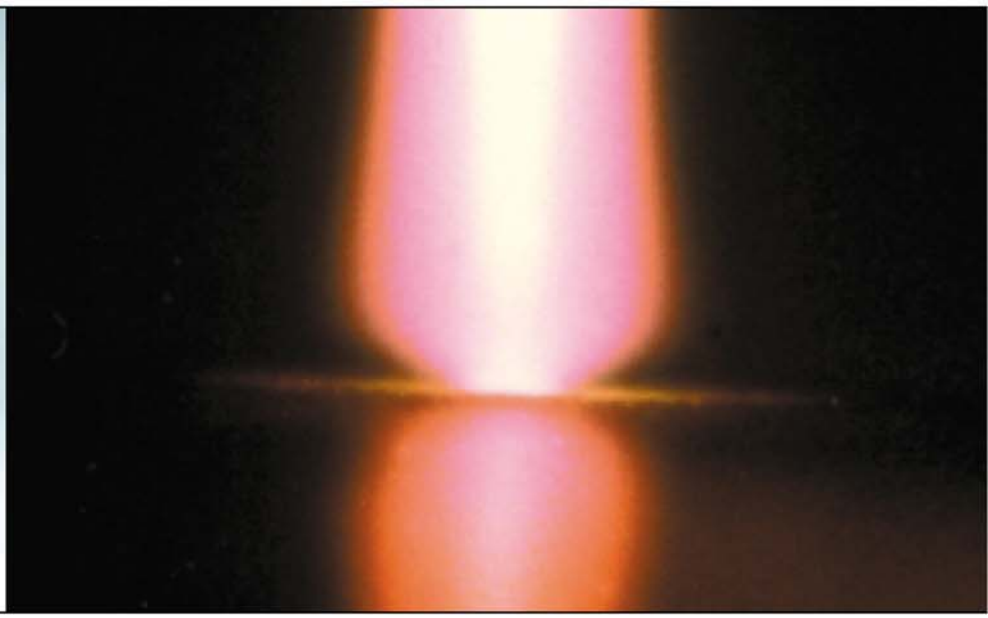


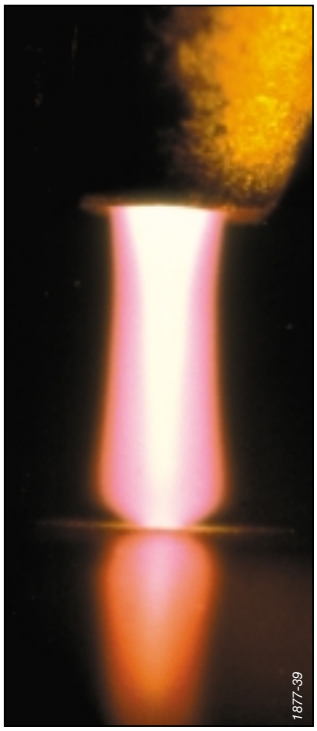
OERLIKON

PLASMAFIX 51

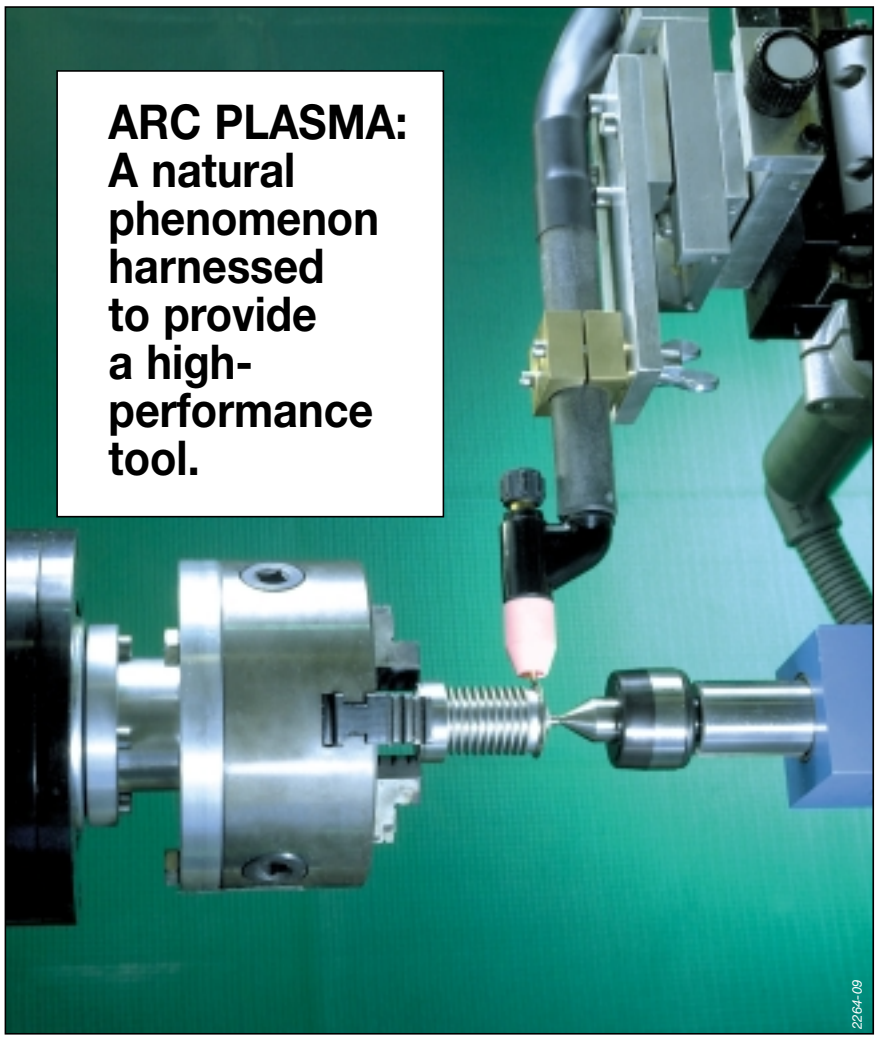
Microplasma welding installation. Manual and automatic applications.

AIR LIQUIDE WELDING

The term PLASMA is usually applied to gaseous environments at temperatures exceeding 3 000°C and at atmospheric pressure. On a temperature scale, a plasma can be regarded as a fourth state of matter after solid, liquid and gas. The plasma comprises excited atoms or molecules, ions and electrons; it is an everyday natural phenomenon: lightning generates a plasma, for example. Since around 1960 the meaning of the word PLASMA has changed slightly to denote the high-energy state resulting from the constriction of an electrical arc by means of a diaphragm or nozzle. This principle is now in widespread use in the iron and steel and non-ferrous metals industry, in chemical engineering and in mechanical engineering.



ARC PLASMA: A natural phenomenon harnessed to provide a high-performance tool.



SAF has harnessed the plasma to produce powerful cutting and welding tools. In the field of welding, it is accepted that the PLASMA process is the major technological development of inert gas shielded free arc (TIG) welding.
The TIG process is very widely used for manual and automatic welding of thicknesses ≥ 1 mm. The electrical energy input required is in excess of 200 to 300 W (20 to 30 A at 10 V) in argon atmosphere, and may be as high as 6 to 7 kW.

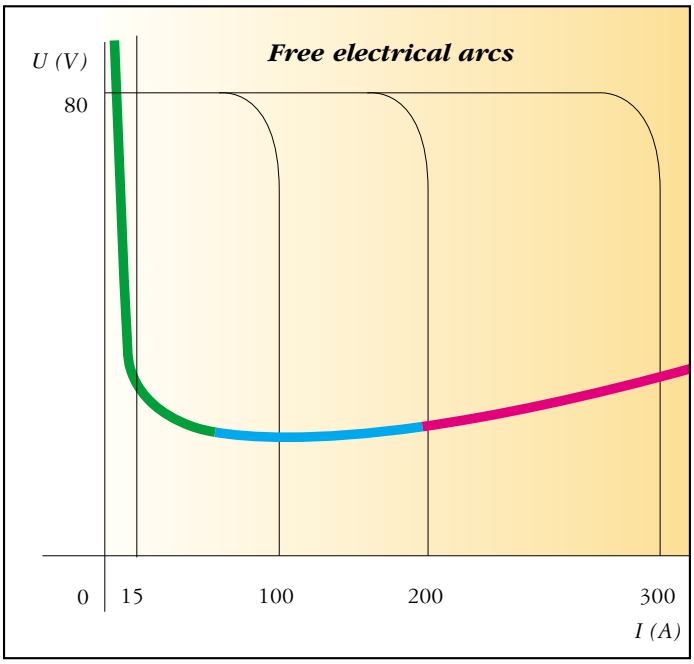
For thinner workpieces it is found difficult to reduce the power of the arc without running into three problems:
- *instability of the TIG arc,*
- *excessively large molten and heat-affected area,*
- *often unacceptable deformation of the workpieces.*

PLASMA ARC:
a totally stable phenomenon even at very low power levels

Free electrical arcs
have a current/voltage characteristic totally unlike that of an ohmic conductor for which the equivalent characteristic is a straight line.
The arc characteristic has three main areas:

- a strong negative slope for low current values,
- a virtually horizontal part for medium current values,
- a positive slope for high current values.

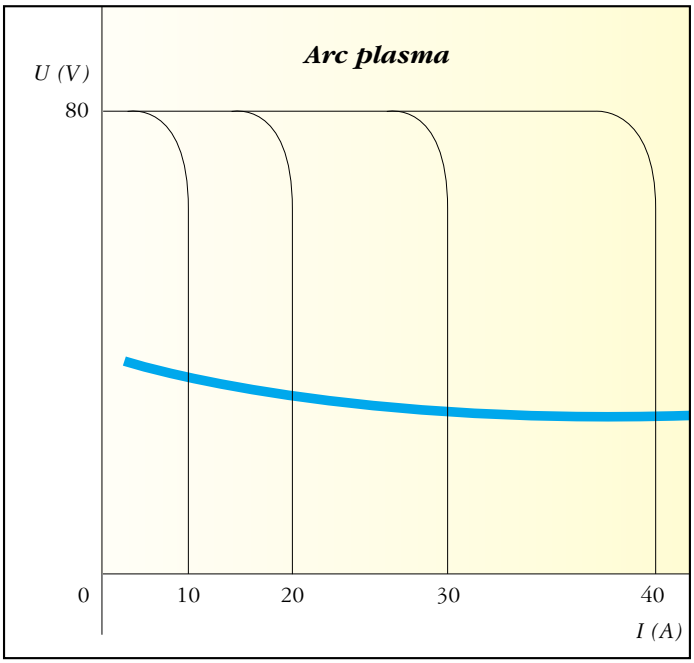
All free arcs (at atmospheric pressure) have this type of characteristic, although it varies somewhat with the gases employed.
At the very low currents needed to weld thin workpieces the steep negative slope makes it impossible to define stable current/voltage conditions representing a regulated power. This instability is accompanied by directional instability of the arc depending on anode conditions: peak effect, very hot spots, etc.



The plasma arc
produced by a strongly cooled nozzle in the immediate vicinity of the cathode changes the characteristic completely

- so that it has only a slightly negative slope.

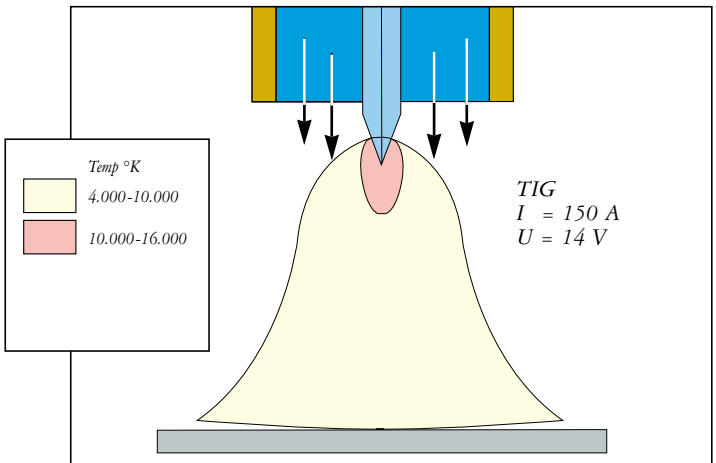
This characteristic intersects with the vertical characteristics of the current source at clearly defined points representing stable operation at currents below 5 A.



Plasma arc:

- high temperatures
- a concentrated beam
- increased productivity

Free Arc (TIG)



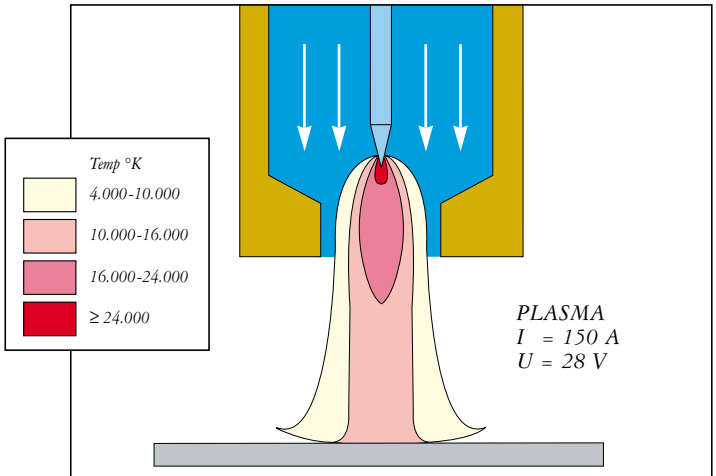
- The arc is conical and a significant proportion of the energy is dissipated at its periphery.
- The high temperature zone, too close to the cathode, is not used.

The isothermal lines in the diagram on the left show clearly how much the energy distribution differs in the PLASMA arc:

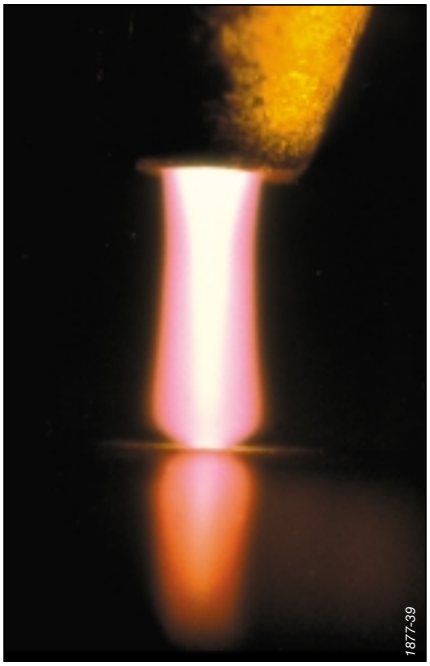
- *the 16 000 to 24 000°K temperature zone extends beyond the nozzle,*
- *the 10 000 to 16 000°K zone is entirely transferred to the workpiece, whereas in the FREE arc process the high temperature zone is too close to the cathode to be usable.*

The 4 000 to 10 000°K temperature zone is narrow in the PLASMA process and broader in the TIG process. This zone is not without use: it affords some surface melting to a depth which decreases with distance from the plane of the joint to provide gentle merging of the welded area with the basic metal. This zone is too wide in TIG welding, however, and this limits performance.

Plasma arc



- The arc diverges only slightly beyond the strongly cooled nozzle.
- The 10 000 - 16 000°K temperature zone is transferred to the workpiece in a concentrated beam.



Plasma Arc: decisive progress in the battle against welding workpiece deformation

The energy input by a welding arc releases localised stresses already in the workpiece (generated by forming, rolling, stamping, etc) and develops other stresses in the environment of the molten area.
These phemonena cause geometrical deformations on a scale directly proportional to the energy input.
On the other hand, the just sufficient degree of melting in depth and most importantly in width is achieved rapidly with a high energy density process.

PLASMA arc welding is unique among welding processes in respect of two criteria: power density, energy input.
It is the most powerful electrical arc process.
Compared to higher energy processes (electron bombardment in vacuum and laser beam) it is remarkably easy to use.
MICROPLASMA arc welding can be used to assemble machined parts without any need for reworking after welding.

Microplasma welding applications

Product design is constantly evolving to meet ongoing demands to reduce weight and manufacturing cost and to increase performance (improved speed, pressure and operating temperature). Materials offering constantly increasing performance are being welded in ever decreasing thicknesses.
The MICROPLASMA process is the most technically efficient and cost-effective solution.

The MICROPLASMA has been used successfully on most noble metals, with the exception of aluminium and its alloys. The adjacent table shows the wide variety of metals and alloys that can be welded by the microplasma process. It also indicates the major operating conditions appropriate to the product and its thickness.

Assembly		*Torch equipment*		*Gases used (l/min)*					*Current*	*Welding speed*
material	thickness (mm)	Ø electrode (mm)	nozzle orifice Ø (mm)	plasma argon	annular Ar %	annular H_2 %	annular He %	annular l/min	A	cm/min
stainless steel	0.06	1	0.8	0.15	95	5	0	4/6	2	65
constantan	0.10	1	0.8	0.15	95	5	0	4/6	3	50
iron/nickel	0.80	1.6	1.5	0.20	95	5	0	5/7	15	45
cupronickel	0.50	1.6	1.2	0.20	95	5	0	5/7	10	60
nickel silver	0.30	1.6	1.8	0.20	0	0	100	7	45	60
titanium, tantalum zirconium	0.50	1.6	1.2	0.20	0	0	100	7	25	70
gold	0.20	1	1	0.15	95	5	0	4/6	5	40

MICROPLASMA WELDING: equipment.

All microplasma welding installations include:
- *a power source: NERTAMATIC 51,*
- *a SP 45 manual or automatic welding torch,*
- *a REFRISAF 51 cooling unit,*
- *two pressure regulator/flowmeters.*

Manual installation for complete microplasma welding, ready for use: reference 9258-0326

- High performance linear amplifier.
- Also applicable for TIG.
- User friendly front panel.
- Multiligual display.
- Totally programmable welding programmes.
- Memory for 100 programmes.
- Configuration which is adapted to the user's needs.
- Remote control.
- Print-out of programmes. Print-out of parameters during welding.
- Control of integrated process.
- Communication with micro-computer. Software under Windows.
- Link with programmable automaton.

Options:
- regrouping carriage: reference 9258-0329,
- double welding command pedal (replaces the torch'trigger): reference 9258-0268,
- trigger and current adjustment pedal: reference: 9258-0354.
- P.C. software for NERTAMATIC 51: Reference: 9258-0353 (see description opposite).
- shielding gas for back of weld : reference 9258-0731.

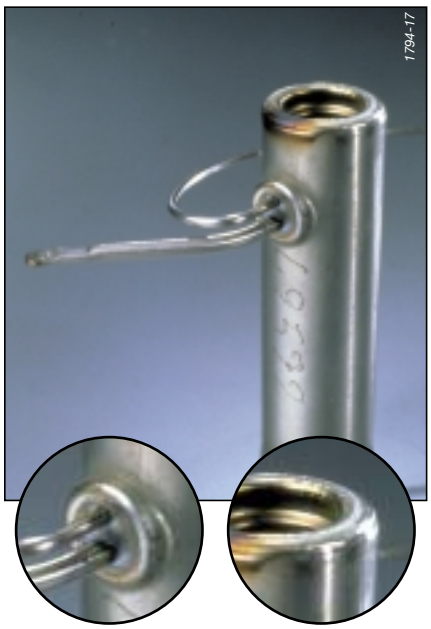
Software for NERTAMATIC 51 Windows 3.1 95-98 compatible.

- Allows NERTAMATIC 51 programmation from a P.C.
- Parameters back-up on P.C.
- Off line programmation.
- On line modification:
  - Programme,
  - Programme number,
  - Intensity.
- Back-up of programmes stored on.
- Configuration loading.
- Programme loading in the NERTAMATIC 51.
- Modifications of programme number while rest or pilot arc time.
- On line intensity modification.
- Programme printing.

Sectors of activity concerned

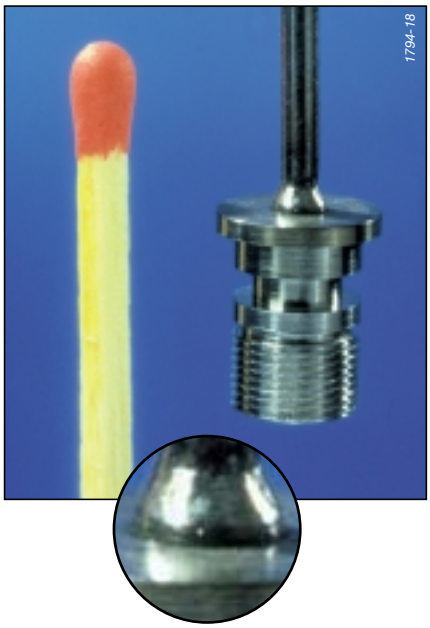
Prefabrication of microbore pipework components and filters

Capillary tube welded to unions for analysis and measurement circuits.



Miniaturised heat exchanger.

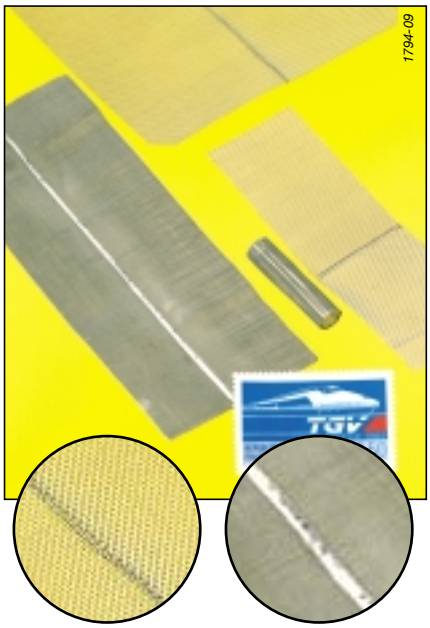
Thermal expansion compensator bellows.



Tube welded to stainless steel union.

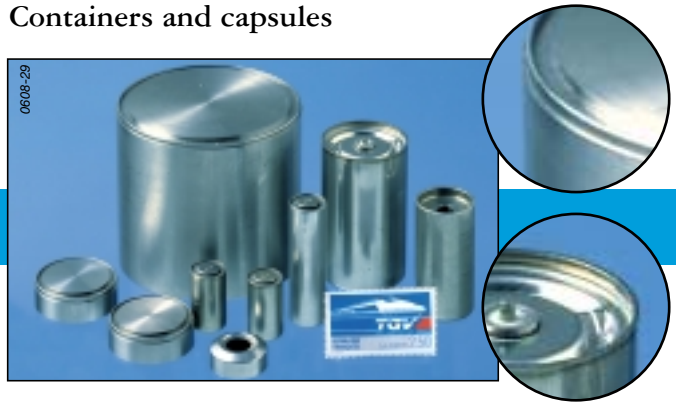
Manufacture of measuring instruments

Welding membranes and thermocouple junctions.



Welding metal fabric and mesh (expanded metal).

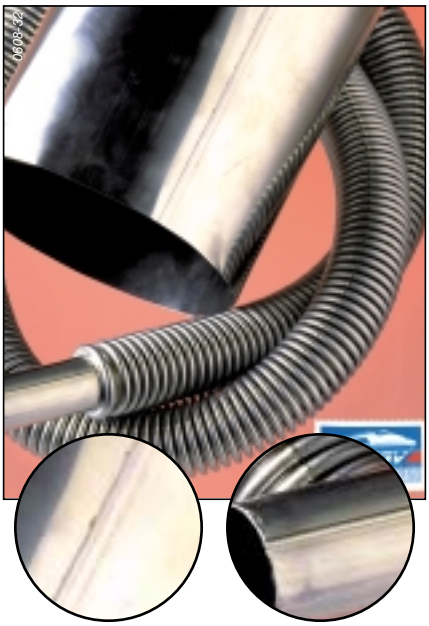
Containers and capsules



Jewellery

Chain links.

Precision welding



Tubes (± 0,4 mm) and hydroformed hose.

Electrical equipment

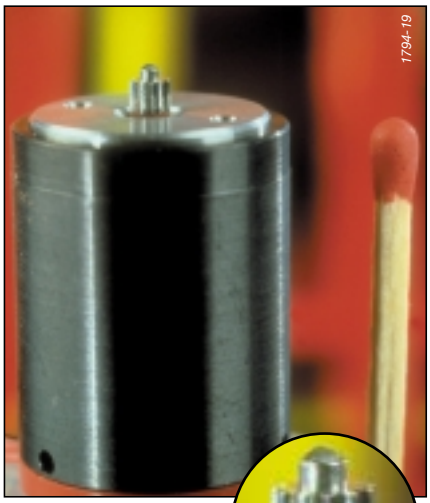
Sealed relays.

Plastics

Repair and resurfacing of tools and moulds.

Precision mechanical end parts

Special seals.



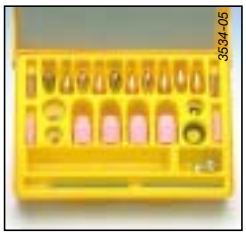
Laminated magnetic circuit, motor armatures, transformers...

NERTAMATIC 51 power source

High performance linear amplifier.

- Primary supply:
  - Tension (V) ..... 230-400-440. 50/60 Hz. Three-phase
  - cos 0.91
  - primary maximum power ..... 6 A (under 400 V)
- Secondary current:
  - PLASMA smoothed and pulsed ..... min. 80 m A - max. 50 A at 100%
  - TIG smoothed and pulsed ..... min. 0.8 A - max. 50 A at 60%
  - off load voltage ..... 106 V
  - pulse frequency ..... 1 Hz to 10 kHz
- Other specifications:
  - front panel programming ..... by keys and codes
  - display ..... by LCD display
  - cooling ..... by cooling unit
  - HF source ..... built-in
  - main and annular gas circuit ..... built-in
  - shielding gas circuit ..... optionnal
  - protection IP23
  - weight ..... 95 kg
  - dimensions L x W x H ..... 650 x 360 x 750 mm

Welding torches



SP 45
Torch maintenance kit
Ref. 9258-0113

SP 45 manual welding torch
Reference 9258-0111

SP 45 automatic welding torch
Reference 9258-0112

Features: water-cooled, tungsten electrodes:
Ø 1 or 1.6 m, 75 or 150 mm long, 4 m harness.
An SP 20 manual or automatic torch can be supplied on request.
This weighs considerably less and has a maximum current rating of 20 A at 100%.

REFRISAF 51 Cooling unit

Reference 9258-0321

Assures the cooling by a cooling liqquid in a closed circuit for a SP 45 torch and the NERTAMATIC 51 power source:

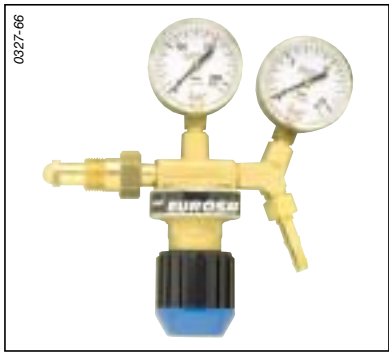
- power supply 230 V /50-60 Hz,
- capacity: 6 l,
- power consumption : 2200 W at 20°C,
- weight: 30 kg,
- dimensions (L x W x H): 720 x 360 x 340 mm.

Pressure regulators flowmeters

For plasma gas : pure Argon or ARCAL 1.
Reference. 9258-0351
Double pressure regulator assures an excellent precision for the PLASMA gasflow.
Inlet coupling: NF-C.
Outlet coupling: M16 x 150 RH.

For annular protection gas in general*:
Argon + 5 % H_2
(Noxal 3 or ARCAL 11).
Reference 0964-1070
EUROSAF pressure regulator.
Inlet coupling: NF-E.
Outlet coupling:
M16 x 150 LH.

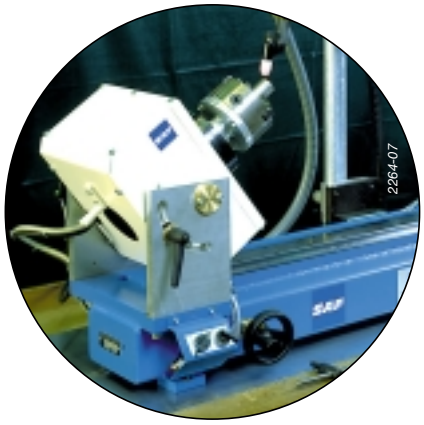
** also for shielding gas.*

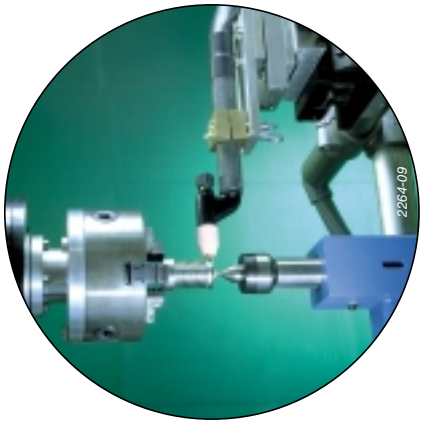


NERTAMATIC 51 automatic applications for microplasma welding.

Precision lathe for microplasma welding.

Power supply	230 V 50 Hz
Rotation speed	0.1-11 tours a minute.
Concentricity of tail stock	± 0.02 mm
Tail stock force	1950 Ncm
Central axis	166 mm
Max. distance between point	500
Ø max. possible	320 mm
Reaming of the lever - with axis of 3 jaws - with fastening holders	Ø 48 mm Ø 20/32/42 mm Ø 16 mm





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