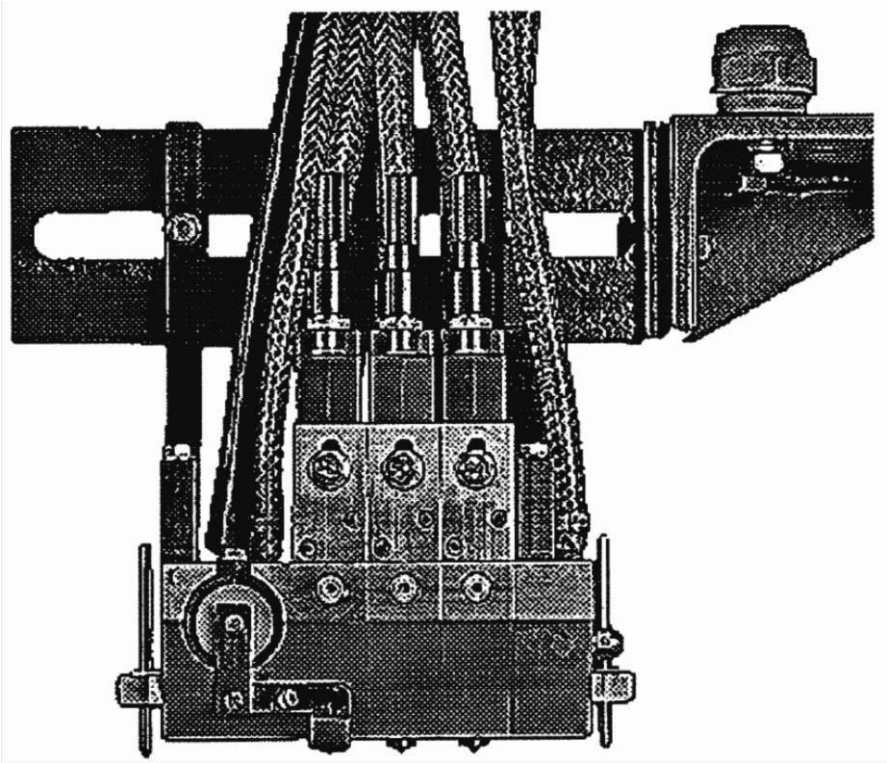
## TRICATHODE TORCH

# E 25

### SAFETY INSTRUCTION FOR USE AND MAINTENANCE



EDITION : EN
REVISION : B
DATE : 10-2018

Instructions for use

REF : **8695 9020**

***Original instructions***

LINCOLN® ELECTRIC

**Thank for the trust you have expressed by purchasing this equipment, which will give you full satisfaction if you follow its instructions for use and maintenance.**

**Its design, component specifications and workmanship comply with applicable European directives.**

**Please refer to the enclosed CE declaration to identify the directives applicable to it.**

**The manufacturer will not be held responsible where items not recommended by themselves are associated with this product.**

**For your safety,there follows a non-restrictive list of recommendations or requirements, many of which appear in the employment code.**

**Finally we would ask you kindly to inform your supplier of any error which you may find in this instruction manual.**

# CONTENTS

# REVISIONS

**REVISION B** **10/18**

| DESIGNATION | PAGE |
|---|---|
| Complete update | |
| To change logos | |

| TABLEAU D'EQUIVALENCE A COMPTER D'OCTOBRE 2008 | E25<br>8695 9020 | TABLE OF EQUIVALENCE AS FROM OCTOBER, 2008 |
|---|---|---|

| Ref old | Ref new |
|---|---|
| 00260405 | 00260405 |
| 00260412 | 00260412 |
| 00260444 | W000335136 |
| 00642004 | 00642004 |
| 03710260 | W000010006 |
| 03710261 | W000010008 |
| 03710407 | 03710407 |
| 03710408 | 03710408 |
| 08000270 | 08000270 |
| 08000273 | 08000273 |
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| Ref old | Ref new |
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| 92572593 | 92572593 |
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| 92572611 | 92572611 |
| 92572624 | 92572624 |
| 92572625 | W000315758 |
| 92572738 | 92572738 |
| 92579602 | 92579602 |

# A - TRICATHODE TORCH

This modular torch uses the dual fiux TIG welding process.
It forms part of an installation intended primarily for use on tube forming rigs and comprising:

. a contrai and arc-striking cabinet
. an adjustment and parameter monitoring box
. a mechanical position adjustment system
. a connecting harness assembly
. three generators

## 1 - DUAL FLUX TIG WELDING PROCESS

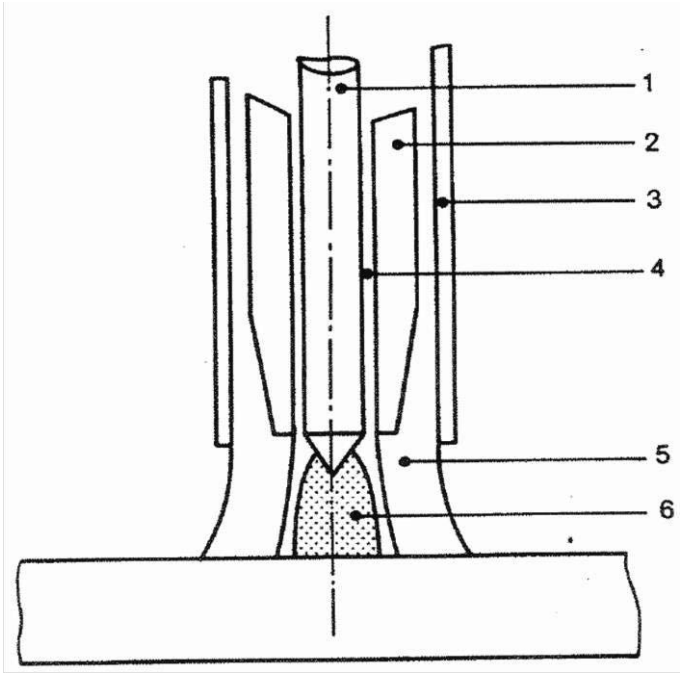
The automatic TIG welding process produces welded joints of good metallurgical quality. It is applicable only to thin workpieces, bowever, and is restricted to slow welding speeds. Productivity considerations call for high-speed execution of welding, however.
Development work undertaken by our Technical Centre bas lead to the design of equipment permitting a substantial increase in welding speed and/or the thicknesses butt weldable.
One result of tbis development work is the Dual Flux TIG welding process on which a patent bas been ftled.

## 2 - DUAL FLUX TIG PRINCIPLE

**Torch connection**

The dual fiux TIG process is based on the use of two protective gases.

1 Electrode
2 Sleeve
3 Nozzle
4 Electrode gas
5 Annular gas
6 Electric arc



# 3 - GAS FUNCTIONS

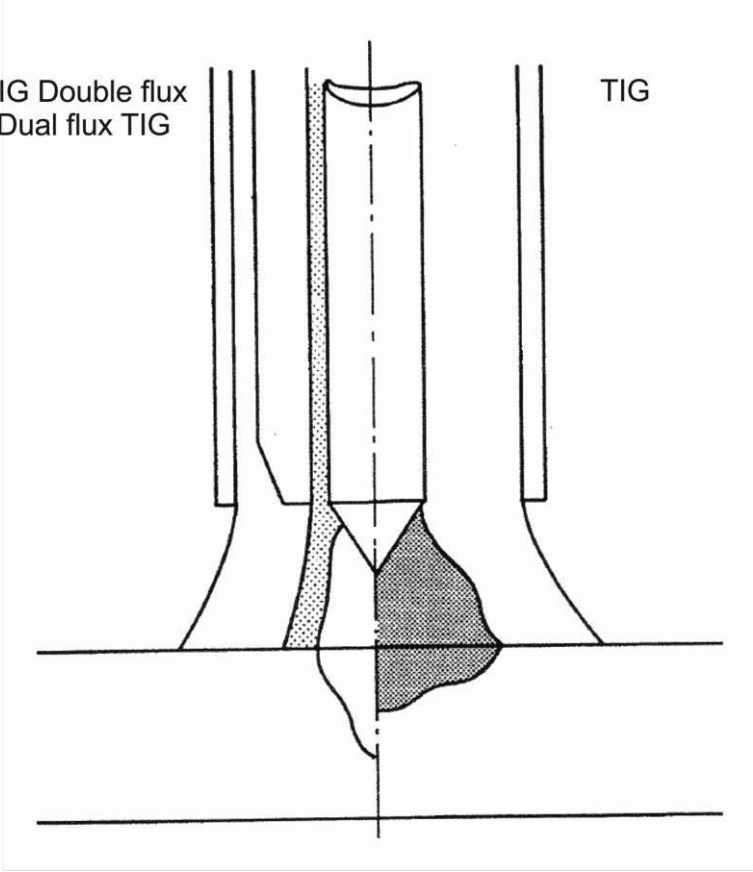
**Electrode gas:**

This gas flows between the electrode and the sleeve. As compared with conventional TIG welding, this stiffens the arc, improves its stability and increases the service life of the electrode.
A dual flux T/G arc with the same welding current as a conventional TIG arc produces a weld pool which is more concentrated, more regular and more penetrating. This permits the increase in welding speed and/or workpiece thickness.

**Annular gas :**

This gas flows between the sleeve and the nozzle to protect the weld pool against oxidation.

# 4 - COMPARISON OF THE DUAL FLUX TIG PROCESS AND THE STANDARD TIGPROCESS



# 5 - ADVANTAGES OF THE DUAL FLUX TIG PROCESS

It is possible to combine two different gases, as appropriate to the metals to be welded.
Substantially increases penetration, ↗ ↗
Reduced width of weld bead ↘
Substantially increased service life ↗ ↗

# 6 - GENERAL APPLICATIONS OF THE DUAL FLUX TIG WELDING PROCESS

Applications of the dual flux TIG welding process are in two categories:

**Progressive penetration welding**

Using a cylindrical sleeve
The range of application is identical to that for the TIG process, covering the thickness range from 0.5 to 3.5 mm. The dual flux TIG process confers the advantages mentioned above.

**Keyhole welding**

Using a convergent sleeve
The application range, **not possible using the conventional TIG process**, extends from 3.5 to 6 mm for butt welding witbout chamferring with gas support only on the opposite side.
Keyhole welding bas previously been possible only using the Plasma process. It is now possible using the dual flux TIG process as a result of the increased rigidity and stability of the arc resulting from its confinement.

This confinement, obtained for currents exceeding some 300 A, is due to mutual electromagnetic attraction by the current lines.

**Tricathode torch construction**

The basic torch is in three modular parts and incorporates magnetic arc deviation.
The torch is supplied complete with :

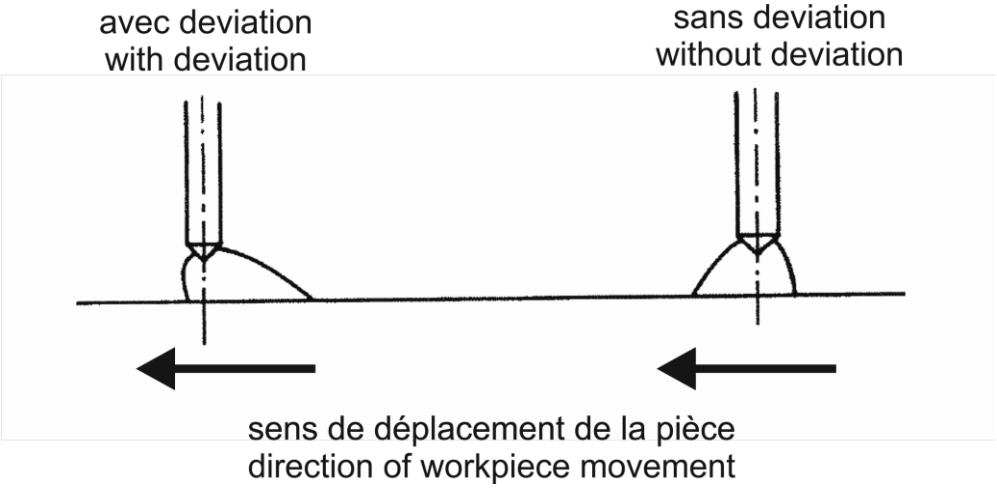
. 2 m gas hases,
. 0.8 m water hases and cable-bose assemblies,
. 3 and 4 mm Ø electrodes,
. a set of spare and replacement parts,
. a template for adjusting the electrodes.

One section is fitted with a magnetic arc deviation unit.
This unit is not used when welding ferritic (magnetic) stainless steels.

**Function of magnetic arc deviation**

In multiple electrode welding, due to the relative/y bigb welding speed, the arc from the first electrode is attracted towards the bot parts, in this case the weld pool, and so is drawn towards the rear
The function of arc deviation is to straighten the arc, or even to deflect it forwardly of the weld pool, this offering two advantages:

. An increase in the maximum current through the first electrode, resulting in an increased prebeating effect.




. Pinching of the arc, resulting in an increase in the length of the trail. This arc configuration ensures better distribution of the energy transmitted to the workpiece.

Both these effects favour increased welding speed.

# B - ELECTRODES

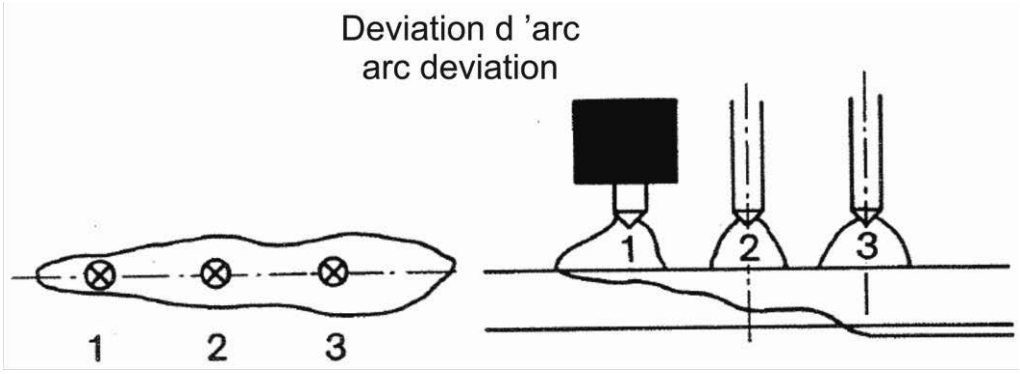
3 and 4 mm Ø thoriated tungsten electrodes are supplied with the torch.
The end of the electrode is mechanically sharpened to a 40° point perfectly centred relative to the remainder of the electrode.
The electrode length must not be less than 55 mm for proper clamping of the electrode in the holder and correct current flow conditions.
In the standard version the electrode speration is 25 mm. This value is imposed by the design of the torch itself.

## 1 - FUNCTION OF THE ELECTRODES

**Progressive penetration welding:** thicknesses from a few tenths of a millimetre to 3.5mm.
The weld pool is continuous under the three electrodes. As a general rule the welding current increases from one electrode to the next. The lowest current is that throug the first electrode (that with arc deviation). The highest current is that through the third electrode.

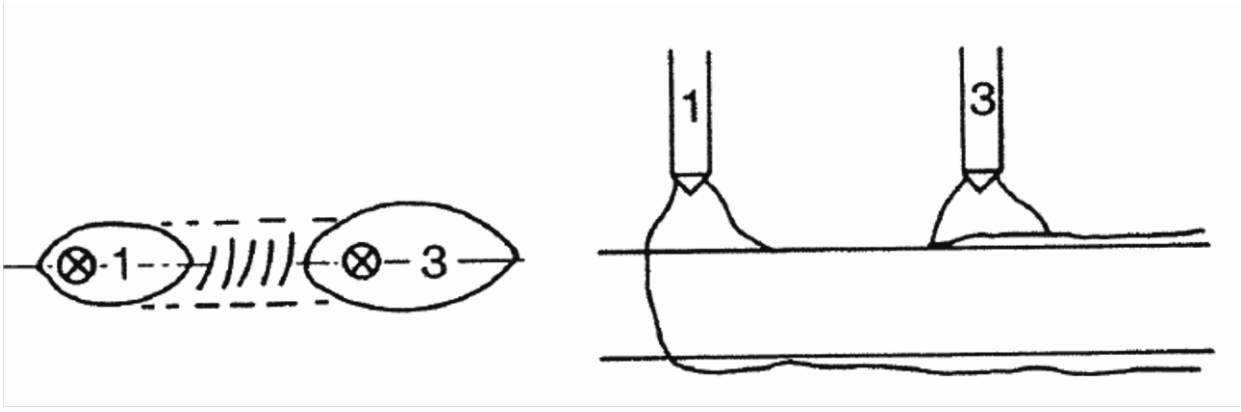
Each electrode contributes to penetration of the weld pool. Penetration is total under the third electrode, which also smooths the bead.

The welding current must never exceed 400 A/lelectrode.




**Keyhole welding :** thicknesses from 3.5 to 6 mm
In this case the weld pool is discontinuous. Only electrodes 1 and 3 are used, the gaseous protection being rendered continuous via electrode 2, in line with which the first weld pool is in the process of solidifying. The first electrode, to which two generators are connected in parallel, produces penetration of the weld pool by the «key hole» technique.
Electrode 3 smooths the bead.

The highest current is applied to the first electrode ( 300 A approx). This generally calls for the use of two THYRISAF 500 generators con- nected in parai/el.



## 2 - ADJUSTMENT OF THE ELECTRODES

The length of electrode projecting from the nozzle must be as follows:
6 mm for progressive penetration welding,
3 mm for keyhole welding.

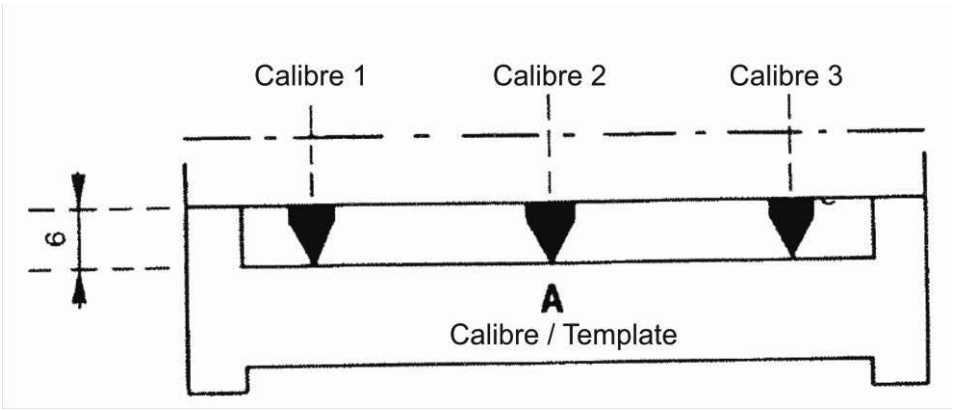
The distance between the tip of the electrode and the workpiece (the arc length) must be approximately :
1,5 mm for each of the three electrodes for progressive penetration welding,
2,5 mm for keyhole welding.

The distance between the bottom of the shoe and the workpiece must be approximately:
7,5 mm for progressive penetration welding,
8,5 mm for keyhole welding.

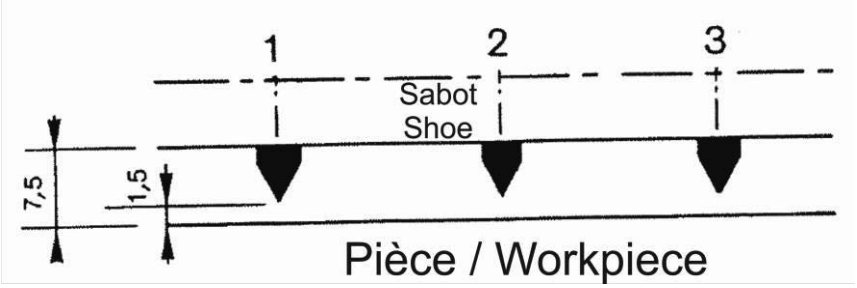
Using the template **supplied with the torch** adjust the electrode and nozzle height as indicated below:

**Progressive penetration welding**

. Fit the three electrodes with cylindrical nozzles,
. Place the template in contact with the shoe,
. Place the bottom surfaces of the nozzles level with the shoe,
. Lower the electrodes by unscrewing the plugs (item 51, drawing 3),
. Check that the electrode tips are in contact with face A of the template (distance between face A of template and shoe is 6 mm),
. Re-tighten the plugs.

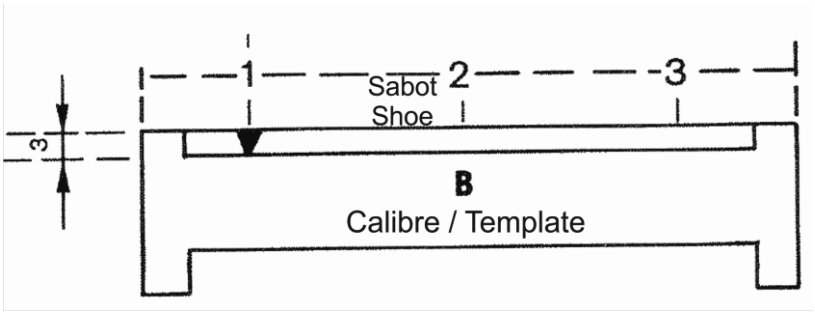



Use a 1.5 mm feeler gauge to adjust the arc length ( distance between tip of electrode and workpiece).

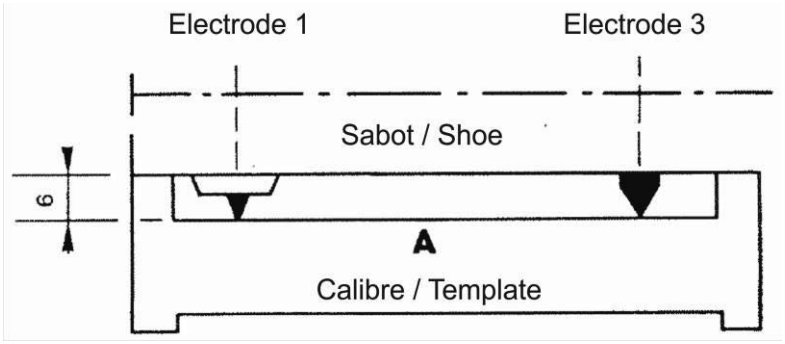


**Keybole welding**

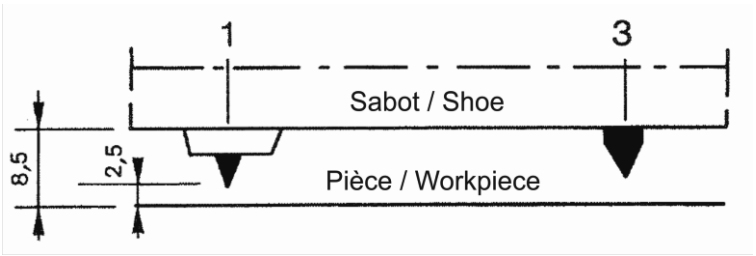
. Fit the first electrode with a convergent nozzle. Place the template in çontact with the shoe,
. Place the lower surface in line with the shoe. Lower the electrode by unscrewing the plug (item 51, drawing 3),
. Check that the tip of the electrode is in contact with face B of the template (distance between face B of template and shoe is 3 mm),
. Re-tighten the plug.




. Lower the first section of the torch, with the convergent nozzle, by operating the guide rod (item 23, drawing 2) after releasing the screws (item 22, drawing 2),
. Check that the tip of the electrode is in contact with face A off the template (distance between face A of template and shoe is 6 mm),
. Re-tighten the screw (item 22, drawing 2),
. Fit the third electrode with a cylindrical nozzle,
. Bring the Lower surface of the nozzle in line with the shoe,
. Lower the third electrode into contact with face A of the template, by loosening the plug (item 51, drawing 3),
. Re-tighten the plug.




. Use a 2.5 mm feeler gauge to adjust the arc length (distance between electrode tip and workpiece).



## 3 - NOZZLES

There are two types of nozzle :

- The cylindrical nozzte ( non-keyhole version) in 5 and 6 mm diameter sizes,
- The convergent nozzle (keyhole version) in 5 mm and 6 m diameter sizes, for use with 3 mm and 4 mm diameter electrodes, respective/y.

Under no circumstances must the nozzles be withdrawn rearwardly of the shoe.

## 4 - ARC VOLTAGE

The electrode may wear during welding, resulting in an increase in the arc voltage.
Each module of the torch is equipped with an adjuster device for raising and lowering the torch section. Thus the distance between the electrode tip and the workpiece may be reset to the initial value (approximately 1.5 mm).
To carry out this adjustment, tighten or loosen the guide rod (item 23, drawing 2) using a screwdriver, after loosening the screw (item 22, drawing 2).
**Note :** remember, next time welding is halted, to re-adjust the length of electrode projecting below the nozzle and the height of the nozzle relative to the shoe.

## 5 - TORCH POSITIONING

The electrodes are perfectly aligned with the guide scales by virtue of the method of construction.
The electrodes are positioned on the joint to be welded by means of scales at each end of the torch.
Remember to raise the two scales before beginning welding. Longitudinal adjustment along the axis of the workpiece to be welded is permitted by the support (item 3, drawing 1), the two arms (item 13, drawing 1) which retain the torch being slidable in the groove in the support beam (item 7, drawing 1). To carry out this adjustment loosen the two screws (item 10, drawing 1).

## 6 - TORCH CONNECTIONS

**Gas :**

The torch requires two separate gas feeds to each electrode.

- . central protective gas, fed via a gyrometer,
- . annular protective gas, fed via a needle-type flowmeter.

The gas flowrate for each electrode is separately adjustable.

**Water :**

Each torch section bas its own cooling water circuit.
A common circuit cools ail shoes.
The cooling water circuits for the three sections are connected in parallel with the shoe cooling circuit.
**Note** : be sure to connect the shoe cooling water circuit to the appropriate connector (marked 5 on the connecting box).
The minimum total cooling water fiow rate is 6 l/min.
Hard water and water containing impurities (especially solids in suspension) must not be used.
ln such cases, use a high-flow rate REFRISAF cooling unit (9257-1700) to constitute a self-contained closed-circuit cooling system.

**Welding current :**

Each section of the torch has its own hose/cable assembly. This provides the return circuit for the cooling wate.

# 7 - ARC STRIKING

The arcs are struck simultaneously with the annular protection gas flowing to prevent the arc passing through the shoe.
Hence the necessity for a time-delay in the annular gas feed, relative to the striking of the arc.

# 8 - TORCH COMPONENT REMOVAL AND REFITTING

**Removal of electrode :**

To facilitate access to the electrodes the torch may be tilted 45° in the forward direction, as follows :

. loosen the nuts (items 8 and 9),
. tilt the torch to the required angle,
. re-tighten the nuts.

To remove the electrode unscrew the plug (item 51).

**Removal of torch section :**

. loosen and remove the screw (item 22),
. unscrew the guide rod (item 23),
. remove the torch section assembly (item 19) from the shoe (item 26).

**Removal of module :**

. loosen and remove the two dome nuts (item 18) threaded onto the studs (item 17),
. uncouple the various modules (items 14, 15 and 16),
. remove the latter [rom the two studs screwed into the magnetic arc deviation shoe.

**Refitting of module :**

. Check that the 0-ring seals (two on each standard shoe, one on the rear flange, one on the magnetic arc deviation shoe) are correctly positioned in the grooves in the shoe.

Correct positioning is essential to proper sealing of the water circuits.

# 9 - OPTIONS

The tricathode torch is of modular design and offers the advantage of providing for add-on optional units.

**Cold filler wire feed :**

This unit is of the same profile as the torch assembly. For thicknesses above 3 mm and for certain tube diameters the use of a cold filler wire may be beneficial in avoiding defects in respect of appearance.

This unit is therefore generally used for keyhole welding, normally being positioned between the second and third electrodes so that the wire is fed to a point under and in front of the third electrode.

Two angular adjustments enable the wire to be accurately directed to a point of impact under the electrode.

**Fitting**

. Loosen and remove the two dome nuts (item 18) threaded onto the studs (item 17).
. Uncouple the various modular components (take care with water circuit seals).
. Replace the studs screwed into the magnetic arc deviation shoe with those supplied with the shoe.

**Refitting the torch**

. Magnetic deviation unit
. Torch standard modular unit
. Wire feed unit
. Torch standard modular unit
. Rear fiange
. Cut the studs so that they are 5 mm longer than the torch assembly.

**Note :** check that the 0-ring seals 9two on each standard shoe, one on the rear flange, one on the magnetic arc deviation shoe, 2 on the cold filler wire feed) are correctly positioned in the grooves in the shoe. Correct positioning is essential to proper sealing of the water circuits.

**Magnetic arc oscillation system**

For workpiece thicknesses exceeding 3 mm, oscillation of the arc from the smoothing electrode provides for increasing the width of the weld bead, without increasing the electrode-workpiece separation, eliminating possible defects in respect of appearance.

**Fitting**

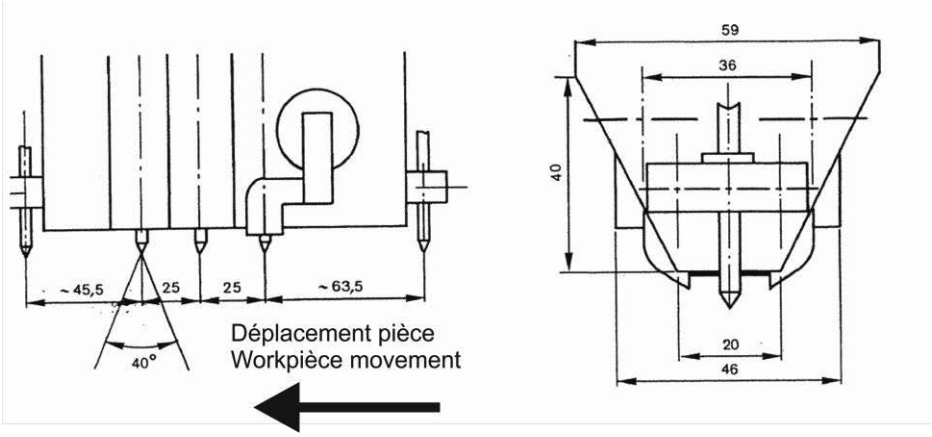
. Loosen and remove the two dome nuts (item 18) threaded onto the studs (item 17).
. Uncouple the various modular components ( take care with water circuit seals).
. Replace the studs screwed into the magnetic arc deviation shoe with those supplied with the shoe.
Remove torch section n° 3 from the standard shoe and place instead in oscillation shoe.
. Refitting the torch
    . Magnetic arc deviation unit,
    . Torch standard modular unit
    . Cold filler wire feed unit (where applicable), Magnetic arc oscillation unit.

Check that the 0-ring seals (two on each standard shoe, one on the magnetic arc deviation shoe, one on the magnetic arc oscillation unit and two on the cold filler wire feed unit) are correctly positioned in the grooves in the shoe.

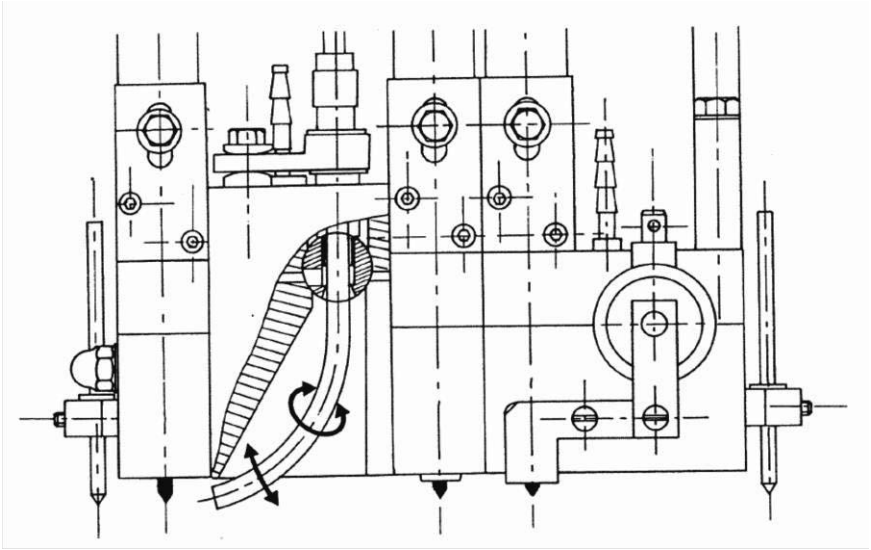
Cut the studs so that they are 5 mm longer than the torch assembly.

Correct positioning is essenttial to proper sealing of the water circuits.

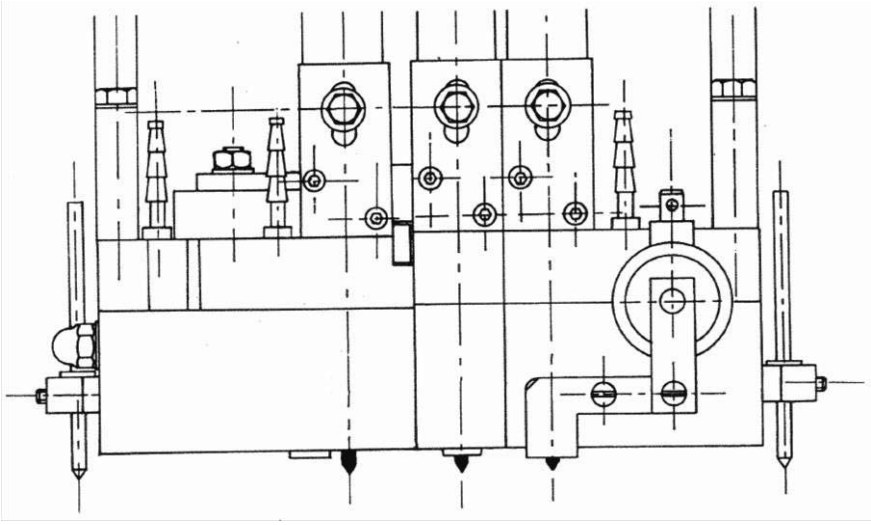
# 10 - TORCH DIMENSIONS




**Torch equipped with optional cold filler wire feed unit**



**Torch equipped with optional magnetic arc oscillation unit**

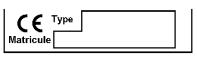


# C - SPARE PARTS

| | |
|---|---|
| ✔ | normally in stock |
| ✘ | not in stock |
| | on request |

| Item | Ref. | Stock | Order | Designation |
|---|---|---|---|---|
| **1** | 9257 2600 | | | Complete equipped torch with accessories |
| **2** | 9257 2611* | | | Torch |
| **3** | 9257 2605* | | | Support assembly, consisting of : |
| **4** | 9104 0398 | | | Insulation unit |
| **5** | 9257 2601* | | | Support bracket |
| **6** | | | | Screw HM 10 x 25 |
| | | | | Washer M 10 U |
| **7** | 9257 2599* | | | Support beam with screw HM 10 x 30 |
| **8** | | | | Washer M 10 U |
| | | | | Nut HM 10 |
| **9** | | | | Screw HM 6x20 |
| | | | | Washer Z 6 U |
| **10** | | | | Screw HM 6x30 |
| | | | | Washer Z 6 U |
| **11** | | | | Screw HM 6x45 |
| | | | | Washer Z 6 U |
| **12** | 9257 2598* | | | Locking knob |
| **13** | 9257 2597* | | | Support arm |
| **14** | 9257 2580 | | | Module with magentic drift |
| **15** | 9257 2565 | | | Standard module |
| **16** | 9257 2602 | | | Rear equipped disc |
| **17** | | | | Threaded rod M6 - Lenght 98 mm Stainless |
| **18** | | | | Blind nut M6 - Stainless steel |
| | | | | Washer M 6 U - Stainless steel |
| **19** | 9257 2560 | | | Complete torch element |
| **20 to 24** | 9257 2590* | | | Adjustment mechanism assembly |
| **20** | 9257 2595* | | | Insulation unit |
| **21** | 9257 2593* | | | Rest |

➢ For parts order, give the quantity required and put the number of your machine in the box below.

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| TYP : |
| Number : |

| | |
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| ✔ | normally in stock |
| ✘ | not in stock |
| | on request |

| Item | Ref. | Stock | Order | Designation |
|---|---|---|---|---|
| **22** | | | | Screw HM6x10 |
| | | | | Washer M 6 U |
| **23** | 9257 2624* | | | Guide rod |
| **24** | | | | Washer M 6 U |
| | | | | Truarc ring E7133 - Ø6 |
| **25** | 9257 2575* | | | Shoe with magnetic drift |
| **26** | 9257 2566* | | | Standard shoe |
| | 9121 2137 | | | Magnetic oscillation which consists of :<br>. 1 **OSCILLARC**<br>. 1 complete oscillation shoe<br>. 1 transformer 220/42V for **OSCILLARC** power supply |
| | 9121 2138 | | | Cold wire supply system which consists of :<br>. 1 motor and gear for wire feeder de dévidage de fil<br>. 1 electronic regulation REC 22 S (for tricathode control box)<br>. 1 wire supply shoe |

- For parts order, give the quantity required and put the number of your machine in the box below.


| |
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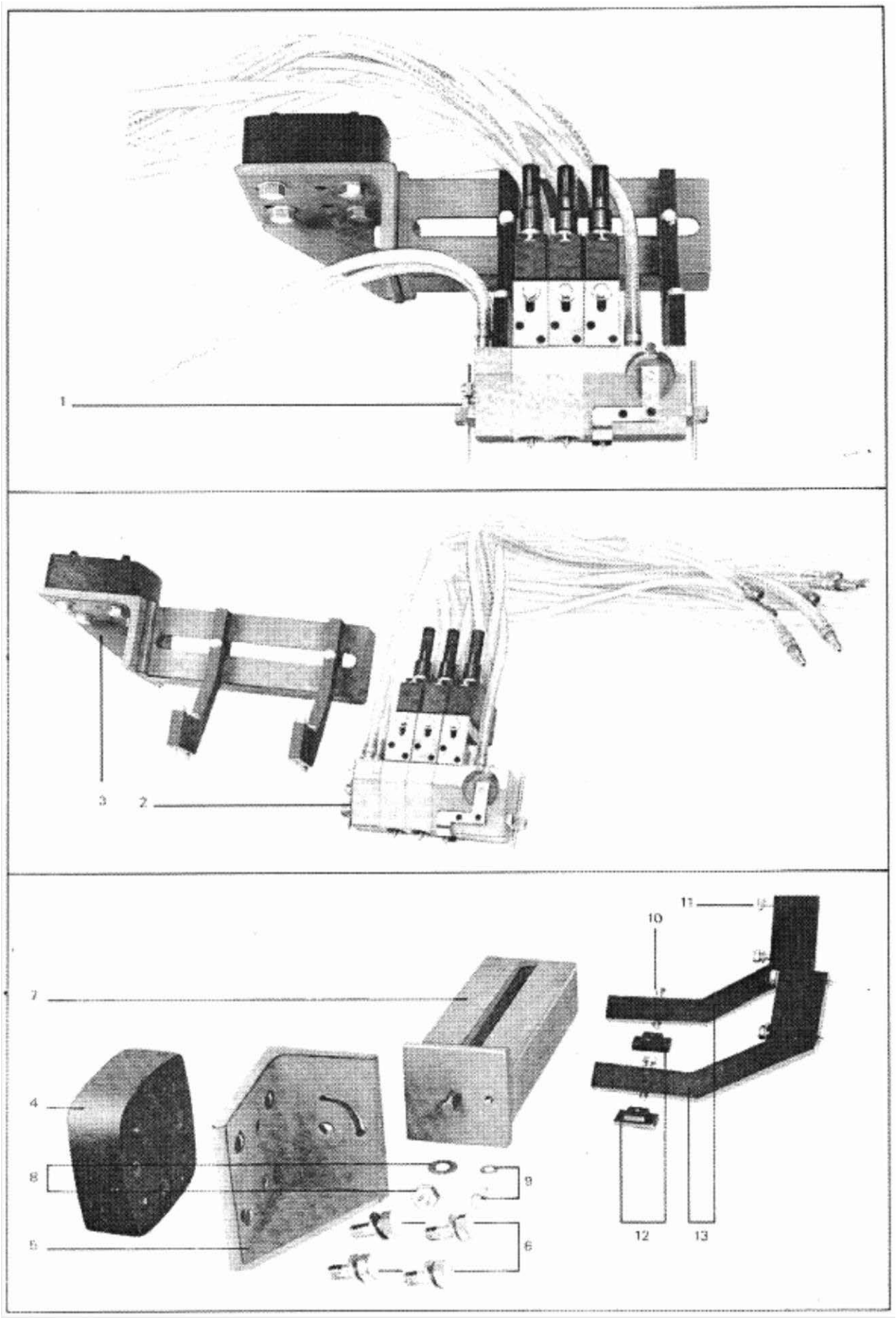
| TYP : |
| Number : |

* Listed part not kept in stock.
Supply on special order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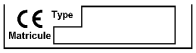
| | |
|---|---|
| ✔ | normally in stock |
| ✘ | not in stock |
| | on request |

| Item | Ref. | Stock | Order | Designation |
|---|---|---|---|---|
| **27 to 45** | 9257 2575* | | | Complete magnetic drift shoe |
| **27** | 9257 2578* | | | Bare shoe |
| **28** | 9257 2581 | | | Removeable flange |
| **29** | | | | Screw FHc/90 M3x10 |
| **30** | 0026 0412 | | | Joint R 5,7 x 9,5 |
| **31 to 36** | 9257 2585* | | | Magnetic drift assembly consisting of : |
| **31** | 9257 2583* | | | LH pole |
| | 9257 2582* | | | RH pole |
| **32** | | | | Screw F/90 3 x 10 Stainless steel |
| **33** | 9257 2584* | | | Intermediary |
| **34** | | | | Screw F/90 3 x 15 Stainless steel |
| **35** | 9257 2586* | | | Core |
| **36** | 9257 2514 | | | Magnetic drift coil |
| **37** | 9257 2596* | | | Guide pointer assembly consisting of : |
| **38** | 9257 2589* | | | Pointer support |
| **39** | | | | Screw FHc M3x10 |
| **40** | | | | Headless screw Hc M4x6 with cupped end |
| **41** | 9257 2588* | | | Insulating sleeve |
| **42** | 9257 2589* | | | Pointer |
| **43** | 9257 2563 | | | Gas piping consisting of : |
| | 0800 0273 | | | PVC pipe 4 x 10 |
| | 9159 1068 | | | Olive |
| | 0026 0405 | | | O ring 6 x 10,4 |
| | 3376 0211 | | | Nut 12 x 100 |
| | | | | Ligarex clamp |
| **44** | 9257 2573 | | | Insulating tube |
| **45** | 9257 2738 | | | Insulating diffuser |
| **46** | 9257 2566* | | | Standard equipped shoe, complete |
| **47** | 9257 2568* | | | Standard shoe, bare |
| **48** | 9257 2560 | | | Torch element equipped with piping |
| **49** | 9257 2555* | | | Molded torch element |

➢ For parts order, give the quantity required and put the number of your machine in the box below.

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| TYP : |
| Number : |

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|---|---|
| ✔ | normally in stock |
| ✘ | not in stock |
| | on request |

| Item | Ref. | Stock | Order | Designation |
|---|---|---|---|---|
| **50** | 9257 2557 | | | Electrode holder grip Ø3 |
| | 9257 2558 | | | Electrode holder grip Ø4 |
| **51** | 9257 2559 | | | Plug with seal |
| | 0026 0444 | | | Seal 9,1 x 1,6 |
| **52** | 9257 2561 | | | Nozzle Ø5 |
| | 9257 2562 | | | Nozzle Ø6 |
| | 9257 2625 | | | Convergent nozzel |
| **53** | 0371 0261 | | | Tungsten electrode Ø4 |
| | 0371 0260 | | | Tungsten electrode Ø3 |
| **54** | 9257 2564* | | | Water inlet pipings, consisting of : |
| | 0800 0273 | | | PVC pipe 4 x 10 |
| | 9159 1068 | | | Olive |
| | 0026 0405 | | | O ring 6 x 10,4 |
| | 3376 0210 | | | Nut 14 x 100 |
| | | | | Ligarex clamp |
| **55** | 9257 2570 | | | Water/electricity piping consisting of : |
| | 0800 0270 | | | PVC pipe 8 x 14 |
| | 0064 2004 | | | Copper braid 8 mm2 |
| | 0371 0407 | | | Olive |
| | 0371 0408 | | | Olive |
| | | | | Ligarex clamp |
| **56** | 9257 2602 | | | Rear disc equipped with pointer and piping |
| | 9257 2607 | | | Front disc equipped with pointer |
| **57** | 9257 2604* | | | Rear bare disc |

➢ For parts order, give the quantity required and put the number of your machine in the box below.


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| TYP : |
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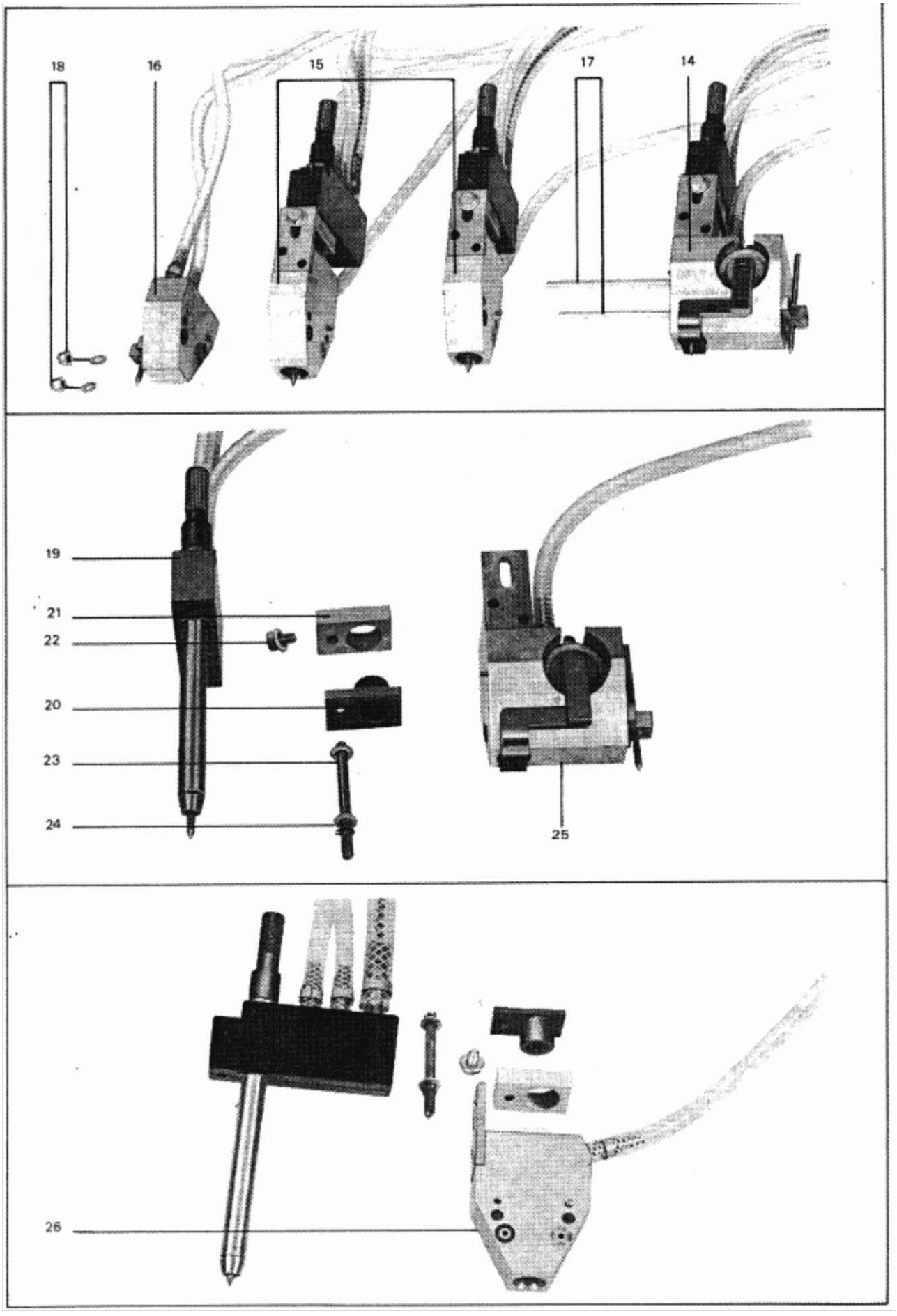
* Listed part not kept in stock.
Supply on special order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List of additional wear parts supplied with torch.

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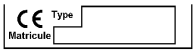
| ✔ | normally in stock |
| ✘ | not in stock |
| | on request |

| Item | Ref. | Stock | Order | Designation |
|---|---|---|---|---|
| | 9257 2562 | | | Nozzel Ø6 |
| | 9257 2568 | | | Electrode holder grip Ø4 |
| | 9257 2561 | | | Nozzel Ø5 |
| | 9257 2557 | | | Electrode holder grip Ø3 |
| | 9257 2738 | | | Insulating diffuser |
| | 9257 2573 | | | Insulating tube |
| | 0026 0412 | | | Seal 5,7x9,5 |
| | 0026 0444 | | | Seal 9,1x1,6 |

- For parts order, give the quantity required and put the number of your machine in the box below.

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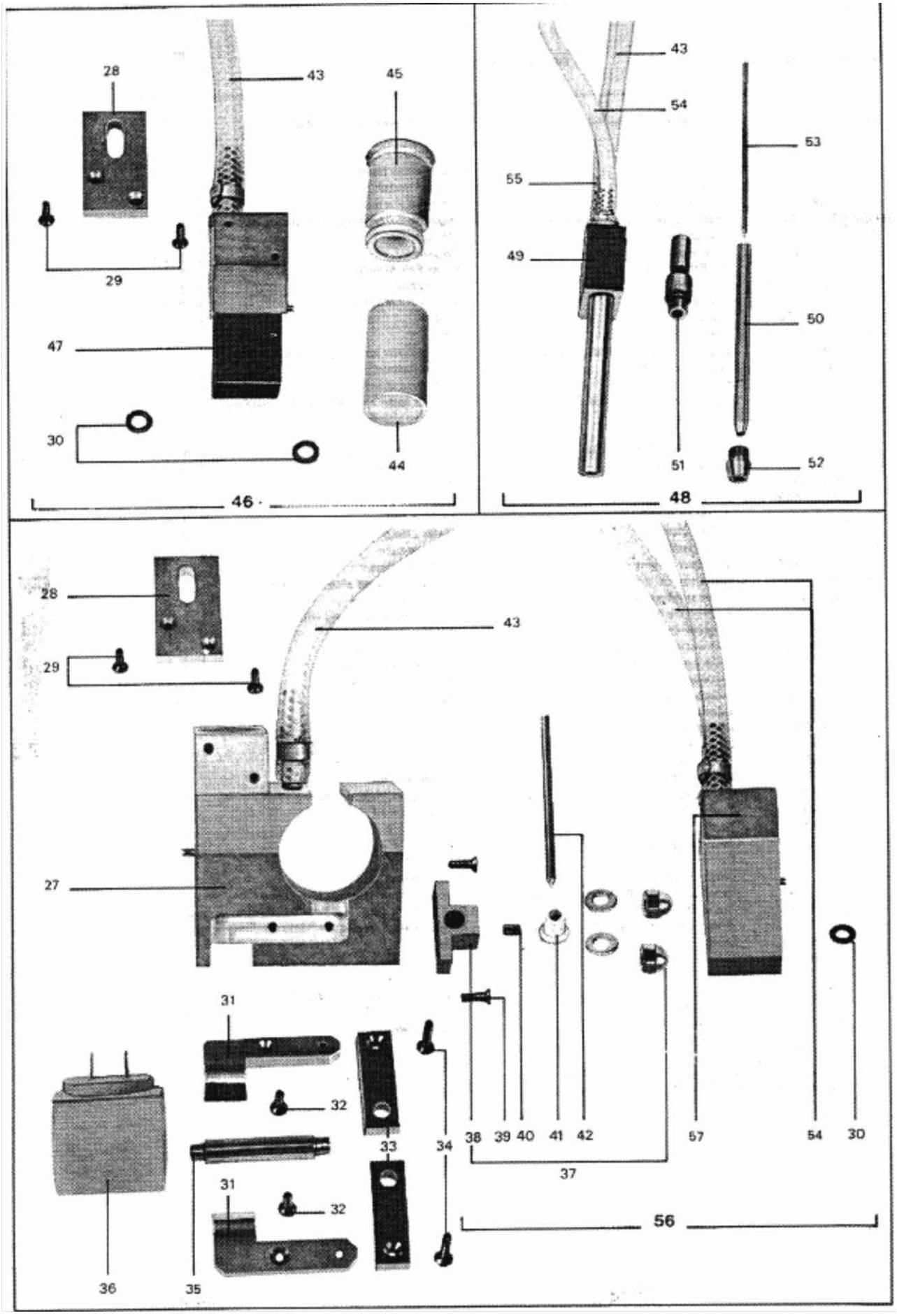
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# PERSONAL NOTES

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**www.lincolnelectriceurope.com**