moulds.

5.4 Luting the moulds (not for AutoSeal® moulds)

5.4.1 Luting the luting moulds

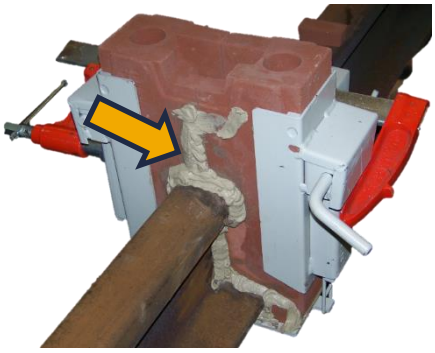
- Lay a bead of paste evenly by hand around the entire perimeter, at the parting line of the side moulds and the bottom briquette
- Take care to smooth the paste at the ends of the bottom briquette



5.4.2 Felted mould – 25 mm welding gap

- Using the cartridge gun, lay a bead of paste starting at the foot of the rail and working your way up to the top of the moulds, so that the paste is properly introduced inside the luting recess (1)
- Apply the paste all the way around and at the parting lines of the refractory parts (2)

(1)



(2)

5.5 Preheating

To ensure a lasting weld, the preheating operation must be done properly. It is therefore imperative that the instructions be followed to the letter.

Preheating is a very important operation. Its purpose is to obtain the essential thermal conditions defined for the process.

- For the **PLA** process, there are many types of preheating:

	Type of preheating	Pressures	25 mm welding gap	68 mm welding gap	Section
Oxy-Propane	22H Version A	**Propane :** 0.4bar **Oxygen:** 1.5bar	✓		**5.5.1**
		Propane: 10psi (0.7bar) **Oxygen:** 70psi (4.9bar**)**	✓		**5.5.2**
	22H Version A	**Propane:** 0.3 bar **Oxygen:** 0.9 bar	✓		**5.5.3**
	3H Version A	**Propane:** 0.2bar **Oxygen:** 0.6bar	✓		**5.5.4**
	Gasbox 22H Version A	**Propane:** 0.20-0.35bar **Oxygen:** 0.5-0.51bar	✓		**5.5.5**
	Gasbox 3H Version A	**Propane:** 0.20-0.35bar **Oxygen:** 0.42-0.43bar			**5.5.6**
Oxy-Acetylene	8H Version A	**Acetylene:** 0.6bar **Oxygen:** 0.6bar	✓		**5.5.7**
Air petrol	GP40 Air petrol	**Air:** 0.3bar	✓		**5.5.8**
Air propane*	GP40 Air propane	**Air:** 0.3bar **Propane:** 0.4/0.5bar	✓		**5.5.9**
	HFP rectangular nozzle Height 90mm	**Propane :** 1bar	✓		**5.5.10**

*For HFP please, refer to HFP Process manual

5.5.1 Oxy-propane preheating 22H version A (1,5/0,4bar)

IMPORTANT

Only use the Pandrol Oxy-Propane 22H Version A preheater

a. Fitting the preheater

To obtain correct preheating, proceed as follows:

- Fit the preheater in its holder and centre the nozzle in the moulds
- Adjust the distance between the end of the nozzle and the top of the rail:
  - **50mm** for a **25mm welding gap**
  - **70mm** for a **68mm welding gap**
- Remove the preheater from its holder

b. Igniting the preheater

- Check that the valves located on the shank of the preheater are closed
- Open the propane and oxygen cylinders
- Preset the **propane** pressure to **0,4bar** using the pressure regulator located on the **propane** cylinder
- Preset the **oxygen** pressure to **1,5bar** using the pressure regulator located on the **oxygen** cylinder
- Slightly open the propane valve located on the preheater shank
- Ignite the preheater
- Slightly open the oxygen valve located on the preheater shank
- Continue to alternate between opening the propane and oxygen valves located on the preheater shank until they are fully open
- Adjust the oxygen pressure to **1,5 bar on the oxygen pressure gauge located on the cylinders**
- Adjust the propane pressure to between **0,4bar and 0,5bar on the propane pressure gauge located on the cylinders, in order to obtain a cone that is between 15 and 20mm**

  In any case, never modify the oxygen pressure (1,5bar)
- Put the preheater in its holder
- During preheating, the flames coming out of the risers should be symmetrical and approximately between **300mm and 400mm in length for a gap 25mm and 120mm and 220mm in length for a gap 68mm**
- Check the pressures during preheating and fine-tune if necessary
- Put the plug on the top of the mould, with the upper side against the flame (be careful not to block the vents as a result)

c. Preheating time (minutes)

PROFILE	WELDING GAP 25mm	WELDING GAP 68mm
≤ 60kg	4 minutes	5 minutes
> 60kg	5 minutes	5 minutes

This preheating time is mandatory and must not be altered by the operator

COMPOSITE WELD INFORMATION

In the case of composite weld, take the preheating time of the largest rail.

During preheating, take the opportunity to prepare the crucible ⇒ **refer to the next chapter.**

WARNING

Never preheat outside the set pressures

The flame cone of the preheater must always be more than 15 mm and less than 20 mm long.

It is important to check the propane and oxygen supply pressures throughout the preheating procedure.

d. Turn the preheater off

Once preheating is complete, the following procedure must be observed for safety reasons:

- Remove the burner, taking care not to damage the internal walls of the moulds
- Shut off the propane supply, followed by the oxygen supply

In the event of a flashback (hissing sound), quickly close the propane valve.

5.5.2 Oxy-propane preheating 22H version A (70/10psi)

IMPORTANT

Only use the Pandrol Oxy-Propane 22H Version A preheater.

a. Fitting the preheater

To obtain correct preheating, proceed as follows:

- Fit the preheater in its holder and centre the nozzle in the moulds
- Adjust the distance between the end of the nozzle and the top of the rail:
  - **50mm** for a **25mm welding gap**
  - **70mm** for a **68mm welding gap**
- Remove the burner from its holder

b. Igniting the preheater

- Check that the valves located on the shank of the burner are closed
- Open the propane and oxygen cylinders
- Preset the **propane** pressure to **0,7bar (10 psi)** using the pressure regulator located on the **propane** cylinder
- Preset the **oxygen** pressure to **4,9bar (70 psi)** using the pressure regulator located on the **oxygen** cylinder
- Slightly open the propane valve located on the burner shank
- Ignite the preheater
- Slightly open the oxygen valve located on the burner shank
- Continue to alternate between opening the propane and oxygen valves located on the burner shank until they are fully open
- Adjust the propane pressure **at the propane pressure gauge located on the cylinders to get a flame cone that is about 12mm**

  In any case, never change the oxygen pressure (4,9bar or 70psi)
- Put the burner in its holder
- Adjust the oxygen flow using the valve on the burner until the flame crackle (popping flame) is correct
- During preheating, the flames coming out of the risers should be symmetrical and approximately between **300mm and 400mm in length for a gap 25mm and 120mm and 220mm in length for a gap 68mm**
- Check the pressures during preheating and fine-tune if necessary
- Put the plug on the top of the mould, with the upper side against the flame (be careful not to block the vents as a result)

c. Preheating time

PROFILE	WELDING GAP 25mm	WELDING GAP 68mm
≤ 60kg	4 minutes	5 minutes
> 60kg	5 minutes	5 minutes

This preheating time is mandatory and must not be altered by the operator

COMPOSITE WELD INFORMATION

In the case of composite weld, take the preheating time of the largest rail.

During preheating, take the opportunity to prepare the crucible ⇒ **refer to the next chapter.**

WARNING

Never preheat outside the set pressures

The flame cone of the preheater must always be more than 15 mm and less than 20 mm long.

It is important to check the propane and oxygen supply pressures throughout the preheating procedure.

d. Turn the preheater off

Once preheating is complete, the following procedure must be observed for safety reasons:

- Remove the burner, taking care not to damage the internal walls of the moulds
- Shut off the propane supply, followed by the oxygen supply

In the event of a flashback (hissing sound), quickly close the propane valve.

5.5.3 Oxy-propane preheating 22H version B

IMPORTANT

Only use the Pandrol Oxy-Propane 22H Version B preheater.

a. Fitting the preheater

To obtain correct preheating, proceed as follows:

- Fit the burner in its holder and centre the nozzle in the moulds
- Adjust the distance between the end of the nozzle and the top of the rail:
  - **50mm** for a **25mm welding gap**
  - **70mm** for a **68mm welding gap**
- Remove the burner from its holder

b. Igniting the preheater

- Check that the valves located on the shank of the burner are closed
- Open the propane and oxygen cylinders
- Preset the **propane** pressure to **0,3bar** using the pressure regulator located after the flashback arrestor
- Preset the **oxygen** pressure to **0,9 bar** using the pressure regulator located after the flashback arrestor
- Slightly open the propane valve located on the burner shank
- Ignite the burner
- Slightly open the oxygen valve located on the burner shank
- Continue to alternate between opening the propane and oxygen valves located on the burner shank until they are fully open
- Adjust the oxygen pressure to **0,9bar on the oxygen pressure gauge located after the flashback arrestor**
- Adjust the propane pressure **on the propane pressure gauge located after the flashback arrestor, in order to obtain a flame cone that is between 15 and 20mm**

  In any case, never modify the oxygen pressure (0,9bar)
- Put the burner in its holder
- During preheating, the flames coming out of the risers should be symmetrical and approximately between **300mm and 400mm in length for a gap 25mm and 120mm and 220mm in length for a gap 68mm**
- Check the pressures during preheating and fine-tune if necessary
- Put the plug on the top of the mould, with the upper side against the flame (be careful not to block the vents as a result)

c. Preheating time

PROFILE	WELDING GAP 25mm	WELDING GAP 68mm
≤ 60kg	4 minutes	5 minutes
> 60kg	5 minutes	5 minutes

This preheating time is mandatory and must not be altered by the operator

COMPOSITE WELD INFORMATION

In the case of composite weld, take the preheating time of the largest rail.

Except for butt welds:

- **50E2/63 kg EB = 4 minutes**
- **60 E1/60EIT2 = 5 minutes**
- **60 E1 T2/60EIT2 = 5 minutes**

During preheating, take the opportunity to prepare the crucible ⇒ **refer to the next chapter.**

WARNING

Never preheat outside the set pressures

The flame cone of the preheater must always be more than 15 mm and less than 20 mm long.

It is important to check the propane and oxygen supply pressures throughout the preheating procedure.

d. Turn the preheater off

Once preheating is complete, the following procedure must be observed for safety reasons:

- Remove the burner, taking care not to damage the internal walls of the moulds
- Shut off the propane supply, followed by the oxygen supply

In the event of a flashback (hissing sound), quickly close the propane valve.

5.5.4 Oxy-propane 3H Version A

IMPORTANT

Only use the Pandrol Oxy-Propane 3H Version A preheater

a. Fitting the preheater

To obtain correct preheating, proceed as follows:

- Fit the burner in its holder and centre the nozzle in the moulds
- Adjust the distance between the end of the nozzle and the top of the rail:
  - **40mm** for a **25mm welding gap**
  - **60 mm** for a **68mm welding gap**
- Remove the burner from its holder

b. Igniting the preheater

- Fully open the valves located on the burner shank
- Slightly open the propane inlet at the pressure regulator located on the propane cylinder
- Ignite the burner
- Slightly open the oxygen inlet at the pressure regulator located on the oxygen cylinder
- Gradually adjust the flow of propane and oxygen until the respective pressures **of 0,2bar and 0,6bar are obtained on the pressure gauges located on the burner**
- Measure the length of the flame cone. It should be **about 20mm** long. If not, adjust the propane pressure to achieve the required flame cone. **In any case, never modify the oxygen pressure (0,6bar)**
- Put the burner in its holder
- During preheating, the flames coming out of the risers should be symmetrical and approximately between **300mm and 400mm in length for a gap 25mm and 120mm and 220mm in length for a gap 68mm**
- Check the pressures during preheating and fine-tune if necessary
- Put the plug on the top of the mould, with the upper side against the flame (be careful not to block the vents as a result)

c. Preheating time

PROFILE	WELDING GAP 25mm	WELDING GAP 68mm
≤ 45kg	4 minutes	
> 45kg	5 minutes	6 minutes

This preheating time is mandatory and must not be altered by the operator

COMPOSITE WELD INFORMATION

In the case of composite weld, take the preheating time of the largest rail.

During preheating, take the opportunity to prepare the crucible ⇒ **refer to the next chapter.**

WARNING

Never preheat outside the set pressures

The flame cone of the preheater must always be about 20 mm long.

It is important to check the propane and oxygen supply pressures throughout the preheating procedure.

d. Turn the preheater off

Once preheating is complete, the following procedure must be observed for safety reasons:

- Remove the burner, taking care not to damage the internal walls of the moulds
- Shut off the propane supply, followed by the oxygen supply

In the event of a flashback (hissing sound), quickly close the propane valve.

5.5.5 GASBOX Oxy-propane 22H Version A

IMPORTANT

Only use the Pandrol GASBOX Oxy-Propane 22H Version A preheater

a. Fitting the preheater

To obtain correct preheating, proceed as follows:

- Fasten the GASBOX on the rail
- Reminder: the distance between the end of the burner nozzle and the top of the rail:
  - **50mm** for a **25mm welding gap**
  - **70mm** for a **68mm welding gap**

This distance was set when the moulds were installed.

- Check that the propane and oxygen valves of the GASBOX are closed
- Connect the GASBOX to the preheating line using the two quick couplings

b. Igniting the preheater

- The two valves of the GASBOX must be closed
- Open the cylinders and set the pressure regulators to their maximum positions
- Switch on the digital pressure gauges of the GASBOX and wait for initialisation (unit: bar, two 00 after the decimal point)
- Remove the preheater from the moulds
- Open the GASBOX valves to get a pressure of **0,5bar to 0,51bar** for the oxygen and about **0,20bar** for the propane
- Turn on the preheater and wait a few seconds for the pressures to stabilise
- Check that the oxygen pressure is **always between 0,5bar and 0,51bar**
- Measure the length of the flame cone, which should be **between 15 and 20mm.** If not, adjust the propane pressure to achieve the required cone length. **The propane pressure must be between 0.20 and 0.35bar. In any case, never modify the oxygen pressure (0,5bar – 0,51bar)**
- Put the preheater in position
- During preheating, the flames coming out of the risers should be symmetrical and approximately between **300mm and 400mm in length for a gap 25mm and 120mm and 220mm in length for a gap 68mm**
- Check the pressures during preheating and fine-tune if necessary
- Put the plug on the top of the mould, with the upper side against the flame (be careful not to block the vents as a result)

c. Preheating time

PROFILE	WELDING GAP 25mm	WELDING GAP 68mm
≤ 60kg	4 minutes	5 minutes
> 60kg	5 minutes	5 minutes

This preheating time is mandatory and must not be altered by the operator

COMPOSITE WELD INFORMATION

In the case of composite weld, take the preheating time of the largest rail.

During preheating, take the opportunity to prepare the crucible ⇒ **refer to the next chapter.**

WARNING

Never preheat outside the set pressures

The flame cone of the preheater must always be more than 15 mm and less than 20 mm long.

It is important to check the propane and oxygen supply pressures throughout the preheating procedure.

d. Turn the preheater off

Once preheating is complete, the following procedure must be observed for safety reasons:

- Remove the preheater, taking care not to damage the internal walls of the moulds
- Shut off the propane supply, followed by the oxygen supply

In the event of a flashback (hissing sound), quickly close the propane valve.

5.5.6 GASBOX Oxy-propane 3H Version A preheating

IMPORTANT

Only use the GASBOX Oxy-Propane 3H Version A preheater

a. Fitting the preheater

To obtain correct preheating, proceed as follows:

- Fasten the GASBOX on the rail
- Reminder: the distance between the end of the nozzle and the top of the rail:
  - **40mm for a 25mm welding gap**
  - **60mm for a 68mm welding gap**

This distance was set when the moulds were installed.

- Check that the propane and oxygen valves of the GASBOX are closed
- Connect the GASBOX to the preheating line using the two quick couplings

b. Igniting the preheater

- The two valves of the GASBOX must be closed
- Open the cylinders and set the pressure regulators to their maximum positions
- Switch on the digital pressure gauges of the GASBOX and wait for initialisation (unit: bar, two 00 after the decimal point)
- Remove the preheater from the moulds
- Open the GASBOX valves to get a pressure **0,42bar/0,43bar** for the oxygen and about **0,20bar** for the propane
- Turn on the preheater and wait a few seconds for the pressures to stabilise
- Check that the oxygen pressure is **always between 0.42bar and 0.43bar**
- Measure the length of the flame cone, which should be **about 20mm.** If not, adjust the propane pressure to achieve the required cone length. **The propane pressure must be between 0,20 and 0,35bar. In any case, never change the oxygen pressure (0,42bar – 0,43 bar)**
- Put the preheater in position
- During preheating, the flames coming out of the risers should be symmetrical and approximately between **300mm and 400mm in length for a gap 25mm and 120mm and 220mm in length for a gap 68mm**
- Check the pressures during preheating and fine-tune if necessary
- Put the plug on the top of the mould, with the upper side against the flame (be careful not to block the vents as a result)

c. Preheating time

PROFILE	WELDING GAP 25mm	WELDING GAP 68mm
≤ 45kg	4 minutes	
> 45kg	5 minutes	6 minutes

This preheating time is mandatory and must not be altered by the operator

COMPOSITE WELD INFORMATION

In the case of composite weld, take the preheating time of the largest rail.

During preheating, take the opportunity to prepare the crucible ⇒ **refer to the next chapter.**

WARNING

Never preheat outside the set pressures

The flame cone of the preheater must always be about 20mm long.

It is important to check the propane and oxygen supply pressures throughout the preheating procedure.

d. Turn the preheater off

Once preheating is complete, the following procedure must be observed for safety reasons:

- Remove the preheater, taking care not to damage the internal walls of the moulds
- Shut off the propane supply, followed by the oxygen supply

In the event of a flashback (hissing sound), quickly close the propane valve.

5.5.7 Oxy-acetylene 8H Version A preheating

IMPORTANT

Only use the Pandrol Oxy-Acetylene 8H Version A preheater.

a. Fitting the preheater

To obtain correct preheating, proceed as follows:

- Fit the preheater in its holder and centre the nozzle in the moulds
- The distance between the end of the burner and the top of the rail is**:**
  - **50mm** for a **25mm welding gap**
  - **70mm** for a **68mm welding gap**
- This distance is obtained by placing the burner directly in the holder.
- Remove the burner from its holder

b. Igniting the preheater

- The acetylene and oxygen valves located on the preheater shank are closed
- Open the acetylene and oxygen cylinders
- Adjust the pressures to **0,6bar for the acetylene** and **0,6bar for the oxygen** using the pressure regulators located on the cylinders
- Slightly open the acetylene valve located on the preheater shank
- Ignite the burner
- While keeping the flame touching the burner, open the **oxygen** and **acetylene** located on the preheater shank alternately until they are fully open
- Using the pressure gauges located on the cylinders, gradually adjust the **oxygen** and **acetylene** pressures to **0,6b** and **0,6b**
- **The flame cone should be between 6mm and 8mm.** Otherwise, adjust the acetylene pressure using the acetylene pressure regulator to obtain the required cone length
- During preheating, the flames coming out of the risers should be symmetrical and approximately between **100mm and 200mm in length**
- Check the pressures during preheating and fine-tune if necessary
- Put the plug on the top of the mould, with the upper side against the flame (be careful not to block the vents as a result)

In any case, never modify the oxygen pressure of **0,6bar.**

- Theoretical pressures on the pressure gauges located on the cylinders:

  - **ACETYLENE 0,6bar**
  - **OXYGEN 0,6bar**

c. Preheating time

PROFILES	WELDING GAP 25mm	WELDING GAP 68mm
All profiles	6 min 30 sec	8 minutes

This preheating time is mandatory and must not be altered by the operator

COMPOSITE WELD INFORMATION

In the case of composite weld, take the preheating time of the largest rail.

During preheating, take the opportunity to prepare the crucible ⇒ **refer to the next chapter.**

WARNING

Never preheat outside the set pressures

The flame cone of the preheater must always be more than 6mm and less than 8mm long.

It is important to check the acetylene and oxygen supply pressures throughout the preheating procedure.

d. Turn the preheater off

Once preheating is complete, the following procedure must be observed for safety reasons:

- Remove the preheater, taking care not to damage the internal walls of the moulds
- Shut off the acetylene supply, followed by the oxygen supply

In the event of a flashback (hissing sound), quickly close the acetylene valve.

5.5.8 GP40 Air petrol preheating

IMPORTANT

Only use the Pandrol GP40 forced draught petrol line

a. Fitting the burner

To obtain correct preheating, proceed as follows:

- Place the burner so that it is aligned with the moulds
- Centre the burner nozzle in the pouring basin of the moulds, so that it is aligned with the middle of the gap and the central axis of the rails
- Take care not to damage the inside of the moulds with the nozzle (so that no sand gets inside)

b. Burner ignition

To light the burner correctly, proceed as follows:

- Tilt the burner slightly in the pouring basin of the mould
- Start the unit, with the engine at maximum speed according to the factory preset
- Adjust the air leakage valve so that the gauge shows a pressure of **0,2bar**
- The fuel control valve is open by about one turn
- Position the lighter against the burner heater (until adjustment is complete)
- Continue to open the fuel valve until the burner ignites
- Centre the burner in the mould
- Close the air leakage valve so that the gauge shows a pressure of **0,3bar**
- Gradually close the fuel control valve until a clean combustion is obtained
- Make sure that the heater is always on
- Adjust the various petrol air adjustment elements of the preheater, in order to obtain blue flames at the outlet of the risers and yellow flames at the outlet of the mould that are about **100 to 150mm**
- Check the pressures during preheating and fine-tune if necessary
- Put the plug on the top of the mould, with the upper side against the flame (be careful not to block the vents as a result)

c. Preheating time

PROFILES	WELDING GAP 25mm	WELDING GAP 68mm
All profiles	6 minutes	8 minutes

This preheating time is mandatory and must not be altered by the operator

COMPOSITE WELD INFORMATION

In the case of composite weld, take the preheating time of the largest rail.

During preheating, take the opportunity to prepare the crucible ⇒ **refer to the next chapter.**

WARNING

Never preheat outside the set pressures

It is important to check the supply pressures throughout the preheating procedure.

d. Turn the burner off

At the end of the preheating time, proceed as follows to stop the preheating unit.

The procedure below must be followed for safety reasons:

- Remove the burner, taking care not to damage the internal walls of the moulds
- Use the burner to blow the top of the moulds to remove and expel any debris
- Close the fuel tank valve(s)
- Wait for the burner flame to stop
- Stop the engine

5.5.9 GP40 Air propane preheating

NOTE

Only use the Pandrol GP40 forced draught propane line

a. Fitting the burner

To obtain correct preheating, proceed as follows:

- Place the burner so that it is aligned with the moulds
- Centre the burner nozzle in the pouring basin of the moulds, so that it is aligned with the middle of the gap and the central axis of the rails
- Take care not to damage the inside of the moulds with the nozzle (so that no sand gets inside)

b. Burner ignition

To light the burner correctly, proceed as follows:

- The burner in the heating position, flush with the mould
- Start the unit, with the engine at max speed according to the factory preset
- Set the air leakage valve so that the gauge shows a pressure of **0,3bar**
- If necessary, adjust the engine speed
- Position the lighter against the burner heater (until adjustment is complete)
- Open the propane and adjust the pressure gauge between **0,5 and 0,6bar**
- Burner ignition
- Adjust the propane pressure until a clean combustion is obtained
- Make sure that the heater is always on
- Adjust the various petrol air adjustment elements of the preheater (in accordance with the preheater user manuals) to obtain blue flames at the outlet of the risers and yellow flames at the outlet that are about **100 to 150mm**
- Check the pressures during preheating and fine-tune if necessary
- Put the plug on the top of the mould, with the upper side against the flame (be careful not to block the vents as a result)

c. Preheating time

PROFILE	WELDING GAP 25mm	WELDING GAP 68mm
All profiles	6 minutes	8 minutes

This preheating time is mandatory and must not be altered by the operator

COMPOSITE WELD INFORMATION

In the case of composite weld, take the preheating time of the largest rail.

During preheating, take the opportunity to prepare the crucible ⇒ **refer to the next chapter.**

WARNING

Never preheat outside the set pressures

It is important to check the supply pressures throughout the preheating procedure.

d. Turn the burner off

At the end of the preheating time, proceed as follows to stop the preheating unit.

The procedure below must be followed for safety reasons:

- Remove the burner, taking care not to damage the internal walls of the moulds
- Use the burner to blow the top of the moulds to remove and expel any debris
- Close the propane tank valve(s)
- Wait for the burner flame to stop
- Stop the engine

5.5.10 Préchauffage HFP

IMPORTANT

Only use the HFP Pandrol

(HFP → Yellow support or universal support– Height 90mm − Rectangular Torch)

In this preheating procedure, we assume that the equipment is mastered, ready for use and that the checks have been made, as recommended in the instructions for use and maintenance of the HFP.

a. Setting up the HFP

To obtain correct preheating, proceed as follows:

- Set up the support of the HFP at **350mm** from the rail end
- Place the HFP on its support frame in such a way that the spout of the HFP is positioned in the middle of the mold
- If necessary, loosen the support to reorient its inclination
- Ensure the stability of the HFP preheat

b. Universal support setting

This modular support can be adapted to all rail profiles. It includes Large and / or narrow foot support and HFP support. Height could be adjusted with discs.

Large foot support

width 80<Head≤150mm

Ref :21245028

Narrow foot support

width Head≤80mm

Ref :21245027

HFP support

Ref :21245026

Discs

Set Screw

- **Height adjustment**

Please refer to the welding instructions for height adjustment. Two discs are used to adjust the height of the support. When they aren't use, they are attached to the HFP support.

With discs: **Height = 90mm**

- Welding on inclined rails

When welding on sloping rails, the HFP is positioned on the upper part of the support. The 2 screws are screwed onto the lower part of the support.

Support with screws onto lower part of the support

Support with screws to hold it in place

c. Igniting the HFP

- Ensure the proper centering of the HFP spout above the center of the mold
- Position the general switch on position I
- Adjust the warm-up time on the HFP timer
- Preset propane pressure to **1 bar**
- Turn on the HFP Preheat by pressing the "START" button
- The green "RUN" light illuminates for the duration of the junction preheating cycle

In the event of a defect or malfunction detected by the on-board CONTROLLER, the "ERROR" light will illuminate and the HFP will turn off. In this case refer to the HFP user and maintenance manual.

- During preheating, the flames coming out of the risers should be symmetrical and approximately between **150mm and 200mm**

- Check propane pressure during preheating and readjust if necessary
- Put the plug on the top of the mould, with the upper side against the flame (be careful not to block the vents as a result)

d. Preheating time (minutes)

PROFILES	GAP 25 mm
< 60Kg	**6 minutes**
≥ 60Kg	**8 minutes**

This preheating time is mandatory and must not be altered by the operator

During preheating, take the opportunity to prepare the crucible ⇒ **refer to the next chapter.**

WARNING

Never preheat outside the set pressures

It is important to check the propane supply pressure throughout the preheating procedure.

e. Turn the HFP off

Once the preheating is complete, it is imperative to follow the following procedure as a safety measure:

With the required operating time up, the HFP stops on its own.

- Close the gas inflow valve on the cylinder
- Return the general switch to the O position
- Carefully remove the HFP Preheat from its support, taking care not to deteriorate the internal walls of the mold and to accompany the gas pipe well
- Carefully place the HFP Preheator nearby, but outside the scope of the casting operation, taking care not to touch the nose of the torch, not to place it near or against a flammable or sensitive element and not to hit the nose so as not to damage it
- Loosen the clamping screw on the rail of the HFP Preheat bracket and remove it

5.6 After the preheating – AutoSeal® moulds

AUTOSEAL® MOULDS

Depending on the type of preheating used, the expansive strip of AutoSeal® moulds expands between 2 to 3 minutes.

The result is visible below

During preheating, no flame must not come out of the moulds. If so, the moulds were misplaced. We recommend to remove the mould, wait for the rail cool down and set up new moulds

5.7 Positioning and loading the crucible

⇒*The crucible should be prepared during the preheating time.*

Use only the portion supplied in the kit. Never modify a portion: do not add anything, do not mix portions, etc.

- Open the aluminothermic portion bag and pour the portion into the one-shot crucible
- Place the crucible close to the work area
- Put a STARTWEL® starter in the lid or an igniter in the portion
  When using a STARTWEL® starter and a filtering lid, remove the sand seal and insert the STARTWEL®
- Prepare the fork to remove the crucible

WARNING

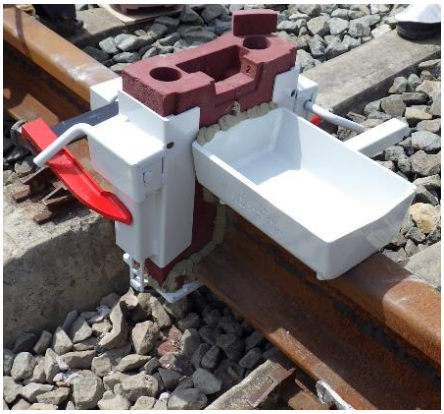
When using the STARTWEL® system, the aluminothermic portion must always be horizontal in the crucible

NO **YES**

5.8 Pour

5.8.1 Fitting the plug

- Fit the slag bowl and adjust the gap between the bowl and the moulds
- Put the plug in its housing using the plug holder provided
- Press down on the plug slightly using the holder provided



AUTOSEAL® MOULDS – SLAG BOWL

In the case of AutoSeal® moulds, using the extra parts of felt to seal the junction between the moulds and the slag bowl.

We recommend using a tray in good condition (no deformation) when welding using AutoSeal® moulds.

WARNING

- **Make sure that the plug is correctly positioned**
- **No time should be wasted between preheating and pouring. So, one operation must immediately follow the other**
- **The maximum time between the end of preheating and igniting the portion must be 1 minute**

5.8.2 Reaction

- Place and centre the crucible on the moulds

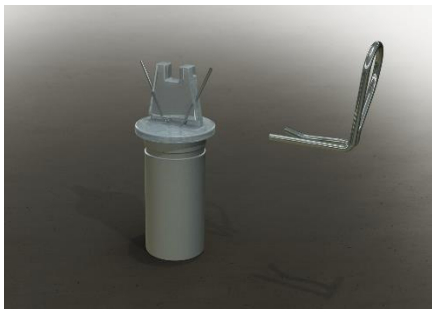
Depending on the portion ignition system used, i.e. the **STARTWEL® or igniter system**, follow the procedure below:

<u>Using the STARTWEL® system</u>

Depending on the crucible lid used, choose one of the 3 procedures below:

- **Non-filtering lid** ⇒ remove the pin and insert the starter in the lid (1) & (2) & (3)
- **Filtering lid** ⇒ remove the pin from the starter already inserted in the lid (1) & (2) & (3)
- **Lid pre-fitted with a starter** ⇒ remove the starter pin

(1)



(2)

(3)

- Place, press and hold the electrodes of the electric trigger on the starter terminals **for 3 seconds** (4)

A light seen through the translucent seal (5) shows that the starter has ignited properly

The reaction occurs in a few seconds and the pouring takes place automatically after the end of the reaction in the crucible

*The tapping time is between **17 and 32 seconds** (starting from the moment the light appears through the translucent seal)*

- Remove the crucible using the crucible fork, one minute after the end of the pour (6)

(4)

(5)

(6)

Non-contractual photos, data given by way of example to represent the different operations.

Using the igniter

- Light the igniter by holding it against the hot inner sides of the moulds (1)
- Lift the lid and put the igniter in the portion (about 3cm). *Sticking it in too deep can affect the tapping time*
- Put the lid back on the crucible (2)

The reaction occurs in a few seconds and the pouring takes place automatically after the end of the reaction (3) & (4)
*The tapping time is between**17 and 32 seconds**. The time starts when the igniter is inserted in the portion*

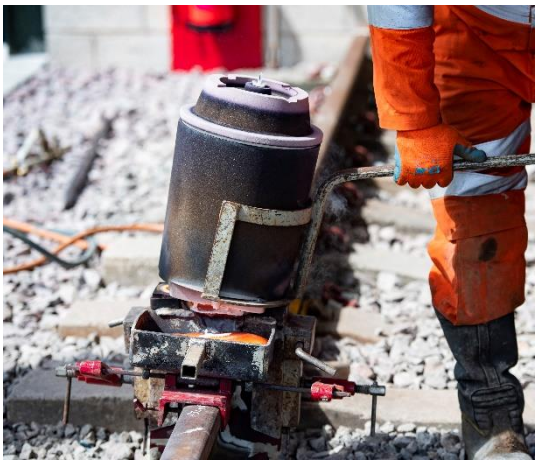
- Remove the crucible using the crucible fork, one minute after the end of the pour (5)

(1)

(2)

(3)

(4)



(5)

Non-contractual photos, data given by way of example to represent the different operations.

SAFETY

If the tapping mechanism fails:

- The molten steel flows through the safety valve. This occurs approximately **1 minute** after the standard tapping time
- The crucible is then removed using the special fork provided for this purpose

NEVER REMOVE THE CRUCIBLE WITH YOUR HANDS

In the event of the failure of the tapping mechanism, and the safety valve or crucible valve:

- The crucible must be left in position until its self-destruction

IF THE TAPPING MECHANISM FAILS, THE WELD MUST BE IMMEDIATELY DECLARED DEFECTIVE AND REPLACED, ACCORDING TO NETWORK REQUIREMENTS

5.9 Removing the slag bowl

- **3 minutes after the end of the pour**, break off the solidified slag at the outflow between the moulds and the bowl. Then remove the slag bowl using the fork

If the solidified slag is not broken, the luting paste and the mould can be torn off when removing the bowl, causing a leak.

WARNING

- **Never remove the slag bowl before its contents have completely solidified: wait 3 minutes after the end of the pour**
- **Never put the slag bowl or pour out its contents:**
  - **On a sleeper**
  - **On wet or frozen ground**
  - **In water**

5.10 Stripping

The stripping operation:

- Is mandatory when using a narrow **EME1** or**EGH1**
- Not required when using a wide **EME2** or**EGH2 type shearing machine** *(shearing directly through the moulds)*

SAFETY

Do not tilt the upper part of the moulds if the steel is still liquid

	MEASUREMENT TIME AFTER THE END OF POURING (minutes)	
	WELDING GAP 25mm	**WELDING GAP 68mm**
Remove the mould shoes and bottom plate	**3** minutes	**5** minutes
Start stripping at	**5** minutes	**8** minutes

The times indicated in this table are provided as a guide. They may be fine tuned by the welder according to the atmospheric conditions.

- Remove the luting paste on both sides of the moulds
- Tilt and remove the upper part of the moulds

Use the appropriate equipment such as a rectangular shovel or a track chisel

- Clean the running surface (brushing) before shearing

5.11 Shearing

SAFETY

Strictly comply with the safety instructions for using the equipment

	SHEARING TIME AFTER THE END OF POURING (minutes)	
	WELDING GAP 25mm	**WELDING GAP 68mm**
Start shearing at	**6** minutes	**10** minutes

The times indicated in this table are provided as a guide. They may be fine-tuned by the welder according to the atmospheric conditions. In all cases, shear the riser when the weld has solidified enough.

If stripping has been done:

- Place and lock the shearing machine to the rail
- Shear the excess weld material
- Remove the shearing machine quickly after shearing

If stripping has not been done:

- Remove the luting paste on both sides of the moulds
- Place and lock the shearing machine to the rail
- Shear through the moulds
- Remove the shearing machine quickly after shearing

NOTE

Do not shear using the track chisel and sledge hammer. Preferably use a shearing machine to maintain the geometry of the weld.

During shearing, make sure that the support blocks added when the rails were aligned are still supporting the rail foot.

For 25mm, wait at least 15 minutes after the end of pouring before removing the wedges if they were used for the rail setting

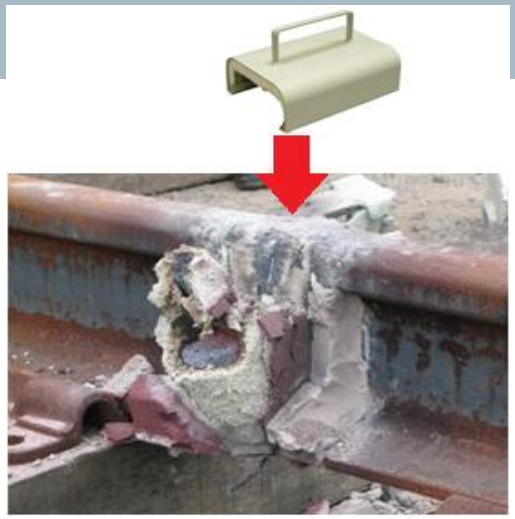
For 68mm, wait at least 25 minutes after the end of pouring before removing the wedges if they were used for the rail setting

SPECIAL COOLING PREMIUM GRADE

For R320Cr, B320, R350LHT and R370CrHT grade rail welds, a cooling calliper must be used.

The cooling cap is put immediately after shearing and left in position for at least 8 minutes.

Do not strip the lower part of the moulds.



5.12 Removing the vent risers

To remove the vent risers, without damaging the rails, the following procedures are recommended:

- Cut off the base of the vents, when hot or cold, using a grinder
- When hot, create a notch at the base of the vent risers, and then, break them off when they have cooled. *Make the notch when they are hot, i.e. soon after shearing. If not, the metal will be too cold making the operation very difficult*

AUTOSEAL® MOULDS – REMOVING VENT RISERS

In the case of AutoSeal® moulds :

The vent risers can be removed manually by knocking them evenly each side along the rail until fracture occurs.

This must be completed between **20 to 40 minutes** from completion of pour. If this cannot be achieved, removal shall be done by mechanical means. If welding Premium Grade steel the vent risers can be manually removed between **30 to 40 minutes.**

WARNING

There is a risk that the weld and/or rail will crack when:

- **The vent risers are fully sheared when hot, with a manual track chisel**
- **The vent risers are broken off when they have cooled without having been hot-notched beforehand**

5.13 Rough grinding

Rough grinding involves removing the excess weld metal left by the shearing operation so that the track can be opened to traffic awaiting final grinding.

SAFETY

Strictly comply with the safety instructions for using the equipment.

- Grind the top of the rail head and the inner side
- Leave excess metal weld on the rail head in accordance with the network requirements

5.14 Commissioning

Commissioning means that the track is open to traffic, including work trains, or that tension can be placed on the weld through the use of hydraulic rail tensors (tension with the tensor, removal of the tensor, etc.)

Commissioning corresponds to a maximum **temperature of the weld of about 350°C**.

	COMMISSIONING TIME AFTER THE END OF POURING (minutes)	
	WELDING GAP 25mm	**WELDING GAP 68mm**
Commissioning	**25** minutes	**35** minutes

The removal of the support blocks, used to align the rails, as well as the tightening of the sleepers around the weld is not sufficient for commissioning.

For a gap 25mm, it is advisable to wait for at least 15 minutes after the end of pouring to perform these operations.

For a gap 68mm, it is advisable to wait for at least 25 minutes after the end of pouring to perform these operations.

5.15 Welding completion

5.15.1 Final grinding

- The purpose of final grinding is to restore the geometric continuity of the rail head, with a tolerance level that must comply with the requirements of the network
- This grinding should preferably be carried out on a completely cold rail, on which a passenger or work train has passed, or to operate on a stabilised surface

SAFETY

Strictly comply with the safety instructions for using the equipment.

5.15.2 Cleaning

Refer to network requirements.

Recommendations:

- Remove all signs of refractory products, including under the rail foot
- Remove burrs with a chisel
- Grind the base of the vent risers and the protuberances of the bead at the foot

5.15.3 Verification

Refer to network requirements.

5.15.4 Marking and traceability

Refer to network requirements.

5.16 Reminder – Timing of operations

OPERATIONS (in minutes after pouring)		
PLA PROCESS		
Welding gaps (mm)	**25 +/ 2mm**	**68 +/- 3mm**
➢ **Removing the crucible**	**1** minute	
➢ **Removing the slag bowl**	**3** minutes	
➢ **Removing the side mould shoes**	**3** minutes	**5** minutes
➢ **Stripping**	**5** minutes	**8** minutes
➢ **Shearing**	**6** minutes	**10** minutes
➢ **Wedges removing**	**15** minutes minimum	**25** minutes minimum
➢ **Commissioning of the weld**	**25** minutes	**35** minutes

5.17 Reminder – Preheating time

	Type of preheating	Pressures	Preheating time (in minutes)		Section
			25mm	68mm	
Oxy-Propane	22H Version A	**Propane:** 0.4bar **Oxygen:** 1.5bar	≤ 60kg **4min** > 60kg **5min**	**5min**	**5.5.1**
		Propane: 10psi (0.7bar) **Oxygen:** 70psi (4.9 bar)	≤ 60kg **4min**	**5min**	**5.5.2**
	22H Version B	**Propane:** 0.3bar **Oxygen:** 0.9bar	≤ 60kg **4min** > 60kg **5min**		**5.5.3**
	3H Version A	**Propane:** 0.20-0.35bar **Oxygen:** 0.6bar	≤ 45kg **4min** > 45kg **5min**	> 45kg **6min**	**5.5.4**
	Gasbox 22H Version A	**Propane:** 0.20-0.35bar **Oxygen:** 0.5-0.51bar	≤ 60kg **4min** > 60kg **5min**	**5min**	**5.5.5**
	Gasbox 3H Version A	**Propane:** 0.20-0.35bar **Oxygen:** 0.42--0.43bar	≤ 45kg **4min** > 45kg **5min**	> 45kg **6min**	**5.5.6**
Oxy-Acetylene	8H Version A	**Acetylene:** 0.6bar **Oxygen:** 0.6bar	**6min30sec**	**8min**	**5.5.7**
Air petrol	GP40 Air petrol	**Air:** 0.2bar	**6min**	**8min**	**5.5.8**
Air Propane*	GP40 Air propane	**Air:** 0.3bar **Propane:** 0.4-0.5bar	**6min**	**8min**	**5.5.9**
	HFP rectangular nozzle Height 90mm	**Propane:** 1bar	< 60kg **6min** ≥ 60kg **8min**	/	**5.5.10**

*For HFP please, refer to HFP Process manual

Appendices

A. Welding equipment

B. Mobile app - Pandrol Connect

C. Welding products storage conditions

D. Waste/information

E. Preheating line

A. Welding equipment

A.1. Welding tools

A.1.1. Tools

SIDE MOULD SHOES

SET OF MOULD SHOES 25mm	83200001
SET OF MOULD SHOES 68mm	83200002
1 MOULD SHOE FOR POINTS, SWITCHES AND TURNOUTS	83200003

BOTTOM PLATES

BOTTOM PLATE type 25mm	83100002
BOTTOM PLATE type 68mm	83100003

SLAG BOWL

SLAG BOWL	81532010

PLUG HOLDER

90° ANGLED PLUG HOLDER	83432921
STRAIGHT PLUG HOLDER	83432922

HOT WASTE METAL TRAY

HOT WASTE METAL TRAY	11319003

MOULD CLAMP

MOULD CLAMP	81250902

A.1.2. One-shot crucible and cooling cap

ONE-SHOT CRUCIBLE

CJ1F1 CRUCIBLE	**83450116**
STARTWEL® CJ1 F1 CRUCIBLE	**83450152**
STARTWEL® CJ1 F1 PLASTIC FILM	**83450151**
CJ1F1 CFL* CRUCIBLE	**83450128**
STARTWEL® CJ1 F1 CFL CRUCIBLE	**83450150**
STARTWEL® CJ1 F1 CFL PLASTIC FILM	**83450129**
CJ2F1 CRUCIBLE	**83450113**
STARTWEL® CJ2 F1 CRUCIBLE	**83450160**
STARTWEL® CJ2 F1 PLASTIC FILM	**83450159**
CJ2F1 CFL* CRUCIBLE	**83450121**
STARTWEL® CJ2 F1 CFL CRUCIBLE	**83450158**
STARTWEL® CJ2 F1 CFL PLASTIC FILM	**83450157**

**CFL: Crucible Filtering Lid*

FORK

CJ FORK	**82631411**

COOLING CAP

COOLING CAP	**82620500**

A.1.3. Ignition of the weld

STARTWEL®

COMPLETE CASE	**82632507**

The complete suitcase includes the following:

- 1 electric trigger **(1)**
- 1 14.4V Ion-Lithium battery **(2)**
- 1 box of 10 STARTWEL® **thermal starters (3)**
- 1 battery charger **(4)**

CASE WITHOUT CHARGER	**82632508**

The case, without charger, includes the following:

- 1 electric trigger with 1 x 14.4V Ion-Lithium battery
- 1 box of 10 STARTWEL®

STARTWEL®

STARTWEL® thermal starter packaged in boxes of 10 units:

BOX of 10 U. STARTWEL®	**82632501**

STARTWEL® thermal starter packaged in 10 boxes of 10 units:

BOX of 10 x 10 U. STARTWEL®	**82632502**

STARTWEL®

The STARTWEL® electric trigger is equipped with a long-life 14.4V Ion-Lithium battery, as standard.

COMPLETE ELECTRIC TRIGGER	**82632503**
ELECTRIC TRIGGER WITHOUT BATTERY	**82632509**
BATTERY	**82632504**

CHARGER FOR STARTWEL®

220V CHARGER FOR STARTWEL®	**82632505**

EMPTY STARTWEL®

EMPTY CASE	82632506

IGNITERS

BOX OF IGNITERS (x100)	82632450

STRIKER

STRIKER	CSB40004
BOX OF STRIKERS	CSB40005

ELECTRIC BLANKET

ELECTRIC BLANKET 860x330/1000 Watt	TZZ00014

WELDING TENT

WELDING TENT 2.6 x 2.6 x 2.1	TSV00010

A.1.4. Luting

PASTE BUCKET

LUTING PASTE BUCKET	83661130

CARTRIDGE GUN

CARTRIDGE GUN WITH COMPENSATION	83461110
CARTRIDGE GUN WITHOUT COMPENSATION	83461109

PASTE CARTRIDGE

BOX OF PASTE CARTRIDGES (x 12)	83661111

FOR WORN RAILS

SEALING FELT

Sealing felt is used when welding worn rails.

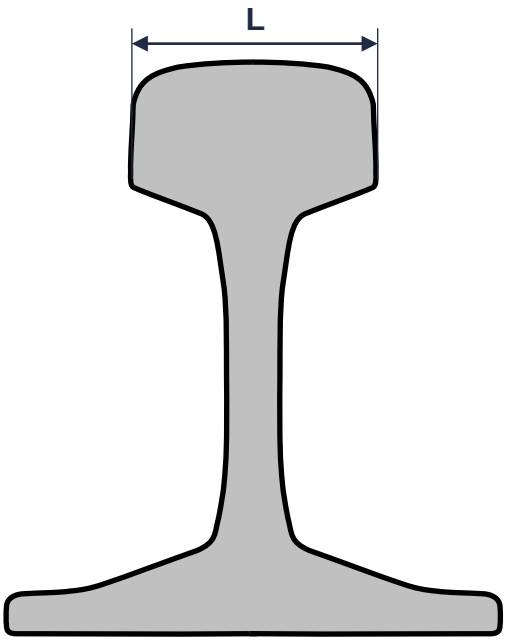
The felt can only be used on luting moulds.

The sealing felt is packaged in boxes of 30 units:

CLASSIC SEALING FELT (x30)	83661115
SNCF SEALING FELT (x30)	83661116

A.1.5. Shearing blades

Pair of shearing blades	Head width L (mm)	References
REP32	58 <L	11335018
REP36	59 < L < 62	11335019
REP40	63 < L < 66	11335024
REP45	67 < L < 71	11335022
REP48	72 < L < 76	11335023



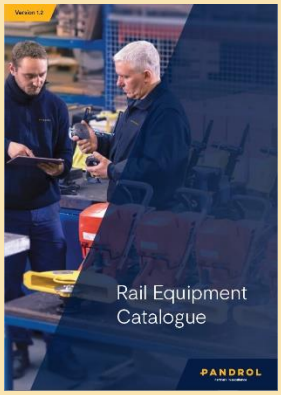
A.2. Measures to be taken in the event of incorrect pressures

If the pressures are not constant and correct during preheating, the quality of the weld cannot be guaranteed. The welder must follow the procedure set by the network. In general, the welder can choose between the following two procedures:

- The welder finishes off the weld and declares the weld defective
- The welder starts the welding process from the beginning again, after it has cooled completely *(verification of the welding gap, installation of new moulds, etc.)*

A.3. Non-exhaustive check list for a team

For all the references of the Pandrol equipment, refer to the equipment catalogue: "Rail Equipment Catalogue".



"Rail Equipment Catalogue" catalogue link

https://www.pandrol.com/fr/?resource_type=catalogue&s=&post_type=resource&search_type=resource_type

MISCELLANEOUS		
TYPE	***Quantity***	***References***
Wire brush	1	48401004
Electronic timer	1	48703001
1 m straight flat ruler	1	19123001
Nibbed 1m straightedge	1	19123002
1 m x 25 mm wooden handle	1	39980001
Bare hot cutter without a handle	1	33910001
Hammer	1	48401013
Set of numbers	1	48409002
Set of letters	1	48409003
Thickness shim set	1	48701005
Copper hammer	1	48401014
Metal bucket for welding waste	1	90700092
SAFETY EQUIPMENT		
Leather gloves	1	48801002
Safety shoes	1	according to size
Gaiters	1	TSV00008
Welding goggles with tinted lenses	1 pair	48802001
Unisex safety glasses with white lenses	1 pair	48802004

B. Mobile app - Pandrol Connect

Recording of weld data

The weld data must be recorded during the welding process. The data to be recorded depend on the owner of the network and the internal instructions of the company. In order to monitor the weld properly and provide a specialist assessment in the event of non-compliance, PANDROL recommends recording the following data (minimum requirement):

- Batch number and portion number
- Batch number of the mould
- Batch number of the crucible
- Tapping time

The PANDROL CONNECT traceability app available on ANDROID and iOS is designed to digitise all the welding data. It can be used to record welds on a smartphone and post them online so that they can be shared and reviewed by all those involved in the weld. (Internal audit, company responsible for the site, final acceptance, etc.) The data is available using the online app, or directly on the track with a mobile phone (with or without a network signal). It only takes a few seconds to find a weld and find out who made it, and when, where and how was it made.
In addition to the daily monitoring, PANDROL CONNECT has the following features:

- Compilation in a single report of all of the information about a weld (pouring, grinding, acceptance)
- Extractions of data in Excel with 1 click

More information is available at https://www.pandrol.com/fr/product/application-de-tracabilite-soudure-pandrol-connect/ and by going to pandrolconnect@pandrol.com.

C. Welding products storage conditions

The information in this document is given as a rough guide.

We disclaim any liability for damage related to the storage and handling of aluminothermic products.

Everyone should be aware of the local, national or international regulations in force in this area as well as the safety data sheets specific to the product.

C.1. Welding kit

The welding kits must be stored in their original packaging in a room with the following characteristics:

- Dry, ventilated and protected from humidity (60 to 80% maximum humidity) where there is no condensation run-off.
- The storage temperature of the kits must be between -5°C and 30°C
- No sparks, hot spots and any source of heat or ignition (this prohibition must be displayed)
- Provide access to fire and rescue services
- More than 8m away from other stored materials: combustible, flammable and other products or objects that are hazardous in use.

Pallets of welding kits will be stored in suitable racks or stacked on two levels maximum

NOTE

1/ the welding kits must never be stored with igniters

2/ the use of water to extinguish a potential fire involving the kits is prohibited:
Risk of explosion

This product is guaranteed for 3 years from the packaging date noted on the packaging.

C.2. Luting paste in a tube

The tubes of luting paste must be stored in their original packaging in a room with the following characteristics:

- Ventilated and away from heat (60 to 80% maximum humidity)
- The storage temperature of the tubes must be between -5°C and 30°C

Pallets of paste tubes must be stored on suitable racks or stacked on more than two levels.

NOTE

This product is guaranteed for 14 months, and the expiry date is noted on the packaging.

C.3. Bucket of luting paste

The buckets of luting paste must be stored in their original packaging in a room with the following characteristics:

- Ventilated and away from heat (60 to 80% maximum humidity)
- The storage temperature of the paste buckets must be between -5°C and +30°C

Pallets of paste buckets must be stored on suitable racks or stacked on no more two levels.

NOTE

This product is guaranteed for 24 months from the packaging date noted on the packaging.

C.4. Tube of binding paste

The binder tubes must be stored in their original packaging in a dry, spacious and well-ventilated room.

NOTE

This product is guaranteed for 24 months from the packaging date noted on the packaging.

C.5. One-shot crucible

One-shot crucibles must be stored in their original packaging in a dry, ventilated room protected from humidity (60 to 80% maximum humidity) where there is no condensation run-off. Pallets of one-shot crucibles must be stored on suitable racks or stacked on no more three levels.

NOTE

This product is guaranteed for 24 months from the packaging date noted on the packaging.

C.6. Welding equipment

The welding equipment must be stored in its original packaging in a dry, spacious and well-ventilated room protected from humidity (60 to 80% maximum humidity) where there is no condensation run-off.

NOTE

This product is guaranteed for 12 months from the delivery date.

C.7. Startwel ®

The Startwel® must be stored in its original packaging in a dry, spacious and well-ventilated room. It must be kept away from heat, sparks, flames and any source of ignition.

NOTE

This product is guaranteed for 24 months from the packaging date noted on the packaging.

Do not expose thermal starters to electric currents.

C.8. Igniter

Warning: this product is classified as a class 1.4 G explosive product.

NOTE

This product is not concerned by the warranty.

D. Waste – Information

In recent years, the requirements, regulations and attitudes in terms of the environment and sustainable development have changed. This development also applies to the aluminothermic welding profession:

- Business commitment on environmental issues
- Consideration of environmental impacts on construction sites
- Waste management
- Service creation

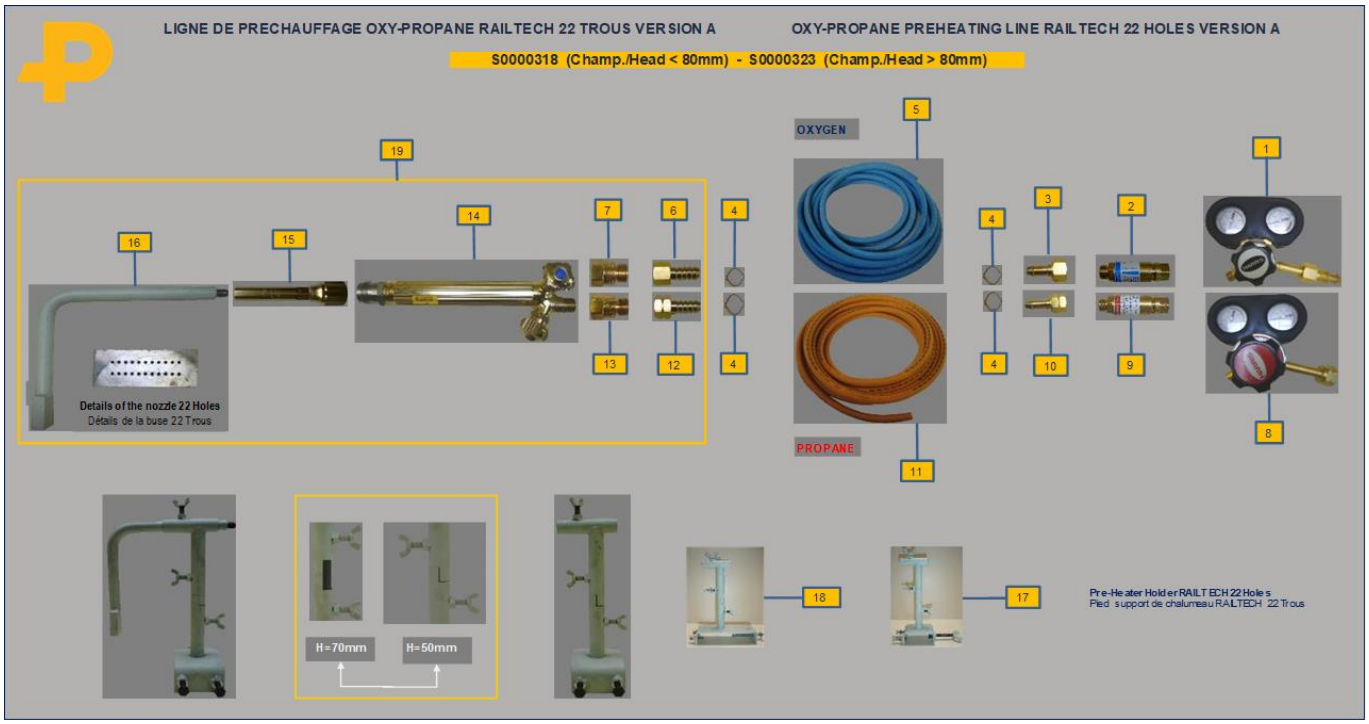
Please contact your Pandrol point of contact.

E. Preheating line

E.1. Oxy-Propane 22H Version A

Complete Oxy Propane 22H Version A line – Head ≤80 mm: S0000318

Complete Oxy Propane 22H Version A line – Head >80 mm: S0000323

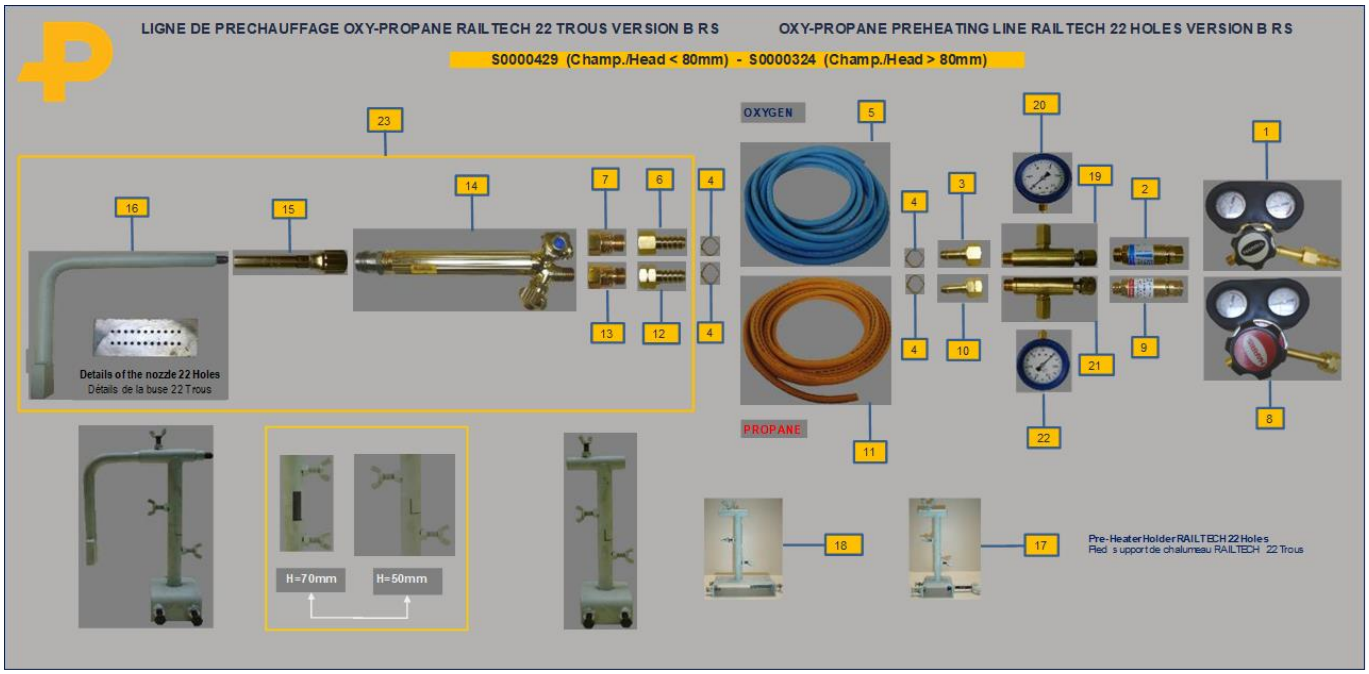


R	Désignation (EN)	Références
1	Regulator Harris model 801 Oxygen with protection	48102015
2	Flashback Arrestor Harris Model 188-FFR Oxygen,	48302029
3	Oxygen hose connector F38R1 Ø10mm (Øinternal 5,5mm) supplied with regulator	
4	Hose band clip Ø 10mm	48301073
5	Oxygen Hose Ø 10/17, 10m length	39960006
6	Oxygen hose connector 38R1 Ø10mm (Øinternal 6,5mm) supplied with Shank	
7	Flash guard Harris 88-6CVTR Oxygen	48302005
8	Regulator Harris Model 825 1,5 PS Propane with protection (Entry 0 à 40 bars,exit 0 to 2,5 bars)	48102016
9	Flashback Arrestor Harris Model 188FFL Propane	48302006
10	Propane hose connector F38L1 Ø10mm (Øinternal 5,5mm) supplied with regulator	
11	Hose Propane Ø 10/17, 10m length	39960003
12	Propane hose connector 38L1 Ø10mm (Øinternal 6,5mm) supplied with Shank	
13	Flash guard Harris 88-6CVTL Fuel Gas	48302028
14	Harris Model K:43-2 Shank	48302004
15	RTI Harris F43 propane Mixer	48302003
16	22 Holes Pre-Heater	35910229
17	Pre-Heater Holder RAILTECH 22 Holes for width of rail head < 80mm	11234003
18	Pre-Heater Holder RAILTECH 22 Holes for width of rail head >80mm / Crane rail n°5 to 7 / Groove Rail	11234004
19	R T I TORCH OXY PROPANE PREHEATING	11231007

E.2. Oxy-propane 22H Version B line

Complete Oxy Propane 22H Version B line – Head ≤80mm: S0000429

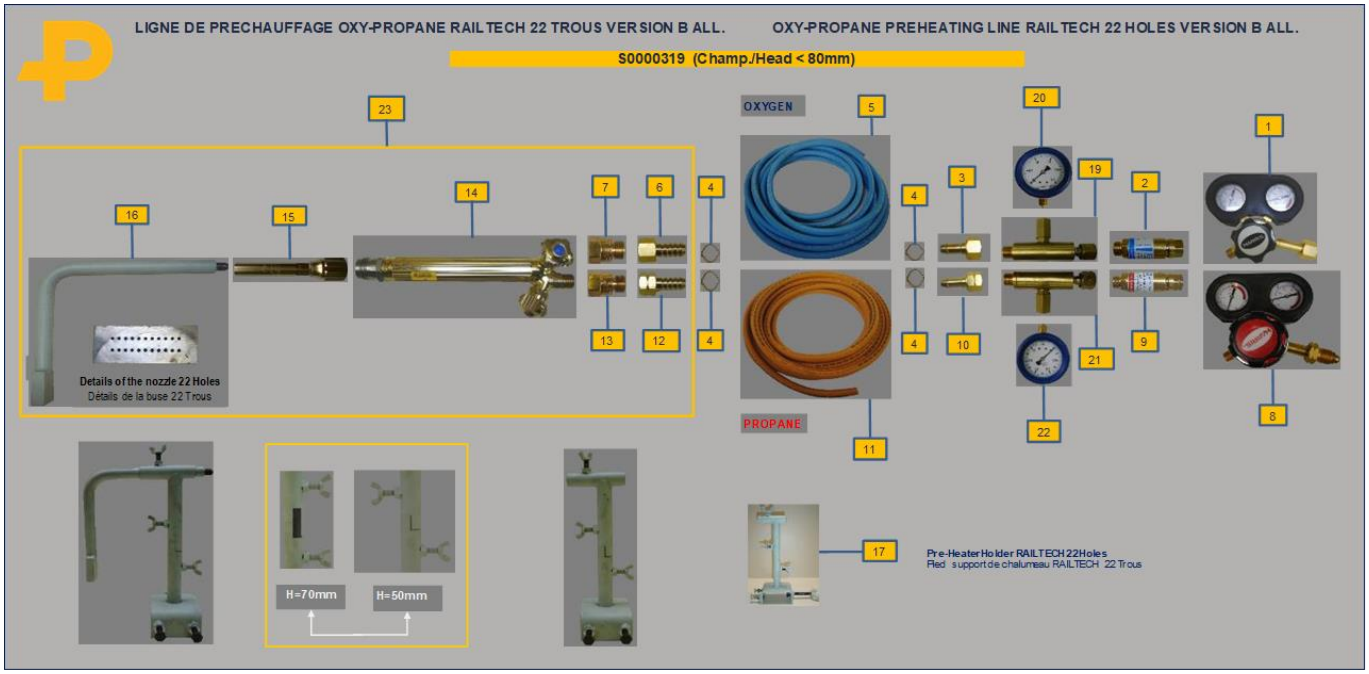
Complete Oxy Propane 22H Version B line – Head >80mm: S0000324



R	Désignation (EN)	Références
1	Regulator Harris model 801 Oxygen with protection	48102015
2	Flashback Arrestor Harris Model 188-FFR Oxygen,	48302029
3	Oxygen hose connector F38R1 Ø10mm (Øinternal 5,5mm) supplied with regulator	
4	Hose band clip Ø 10mm	48301073
5	Oxygen Hose Ø 10/17, 10m length	39960006
6	Oxygen hose connector 38R1 Ø10mm (Øinternal 6,5mm) supplied with Shank	
7	Flash guard Harris 88-6CVTR Oxygen	48302005
8	Regulator Harris Model 825 1,5 PS Propane with protection (Entry 0 à 40 bars,exit 0 to 2,5 bars)	48102016
9	Flashback Arrestor Harris Model 188FFL Propane	48302028
10	Propane hose connector F38L1 Ø10mm (Øinternal 5,5mm) supplied with regulator	
11	Hose Propane Ø 10/17, 10m length	39960003
12	Propane hose connector 38L1 Ø10mm (Øinternal 6,5mm) supplied with Shank	
13	Flash guard Harris 88-6CVTL Fuel Gas	48302006
14	Harris Model K:43-2 Shank	48302004
15	RTI Harris F43 propane Mixer	39960003
16	22 Holes Pre-Heater	35910229
17	Pre-Heater Holder RAILTECH 22 Holes for width of rail head < 80mm	11234003
18	Pre-Heater Holder RAILTECH 22 Holes for width of rail head >80mm / Crane rail n°5 to 7 / Groove Rail	11234004
19	T-piece Oxygen M16x50	S0000389
20	Gauge 0-2,5 bar Oxygen	S0000217
21	T-piece Gas M16x50	S0000388
22	Gauge 0-1 bar fuel gas	48101005
23	R T I TORCH OXY PROPANE PREHEATING	11231007

E.3. Oxy-propane 22H Version B DIN 9 line – German fitting

Complete Oxy Propane 22H Version B DIN9 line – Head ≤80mm: S0000319

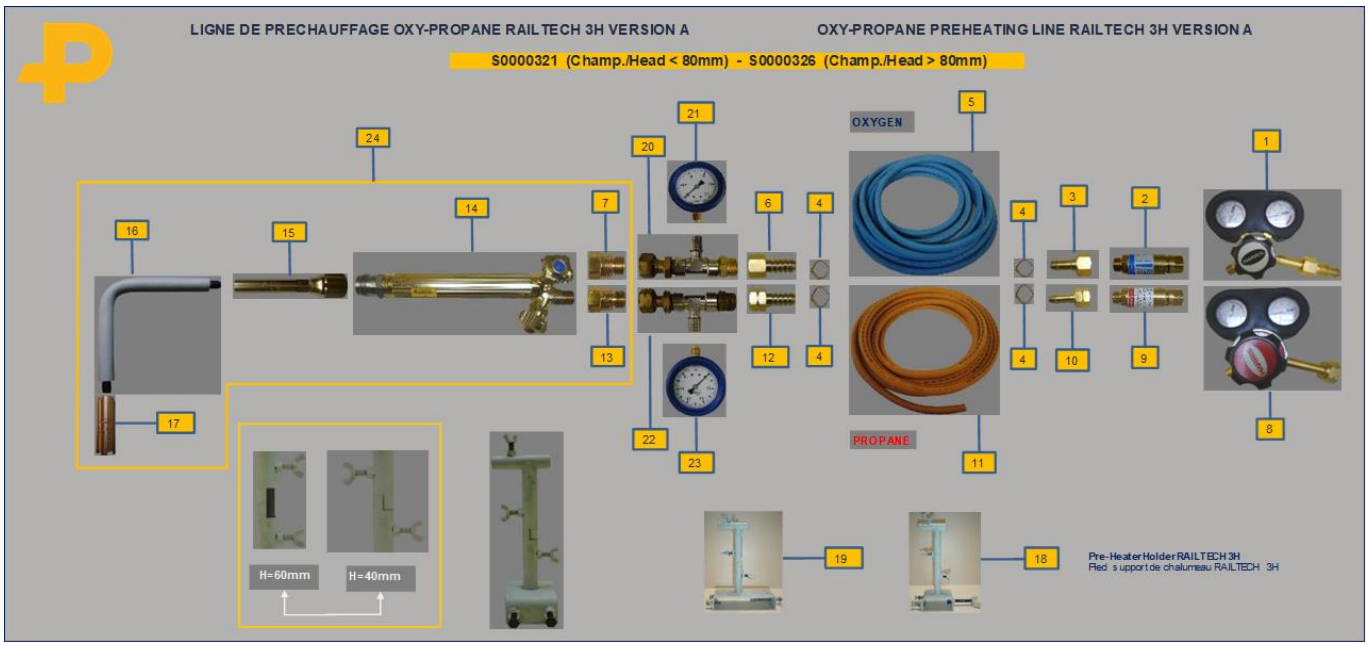


R	Désignation (EN)	Références
1	Regulator Harris model 801 Oxygen with protection DIN9	S0000214
2	Flashback Arrestor Harris Model 188-FFR Oxygen,	48302029
3	Oxygen hose connector F38R1 Ø10mm (Øinternal 5,5mm) supplied with regulator	
4	Hose band clip Ø 10mm	48301073
5	Oxygen Hose Ø 10/17, 10m length	39960006
6	Oxygen hose connector 38R1 Ø10mm (Øinternal 6,5mm) supplied with Shank	
7	Flash guard Harris 88-6CVTR Oxygen	48302005
8	Regulator Harris Model 825 1,5 PS Propane with protection (Entry 0 à 40 bars,exit 0 to 2,5 bars)	48102016
9	Flashback Arrestor Harris Model 188FFL Propane	48302028
10	Propane hose connector F38L1 Ø10mm (Øinternal 5,5mm) supplied with regulator	
11	Hose Propane Ø 10/17, 10m length	39960003
12	Propane hose connector 38L1 Ø10mm (Øinternal 6,5mm) supplied with Shank	
13	Flash guard Harris 88-6CVTL Fuel Gas	48302006
14	Harris Model K:43-2 Shank	48302004
15	RTI Harris F43 propane Mixer	39960003
16	22 Holes Pre-Heater	35910229
17	Pre-Heater Holder RAILTECH 22 Holes for width of rail head < 80mm	11234003
19	T-piece Oxygen M16x50	S0000389
20	Gauge 0-2,5 bar Oxygen	S0000217
21	T-piece Gas M16x50	S0000388
22	Gauge 0-1 bar fuel gas	48101005
23	R T I TORCH OXY PROPANE PREHEATING	11231007

E.4. Oxy-Propane 3H Version A line

Complete Oxy Propane 3H Version A line - Head <80mm: S0000321

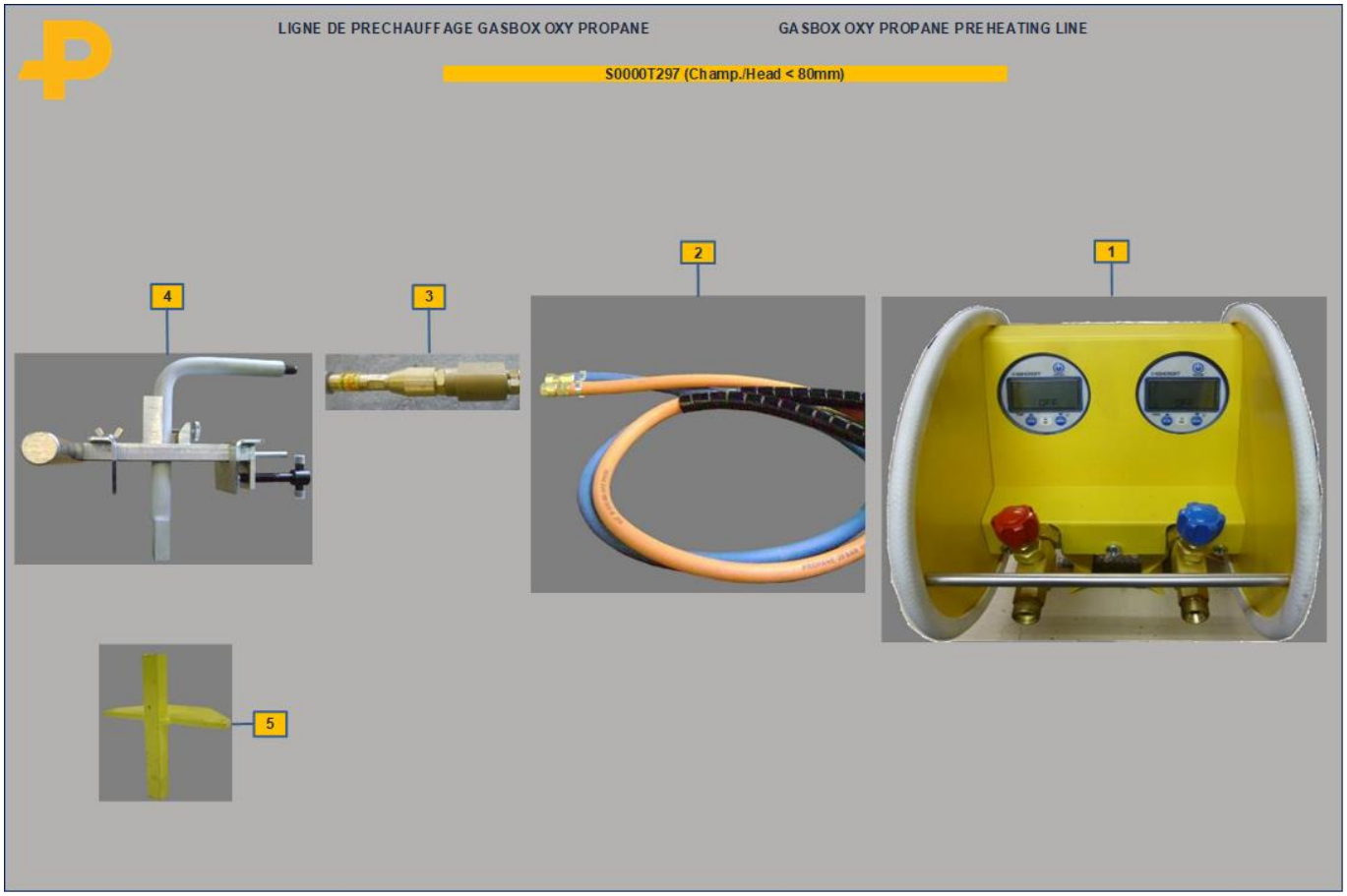
Complete Oxy Propane 3H Version A line - Head >80mm: S0000326



R	Désignation (EN)	Références
1	Regulator Harris model 801 Oxygen with protection	48102015
2	Flashback Arrestor Harris Model 188-FFR Oxygen,	48302029
3	Oxygen hose connector F38R1 Ø10mm (Øinternal 5,5mm) supplied with regulator	
4	Hose band clip Ø 10mm	48301073
5	Oxygen Hose Ø 10/17, 10m length	39960006
6	Oxygen hose connector 38R1 Ø10mm (Øinternal 6,5mm) supplied with Shank	
7	Flash guard Harris 88-6CVTR Oxygen	48302005
8	Regulator Harris Model 825 1,5 PS Propane with protection (Entry 0 à 40 bars,exit 0 to 2,5 bars) CGA 510	48102023
9	Flashback Arrestor Harris Model 188FFL Propane	48302028
10	Propane hose connector F38L1 Ø10mm (Øinternal 5,5mm) supplied with regulator	
11	Hose Propane Ø 10/17, 10m length	39960003
12	Propane hose connector 38L1 Ø10mm (Øinternal 6,5mm) supplied with Shank	
13	Flash guard Harris 88-6CVTL Fuel Gas	48302006
14	Harris Model K:43-2 Shank	48302004
15	RTI Harris F43 propane Mixer	48302003
16	Extension of blowtorch (No 3H tip)	35910160
17	Bloxtorch nozzle 2290 3H	48301003
18	Pre-Heater Holder RAILTECH 3H for width of rail head < 80mm	11234002
19	Pre-Heater Holder RAILTECH 3H for width of rail head >80mm	11234005
20	T-piece Oxygen	48301078
21	Gauge 0-2,5 bar Oxygen	S0000217
22	T-piece Propan 9/16-18	48301077
23	Gauge 0 - 1 bar Propane	48101005
24	3H R T I TORCH OXY PROPANE PREHEATING	11231002

E.5. GASBOX Oxy-propane 22H Version A

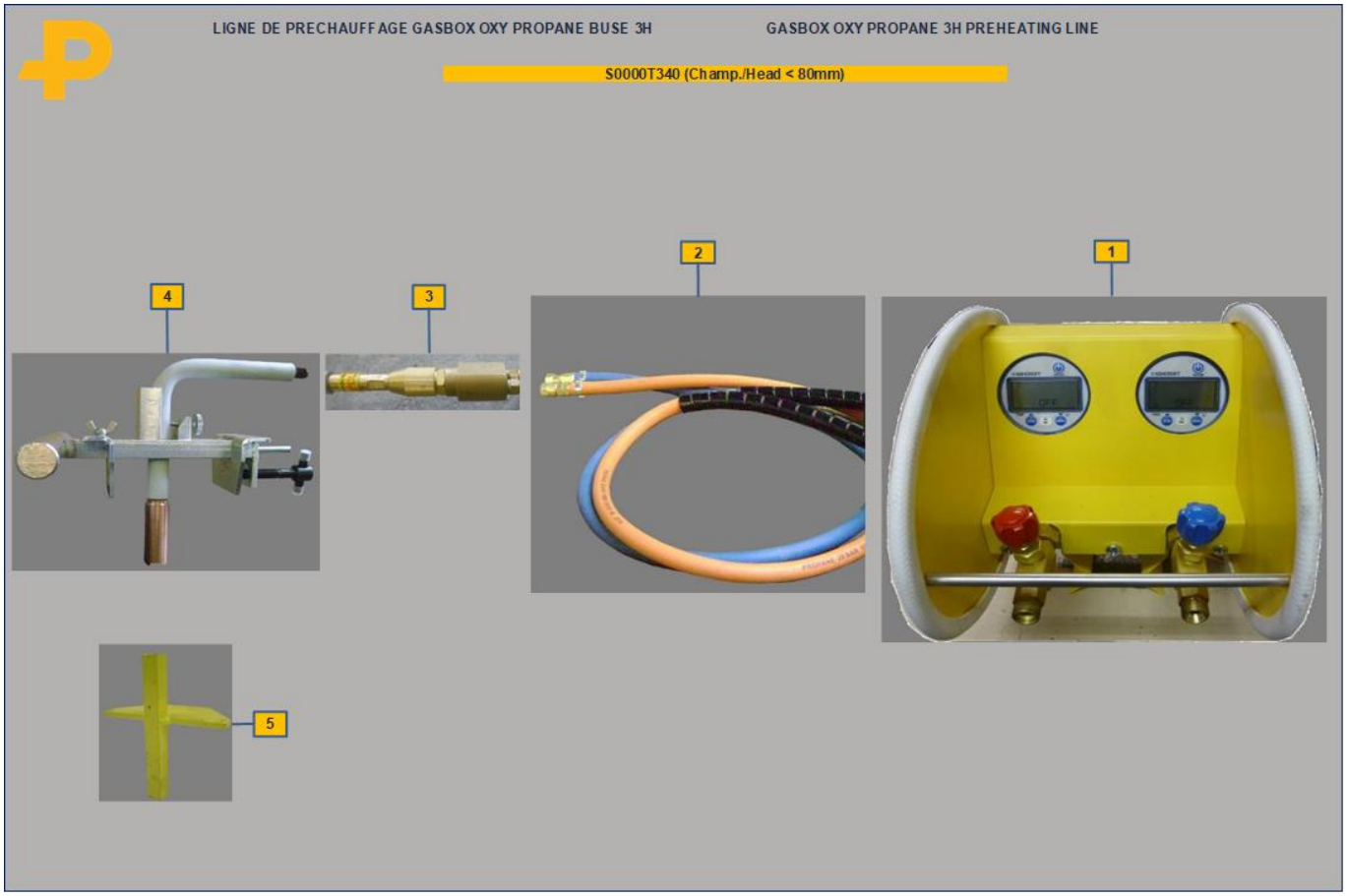
Complete GASBOX Oxy-propane 22H version A line: S000T297



R	Désignation (EN)	39960003
1	GASBOX Truflame	S0000T265
2	GASBOX suply	S0000T001
3	Small torch set	S0000T263
4	22 holes selfcentering burner	S0000288
5	Height adjustment 50/70mm	S0000290

E.6. GASBOX Oxy-propane 3H Version A line

Complete GASBOX Oxy-propane 3H version A line: S000T340

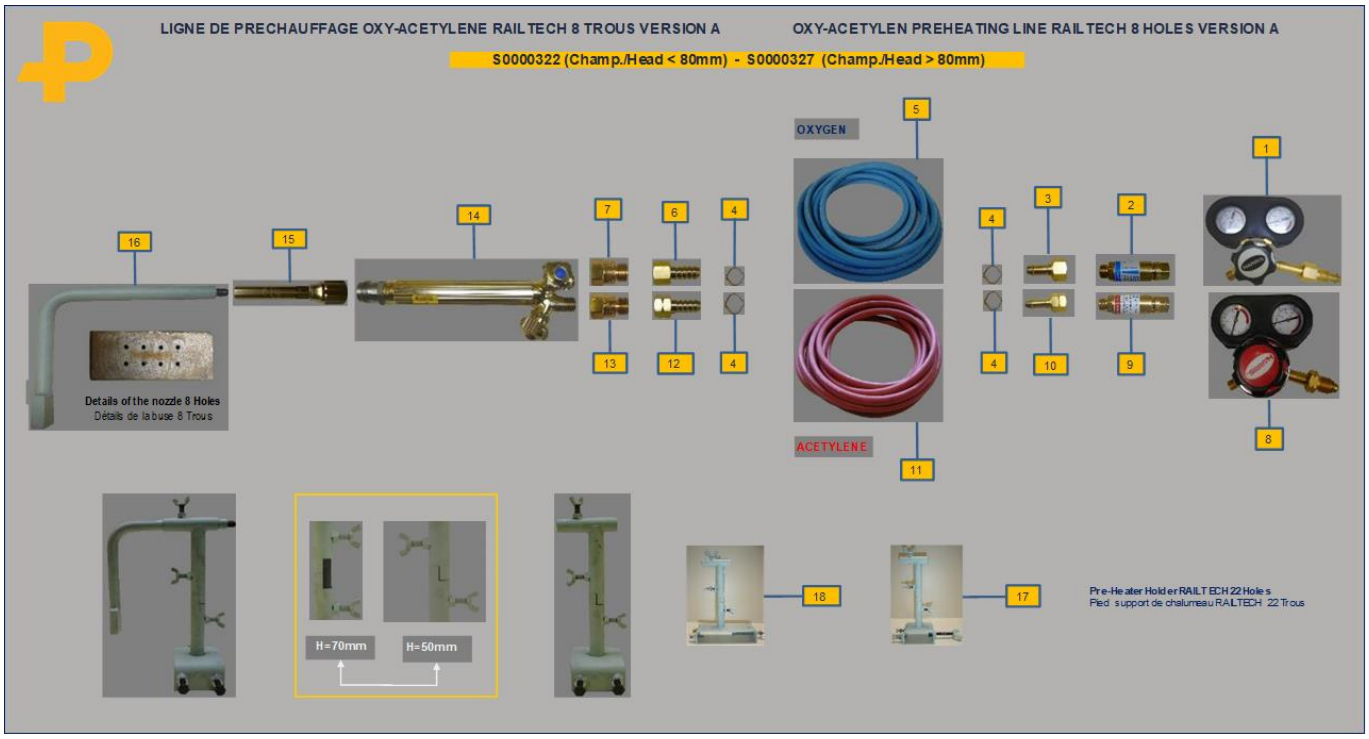


R	Désignation (EN)	39960003
1	GASBOX Truflame	S0000T265
2	GASBOX suply	S0000T001
3	Small torch set	S0000T263
4	3H selfcentering burner	S0000348
5	Height adjustment 40/60mm	S0000350

E.7. Oxy-Acetylene 8H Version A

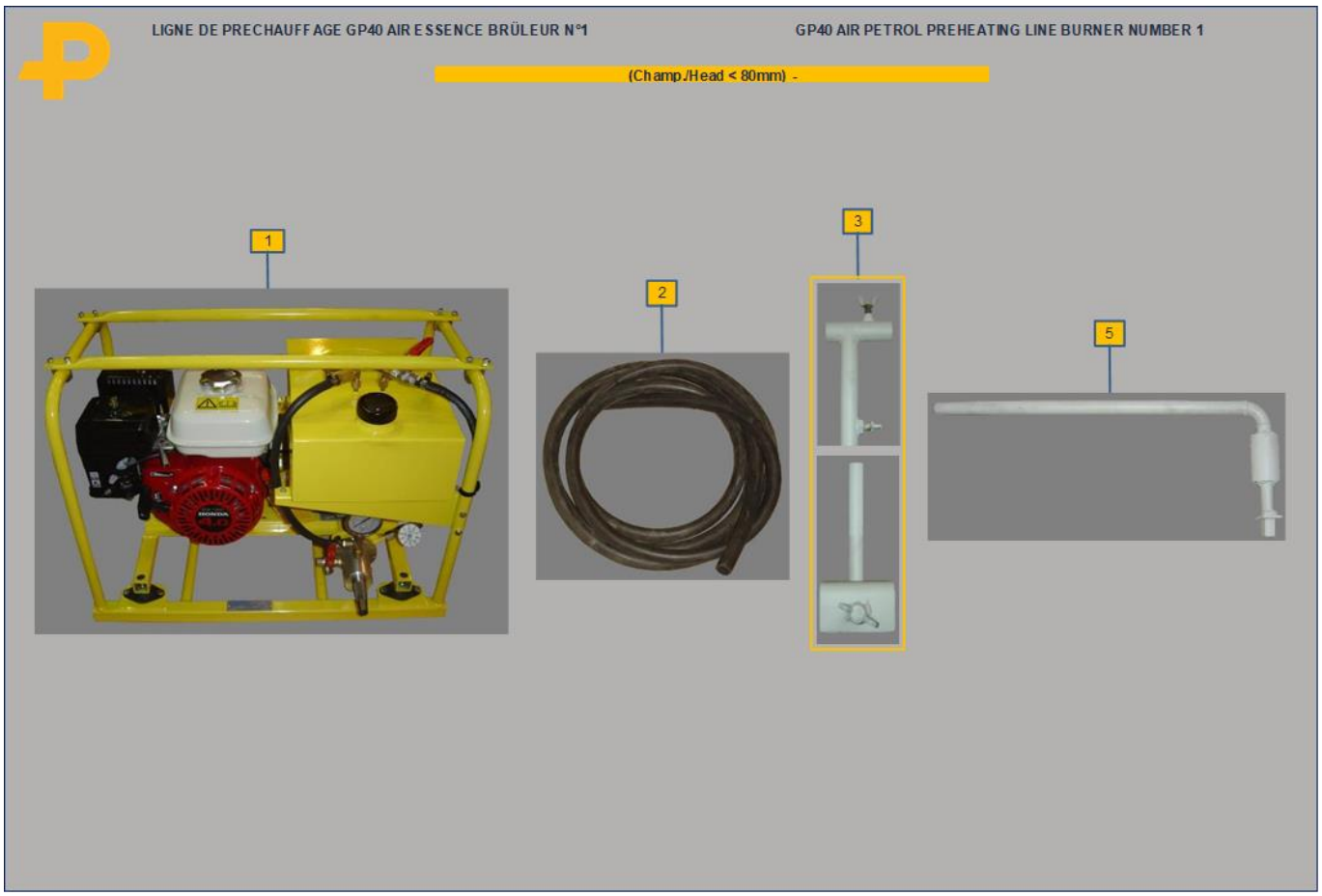
Complete Oxy Propane 8H Version A <80mm: S0000322

Complete Oxy Propane 8H Version A >80mm: S0000327



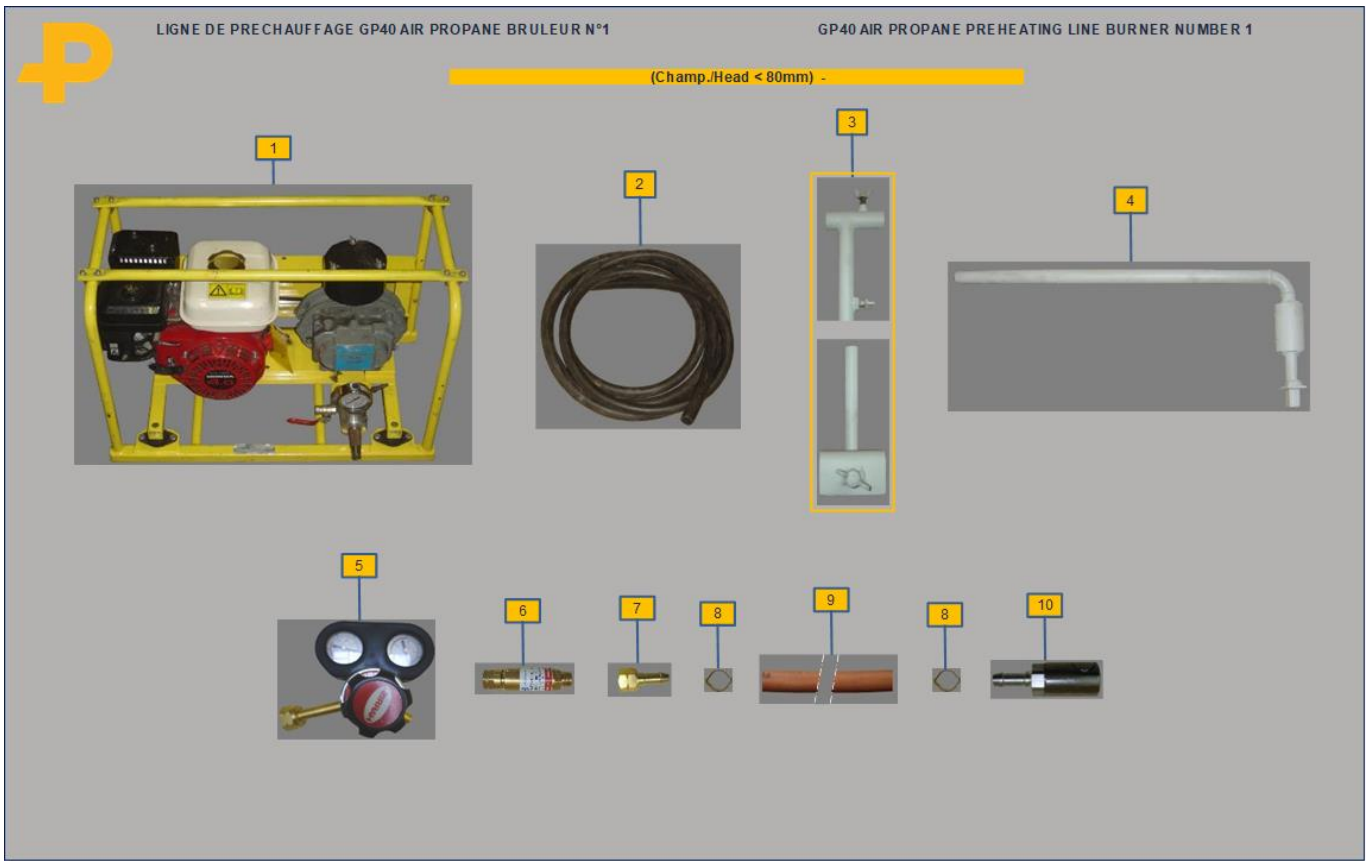
R	Désignation (EN)	Références
1	Regulator Harris model 801 Oxygen with protection	48102015
2	Flashback Arrestor Harris Model 188-FFR Oxygen,	48302029
3	Oxygen hose connector F38R1 Ø10mm (Øinternal 5,5mm) supplied with regulator	
4	Hose band clip Ø 10mm	48301073
5	Oxygen Hose Ø 10/17, 10m length	39960006
6	Oxygen hose connector 38R1 Ø10mm (Øinternal 6,5mm) supplied with Shank	
7	Flash guard Harris 88-6CVTR Oxygen	48302005
8	Regulator Harris Model 825 1,5 PS Propane with protection (Entry 0 à 40 bars,exit 0 to 2,5 bars)	48102017
9	Flashback Arrestor Harris Model 188FFL Acetylene	48302028
10	Propane hose connector F38L1 Ø10mm (Øinternal 5,5mm) supplied with regulator	
11	Hose Acetylene Ø 10/17, 10m length	39960003
12	Propane hose connector 38L1 Ø10mm (Øinternal 6,5mm) supplied with Shank	
13	Flash guard Harris 88-6CVTL Fuel Gas	48302006
14	Harris Model K:43-2 Shank	48302004
15	RTI Harris E2 43 Acetylene Mixer	48302027
16	8 Holes Pre-Heater	35910247
17	Pre-Heater Holder RAILTECH 22 Holes for width of rail head < 80mm	11234003
18	Pre-Heater Holder RAILTECH 22 Holes for width of rail head >80mm / Crane rail n°5 to 7 / Groove Rail	11234004

E.8. GP 40 AIR PETROL – Burner No. 1



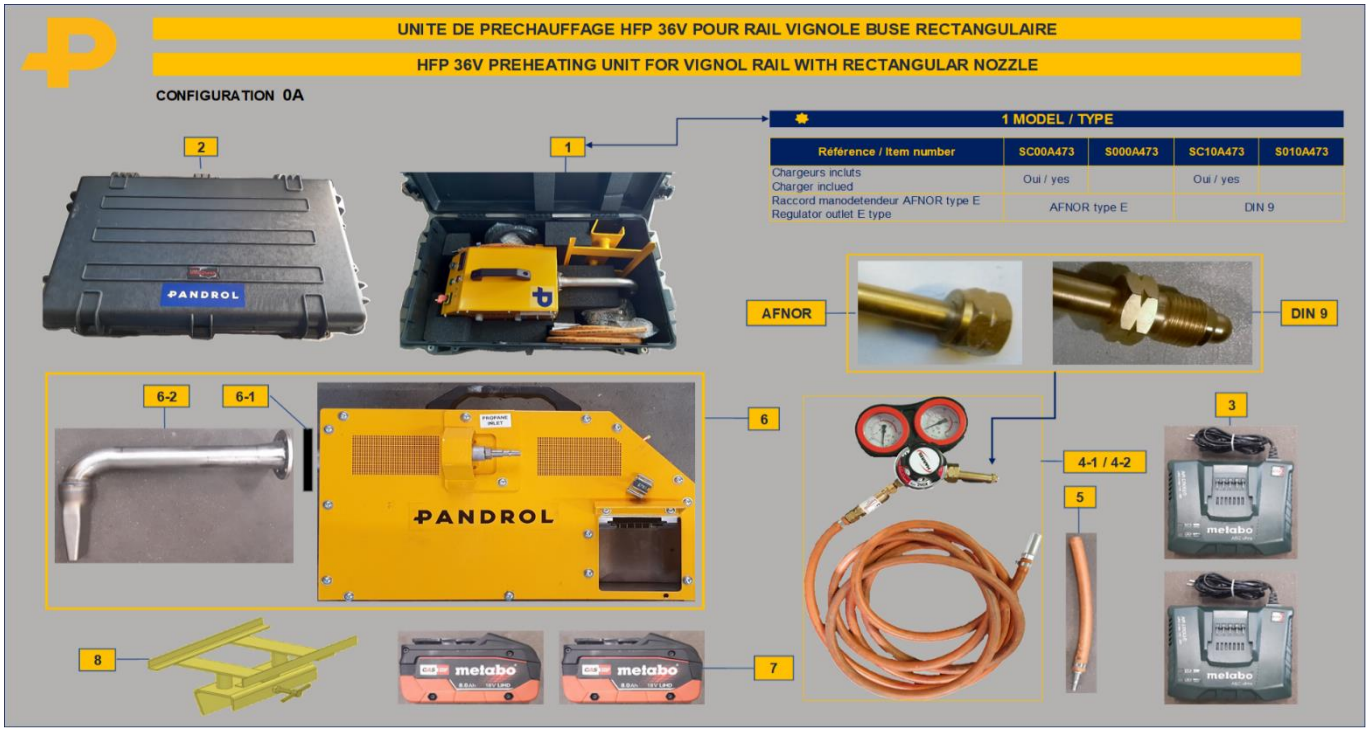
R	Désignation (EN)	Références
1	Thermic petrol preheating unit GP40	11211020
2	Hose ø20mm, 5m lenght	39960002
3	Complet support for burner number 1 for width of rail head < 80mm	S0000127
4	Burner number 1	S0000126

E.9. GP 40 AIR PROPANE – Burner No. 1



R	Désignation (EN)	Références
1	Thermic petrol preheating unit GP40	11211019
2	Hose ø20mm, 5m lenght	39960002
3	Complet support for burner number 1 for width of rail head < 80mm	39960003
4	Burner number 1	S0000126
5	Regulator Harris Model 825 1,5 PS Propane with protection (Entry 0 à 40 bars,exit 0 to 2,5 bars)	48102016
6	Flash guard Harris 88-6CVTL Fuel Gas	48302028
7	Propane hose connector F38L1 Ø10mm (Øinternal 5,5mm) supplied with regulator	
8	Hose band clip Ø 10mm	48301073
9	Hose Propane Ø 10/17, 2,5m length	39960003
10	Snap connector (female)	48301103

E.10. Preheating line HFP



R	Désignation (EN)	Référence
1	Air / propane preheating unit HFP	✸
2	Cases for transport with protection for HFP	42005005
3	Battery charger Metabo (x 2)	48402033
4-1	HFP propane supply line (AFNOR type E)	S0000425
4-2	HFP propane supply line (DIN 9 type)	S0000477
5	Gaz purge pipe	S0000476
6	HFP with rectangulare nozzle	S0000473
6-1	Nozzle seal	31260007
6-2	Rectangulare nozzle	35210008
7	LIHD Battry 18V-8,0Ah Metabo (x 2)	48402027
8	Foot support for vignol rail Torch height 90mm	21245008

Universal support		
9	HFP support	21245026
10	Large foot support width 80< Head ≤150mm	21245028
11	Narrow foot support width head ≤80mm	21245027

PANDROL

Find out more at

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