



Owner's Manual

Tube To Tube Sheet Welding Head

**Typ P-16-M
AVC**





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1.) GENERAL INFORMATION

The recent technological advances in the design and manufacturing processes of heat exchangers and equipment for chemical, nuclear and mechanical industry has forced the extensive use of new materials which require sophisticated and, therefore, highly precise and efficient welding systems.

These critical weld joints must be sound and safe because the smallest defect may have serious consequences.

The welding process commonly applied for welding tubes for heat-exchangers is TIG with filler metal, carried out with fully automatic equipment. This system allows the welding operation to be completely unaffected by the skill of the welder and produces perfectly repeatable high quality welds.

The model P-16-M weld head has been specifically designed to meet these requirements. It automatically performs tube to tube sheet welds for tubes from 20 to 100 mm O.D.

1.1) Technical Specifications

Welding Process:	TIG and TIG + filler wire
Welding position:	horizontal, vertical, inclined
Positioning of weld head:	by means of a spring loaded balancer or positioning frame with x-y-z movement
Centering of torch:	by means of a series of spring loaded centering cartridges and mandrels
Torch cooling:	water cooled
Welding diameters:	20 - 100 mm electrode parallel to tube axis bigger and smaller diameters at request
Welding current (60% duty cycle):	max. 200 A DC pulsed max. 180 A DC linear

Rotation speed: (stepless adjustment)	0,33 - 6,00 rpm
Weld head front diameter:	standard 120 mm
Support on tube sheet:	three-point (with ring)
AVC stroke	10 mm
Filler wire group:	removable if not used
Filler wire speed: (stepless adjustment)	0,15 - 1,50 m/min
Filler wire spool:	Midget or Sigmette 1 Kg
Wire diameter with rollers type 1:	0,6 - 0,9 mm
Wire diameter with rollers type 2:	0,9 - 1,2 mm
	If not specified the machine is delivered with rollers type 1

Dimensions:

- Machine body	100 mm diameter
- Spool protection cage	120 mm diameter
- Length:	
without wire group	420 mm
with wire group	580 mm
- Weight:	
without wire group	10 Kg
with wire group	12 Kg

2.) **DESCRIPTION OF THE WELD HEAD**

- A) The weld head can rotate indefinitely as current, cooling water and gas are brought to the torch by means of a special designed rotating coupling. In this way cable connections remain fixed.
- B) It is important to note that the machine body itself is water cooled, in order to guarantee a better protection in case of preheated tube plates.
- C) The wire spool rotates coaxially with the machine avoiding dangerous wire windings and torsions.
- D) Electrode and wire nozzle are both completely moveable towards the tube axis. In this way the electrode and the wire nozzle inclination can be easily optimized.
- E) All normal work operations and small maintenance jobs can easily be performed directly by the operator (replacement of spool, electrode, wire hose, etc.).

The weld head is composed of three groups:

- Central body and rotating coupling drawing 16.01.10.00
- Wire group with standard motors drawing 16.02.02.00
- Wire group with tachofeedback motors drawing 16.02.03.00
- Front body and torch drawing 16.03.05.00

On request can be supplied:

- Front dual flow cage for second gas (for titanium welding e.g.), at request with three point support.
- Rear transparent anti-dust spool protection.
- Vertical suspension kit.

2.1) **Main Body and Rotating Coupling**

{drawing 16.01.10.00}

This group is composed of the following main items or subassemblies:

- Connection block {pos. 22} to the main cable for cooling water, welding current and protection gas. To this block are connected two Viton hoses for the cooling water of the machine body.
- Electric socket {pos. 33} for connection to the welding programmer.
- Rotation joint spindle {pos. 52} and main distributor {pos. 51} for cooling water, protection gas and welding current. The electrical contact between the parts is obtained by means of a lamellar joint.
- Self-lubricating bearings {pos. 53; 57} for supporting the rotation joint spindle.
- Rotation gear-motor. {pos. 18 standard; pos. 97 with tachometer feedback}
- Conical gear wheel {pos. 03} between crown wheel-pinion {pos. 17} for transmission of rotation from the gear-motor to the welding head.
- Electro mechanic pulse-counter for controlling the welding cycle with respect to the torch position. The microswitch {pos. 95} is actuated by a wheel with 20 cams which supplies 60 impulses during a 360° rotation of the torch.
- A second pulse-counter {pos. 95} may be mounted on the rear part. It supplies 1 impulse during a 360° of the torch (home switch).
- Machine body {pos. 02} with hook {pos. 49}. (Standard for welding in horizontal position).
- Contact flange {pos. 07} for supplying current to the wire motor with carbon brushes {pos. 38}.
- Mandrel support vessel {pos. 54} machined out of stainless steel.
- Ball bearing {pos. 73} which allows the rotation of the mandrel support vessel and the front part of the welding head.
- Handle {pos. 20}.
- Ring {pos. 01} for axial translation device to adjust distance electrode-work piece (+/- 5 mm).
- Start button {pos. 93} for starting the welding cycle or act the emergency stop (if pushed during the cycle); only valid if connected to P.R.A.I. controller.

2.2) Filler Wire Group

{drawing 16.02.02.00 standard motors}

{drawing 16.02.03.00 tachometer feedback motors}

- Filler wire gear-motor {pos. 14}.
- Pair of wire feed rollers {pos. 21; 22}. On the machine usually are mounted rollers for wire 0,6-0,9 mm. On request can be supplied rollers for the wire 0,9-1,2 mm.
- Wire spool support {pos. 34}: Standard spool is Sigmette or Midget (1 Kg).
- Elastic (spring loaded) blocking device {pos. 38} which avoids by a clutch system {pos. 43} the unrolling of the spool.
- Spool protection cage {pos. 07}.

2.3) Front Body and Torch

{drawing 16.03.05.00}

- Torch body {pos. 03} is water cooled and covered by a special insulating painting in order to insulate the piece against high frequency.
- Water- and current cable {pos. 22} supplies current to the torch {pos. 03}.
- Stainless steel spindle support vessel {pos. 34}. Mandrels with centering cartridges are mounted to obtain the exact centering of the head.
- The welding head can be attached on the tube plate by means of three-point support {pos. 09; 30 ; or 39} or by means of a cage {pos. 97 and 98} with support ring {pos. 96} on which can be mounted three feet {pos. A8} or support ring {pos. 91}.
- The wire group (detail "A") is composed as following:
 - Wire nozzle {pos. B5}
 - Wire nozzle support {pos. A6}
 - Insulating bushing {pos. A3}
 - Shaft {pos. A4 }and shaft support {pos. A5}
 - Screws
- AVC group mounted on the spindle support vessel by means of screws {pos. 71}. Positioning of the group can be chosen according to the welding geometries.
- AVC group support {pos. 95} can be adjusted by means of screws {pos. 78}.
- A gear motor {pos. 27} allows the movement and the limit of the torch.
- 2 microswitches {pos. 81} to limit AVC stroke.
- Gear rod {pos. 14} and gear {pos. 06}.

2.4) Centering Feature for External Weldings

Is needed in order to maintain the welding gun perfectly in axis with the tube to be welded. It consists of a spindle which is mounted by means of 5 screws on the support vessel. On this mandrel are mounted the centering cartridges which will be located into the tube to be welded (bayonet attachment and blocked by a spring loaded ball). The centering cartridge is equipped with four rows of spring loaded balls guaranteeing in this way a perfect centering of the welding head.

All mandrels and centering cartridges must be chosen with respect to the internal diameter of the tube to be welded.

Hereafter the list of all available standard centering cartridges and mandrels. Special types can be supplied on request.

Centering Device Type	Internal Tube Diameter		Mandrel Type
	min. mm	max.	
01	10	10.5	A
02	10.5	11	A
03	11	11.5	A
04	11.5	12	A
05	12	12.5	A
06	12.5	13	A
07	12.8	14	B
08	13.8	15	B
09	14.8	16	B
10	15.8	17	B
11	16.8	18	B
12	17.8	19	B
13	18.8	20.5	B
14	19.8	22.5	B
15	22.3	25	C
16	24.5	27	C
17	26.5	29	C
18	28.5	31	C
19	30.5	33	C
20	32.5	36	C
21	35.5	39	C
22	38.5	42	C
23	41.5	45	C
24	44.5	48	C
25	47.5	51	C
26	50.5	54	D
27	53.5	58	D
28	57.5	62	D
29	61.5	66	D
30	65.5	70	D
31	69.5	74	D
32	73.5	78	D
33	77.5	82	D

2.5) **Connections**
{drawing 16.01.10.00}

Together with weld head P-16-M is supplied a connection cable L=8m which allows the connection to the welding programmer/power supply.

The cable contains the following tubes:

- cooling water to the torch (blue)
- water out and welding current (red)
- protection gas (yellow)
- gas 2 (eventually to be used for double gas)
- electrical cable
- cable for AVC

3) **ACCESSORIES AND MODIFICATIONS**

3.1 **Front Cage for Dual Gas Flow**

For welding special material (e.g. titanium) it is necessary to obtain a completely inert environment. For this reason it is possible to fit on welding head P-16-M a front cage with a transparent glass which allows to create an inert environment around the torch. This cage can be equipped with a three point support to render easier the positioning of the weld head on the tube plate.

The accessory is supplied complete with:

- Front cage with stainless steel front ring
- Pyrex glass
- Gas hose
- Nipple
- Upon request three point support

3.2) **Spool Protection**

This accessory is composed of two elements which contain hermetically sealed the filler wire group.

With this device can be performed weldings in particularly dusty or humid environments avoiding that the filler wire gets in contact with impurities which would have a negative result on the welding.

This kit is composed of:

- Protection bush
- Transparent cap

4.) SPARE PARTS LIST

4.1) MAIN BODY AND ROTATING COUPLING ASSEMBLY DRAWING: 16.01.10.00

<u>POS.</u>	<u>DESCRIPTION</u>	<u>P/N</u>
01	BUSHING	16.01.00.01
02	MACHINE BODY	16.01.00.02
03	CONICAL WHEEL	16.01.01.03
04	PLATE	16.01.00.04
05	INSULATING BODY	16.01.00.05
06	COLLECTOR FLANGE	16.01.04.01
07	COLLECTOR RING	16.01.00.07
08	INSULATING COLLECTOR RING	16.01.00.08
09	INSULATING COLLECTOR RING	16.01.00.09
10	DISC	16.01.00.10
11	SCREW PLUG	16.01.00.11
12	DOWEL	16.01.00.12
13	WATER CONNECTION BASE	16.01.00.13
14	WATER HOSE	16.01.04.02
15	WATER HOSE	16.01.04.03
16	MOTOR SUPPORT	16.01.07.01
17	PIGNON WITH TOPS COUNTER	16.01.01.02
18	ROTATION GEARMOTOR STD	16.01.07.02
20	SOCKET	16.01.07.03
21	GAS HOSE	16.01.00.21
22	CONNECTION PLUG	16.01.07.04.00
23	FUNNEL RING	16.01.04.06.00
24	BLOCK	16.01.04.11
25	INSULATING FLANGE	16.01.00.25
26	BRUSH HOLDER BLOCK	16.01.00.26
27	COVER	16.01.00.27
28	BLEEDING HOSE	16.01.04.07
29	THREADED PLUG	16.01.00.29
30	WORK	16.01.00.30
31	WIRING OF MACHNE CONNECTOR	16.01.01.10
32	BUSH	04.04.00.02.02
33	PLUG	16.01.01.11
34	SPRING FOR BRUSHES	04.04.00.14
35	NUT	04.04.00.20
36	NUT	04.04.00.21
37	GUIDE FOR SPRING	04.04.00.26
38	BRUSH	04.04.00.31
39	CONNECTING RING	04.04.00.59
40	WRENCH NUT	06.06.00.02
41	SPRING	10.01.00.41.00
42	PROTECTION FOR PUSH BUTTON	10.01.00.70
43	SLIDING RING	13.01.00.01
44	SEALING BUSH	16.01.04.08
45	TONGUE	13.01.00.04
47	SPACER	13.01.00.07
48	INSULATING BUSH	16.01.01.12.00
49	SUPPORT	13.01.00.10
50	GASKET	13.01.00.11
51	DISTRIBUTOR SPINDLE	13.01.00.16
52	DISTRIBUTOR	13.01.00.17

MAIN BODY AND ROTATING COUPLING

ASSEMBLY DRAWING: 16.01.10.00

<u>POS.</u>	<u>DESCRIPTION</u>	<u>P/N</u>
53	BEARING	13.01.00.24
54	SPINDLE SUPPORT VESSEL	13.01.01.01.00
55	PROTECTION	13.01.00.26
56	RING	13.01.00.28
57	BEARING	13.01.00.29
58	PASTILLE	13.01.00.30
59	KNURLING KNOB	13.01.00.37
60	GAS CONNECTION	13.01.00.41
61	BASE	13.01.00.46
62	SIDE PLATE	13.01.00.47
63	PLATE	13.01.00.49
64	BRUSH HOLDER	13.01.01.07
65	CLAMP BLOCK	33.01.00.30
66	CABLE CLAMP	33.01.00.31
67	INSULATING SHELL	89.01.00.38
68	SCREW	50.05.05.01.09
69	SCREW	50.03.01.01.04
70	GRUB SCREW	50.17.21.01.02
71	SCREW	50.03.01.01.05
72	CLAMPING RING	53.20.11.25.15
73	BALL BEARING	55.19.55.32.13
75	SEEGER RING	53.01.15.22.29
76	SCREW	50.03.05.01.17
77	SCREW	50.03.03.01.02
78	O-RING	56.40.00.40.31
79	ORING	56.40.00.40.32
80	O-RING	56.40.01.40.02
81	SCREW	50.03.03.01.05
82	LAMELLAR COUPLING	68.60.00.39.03
83	SCRE	50.03.05.01.16
84	MALE PIN	86.73.03.39.84
85	SCREW	50.03.05.01.03
87	O-RING	56.40.00.40.02
88	GRUB SCREW	50.18.21.01.02
89	SCREW	50.04.05.01.20
90	SCREW	50.04.05.01.04
91	TONGUE	54.20.42.29.27
92	SCREW	50.04.05.01.03
93	START/STOP BUTTON	63.62.00.39.01
94	SCREW	50.03.01.01.03
95	MICROSWITCH	62.25.01.39.02
96	SCREW	50.01.01.01.06
97	ROTATION GEARMOTOR WITH TACHO	16.01.07.05
98	CONNECTING CABLE	15.01.01.18.00
99	CONTACT BLOCK ASSEMBLY	16.01.00.34.00

MAIN BODY AND ROTATING COUPLING

ASSEMBLY DRAWING: 16.01.10.00

<u>POS.</u>	<u>DESCRIPTION</u>	<u>P/N</u>
A1	TEFLON HOSE	16.01.00.35
A2	TEFLON HOSE	16.01.00.36
A3	SCREW	50.02.01.01.05
A4	CENTERING RING	16.01.04.09
A5	TONGUE	54.20.42.29.26
A6	REAR BLOCK PROTECTION	16.01.02.06
A7	FRONT BLOCK PROTECTION	16.01.02.07
A8	GRUB SCREW	50.19.21.01.04
A9	TONGUE	54.20.42.29.23
B1	PLATE	16.01.04.10
B2	SCREW	50.40.05.01.02
B3	TONGUE	54.20.42.29.20
B4	COVER	16.01.01.04
B5	THREADED BUSH	16.01.01.05
B6	FLANGE	16.01.01.06
B7	INSULATING COLLECTOR RING	16.01.01.07
B8	COLLECTOR RING	16.01.01.08
B9	INSULATING COLLECTOR RING	16.01.01.09
C1	SCRE	50.03.05.01.19
C2	SPACING WASHER	16.01.07.06

4.2) FILLER WIRE GROUP

ASSEMBLY DRAWING: 16.02.02.00
(STANDARD MOTORS)

<u>POS.</u>	<u>DESCRIPTION</u>	<u>P/N</u>
01	FRONT WIRE HOSE	16.02.00.01
02	WASHER	16.02.00.02
03	BEARING SUPPORT BELL	16.02.00.03
04	SPACER	16.02.00.04
06	BUSH	16.02.00.06
07	CAGE	16.02.00.07
08	SPOOL SUPPORT	16.02.00.08
09	BUSH FOR BEARING	16.02.00.09
10	FLANGE	16.02.00.10
11	STIRRUP	16.02.00.11
12	GEARED SPINDLE	16.02.00.12
13	GEARMOTOR SUPPORT	16.02.02.01
14	FILLER WIRE GEARMOTOR	16.02.00.14
15	WASHER	16.02.00.15
16	STIRRUP	16.02.00.16
17	REAR WIRE INLET	03.04.00.29
18	DOWEL	04.05.00.01
19	BUSH	04.05.00.02
20	DOWEL	04.05.00.03
21	WIRE FEEDING WHEEL (ø 0,6 - 0,8 mm)	04.05.00.04
22	WIRE FEEDING WHEEL (ø 0,6 - 0,8 mm)	04.05.00.05
23	FEMALE THREAD BOLT	04.05.00.06
24	SPACING WASHER	04.05.00.07
25	BOLT	04.05.00.08
26	WIRE FEEDING WHEEL (ø 0,9 - 1,2 mm)	04.05.00.09
27	WIRE FEEDING WHEEL (ø 0,9 - 1,2 mm)	04.05.00.10
28	STIRRUP	04.05.00.11
29	WIRE PUSH ASSY BODY	04.05.00.12
30	INSULATING BUSH	04.05.00.13
31	WIRE SHAFT WITH INSULATING BUSHING	04.05.00.14.00
	--- INSULATING BUSHING	04.05.00.14.02
	--- SHAFT	04.05.00.14.01
32	SHAFT SUPPORT	04.05.00.15
33	WIRE NOZZLE SUPPORT	04.05.00.16
34	SPOOL SHAFT	04.05.00.17.00
35	GEAR	04.05.00.20
36	MOTOR PIGNON	04.05.00.21.00
37	REAR WIRE HOSE	15.01.00.21
38	KNOB	04.05.00.27
39	NUT	04.05.00.28
40	SPRING	04.05.00.29
41	WASHER	04.05.00.30
42	CLUTCH DISC	04.05.00.31
43	CLUTCH	04.05.00.32
44	CUSH	04.05.00.33
45	WIRE EXIT NOZZLE	04.05.00.34
46	WIRE ENTRY NOZZLE	04.05.00.35
47	WIRE NOZZLE	04.05.00.36
48	BUSH	06.04.00.10
49	FEMALE PIN	15.01.00.15.04
50	SCREW	50.04.05.01.02

FILLER WIRE GROUP

ASSEMBLY DRAWING: 16.02.02.00
(STANDARD MOTORS)

<u>POS.</u>	<u>DESCRIPTION</u>	<u>P/N</u>
51	SCREW	50.04.05.01.03
52	SEEGER RING	53.01.15.22.31
53	SCREW	50.03.05.01.07
54	BALL BEARING	55.19.55.32.13
55	SCREW	50.04.05.01.17
56	SCREW	50.03.03.01.02
57	SCREW	50.03.05.01.17
58	PIN	52.60.00.10.22
59	SCREW	50.05.05.01.04
60	NUT	50.78.08.01.06
61	SCREW	50.03.03.01.03
62	PIN	52.60.00.10.14
63	BALL BEARING	55.19.55.32.69
64	BALL BEARING	55.19.55.32.55
65	GRUB SCREW	50.17.21.01.02
66	SCREW	50.03.05.01.03
67	RING	53.20.11.25.03
68	BALL BEARING	55.19.55.32.63
69	ROLLER CAGE	55.49.55.61.02
70	SCREW	50.01.03.01.02
71	SPRING	57.00.00.26.03
72	SCREW	50.03.05.01.10
73	MALE PIN	86.73.01.39.84
74	FEMALE PIN	86.73.01.39.85
75	SCREW	50.04.01.01.02
76	WASHER	51.25.27.01.03
99	COMPLETE WIRE THRUST GROUP	23.01.00.99

4.3) FILLER WIRE GROUP

ASSEMBLY DRAWING: 16.02.03.00
(TACHOFEEDBACK MOTORS)

<u>POS.</u>	<u>DESCRIPTION</u>	<u>P/N</u>
01	FRONT WIRE HOSE	16.02.00.01
02	WASHER	16.02.00.02
03	BEARING SUPPORT BELL	16.02.01.01
04	SPACER	16.02.00.04
06	BUSH	16.02.00.06
07	CAGE	16.02.01.02
08	SPOOL SUPPORT	16.02.01.03
09	BUSH FOR BEARING	16.02.00.09
10	FLANGE	16.02.01.04
11	STIRRUP	16.02.00.11
12	GEARED SPINDLE	16.02.01.05
13	GEARMOTOR SUPPORT	16.02.02.01
14	FILLER WIRE GEARMOTOR	16.02.01.07
15	WASHER	16.02.00.15
16	STIRRUP	16.02.00.16
17	REAR WIRE INLET	03.04.00.29
18	DOWEL	04.05.00.01
19	BUSH	04.05.00.02
20	DOWEL	04.05.00.03
21	WIRE FEEDING WHEEL (ø 0,6 - 0,8 mm)	04.05.00.04
22	WIRE FEEDING WHEEL (ø 0,6 - 0,8 mm)	04.05.00.05
23	FEMALE THREAD BOLT	04.05.00.06
24	SPACING WASHER	04.05.00.07
25	BOLT	04.05.00.08
26	WIRE FEEDING WHEEL (ø 0,9 - 1,2 mm)	04.05.00.09
27	WIRE FEEDING WHEEL (ø 0,9 - 1,2 mm)	04.05.00.10
28	STIRRUP	04.05.00.11
29	WIRE PUSH ASSY BODY	04.05.00.12
30	INSULATING BUSH	04.05.00.13
31	WIRE SHAFT WITH INSULATING BUSHING	04.05.00.14.00
	--- INSULATING BUSHING	04.05.00.14.02
	--- SHAFT	04.05.00.14.01
32	SHAFT SUPPORT	04.05.00.15
33	WIRE NOZZLE SUPPORT	04.05.00.16
34	SPOOL SHAFT	04.05.00.17.00
35	GEAR	04.05.00.20
36	MOTOR PIGNON	04.05.00.21.00
37	REAR WIRE HOSE	15.01.00.21
38	KNOB	04.05.00.27
39	NUT	04.05.00.28
40	SPRING	04.05.00.29
41	WASHER	04.05.00.30
42	CLUTCH DISC	04.05.00.31
43	CLUTCH	04.05.00.32
44	BUSH	04.05.00.33
45	WIRE EXIT NOZZLE	04.05.00.34
46	WIRE ENTRY NOZZLE	04.05.00.35
47	WIRE NOZZLE	04.05.00.36
48	BUSH	06.04.00.10
49	FEMALE PIN	15.01.00.15.04
50	SCREW	50.04.05.01.02

FILLER WIRE GROUP

ASSEMBLY DRAWING: 16.02.03.00
(TACHOFEEDBACK MOTORS)

<u>POS.</u>	<u>DESCRIPTION</u>	<u>P/N</u>
51	SCREW	50.04.05.01.03
52	SEEGER RING	53.01.15.22.31
53	SCREW	50.03.05.01.09
54	BALL BEARING	55.19.55.32.13
55	SCREW	50.04.05.01.17
56	SCREW	50.03.03.01.02
57	SCREW	50.03.05.01.17
58	PIN	52.60.00.10.22
59	SCREW	50.05.05.01.04
60	NUT	50.78.08.01.06
61	SCREW	50.03.03.01.03
62	PIN	52.60.00.10.14
63	BALL BEARING	55.19.55.32.69
64	BALL BEARING	55.19.55.32.55
65	GRUB SCREW	50.17.21.01.02
66	SCREW	50.03.05.01.03
67	RING	53.20.11.25.03
68	BALL BEARING	55.19.55.32.63
69	ROLLER CAGE	55.49.55.61.02
70	SCREW	50.01.03.01.02
71	SPRING	57.00.00.26.03
72	SCREW	50.03.05.01.10
73	MALE PIN	86.73.01.39.84
74	FEMALE PIN	86.73.01.39.85
75	SPACER	16.02.01.06
76	CAP	16.02.01.08
77	CLOSING BODY	16.02.01.09
78	RING	16.02.01.10
79	WASHER	51.25.27.01.03
80	SCREW	50.04.01.01.02
81-98	EMPTY LINES	
99	COMPLETE WIRE THRUST GROUP	23.01.00.99

4.4) FRONT BODY AND TORCH

ASSEMBLY DRAWING: 16.03.05.00

<u>POS.</u>	<u>DESCRIPTION</u>	<u>P/N</u>
01	TORCH SUPPORT	16.03.05.01.00
02	TORCH SUPPORT SLIDE	16.03.05.02
03	TORCH BODY	16.03.01.03.00
04	INSULATING PLATE	16.03.01.04
05	GEARMOTOR FLANGE	16.03.05.03
06	GEARMOTOR PINION	16.03.01.06.00
07	AVC-SLIDE	16.03.05.04
09	COLUMN BASIS	16.03.01.09.00
10	FLANGE	16.03.01.10
11	PLATE	16.03.01.11
12	SLIDE BODY	16.03.01.12.00
13	WATER HOSE	16.03.01.13
14	ROD	16.03.01.14
15	INSULATING BODY	16.03.01.15
16	SHAFT	16.03.05.05
17	PLATE	16.03.05.06
18	COVER	16.03.05.07
20	CAP	16.03.01.20
21	FILLER WIRE GUIDING HOSE	16.03.01.21
22	WATER RETURN HOSE	16.03.01.22.00
23	INSULATING HOSE	16.03.01.23
24	FALNGE	16.03.01.24
25	DISTRIBUTOR BLOCK	16.03.01.25.00
26	AVC-GEARMOTOR	16.03.01.27
27	GUIDE	16.03.01.28.00
28	BUSHING	16.03.01.29
30	FOOT	16.03.01.30
31	COVER	16.03.01.31
32	BUSHING	16.03.01.32
33	PROTECTION	16.03.01.33
34	SPINDLE VESSEL SHELL	16.03.01.34
35	LIMIT SWITCH	16.03.01.35
36	WATER OUT HOSE	16.03.01.36
37	GAS HOSE	16.03.01.37
38	BASIS MICROSWITCH	16.03.01.38
39	FOOT	16.03.01.39
40	TORCH GASKET	03.06.00.16
41	SCREW	03.06.00.31
43	GAS LENS	04.06.00.10
44	TORCH GASKET	04.06.00.15
45	SCREW SHAFT	04.06.00.17.00
46	SCREW	04.06.00.18
47	FEMALE PIN HOLDER	06.05.00.21
48	MALE PIN HOLDER	06.05.00.22
49	WRENCH NUT	06.06.00.02
50	KEY	54.20.42.29.14
51	SCREW	50.01.01.01.03
52	CERAMIC NOZLLE FOR GAS LENS	64.20.03.39.10

FRONT BODY AND TORCH

ASSEMBLY DRAWING: 16.03.05.00

<u>POS.</u>	<u>DESCRIPTION</u>	<u>P/N</u>
54	WASHER	51.25.27.01.10
55	SCREW	50.03.03.01.03
56	SCREW	50.03.05.01.19
57	RING	53.40.39.22.03
58	SCREW	50.05.05.01.03
59	GRUB SCREW	50.18.21.01.07
60	SCREW	50.03.01.01.03
61	SCREW	50.03.05.01.03
62	SCREW	50.03.05.01.09
63	WASHER	51.25.27.01.09
64	NUT	50.76.08.01.06
65	ELECTRODE	64.20.01.39.03
66	CERAMIC NOZZLE	64.20.03.39.08
67	GAS DIFFUSOR	64.20.04.39.05
68	ELECTRODE COLLET	64.20.02.39.11
69	SCREW	50.04.01.01.02
70	O-RING	56.40.00.40.02
71	SCREW	50.04.05.01.02
72	SCREW	50.02.03.01.03
73	SCREW	50.03.05.01.02
74	SCREW	50.03.03.01.05
75	FEMALE PIN	86.73.03.39.85
76	MALE PIN	86.73.03.39.84
77	WASHER	51.25.27.01.03
78	SCREW	50.04.05.01.23
79	SCREW	50.02.01.01.04
80	DIODE	85.72.01.39.14
81	MICROSWITCH	62.25.01.39.06
82	SCREW	50.01.01.01.04
83	GRUB SCREW	50.17.21.01.02
84	SCREW	50.03.05.01.17
85	WASHER	51.25.27.01.01
86	SCREW	50.01.01.01.02
87	SLIDE SCREW	16.03.01.40
88	WASHER	16.03.01.41
90	FOOT SPACING	16.03.01.42
91	FRONT RING	16.03.01.43
92	INSULATING BUSH	16.03.01.44
95	GEARMOTOR SUPPORT	16.03.01.47
96	FRONT RING	16.03.01.48
97	CAGE	16.03.01.49
98	SUPPORT RING	16.03.01.50
99	WIRE NOZZLE	16.03.01.51

FRONT BODY AND TORCH

ASSEMBLY DRAWING: 16.03.05.00

<u>POS.</u>	<u>DESCRIPTION</u>	<u>P/N</u>
A1	BALL BUSHING	55.32.55.32.12
A2	COVER	16.03.05.08
A3	INSULATING BUSH	04.05.00.13
A4	WIRE SHAFT COMPLETE	04.05.00.14.00
	-- SHAFT	04.05.00.14.01
	-- INSULATING BUSH	04.05.00.14.02
A5	SHAFT SUPPORT	04.05.00.15
A6	WIRE NOZZLE SUPPORT	04.05.00.16
A7	SCREW	50.04.05.01.03
A8	FOOT	04.09.00.01
A9	FOOT SUPPORT	04.09.00.03
B1	NUT	50.76.08.01.05
B2	WASHER	51.25.27.01.05
B3	WASHER	51.50.01.01.02
B4	NUT	50.76.08.01.04
B5	WIRE NOZZLE	16.03.01.54
B6	SCREW	50.01.01.01.17
B7	SIDE PLATE	16.03.05.09

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5) GENERAL SAFETY RULES

These rules apply to AC and DC welding generators, AC transformers, AC/DC welding machines and DC transformer welding rectifiers.

In arc welding operations, where electrically charged parts are exposed, the following rules should be observed to assure maximum safety and protection to operator and surroundings.

Failure to observe these safety precautions may expose, not only the operator himself, but also fellow workers, to serious injuries. Once these rules are studied and well kept in mind, proceed, in any case with maximum care.

Welding Cables: DO NOT overload cables.

DO NOT use welding cables at excessive current rates compared to their capacity. It will cause overheating and rapid deterioration of their insulation. It is certainly uneconomical.

DO NOT use worn-out or poorly connected cables.

INSPECT cables frequently. Repair immediately all breaks in insulation with rubber and friction tapes. Tighten and adequately insulate all cable connections. It is dangerous when exposed sections of cable come in contact with grounded metallic objects causing an arc. Unprotected eyes may be injured and fire may result if combustible materials such as oil or grease are in the vicinity.

Binding Code: Welding machines must be installed and maintained in accordance with the local National Electric Code.

Polarity Switch: DO NOT operate the polarity switch under load.

The polarity switch, when supplied, is provided for changing the electrode lead mutually from positive to negative. Operate this switch only while the machine is not in use and the welding circuit is open. Potential dangers of opening the circuit while charged with current are the following:

- An arc could form between contact surfaces of the switch.
- The person using the switch may receive a severe burn from this arc.

Ground Power Circuit: DO NOT use welding machine without grounding frame of case.

GROUND every power circuit to prevent accidental shock by stray current.

DO NOT ground to pipelines carrying gas or inflammable liquids and lines carrying electrical conductors.

BE SURE that conductors can safely carry the ground current.

Welding Operations: NEVER weld pieces without cleaning or inerting materials which, when heated, give off inflammable or toxic vapors.

USE steam to clean superficial material.

USE a strong cleaning solution to clean out heavy oils or grease.

BE SURE to remove any residues of inflammable gas or liquid.

NEVER use oxygen to ventilate the welding piece.

CAUTION when cleaning with steam or caustic soda.

WEAR goggles and gloves.

DO NOT clean where there is poor ventilation.

Ventilation is necessary to divert harmful or explosive vapors.

DO NOT clean in the presence of open flames or arc.

USE a wet tool to avoid sparks, when scaring or hammering to remove heavy sludge or scale.

KEEP head and arms distant from work as possible.

Explosion Hazards: NEVER weld in or near explosive atmospheres.
Such atmospheres can be created by inflammable gas leaks or by vapors from inflammable liquids or by combustible dusts.

Ventilation: DO NOT weld in enclosed spaces without adequate ventilation.

When welding in enclosed spaces always provide adequate ventilation with fans, air pipes, etc.

NEVER use compressed oxygen.

Heat and fumes from welding could cause severe discomfort or serious illnesses.

When toxic fumes from lead or cadmium content materials or any other substances are present in proportions that could be harmful always use a gas mask.

Solvents: DO NOT weld in the presence of even a small amount of vapor from solvents such as perchloroethylene or trichloroethylene.

Ultraviolet light from the electric arc can decompose the vapors forming phosgene, a poisonous gas.

Fire Hazards: DO NOT weld near inflammable or combustible materials.

Fire can be caused by the arc, on contact with heated metal, by slag or sparks.

KEEP combustibles at least 10 m from the arc, on the contrary they should be suitably protected by a flame-proof shielded.

Dangers of Electric Shock: OPEN power circuits before checking machines.

DO NOT touch electrically heated parts.

NEVER touch any exposed or insulated part of the cables, cable connectors, electrodes, etc. to avoid harmful or fatal electric shock or burns.

NEVER work in a damp area without suitable insulation.

KEEP hands, feet and clothing dry at all times.

Salt in perspiration or sea water dangerously lowers contact resistances.

Face Protection: DO NOT use cracked or defective helmets or shields.

KEEP helmet and hand and face shield in good condition.

If cracks occur in fibred material, replace shield, since leakage of arc rays may cause serious burns.

Eye Protection: DO NOT under any circumstances, view an electric arc without eye protection.

MAKE sure that flash goggles are used under the welding helmet at all times.

In some types of arc welding, such as TIG welding, ultra-violet and infrared radiation from the arc is particularly intense and requires constant attention to avoid arc flashes reaching welder or other exposed persons.

NEVER use cracked, ill-fitting or defective filter plates.

Eye burns from the arc, though not generally permanent injuries, are exceedingly painful.

Such burns, frequently referred to as flashes, feel like hot sand in the eye.

For eye burns, consult your first aid station or doctor.

Clothing: DO NOT use inadequate or worn-out clothing.

Proper and dry, oil-free clothing is essential for welders protection.

Clothing must not only keep off sparks and molten particles, but must also obstruct the rays from the arc.

They must insulate the body from harmful electric currents.

Wear leather or asbestos gloves at all times to protect hand and wrists.

Dark coloured shirts are preferred to light ones since arc rays readily penetrate light-coloured fabrics.

In case of gas-shielded arc welding, light colours are more reflective and may cause eye burns due to intense ultra-violet rays given off by the process.

Avoid cotton fabrics with gas shielded arc welding.

Hot Metals Burns: DO NOT touch hot metals.

DO NOT touch pieces of metal which have just been welded or heated.

DO NOT substitute electrodes or centering cartridges immediately after welding.