

**I.T.S. by Tecnodue**

**PT 160**

**Edition 1208**

**Operating Manual**

The technical data and information contained on this manual can be changed without any notice

# PT 160

The machine has been designed and constructed for the welding of PE, PP, PVDF and other thermoplastics pipes and fittings.

## I.T.S. Ital Trade Services S.r.l.

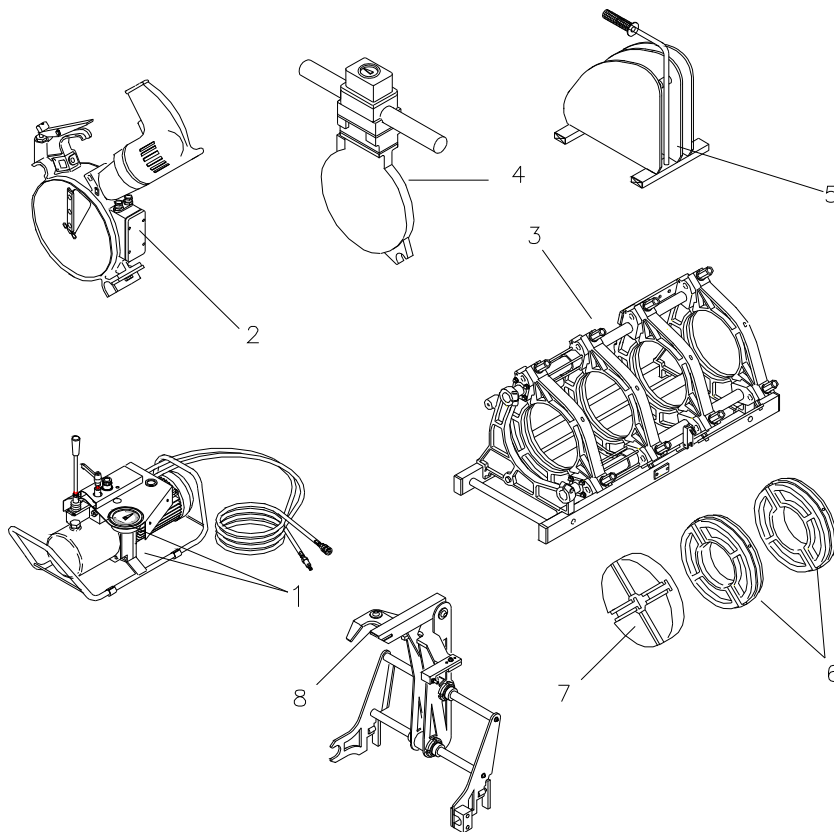
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### **Standard Components**

1. Hydraulic Unit
2. Facing Tool
3. Basic machine
4. Heating Mirror
5. Support for facing tool and heating mirror

### **On request can be supplied:**

6. Light weight alloy reducing rings for pipes and fittings d. 40,50,63,50,75,90,110,125,140mm
7. Stub End Device
8. MDD (PT automatic mirror device)
  - Short spigot fittings clamp d. 160mm
  - Wooden transport box according to ISPM 15
  - LDU (printing and storing data machine)
  - Electric board with automatic circuit breaker
  - Rollers

# SAFETY RULES ACCORDING TO DIRECTIVES CEE

( To be read carefully and apply while utilizing the PT 160 )

Due to the specific use, this machine cannot be supplied with all kind of fix and removable protections suitable to avoid any risk of accident. The machine, therefore, must be utilized, adjusted and keep in the perfect functioning conditions by skill operators.

## Warning - Rules – Obligations

The use of machines composed by electrical components and movable parts, it's always a potential danger. In order to avoid any kind of accident caused by electrical or mechanical sources it' strongly suggested to read and follow carefully the following safety rules before operating the machine.

### TRANSPORT

-Basic Machine , Keep the maximum care while moving and it's suggested to utilize mechanical aids.

-Facing Tool ,supplied with transport's hook.

Keep the maximum care while moving it and it's compulsory to utilize the handle also take care about the blades mounted in, it's compulsory use gloves.

-Heating Mirror ,supplied with transport's handles

Keep the maximum care while moving it also keep the maximum care while utilizing it due to the high temperature involved always more than 200°C , it's strongly suggested to use suitable gloves.

In order to move from one working place to the other , the facing tool and the mirror must located into the special support , this support is heavy therefore it's necessary to utilize the maximum care to move it

-Hydraulic unit, supplied with transport's frame.

Keep the maximum care while moving it and in case utilize two person.

Avoid to transport the components by holding from the cable and remember to use suitable gloves.

### ELECTRIC CONNECTIONS

The machine is operated by 230 Volts therefore be sure that the power supply plug is supplied with the safety devices according to the standard requirements , also check that the power supply will be on the range of maximum 10% of the machine's nominal tension.

While the facing tool is connected to the power supply do not leave it into the basic machine but place it into the special support. In this position, even if the start bottom is pushed the engine does not start.

Check regularly the cables and the plug and in case substitute by qualify personnel.

In case the heating mirror cable must be substitute the cable must be H07RN-F

Before carry out a reparation or maintenance all the plugs must with plug out from the power supply

### ENVIRONMENTAL CONDITIONS

The working area must be clean and duly lighted. It's very dangerous to utilize the machine in case of rain or in wheat conditions or close to flammable agents.

### CLOTHES

Keep the maximum care while utilizing the machine due to the high temperature involved on the heating mirror always more than 200°C , it's strongly suggested to use suitable gloves. Avoid long clothes and avoid bracelets , necklaces that might be hooked into the machine.

### CORRECT MACHINE'S OPERATION

Remember to check and read carefully the operating manual before utilizing the machine and the accessories.

### KEEP ALWAYS THE MAXIMUN ATTENTION

After the heating mirror has been disconnected temperature will be hot for some minutes.

Keep the maximum care while utilizing the facing tool. Be careful to the blades , it's strongly suggested to use suitable gloves. During the facing operation ( facing tool in movement ) it's forbidden to take out the shavings

Avoid utilizing the machine after drinking or drugs use

Take care that all the people around the machine are at safety distance

While starting operating take care to avoid leave arms between the movable and fix trolleys.

### SQUASHING DANGER

While starting operating take care to avoid leave legs or arms between the movable and fix trolleys. It's compulsory to be far from the basic machine

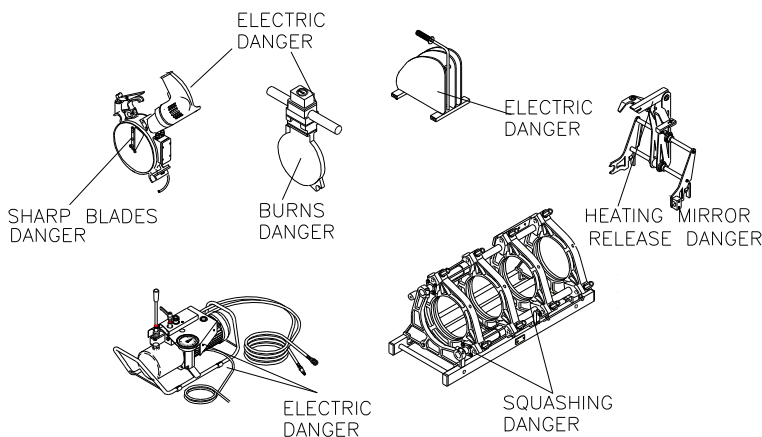
### ACOUSTIC POLLUTION

The acoustic pollution of the drill engine is less than 85 dB ( value measured at 1 meter distance from the operator)

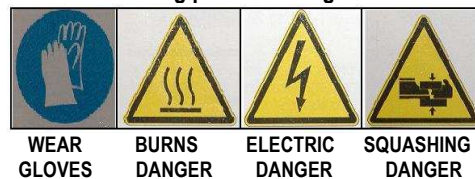
Due to some particular cases such as too much pressure during the facing the noise should be increased , therefore it's suggested to utilize some protections.

### IMPORTANT !!!!

Keep the maximum care reading and following the above Warning - Rules - Obligations the Ital Trade Services S.r.l. decline all responsibilities if are not followed totally



Label on machine's components showing potential dangers



# 1. Technical data

<b>Operating data</b>	
Ambient temperature	0...50°C
Humidity (without condensation)	95 RH%
Transport and storing Temperature	-10...60°C
<b>Electrical data</b>	
Voltage	230 V
Frequency	50 Hz
Total power installed	2.40 KW 10.4 A
Heating mirror	IP 54 1.0 KW
Facing tool	IP 20 0.8 KW
Hydraulic unit	IP 44 0.6 KW
<b>Hydraulic data</b>	
Maximum working pressure	100 bar
Cylinder's section	4,32 cm <sup>2</sup>
Pressure gauge	0 - 100 bar
Pressure gauge precision class	Cl. 1.0
Hydraulic unit engine revolutions	1400 rpm
Volumetric pump's capacity	1,2 cc/rev.
Pump's capacity	1.68 l/min
Hydraulic oil	ISO 46
Oil tank's capacity	1.5 liter
<b>Mechanical Data</b>	
Facing tool transmission system	Gear drive
Trolley maximum stroke	145 mm
Trolley slide bar diameter	25 mm
Distance between the cylinders centre	270 mm
<b>Dimensions</b>	
Basic machine	915 x 465 x 455 mm
Facing tool	520 x 400 x 80 mm
Heating mirror	415 x 350 x 65 mm
Hydraulic unit	445 x 320 x 270 mm
Support for facing tool and heating mirror	380 x 430 x 450 mm
<b>Weights</b>	
Basic machine	35 Kg
Facing tool	11 Kg
Heating mirror	5 Kg
Hydraulic unit	26 Kg
Support for facing tool and heating mirror	7 Kg
Wooden transport box	47 Kg
Stub end device	3.5 Kg
Reducing inserts complete set	26.5 Kg

## 2. General description and application field

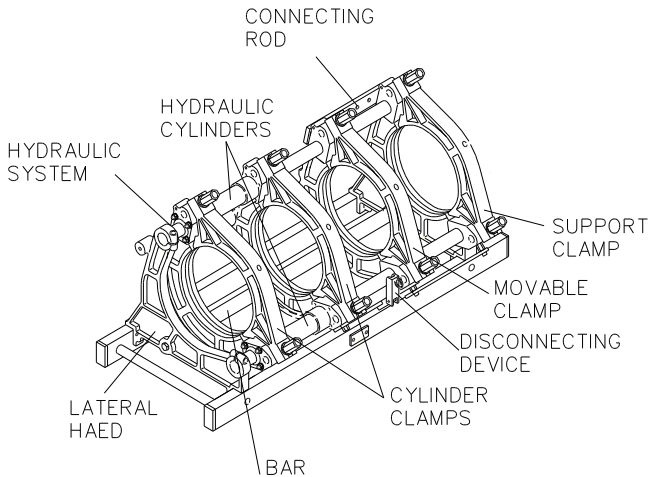
Hydraulic operated butt welding machines suitable for PE,PP,PVDF and other thermoplastics pipes and fittings.

The self aligning frame and the compact dimensions make the machines highly suited for working in road constructions, ditches , aqueducts, gas ducts , sewers and irrigation systems.

The machine is supplied complete of:

- 1) Basic machine d. 160 mm complete with a tools blue bag
- 2) Removable electric facing tool with safety switch
- 3) Removable PTFE coated heating mirror with a temperature control box.
- 4) Electro-hydraulic motor with accumulator and flexible hoses with quick couplings.
- 5) Support for facing tool and heating mirror

### 2.1 Basic machine



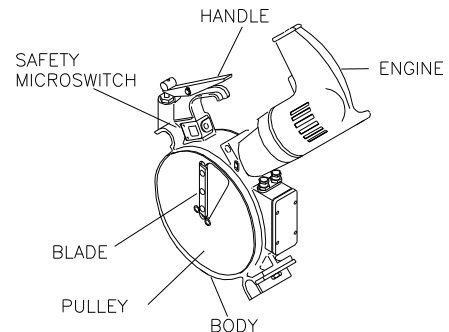
The basic machine is composed by:

- Two cylinders on which heads are mounted two complete clamps d. 160 mm
- One movable clamp d.160 mm sliding on cylinder's stem and fixable in different positions by means of using the clamps connecting rods.
- A stiffening bar
- One side support clamp d.160 mm (PT 160)
- A frame including the hydraulic circuit with the anti-drop quick couplings.
- A heating mirror disconnecting device

### 2.2 Facing Tool

The electric facing tool is composed by:

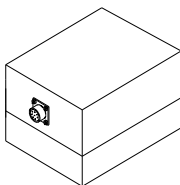
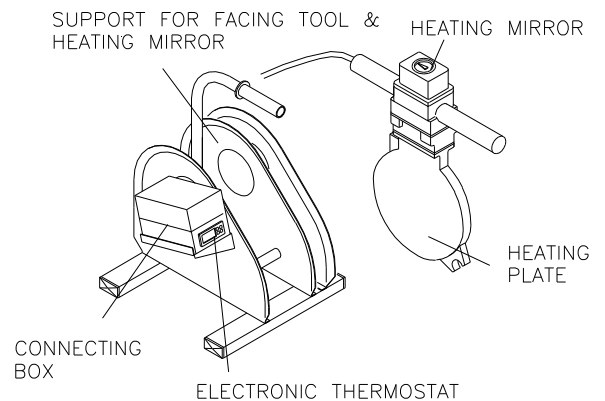
- The facing tool body
- Two disks where are mounted the blades
- A drill engine supplied with a safety pin that, while connected keep the facing tool hooked to the machine.
- An handle with safety micro-switch allowing the engine starts only when the facing tool is fit into the machine, avoiding the start of the engine out of this position.



### 2.3 Heating Mirror

The heating mirror is composed by:

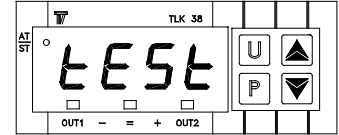
- The heating mirror coated with green color PTFE complete with thermometer (the thermometer does not depend upon the power supply and always survey the real temperature of the heating plate) and connecting box
- The support suitable for the heating mirror and the facing tool where is located the connecting box
- The electronic thermostat located on the connecting box .
- LDU connector. (The below figure shows where the LDU connector is located ).



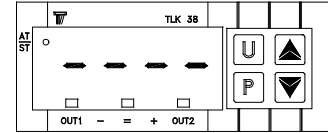
LDU Connector

### 2.3.1 Electronic thermostat – different functions

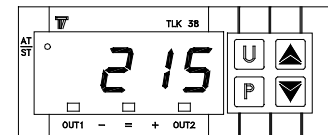
At each startup on the display will blink the writing 'TEST'. This means that the thermostat is testing the connection between the probe and the heating mirror.



If the test fails, the display will show 4 blinking upper scores (as per figure aside), in this case the probe or the connection between the thermostat and the heating mirror could be interrupted.



If the test success, the display will show the **real temperature of the heating mirror** and the heating mirror warms up (the OUT1 red led is switched on) until the set point value (the selected temperature) has been achieved (central green light led).



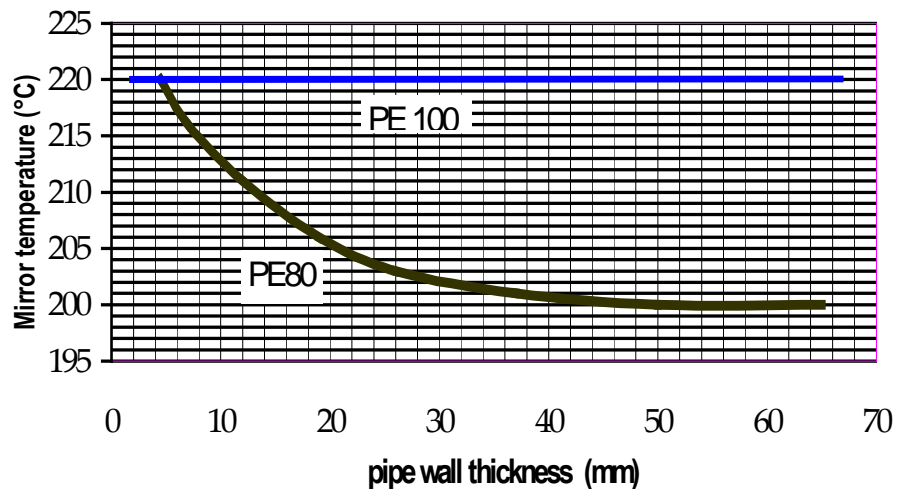
To display the actual set point value of the temperature stored by the thermostat, push the key P. The display will show alternately the writing 'SP1' and the set point value of the temperature. After 5 seconds the display will show again the real value of the heating mirror temperature

To select a new value for the thermostat set point value (default value = 220°C):

1. Push the key P (The display will show alternately the writing 'SP1' and the set point value of the temperature)
2. By acting on the arrow keys UP and DOWN it is possible to increase or decrease the set point value.
3. When you reach the desired value push the key P to confirm.
4. The display will show again the real value of the heating mirror temperature
5. When the heating mirror will reach the set point value on the display the central green light led will be switched on.

**Warning: On the thermostat display is always shown the actual value of the heating mirror temperature (and never the set point value!)**

Temperature of the welding mirror for welding PE DVS 2207-1 norm



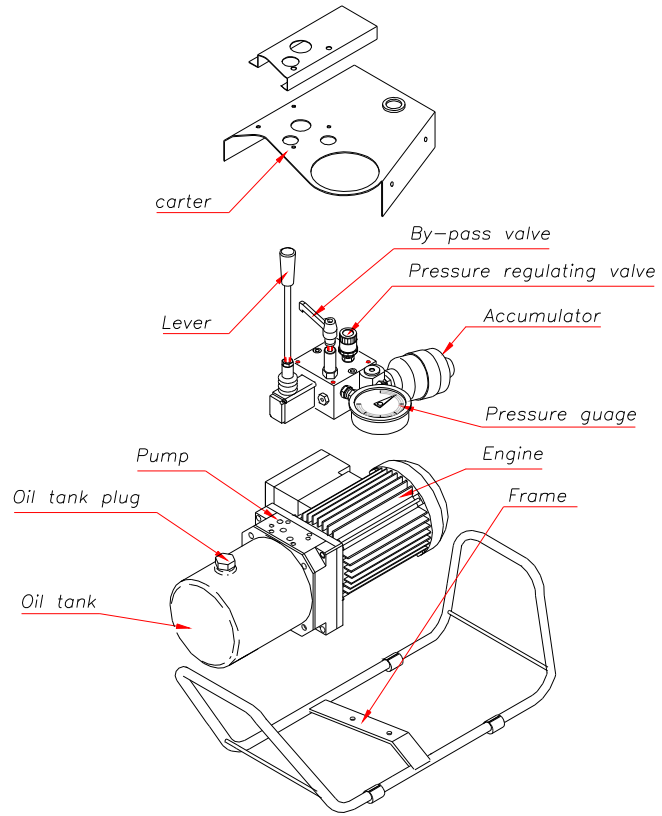
**Remember**

When welding PVDF, the temperature of the welding mirror should be adjusted for every wall thickness at 240°C +/- 8°C  
 When welding PP, the temperature of the welding mirror should be adjusted for every wall thickness at 210°C +/- 10°C

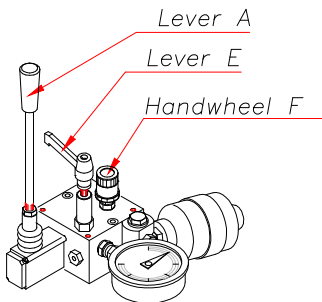
## 2.4 Hydraulic Unit

The basic components of the hydraulic unit are the following:

- Electric engine
- Hydraulic pump
- Oil tank
- Hydraulic unit controls
- Pressure accumulator
- Pressure gauge
- Metal frame



### 2.4.1 Hydraulic Unit Controls

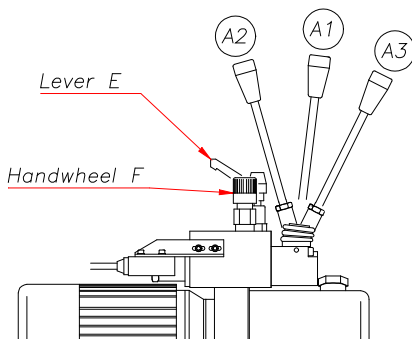


The control lever **A** open and close the machine's trolley according to the position selected.

Bring the lever **A** into position **A2** (position with automatic return) the trolley is opening with the maximum pressure set up into the hydraulic unit

In position **A1** the lever shut down automatically the engine ( release position ).

Bring the lever **A** into the position **A3** ( position with hooking) the trolley is closing, the hooking of such position allow the operator handling.



The hand wheel **F** of the pressure control allow the setting up of the pressure at the requested values by turning anti clockwise the pressure release , while turning clockwise the pressure increase .

The pressure by pass lever **E** allow ,by turning anti clockwise the pressure releasing , while turning clockwise allow the pressure increasing by means of using the hand wheel **F** and fixing. If you completely clockwise turn the by pass valve, the pressure will be blocked and the hydraulic unit will maintain the same pressure in case of engine switched off.



## 2.4.2 How to use the hydraulic unit

### Operating Instructions

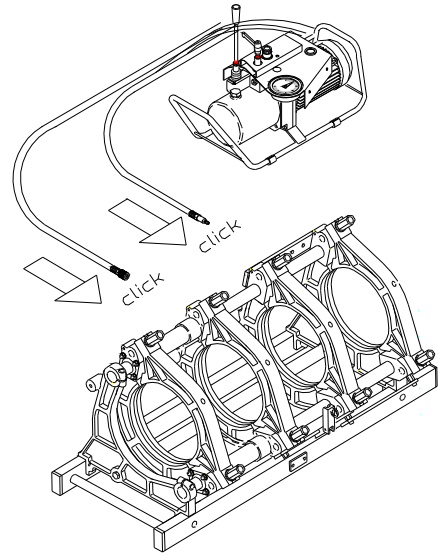
In order to make easy the learning we shall proceed to the description step by step of all operations need in order to complete a welding according to the following description:

#### Important !

Before begin the following operation be sure that:

- The lever **A** is fixed into the special housing
- Substitute the metal plug with the plastic black and red plug the plastic plug is supplied with the machine into a plastic bag.

01. Fit the two pipes to be weld ( see relative instructions )
02. By turning the lever **E** anticlockwise bring the pressure to zero, checking the pressure gauge **D**
03. Turn clockwise the lever **E** until closing ( please avoid using an excessive strength )
04. Bring the lever **A** into position **A3**
05. By turning clockwise the hand wheel **F** achieve the inertial pressure value ( value of pressure need in order to allow the trolley moving ) note the value of inertial pressure read into the pressure gauge **D**, then by still operating the hand wheel **F** , increase the inertial pressure value by the welding theoretical pressure value as per attached table.
06. Achieved the true welding pressure value ( inertial pressure plus theoretical welding pressure ) bring the lever **A** into position **A2**.
07. Fit the facing tool (see relative instructions )
08. By acting on lever **E** anticlockwise achieve a pressure value of approx 5 bar more than the inertial pressure value checked and then proceed to the facing tool operation (taking care that the engine's overloading).
09. At the end of the facing operation bring the lever **A** into position **A3** and remove the facing tool.
10. Fit the heating mirror taking care that the temperature of the surfaces is the one selected (see relative instructions)
11. Bring the lever **A** into **A3** in order to have the bead formation as per attached table, this operation must be done with the true welding pressure value.
12. After bead formation act on lever **E** anticlockwise in order to bring the pressure to zero and proceed to the heating time as per attached table.
13. Elapsed the heating time at pressure zero bring the lever **A** into position **A2** and remove the heating mirror and immediately bring the lever **A** into position **A3** and acting on lever **E** clockwise put in contact the two pipes until achieving the true welding pressure value by checking the pressure gauge **D**. These operations must be done according to the time indicated into the attached table.
14. Bring the lever **A** into position **A1** and keep such situation for all the cooling time indicated into the attached table, taking care that the pressure will not decrease too much, in case bring for a little while the lever **A** into position **A3** and put back into position **A1**
15. Elapsed the cooling time by acting on lever **E** anticlockwise bring the pressure to zero.
16. Take away the pipes welded



**WE STRONGLY SUGGEST TO TRY MANY TIMES AND GET FAMILIAR TO THE UNIT BEFORE CARRYING ON WITH COMPLETE WELDING. A WRONG USE OF THE HYDRAULIC UNIT COULD COMPROMISE YOUR WELDINGS..**

### 3. Heating mirror disconnecting device

You can configure the machine according to the kind of welding to be executed as per the following different ways:

- Two fixed clamps and two moveable clamps Fig. 1
- One fixed clamp and three moveable clamps Fig. 2

You can change from a configuration to another in a quick way by simply acting on the two spacers and on the disconnecting device.

In the first configuration of the machine the disconnecting devices is between the two moveable clamps and the two fixed clamps.

The spacers are between the two fixed clamps.

In the second configuration of the machine the disconnecting devices is between the three moveable clamps and the fixed clamp.

The spacers are between the second and third moveable clamps.

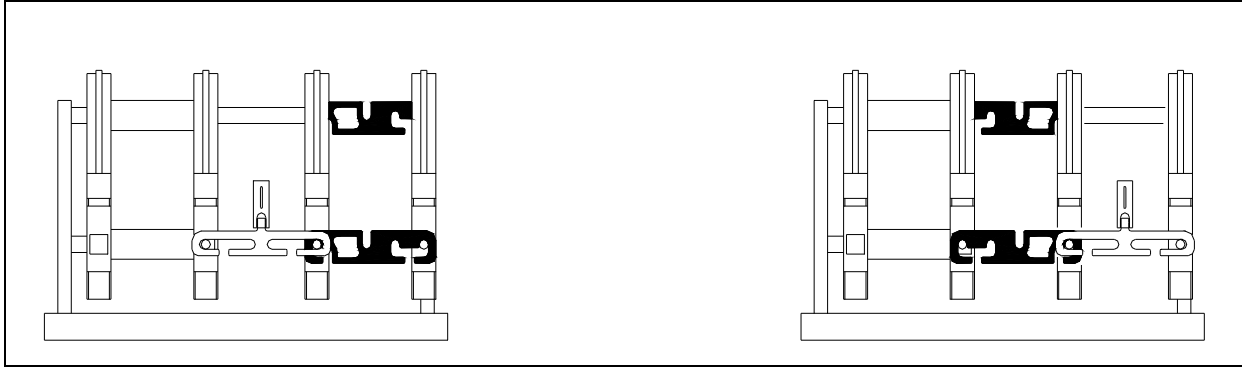


Figure 1. Configuration 2 moveable clamps + 2 fixed clamps

Figure 2. Configuration 3 moveable clamps + 1 fixed clamp

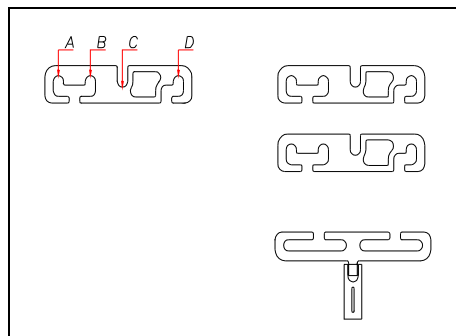


Figure 3.

**On the left:** The special shape of the spacers let a quick configuration of the machine.

You can easily change the spacer position without using any kind of tool.

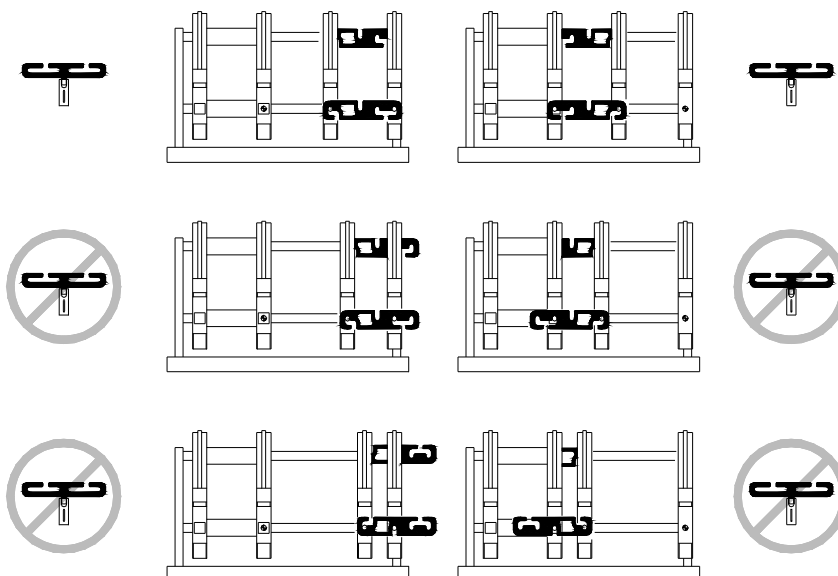
You can modify the distance between the clamps connected by the spacers.

Fix the first clamp to the hole D and the second clamp in one of the holes A,B,C

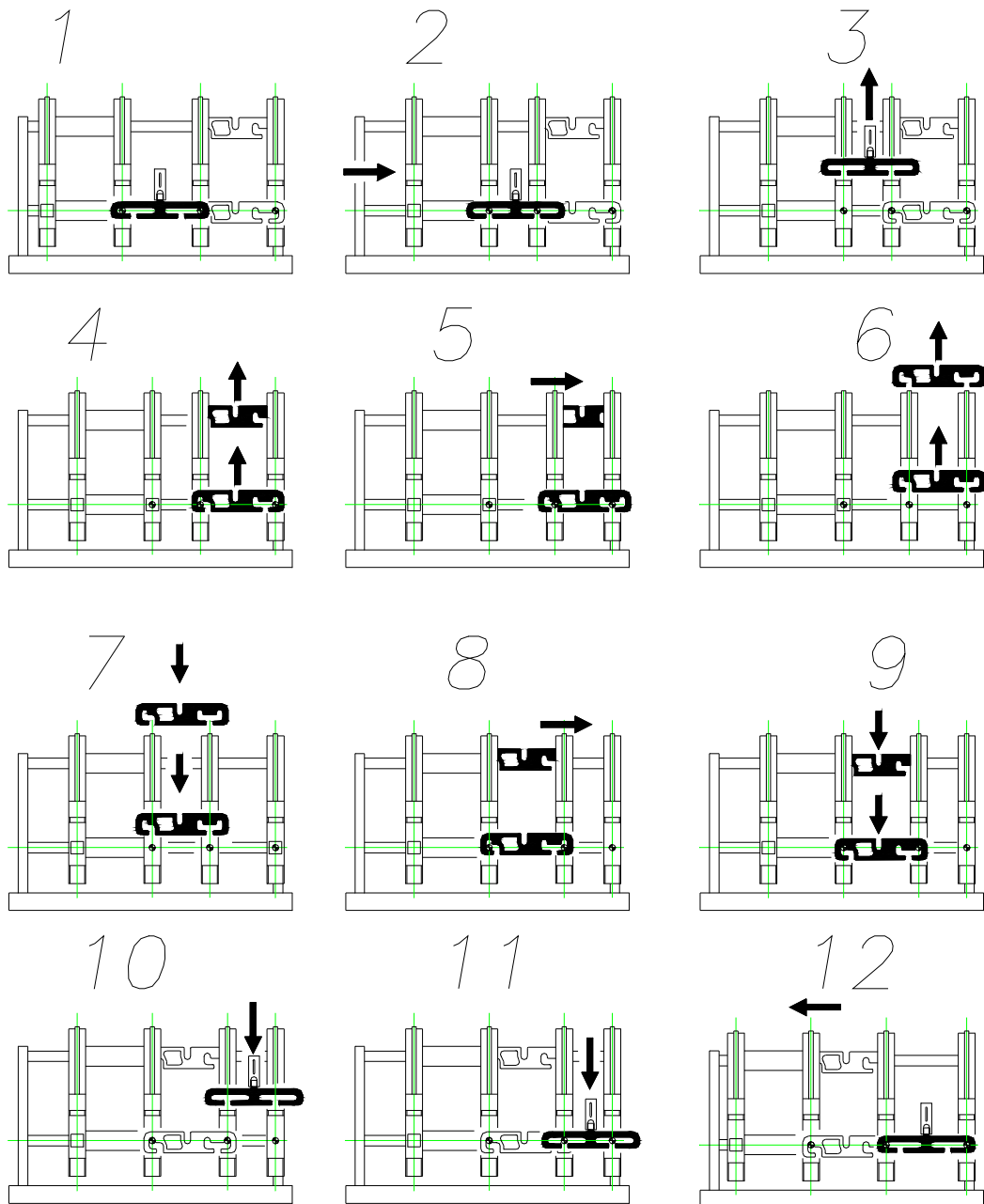
**On the right (from above)** Upper and lower spacer (interchangeable) and disconnecting device

#### WARNING !

Only in two configurations you can use the disconnecting device with spacer! In the other configuration use only the spacer to avoid serious damages to the basic machine!



How to change the configuration from two fixed clamps and two sliding clamps into one fixed clamp and three sliding clamps



### WARNING!

You can only place the upper and lower spacers in the same clamps and using the same holes. It is strictly forbidden to put the spacer in different clamps and in different holes.

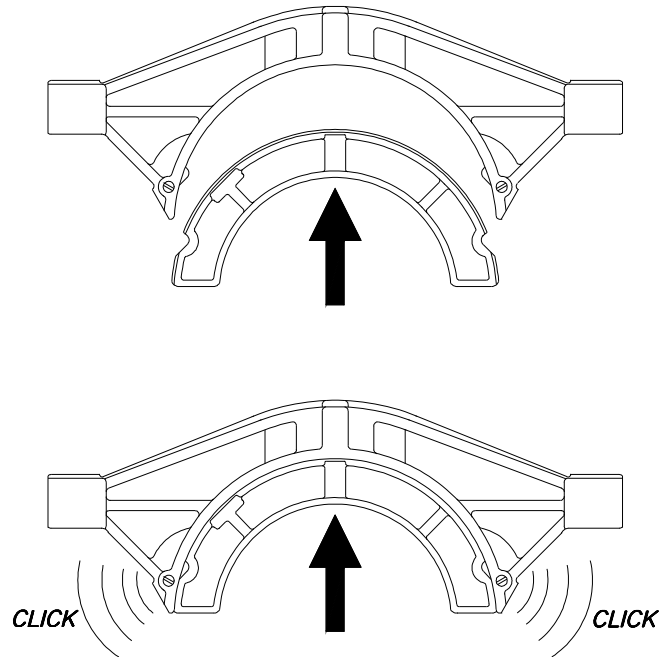
1. Configuration 2 moveable clamps + 2 fixed clamps
2. Not completely close the trolleys
3. Remove the heating mirror disconnecting device
4. Lift the spacers as shown in the figure above
5. By using your hands translate the third clamps as in the figure above
6. Remove the spacers
7. Place the spacers between the two central clamps
8. By using your hands translate the moveable clamps until the clamp reaches the limit stop.
9. Fix the spacers by pushing them down
10. Place the heating mirror disconnecting device
11. To fix the heating mirror disconnecting device open the trolleys
12. Configuration 3 moveable clamps + 1 fixed clamp

To configure the again the machine with 2 moveable clamps you must repeat the procedure above in a reverse sense.

### 3.1 Beep-beep inserts reductions

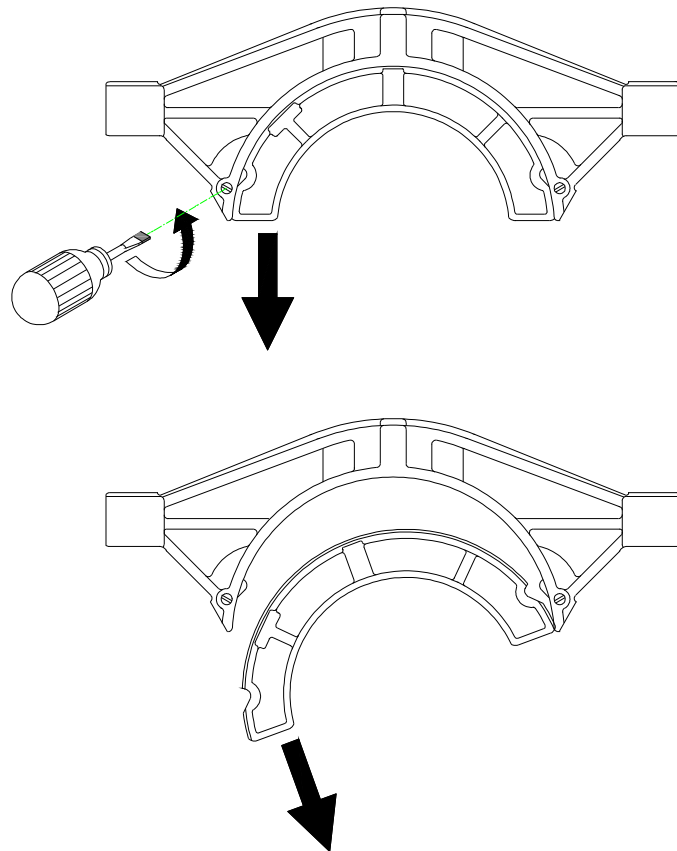
#### To use a beep-beep insert reduction

To use a beep-beep reduction, fix it by lightly pushing the reduction in the direction shown as per figure aside. As you hear a 'click' sound the reduction is properly fixed.



#### To remove the beep-beep reduction

To safely remove the beep-beep reduction by means of a screwdriver turn to left the screw shown in the figure aside. As soon as the reduction is not anymore hooked to the clamp you can remove it.

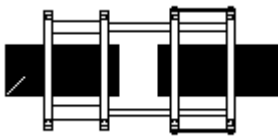


## 4. Butt welding in brief

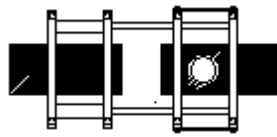
### 4.1 Introduction

Stated that the basic machine it's suitable for all kinds of pipe, fittings and stub end available on the nowadays market. Here follows all the different welding configurations of the machine:

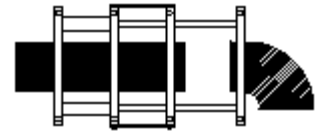
- 1) Pipe with Pipe, standard configuration of the machine
- 2) Pipe with long spigot fitting, standard configuration of the machine
- 3) Pipe with short spigot fitting, to achieve this kind of welding it is strongly suggested to configure the machine with three moveable clamps and 1 fixed clamp. Furthermore you must use the upper fittings clamp to fix better the fittings to the fixed clamp
- 4) Fitting with short spigot stub end, to achieve this kind of welding it is strongly suggested to configure the machine with three moveable clamps and 1 fixed clamp. To fix the stub end you must use a special accessory called stub end device. Place the 4 brackets at the appropriate size punched on the stub end device. Fix the stub end by tighten the bolt of each bracket. The stub end device is supplied with a fixing ring and you can install it on each clamp of the machine.
- 5) Pipe with short spigot stub end, to achieve this kind of welding you can use two different configuration of the machine (5 or 6)
- 6) Pipe with short spigot stub end, to achieve this kind of welding you can use two different configuration of the machine (5 or 6)



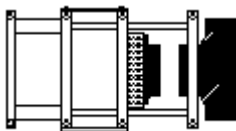
1. PIPE WITH PIPE



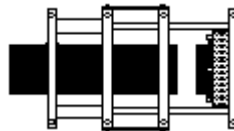
2. PIPE WITH LONG SPIGOT FITTING



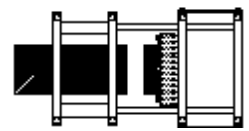
3. PIPE WITH SHORT SPIGOT FITTING



4. FITTING WITH SHORT SPIGOT STUB END



5. PIPE WITH SHORT SPIGOT STUB END

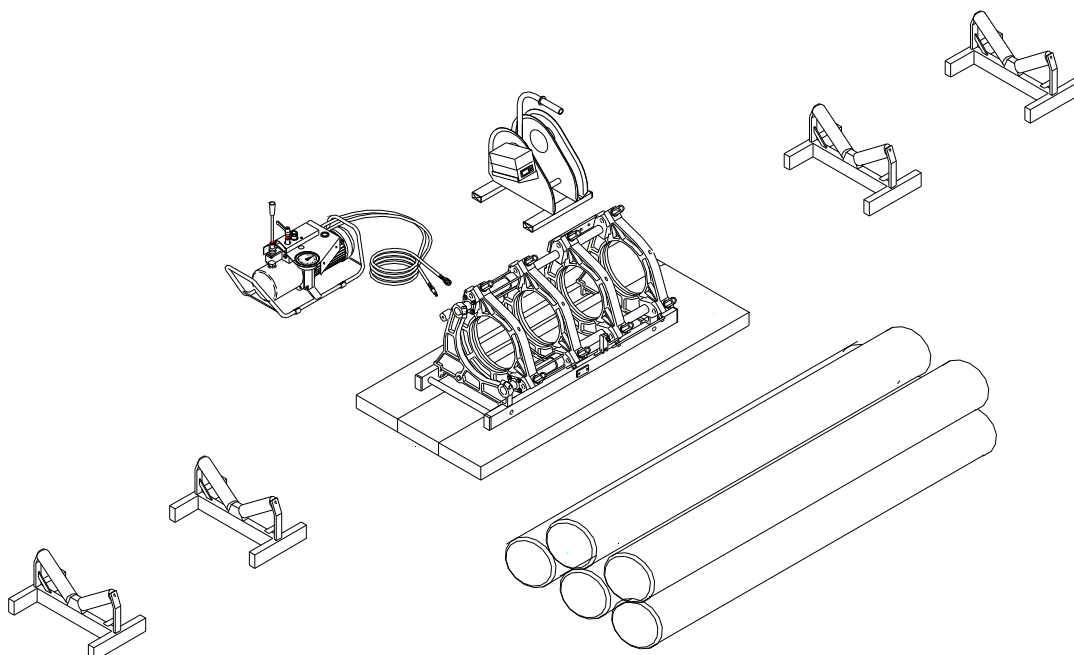


6. PIPE WITH SHORT SPIGOT STUB END

### 4.2 Machine's preparation

It's strongly suggested to use pipe rollers for the sliding of the pipes to be welded and if it's possible positioning the machine with wooden table below, such cares will avoid additional efforts to the machine.

- a) Set up the working area so that welding is protected from the weather. Position the machine's components as per following figure and eventually utilize wooden panels

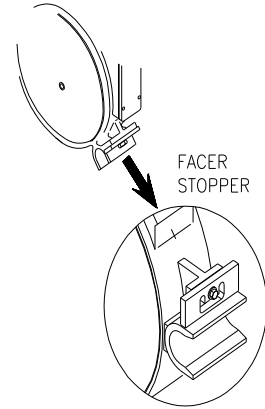


- b) Connect the flexible hoses of the hydraulic unit to the machine

- c) Connect the plugs to the power supply (Hydraulic unit, Facing tool and Heating mirror) after checking that the main power supply is within a 10% of the specified one “ **Warning Heating Mirror start to warm up !** “
- d) Select the correct temperature on the heating mirror
- e) In case fit the inserts of the diameter to be welded into the machine

### 4.3 Pipes positioning into the machine and facing operation

- a) Open the movable trolley of the machine by means of acting the lever **A (hyd. Unit)** and take it in position **A2**
- b) Position the pipes into the machine taking care to leave enough space for the facing tool inserting
- c) Check the pipes alignment, in case adjust it by means of tighten or loosing the clamps bolts. The maximum misalignment could be lesser than 10% of the pipe or fittings wall thickness. In any case the misalignment cannot be over than 2mm.
- d) Clean the pipe ends
- e) Fit in the facing tool between the two pipe's ends to be faced, by means of connecting the facing tool into the special supports. Connect the safety pin and start the facing tool engine
- f) On the facing tool there is a facer stopper (see the figure aside). In case of one of the pipe ends has a small projection; the facer stopper let you select the only pipe to face. Put the facer stopper in the left or in the right hole to prevent the right or left facing. To face all the pipes put the facer stopper in the central hole.



**Warning!!!: Always check that the speed selector of the drill engine is in position 1 (lower speed)**

- g) Slowly approach the pipes ends towards the facing tool by means of acting on the hydraulic control unit (lever **A Table V**) keeping a value of pressure allowing the facing of the surfaces and avoiding an overload of the drill engine (a too much high pressure could burnt out the drill engine). When shavings from both sides will appear continuous and homogeneous, the facing operation is completed.
- h) Put in contact the two pipes ends to be welded and check if the eventual disjunction is within the values of the following table:

Outside diameter mm	Port mm
< 400	0,5
> 400	1,0

In case the above values cannot be fulfilled the facing operation must be repeat.

### 4.4 Inertial pressure measurement

Before begin a welding cycle it is necessary to measure the inertial pressure. This value must be added to the pressure value shown in our welding tables. The inertial pressure value depends on welding operating conditions (ex.: length and weight of the pipe to drag, general condition of the machine, ambient temperature, etc.). To measure the inertial pressure follow these steps:

- a) Completely open the movable trolley of the machine by means of acting the lever **A** and take it in position **A2**
- b) By turning the lever **F (Hyd. Unit)** anticlockwise bring the pressure to zero, checking the pressure gauge
- c) Turn clockwise the lever **E (Hyd. Unit)** until closing
- d) Bring the lever **A (Hyd. Unit)** into position **A3** (the trolleys do not move because there is no pressure)
- e) By turning clockwise the hand wheel **F** note the inertial pressure value ( value of pressure need in order to allow the trolley moving ) by reading it into the pressure gauge

## 4.5 Welding cycle

To obtain the best result we strongly suggest allowing the use of the machine only to experienced operators

The welding phase is composed by 5 phases with 5 different times:

**PHASE 1 =  $t_1$**  = Time requested for the bead formation with the specified wall thickness

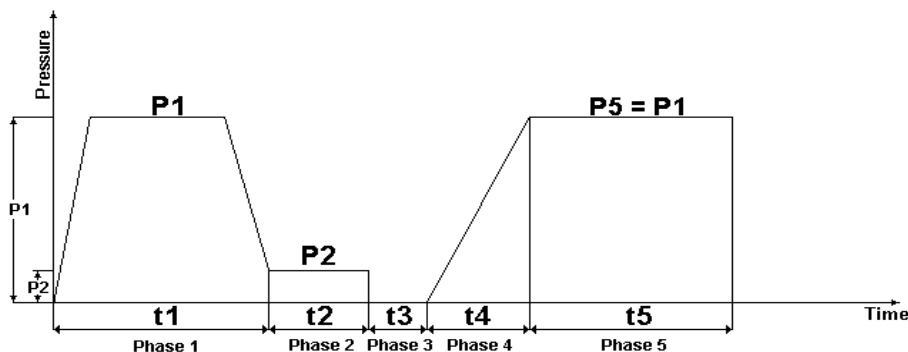
**PHASE 2 =  $t_2$**  = Time requested for the continual heating

**PHASE 3 =  $t_3$**  = Time requested for the change over

**PHASE 4 =  $t_4$**  = Time requested for bringing up the pressure

**PHASE 5 =  $t_5$**  = time requested for cooling down

### Pressure-Time diagram for butt welding



#### PHASE 1 = Heating up $t_1$

- Fit the heating mirror taking care that the temperature of the surfaces is the one selected
- Bring the lever **A (Hyd. Unit)** into position **A3** in order to have the bead formation as per attached table, this operation must be done with the true welding pressure value: ( Inertial pressure +  $P_1$  ).
- Check the Bead formation wall thickness according to the attached welding table

#### PHASE 2 = Heating up $t_2$

- After bead formation act on lever **E (Hyd. Unit)** anticlockwise in order to bring the pressure nearly to zero and proceed to the heating time  $t_2$  at pressure  $P_2$

#### PHASE 3 = Change over $t_3$

- Elapsed the heating time at pressure  $P_2$  bring the lever **A (Hyd. unit)** into position **A2** and remove the heating mirror and immediately bring the lever **A** into position **A3** and acting on lever **E** clockwise put in contact the two pipes

#### PHASE 4 = Bringing up pressure $t_4$

- Achieve the true welding pressure value: ( Inertial pressure +  $P_1 = P_5$  ) by checking the pressure gauge, This operation must be done according to the time indicated into the attached welding table.

#### PHASE 5 = Cooling Down $t_5$

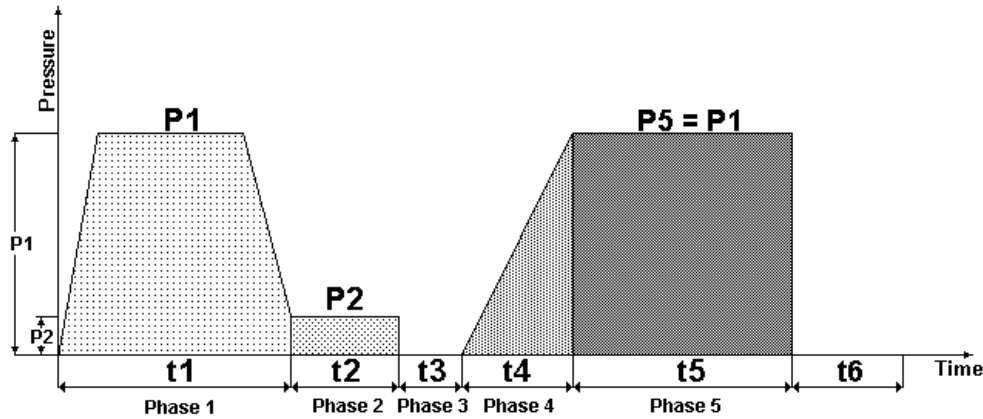
- Bring the lever **A** into position **A1** and keep such situation for all the cooling time indicated into the attached welding table, taking care that the pressure will not decrease too much
- Elapsed the cooling time by acting on lever **E** anticlockwise bring the pressure to zero.
- Take away the pipes welded

#### Important !!!

In case of any doubt please refer to the specific instructions

# 5. Welding Parameters for PE pipes & fittings DVS norm version 2207-1

## Pressure-Time diagram for butt welding



- t1 = Time requested for the bead formation with the specified wall thickness
- t2 = Time requested for the continual heating
- t3 = Time requested for the change over
- t4 = Time requested for bringing up the pressure
- t5 = time requested for cooling down
- P1 = Pressure during the bead formation and the cooling down, this value is the result of the formula:

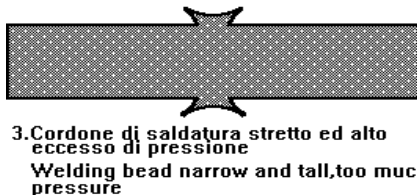
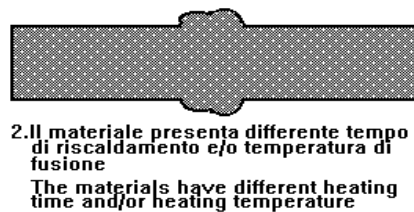
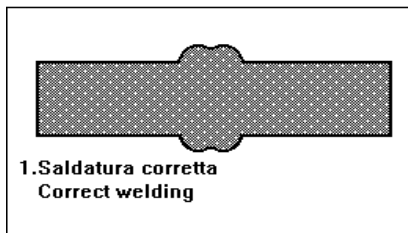
$$\frac{\text{Pipe section (cm}^2\text{)} \times \text{Material thrust coefficient (Kg./cm}^2\text{)}}{\text{Total machine cylinders section (cm}^2\text{)}} = \text{bar}$$

Total machine cylinders section (cm<sup>2</sup>)

Material thrust coefficient for PE s 63	1,5 Kg./cm <sup>2</sup>
Material thrust coefficient for PP	1,0 Kg./cm <sup>2</sup>
Total PT 160 cylinders section	4,32 cm <sup>2</sup>

P2 = Pressure during the continual heating, this value either for HDPE and PP is 0,1 Kg./cm<sup>2</sup>.

## Optical checking of butt welding result

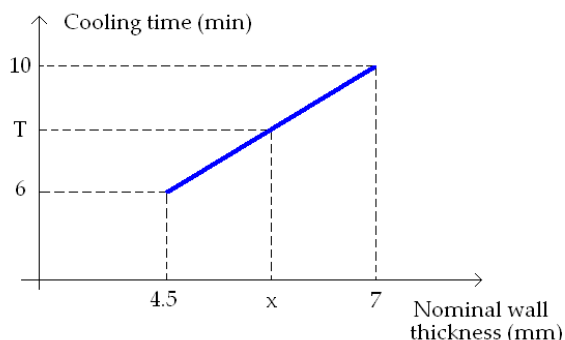




### 5.1 Welding Parameters for PE & PP sheets, pipes & fittings according to DVS 2207-1 – 2207-11

Nominal Wall thickness mm	Alignment Bead height on heater plate at the end of the alignment time (alignment under 0.15 N/mm <sup>2</sup> ) mm (minimum values)	Heating-up Heating-up time= 10 x wallthickness (heating-up 0.02 N/mm <sup>2</sup> ) s	Changeover time S (maximum time)	Joining pressure s	Cooling time under joining pressure p=0.15 N/mm <sup>2</sup> 0.01 Min (minimum values)
<b>MATERIAL PE</b>					
Until 4.5	0.5	45	5	5	6
4.5 ... 7	1.0	45 ... 70	5 ... 6	5 ... 6	6 ... 10
7 ... 12	1.5	70 ... 120	6 ... 8	6 ... 8	10 ... 16
12 ... 19	2.0	120 ... 190	8 ... 10	8 ... 11	16 ... 24
19 ... 26	2.5	190 ... 260	10 ... 12	11 ... 14	24 ... 32
26 ... 37	3.0	260 ... 370	12 ... 16	14 ... 19	32 ... 45
37 ... 50	3.5	370 ... 500	16 ... 20	19 ... 25	45 ... 60
50 ... 70	4.0	500 ... 700	20 ... 25	25 ... 35	60 ... 80
<b>MATERIAL PP</b>					
Until 4.5	0.5	135	5	6	6
4.5 ... 7	0.5	135 ... 175	5 ... 6	6 ... 7	6 ... 12
7 ... 12	1.0	175 ... 245	6 ... 7	6 ... 11	12 ... 20
12 ... 19	1.0	245 ... 330	7 ... 9	11 ... 17	20 ... 30
19 ... 26	1.5	330 ... 400	9 ... 11	17 ... 22	30 ... 40
26 ... 37	2.0	400 ... 485	11 ... 14	22 ... 32	40 ... 55
37 ... 50	2.5	485 ... 560	14 ... 17	32 ... 43	55 ... 70

#### Example on how to calculate the cooling down (t5) time following the DVS NORM



As per drawing above the time T corresponds to wall thickness value X in mm. To calculate this time (t5 in minutes) please follow the formula below:

$$T = 6 + \frac{10 - 6}{7 - 4,5} \cdot (x - 4,5)$$

#### Example:

If you want to calculate the cooling down time for a 6mm wall thickness pipe, you must simply substitute the variable X with the value 6:

$$T = 6 + \frac{10 - 6}{7 - 4,5} \cdot (6 - 4,5) = 8,4 \text{ min}$$

To calculate the other times (t3 and t4) you must use the same principle of linear interpolation.

To obtain the t2 (in seconds) value use the formula below where the variable wt corresponds to the nominal wall thickness

$$T_2(\text{sec}) = 10 \cdot \text{wt}(\text{mm})$$

## 6. Welding Table for PE pipes DVS norm version 2207-1

The following tables show the values to be applied during the welding cycle as per previous instructions and graph.

However in order to clarify once again the meaning of these values please kindly note:

- t1 = Time requested for the bead formation to be done with pressure value = P1 + inertial pressure  
 t2 = Time requested for the continual heating to be done with pressure value = P2 + inertial pressure  
 t3 = Time requested for the change over  
 t4 = Time requested for bringing up the pressure at the value of pressure = P1 + inertial pressure  
 t5 = time requested for cooling down to be done with pressure value = P1 + inertial pressure

### Important

Remember always to add the value checked of inertial pressure to the P1 and P2 values !!!!!!!

PT 160 - DVS 2207-1			Cyl. section cm <sup>2</sup> 4,32				Welding range 90-160 mm			
material PE80-100			SDR 41							
D	S	T	P1 bead		P2 t 2		t 3	t 4	P5 t 5	
DIAMETER	WALL THICK.	TEMP.	BEAD FORMATION		HEATING UP		CHANGE OV.	RAMP	COOLING TIME	
mm	mm	°C	bar	mm	bar	sec	sec	sec	bar	min
90	2,2	220	2,1	0,5	0.. 0,1	22	0.. 5	5	2,1	6
110	2,7	220	3,1	0,5	0.. 0,2	27	0.. 5	5	3,1	6
125	3,0	220	4,1	0,5	0.. 0,3	30	0.. 5	5	4,1	6
140	3,4	220	5,1	0,5	0.. 0,3	34	0.. 5	5	5,1	6
160	3,9	220	6,6	0,5	0.. 0,4	39	0.. 5	5	6,6	6

PT 160 - DVS 2207-1			Cyl. section cm <sup>2</sup> 4,32				Welding range 90-160 mm			
material PE80-100			SDR 33							
D	S	T	P1 bead		P2 t 2		t 3	t 4	P5 t 5	
DIAMETER	WALL THICK.	TEMP.	BEAD FORMATION		HEATING UP		CHANGE OV.	RAMP	COOLING TIME	
mm	mm	°C	bar	mm	bar	sec	sec	sec	bar	min
90	2,7	220	2,6	0,5	0.. 0,2	27	0.. 5	5	2,6	6
110	3,3	220	3,9	0,5	0.. 0,3	33	0.. 5	5	3,9	6
125	3,8	220	5,	0,5	0.. 0,3	38	0.. 5	5	5,	6
140	4,2	220	6,3	0,5	0.. 0,4	42	0.. 5	5	6,3	6
160	4,8	219	8,2	1,0	0.. 0,5	48	0.. 5	5	8,2	7

PT 160 - DVS 2207-1			Cyl. section cm <sup>2</sup> 4,32				Welding range 90-160 mm			
material PE80-100			SDR 27,6							
D	S	T	P1 bead		P2 t 2		t 3	t 4	P5 t 5	
DIAMETER	WALL THICK.	TEMP.	BEAD FORMATION		HEATING UP		CHANGE OV.	RAMP	COOLING TIME	
mm	mm	°C	bar	mm	bar	sec	sec	sec	bar	min
50	1,8	220	1,	0,5	0.. 0,1	18	0.. 5	5	1,	6
63	2,3	220	1,5	0,5	0.. 0,1	23	0.. 5	5	1,5	6
75	2,7	220	2,1	0,5	0.. 0,1	27	0.. 5	5	2,1	6
90	3,3	220	3,1	0,5	0.. 0,2	33	0.. 5	5	3,1	6
110	4,0	220	4,6	0,5	0.. 0,3	40	0.. 5	5	4,6	6
125	4,5	220	5,9	1,0	0.. 0,4	45	0.. 5	5	5,9	6
140	5,1	219	7,5	1,0	0.. 0,5	51	0.. 5	5	7,5	7
160	5,8	218	9,7	1,0	0.. 0,6	58	0.. 6	6	9,7	8

**Warning!: in case of PE100 welding, temperature T must be increased to 220°C**

PT 160 - DVS 2207-1			Cyl. section cm <sup>2</sup> 4,32				Welding range 40-160 mm			
material PE80-100			SDR 26							
D	S	T	P1 bead		P2 t 2		t 3	t 4	P5 t 5	
DIAMETER	WALL THICK.	TEMP.	BEAD FORMATION		HEATING UP		CHANGE OV.	RAMP	COOLING TIME	
mm	mm	°C	bar	mm	bar	sec	sec	sec	bar	min
50	1,9	220	1,	0,5	0.. 0,1	19	0.. 5	5	1,	6
63	2,4	220	1,6	0,5	0.. 0,1	24	0.. 5	5	1,6	6
75	2,9	220	2,3	0,5	0.. 0,2	29	0.. 5	5	2,3	6
90	3,5	220	3,3	0,5	0.. 0,2	35	0.. 5	5	3,3	6
110	4,2	220	4,9	0,5	0.. 0,3	42	0.. 5	5	4,9	6
125	4,8	220	6,3	1,0	0.. 0,4	48	0.. 5	5	6,3	6
140	5,4	219	7,9	1,0	0.. 0,5	54	0.. 5	5	7,9	7
160	6,2	217	10,3	1,0	0.. 0,7	62	0.. 6	6	10,3	9

PT 160 - DVS 2207-1			Cyl. section cm <sup>2</sup> 4,32				Welding range 40-160 mm			
material PE80-100			SDR 22							
D	S	T	P1 bead		P2 t 2		t 3	t 4	P5 t 5	
DIAMETER	WALL THICK.	TEMP.	BEAD FORMATION		HEATING UP		CHANGE OV.	RAMP	COOLING TIME	
mm	mm	°C	bar	mm	bar	sec	sec	sec	bar	min
40	1,8	220	0,8	0,5	0.. 0,1	18	0.. 5	5	0,8	6
50	2,3	220	1,2	0,5	0.. 0,1	23	0.. 5	5	1,2	6
63	2,9	220	1,9	0,5	0.. 0,1	29	0.. 5	5	1,9	6
75	3,4	220	2,7	0,5	0.. 0,2	34	0.. 5	5	2,7	6
90	4,1	220	3,8	0,5	0.. 0,3	41	0.. 5	5	3,8	6
110	5,0	219	5,7	1,0	0.. 0,4	50	0.. 5	5	5,7	7
125	5,7	218	7,4	1,0	0.. 0,5	57	0.. 5	5	7,4	8
140	6,4	217	9,3	1,0	0.. 0,6	64	0.. 6	6	9,3	9
160	7,3	216	12,1	1,5	0.. 0,8	73	0.. 6	6	12,1	10

PT 160 - DVS 2207-1			Cyl. section cm <sup>2</sup> 4,32				Welding range 40-160 mm			
material PE80-100			SDR 21							
D	S	T	P1 bead		P2 t 2		t 3	t 4	P5 t 5	
DIAMETER	WALL THICK.	TEMP.	BEAD FORMATION		HEATING UP		CHANGE OV.	RAMP	COOLING TIME	
mm	mm	°C	bar	mm	bar	sec	sec	sec	bar	min
40	1,9	220	0,8	0,5	0.. 0,1	19	0.. 5	5	0,8	6
50	2,4	220	1,2	0,5	0.. 0,1	24	0.. 5	5	1,2	6
63	3,0	220	2,	0,5	0.. 0,1	30	0.. 5	5	2,	6
75	3,6	220	2,8	0,5	0.. 0,2	36	0.. 5	5	2,8	6
90	4,3	220	4,	0,5	0.. 0,3	43	0.. 5	5	4,	6
110	5,2	219	6,	1,0	0.. 0,4	52	0.. 5	5	6,	7
125	6,0	218	7,7	1,0	0.. 0,5	60	0.. 6	6	7,7	8
140	6,7	217	9,7	1,0	0.. 0,6	67	0.. 6	6	9,7	9
160	7,6	215	12,7	1,5	0.. 0,8	76	0.. 6	6	12,7	11

**Warning!:** in case of PE100 welding, temperature T must be increased to 220°C

PT 160 - DVS 2207-1			Cyl. section cm <sup>2</sup> 4,32				Welding range 40-160 mm			
material PE80-100			SDR 17,6							
D	S	T	P1 bead		P2 t 2		t 3	t 4	P5 t 5	
DIAMETER	WALL THICK.	TEMP.	BEAD FORMATION		HEATING UP		CHANGE OV.	RAMP	COOLING TIME	
mm	mm	°C	bar	mm	bar	sec	sec	sec	bar	min
40	2,3	220	0,9	0,5	0.. 0,1	23	0.. 5	5	0,9	6
50	2,8	220	1,5	0,5	0.. 0,1	28	0.. 5	5	1,5	6
63	3,6	220	2,3	0,5	0.. 0,2	36	0.. 5	5	2,3	6
75	4,3	220	3,3	0,5	0.. 0,2	43	0.. 5	5	3,3	6
90	5,1	219	4,7	1,0	0.. 0,3	51	0.. 5	5	4,7	7
110	6,3	217	7,1	1,0	0.. 0,5	63	0.. 6	6	7,1	9
125	7,1	216	9,1	1,5	0.. 0,6	71	0.. 6	6	9,1	10
140	8,0	215	11,5	1,5	0.. 0,8	80	0.. 6	6	11,5	11
160	9,1	214	15,0	1,5	0.. 1,0	91	0.. 7	7	15,0	13

PT 160 - DVS 2207-1			Cyl. section cm <sup>2</sup> 4,32				Welding range 40-160 mm			
material PE80-100			SDR 17							
D	S	T	P1 bead		P2 t 2		t 3	t 4	P5 t 5	
DIAMETER	WALL THICK.	TEMP.	BEAD FORMATION		HEATING UP		CHANGE OV.	RAMP	COOLING TIME	
mm	mm	°C	bar	mm	bar	sec	sec	sec	bar	min
40	2,4	220	1,	0,5	0.. 0,1	24	0.. 5	5	1,0	6
50	2,9	220	1,5	0,5	0.. 0,1	29	0.. 5	5	1,5	6
63	3,7	220	2,4	0,5	0.. 0,2	37	0.. 5	5	2,4	6
75	4,4	220	3,4	0,5	0.. 0,2	44	0.. 5	5	3,4	6
90	5,3	219	4,9	1,0	0.. 0,3	53	0.. 5	5	4,9	7
110	6,5	217	7,3	1,0	0.. 0,5	65	0.. 6	6	7,3	9
125	7,4	216	9,4	1,5	0.. 0,6	74	0.. 6	6	9,4	10
140	8,2	215	11,8	1,5	0.. 0,8	82	0.. 6	6	11,8	11
160	9,4	214	15,5	1,5	0.. 1,0	94	0.. 7	7	15,5	13

PT 160 - DVS 2207-1			Cyl. section cm <sup>2</sup> 4,32				Welding range 40-160 mm			
material PE80-100			SDR 13,6							
D	S	T	P1 bead		P2 t 2		t 3	t 4	P5 t 5	
DIAMETER	WALL THICK.	TEMP.	BEAD FORMATION		HEATING UP		CHANGE OV.	RAMP	COOLING TIME	
mm	mm	°C	bar	mm	bar	sec	sec	sec	bar	min
40	2,9	220	1,2	0,5	0.. 0,1	29	0.. 5	5	1,2	6
50	3,7	220	1,9	0,5	0.. 0,1	37	0.. 5	5	1,9	6
63	4,6	220	2,9	1,0	0.. 0,2	46	0.. 5	5	2,9	6
75	5,5	218	4,2	1,0	0.. 0,3	55	0.. 5	5	4,2	8
90	6,6	217	6,0	1,0	0.. 0,4	66	0.. 6	6	6,0	9
110	8,1	215	9,0	1,5	0.. 0,6	81	0.. 6	6	9,0	11
125	9,2	214	11,6	1,5	0.. 0,8	92	0.. 7	7	11,6	13
140	10,3	213	14,6	1,5	0.. 1,0	103	0.. 7	7	14,6	14
160	11,8	211	19,0	1,5	0.. 1,3	118	0.. 8	8	19,0	16

**Warning!:** in case of PE100 welding, temperature T must be increased to 220°C

PT 160 - DVS 2207-1			Cyl. section cm <sup>2</sup> 4,32				Welding range 40-160 mm				
material PE80-100			SDR 11								
D	S	T	P1	bead	P2	t 2	t 3	t 4	P5	t 5	
DIAMETER	WALL THICK.	TEMP.	BEAD FORMATION		HEATING UP		CHANGE OV.	RAMP	COOLING TIME		
mm	mm	°C	bar	mm	bar	sec	sec	sec	bar	min	
40	3,6	220	1,4	0,5	0.. 0,1	36	0.. 5	5	1,4	6	
50	4,5	220	2,3	1,0	0.. 0,2	45	0.. 5	5	2,3	6	
63	5,7	218	3,6	1,0	0.. 0,2	57	0.. 5	5	3,6	8	
75	6,8	216	5,1	1,0	0.. 0,3	68	0.. 6	6	5,1	10	
90	8,2	215	7,3	1,5	0.. 0,5	82	0.. 6	6	7,3	11	
110	10,0	213	10,9	1,5	0.. 0,7	100	0.. 7	7	10,9	14	
125	11,4	212	14,1	1,5	0.. 0,9	114	0.. 8	8	14,1	15	
140	12,7	210	17,7	2,0	0.. 1,2	127	0.. 8	8	17,7	17	
160	14,5	209	23,1	2,0	0.. 1,5	145	0.. 9	9	23,1	19	

PT 160 - DVS 2207-1			Cyl. section cm <sup>2</sup> 4,32				Welding range 40-160 mm				
material PE80-100			SDR 9								
D	S	T	P1	bead	P2	t 2	t 3	t 4	P5	t 5	
DIAMETER	WALL THICK.	TEMP.	BEAD FORMATION		HEATING UP		CHANGE OV.	RAMP	COOLING TIME		
mm	mm	°C	bar	mm	bar	sec	sec	sec	bar	min	
40	4,4	220	1,7	0,5	0.. 0,1	44	0.. 5	5	1,7	6	
50	5,6	218	2,7	1,0	0.. 0,2	56	0.. 5	5	2,7	8	
63	7,0	216	4,3	1,0	0.. 0,3	70	0.. 6	6	4,3	10	
75	8,3	215	6,1	1,5	0.. 0,4	83	0.. 7	7	6,1	12	
90	10,0	213	8,7	1,5	0.. 0,6	100	0.. 7	7	8,7	14	
110	12,2	211	13,	2,0	0.. 0,9	122	0.. 8	8	13,	16	
125	13,9	210	16,8	2,0	0.. 1,1	139	0.. 9	9	16,8	18	
140	15,6	208	21,1	2,0	0.. 1,4	156	0.. 9	10	21,1	20	
160	17,8	207	27,6	2,0	0.. 1,8	178	0.. 10	10	27,6	23	

PT 160 - DVS 2207-1			Cyl. section cm <sup>2</sup> 4,32				Welding range 40-160 mm				
material PE80-100			SDR 7,4								
D	S	T	P1	bead	P2	t 2	t 3	t 4	P5	t 5	
DIAMETER	WALL THICK.	TEMP.	BEAD FORMATION		HEATING UP		CHANGE OV.	RAMP	COOLING TIME		
mm	mm	°C	bar	mm	bar	sec	sec	sec	bar	min	
40	5,4	219	2,	1,0	0.. 0,1	54	0.. 5	5	2,	7	
50	6,8	216	3,2	1,0	0.. 0,2	68	0.. 6	6	3,2	10	
63	8,5	214	5,1	1,5	0.. 0,3	85	0.. 7	7	5,1	12	
75	10,1	213	7,2	1,5	0.. 0,5	101	0.. 7	7	7,2	14	
90	12,2	211	10,3	2,0	0.. 0,7	122	0.. 8	8	10,3	16	
110	14,9	209	15,4	2,0	0.. 1,0	149	0.. 9	9	15,4	19	
125	16,9	208	19,9	2,0	0.. 1,3	169	0.. 9	10	19,9	22	
140	18,9	206	25,	2,0	0.. 1,7	189	0.. 10	11	25,	24	
160	21,6	205	32,6	2,5	0.. 2,2	216	0.. 11	12	32,6	27	

**Warning!:** in case of PE100 welding, temperature T must be increased to 220°C

## 7. Welding Parameters for PP pipes & fittings DVS norm version 2207-11

material PP		SDR 41	PP		Cylinder section cm <sup>2</sup> 4,32					
D	S	Temp.	P1	bead	P2	t 2	t 3	t 4	P5	t 5
mm	mm	° C	bar	mm	bar	sec	sec	sec	bar	sec
50	1,8	210°	0,6	0,5	0,1	135	5,0	6,0	0,6	360
63	1,8	210°	0,8	0,5	0,1	135	5,0	6,0	0,8	360
75	1,9	210°	1,0	0,5	0,1	135	5,0	6,0	1,0	360
90	2,2	210°	1,4	0,5	0,1	135	5,0	6,0	1,4	360
110	2,7	210°	2,1	0,5	0,2	135	5,0	6,0	2,1	360
125	3,1	210°	2,7	0,5	0,3	135	5,0	6,0	2,7	360
140	3,5	210°	3,5	0,5	0,3	135	5,0	6,0	3,5	360
160	3,9	210°	4,4	0,5	0,4	135	5,0	6,0	4,4	360
material PP		SDR 33	PP		Cylinder section cm <sup>2</sup> 4,32					
D	S	Temp.	P1	bead	P2	t 2	t 3	t 4	P5	t 5
mm	mm	° C	bar	mm	bar	sec	sec	sec	bar	sec
63	2	210°	0,9	0,5	0,1	135	5,0	6,0	0,9	360
75	2,4	210°	1,3	0,5	0,1	135	5,0	6,0	1,3	360
90	2,8	210°	1,8	0,5	0,2	135	5,0	6,0	1,8	360
110	3,5	210°	2,7	0,5	0,3	135	5,0	6,0	2,7	360
125	3,9	210°	3,4	0,5	0,3	135	5,0	6,0	3,4	360
140	4,4	210°	4,3	0,5	0,4	135	5,0	6,0	4,3	360
160	5	210°	5,6	0,5	0,6	143	5,2	6,2	5,6	432
material PP		SDR 26	PP		Cylinder section cm <sup>2</sup> 4,32					
D	S	Temp.	P1	bead	P2	t 2	t 3	t 4	P5	t 5
mm	mm	° C	bar	mm	bar	sec	sec	sec	bar	sec
50	2	210°	0,7	0,5	0,1	135	5,0	6,0	0,7	360
63	2,5	210°	1,1	0,5	0,1	135	5,0	6,0	1,1	360
75	2,9	210°	1,5	0,5	0,2	135	5,0	6,0	1,5	360
90	3,5	210°	2,2	0,5	0,2	135	5,0	6,0	2,2	360
110	4,3	210°	3,3	0,5	0,3	135	5,0	6,0	3,3	360
125	4,9	210°	4,3	0,5	0,4	141	5,2	6,2	4,3	418
140	5,4	210°	5,3	0,5	0,5	149	5,4	6,4	5,3	490
160	6,2	210°	6,9	0,5	0,7	162	5,7	6,7	6,9	605
material PP		SDR 17.6	PP		Cylinder section cm <sup>2</sup> 4,32					
D	S	Temp.	P1	bead	P2	t 2	t 3	t 4	P5	t 5
mm	mm	° C	bar	mm	bar	sec	sec	sec	bar	sec
40	2,3	210°	0,6	0,5	0,1	135	5,0	6,0	0,6	360
50	2,9	210°	1,0	0,5	0,1	135	5,0	6,0	1,0	360
63	3,6	210°	1,6	0,5	0,2	135	5,0	6,0	1,6	360
75	4,3	210°	2,2	0,5	0,2	135	5,0	6,0	2,2	360
90	5,1	210°	3,1	0,5	0,3	145	5,2	6,2	3,1	446
110	6,3	210°	4,7	0,5	0,5	164	5,7	6,7	4,7	619
125	7,1	210°	6,1	1	0,6	176	6,0	7,1	6,1	730
140	8	210°	7,7	1	0,8	189	6,2	7,8	7,7	816
160	9,1	210°	10,0	1	1,0	204	6,4	8,7	10,0	922

material PP		SDR	11	PP		Cylinder section cm <sup>2</sup> 4,32				
D	S	Temp.	P1	bead	P2	t 2	t 3	t 4	P5	t 5
mm	mm	° C	bar	mm	bar	sec	sec	sec	bar	sec
40	3,7	210°	1,0	0,5	0,1	135	5,0	6,0	1,0	360
50	4,6	210°	1,5	0,5	0,2	137	5,0	6,0	1,5	374
63	5,8	210°	2,4	0,5	0,2	156	5,5	6,5	2,4	547
75	6,9	210°	3,4	0,5	0,3	173	6,0	7,0	3,4	706
90	8,2	210°	4,9	1	0,5	192	6,2	8,0	4,9	835
110	10	210°	7,3	1	0,7	217	6,6	9,4	7,3	1008
125	11,4	210°	9,4	1	0,9	237	6,9	10,5	9,4	1142
140	12,8	210°	11,8	1	1,2	255	7,2	11,7	11,8	1269
160	14,6	210°	15,4	1	1,5	276	7,7	13,2	15,4	1423

## 8. Maintenance

### 8.1 Basic machine

It's strongly suggested to keep always the machine clean with particular care of the bolts and the cylinder's heads .  
Keep attention while insert the electric facing tool and the PTFE coated heating mirror avoiding to damage the machine's slide bars.

### 8.2 Facing tool

It's strongly suggested to keep always clean the blades and wash the pulleys by using a detergent.  
At regular intervals carry out a complete cleaning operation with a internal lubrication as well , as per following instructions:

- Remove the carter by enlighten the screws
- Take out the shavings might be present
- Enlighten the screws and remove the pulley and carry out the cleaning and the lubrication of the bearing .

### 8.3 Heating mirror

Please take care on handling the heating mirror in order to avoid damages to the PTFE coating.  
Keep always clean the PTFE coated surfaces, cleaning must be done with surface still warm by using a soft cloth or paper, avoiding abrasive materials in that might damage the PTFE coated surfaces. To achieve this operation you must wear protective gloves  
At regular intervals we suggest you to:

- Clean the surfaces by a quick evaporation detergent (alcohol)
- Check the tightening of the screws and the cable and plug condition
- Verify the temperature differences on the heating mirror surfaces according to the following table DVS norm 2208-1 here following table:

WELDING SURFACE OF THE MIRROR	$\Delta T_1$	$\Delta T_2$	$\Delta T_{TOT}$
< 250 cm <sup>2</sup>	5 °C	3 °C	8 °C
250 .... 2000 cm <sup>2</sup>	7 °C	3 °C	10 °C
2000 .... 5000 cm <sup>2</sup>	11 °C	3 °C	14 °C
5000 .... 12000 cm <sup>2</sup>	13 °C	3 °C	16 °C
> 12000	14 °C	3 °C	17 °C

$\Delta T_1$  Maximum temperature difference on the mirror surface

$\Delta T_2$  Temperature deviation for the adjustment

$\Delta T_{TOT}$  Maximum accepted difference on the mirror surface

### 8.4 Hydraulic unit

The hydraulic unit does not need particular maintenance nevertheless the following instructions must be followed:

1. Check periodically the oil level and in case add with oil type:  
ESSO NUTO H 68,SHELL TELLUS 68,MOBIL DTE 26,AGIP OSO 46  
The level should not be lower than 5 cm from the tank maximum level.  
A checking every 15 working days it's strongly suggested.
2. Replace totally the oil every 6 months or after 500 working hours.
3. Keep clean the hydraulic unit with particular care on the tank and quick couplings.
4. Avoid to operate with rain or high humidity (95 RH %) value and temperatures below 0°C or above + 50°C.
5. During the transport it's suggested to put the metal plug instead of the plastic one.



## 9. Troubleshooting and relative solutions

### 9.1 Basic machine

**a) The quick couplings can't be connected:**

Check if there's pressure on the hoses in case bring the pressure to zero ( see relative instructions )  
Check if the quick couplings are clean

**b) The machine does not move in linear way:**

The above mentioned situation could happen in case of clash or in case the machine with the pipe assembled in has been fiercely moved. If the damaged part can be located proceed to the substitution, however if the trouble still remain, kindly contact the Customer Service

**c) The nut/s is/are seizure:**

Replace the complete tie rod bolt

**d) Oil leakage in the cylinders:**

Consult the **Customer Service Dept.** verify if it's necessary to replace the cylinders or just the gasket

### 9.2 Facing tool

**a) The engine does not start:**

Unplug the facing tool and check the electric connections and the safety micro-switch

**b) The engine is burnt out:**

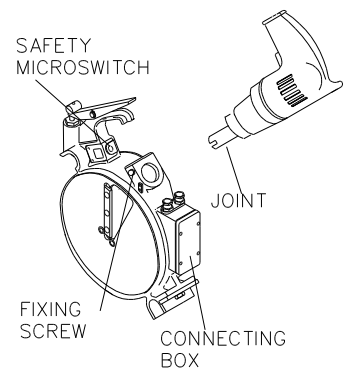
In case it's need to replace the engine the following operations must be done:

- Unplug the facing tool
- Enlighten the screws connecting the engine to the facing tool, disconnect the safety micro-switch and wires
- Remove the engine by means of pulling in upper direction, remove the joint from the drill
- Screw the joint on the new engine
- Mount the new drill engine by taking care to fix the joint gap in a proper way
- Tighten the screws connecting the engine to the facing tool, connect the safety micro-switch and wires

**c) The blades do not remove material:**

Wear and tear of one cutting side enlighten the screws and turn the blades using the other side.

Wear and tear of both cutting side of the blades replace with original spare parts.



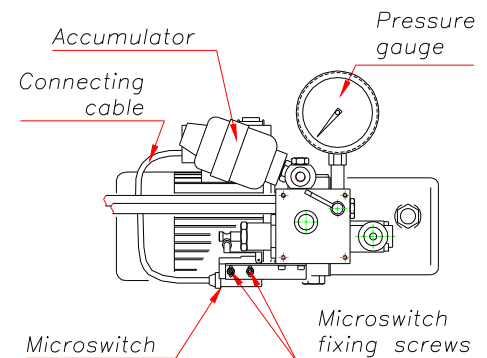
### 9.3 Hydraulic unit

**a) The engine does not start:**

Check that the hydraulic unit engine is switched on

The microswitch is damaged or wrongly adjusted

- To adjust the microswitch you must enlighten the screws show in the figure below and bring the lever A to position A3.
- Move the microswitch towards the internal of the hydraulic until the engine start and tighten the fixing screw.
- Check that in position A1 the engine is switched off.
- In different case adjust the microswitch position again.



**b) The engine replacement:**

Check that the electric plug is disconnected

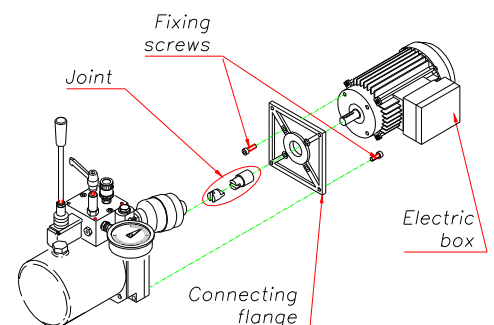
Open the electric connections box and disconnect the micro-switch cable

Enlighten the screws and take out the engine

Take out the joints and insert them on the new engine

Reassemble the engine taking care that the joints are perfectly located on the own housings

Check the anti clockwise rotation of the electric fan

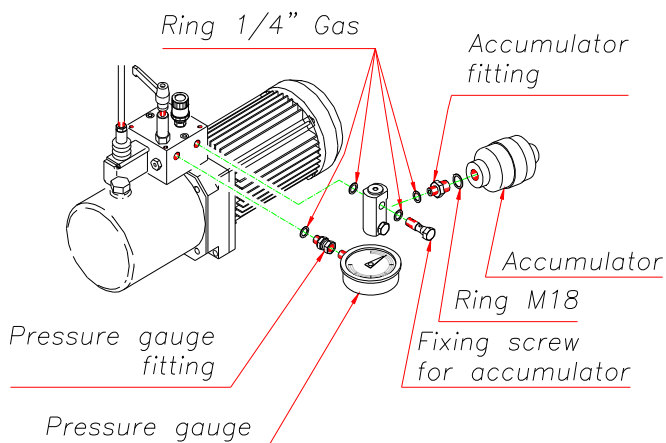


**c) If the hydraulic unit cannot increase the pressure reasons could be :**

- Check the oil level
- The lever **E** is not closed.
- Check if they are some leakage on hydraulic circuit.

**d) If the hydraulic unit cannot maintain a constant pressure reasons could be :**

- The lever **E** is not closed.
- The accumulator is down or damaged. To replace the pressure gauge follows the below steps:
  1. Bring the pressure to zero and enlighten the bolt
  2. Take out the fitting and replace the damaged accumulator with the new one
  3. Tighten the bolt



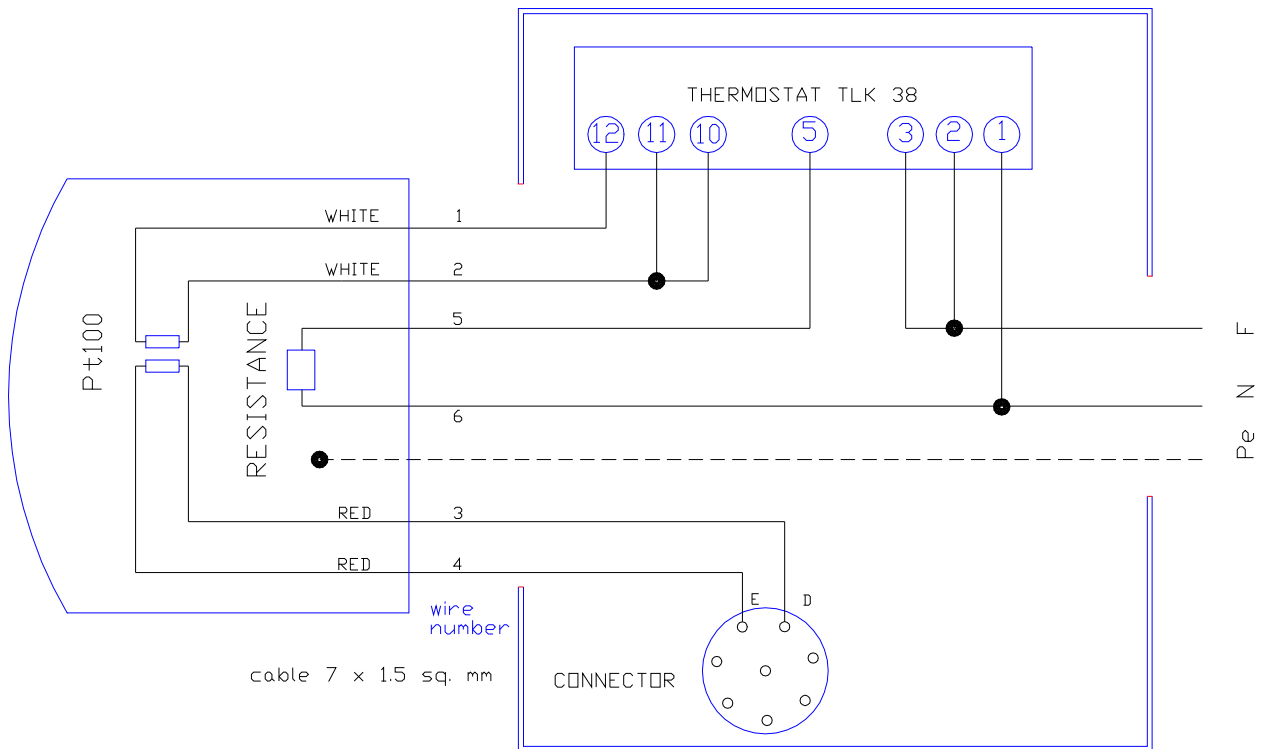
## 9.4 Heating mirror

**a) The heating mirror does not warm up:**

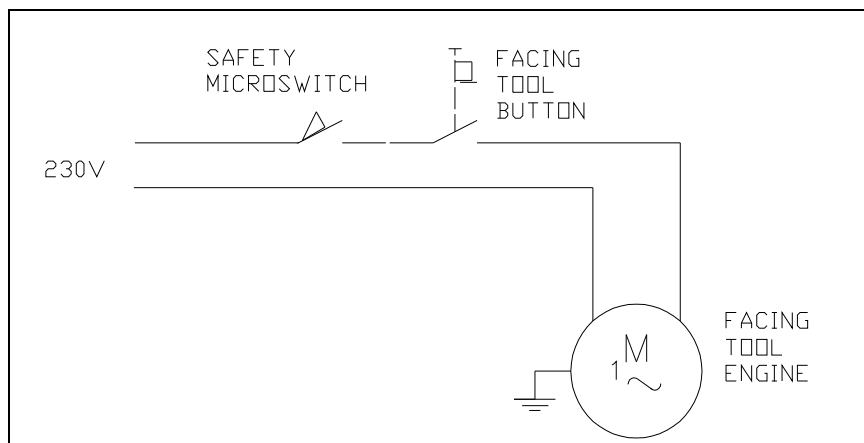
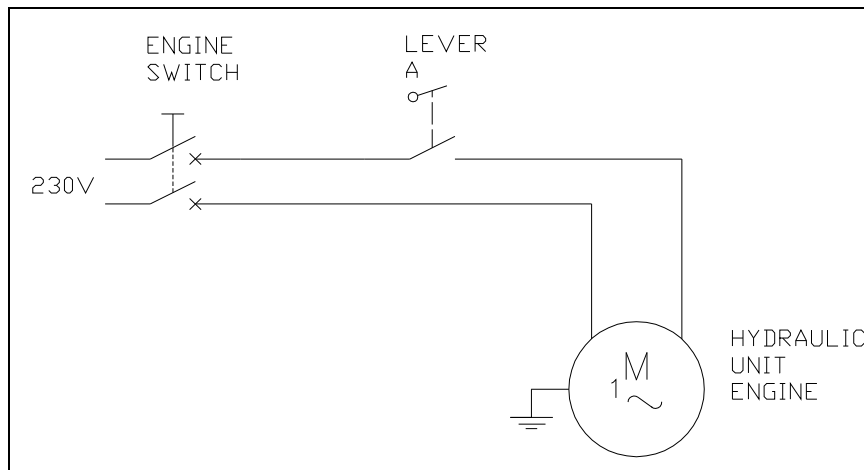
1. Check if the light is switched off, in case check the plug
2. The light is switched on, probably a wire disconnected, check the contacts as follows:
  - Take off the plug from the power
  - Unscrew the nuts and take out the thermostat support
  - Unscrew the screws and remove the cap
  - Check all the electric connections and reassemble
  - Unscrew the screws and take out the cover
  - Check all the electric connections and reassemble
3. By utilizing a Tester check if all the resistances are in good condition, if one or more are broken the heating mirror must be changed
4. By utilizing a tester check the working of the thermostat, in case substitute
5. For additional information on electric components, please refer to our **Technical Dept.**

# 10. Drawings

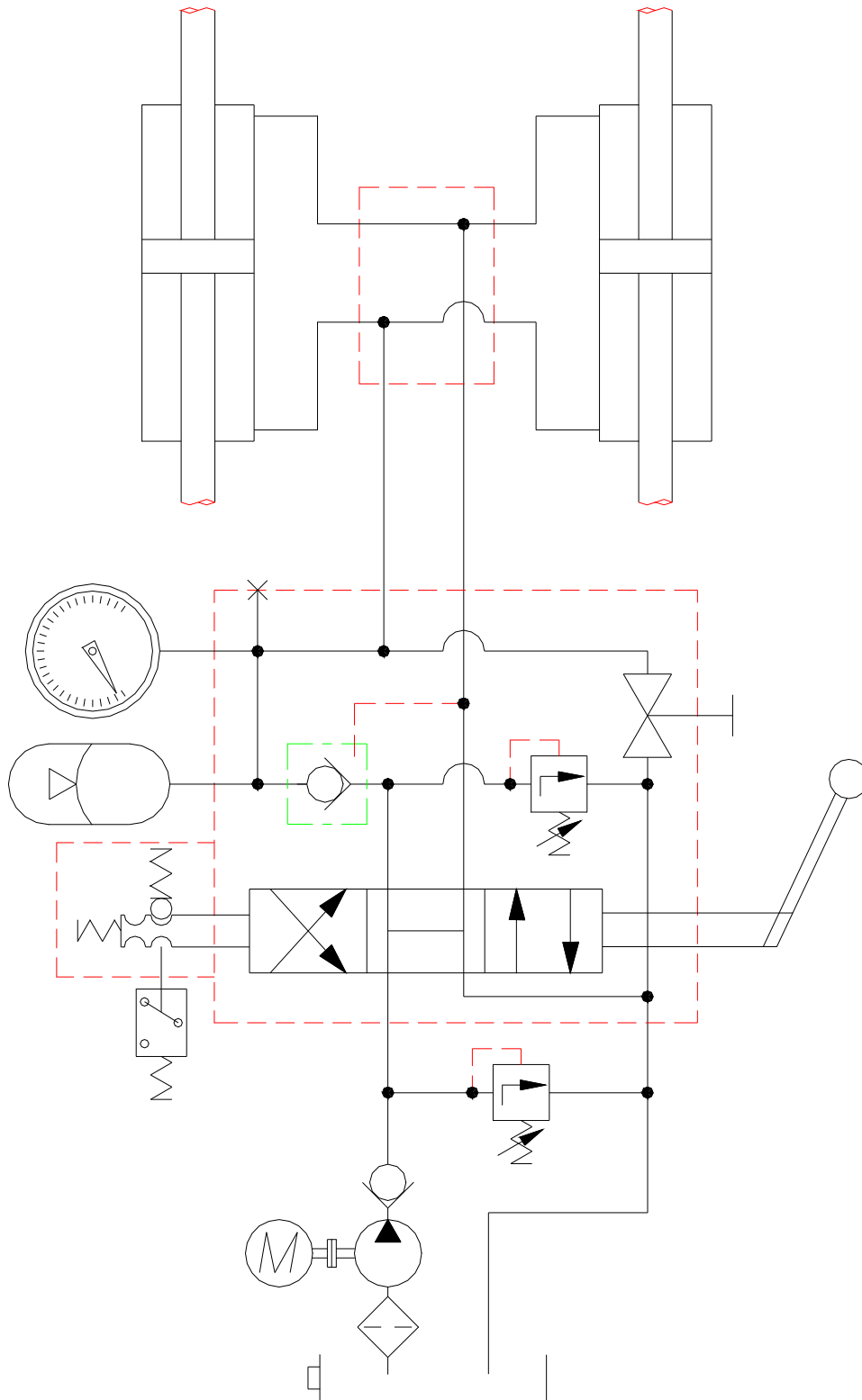
## 10.1 Thermostat connection



## 10.2 Facing tool and hydraulic unit engines connection

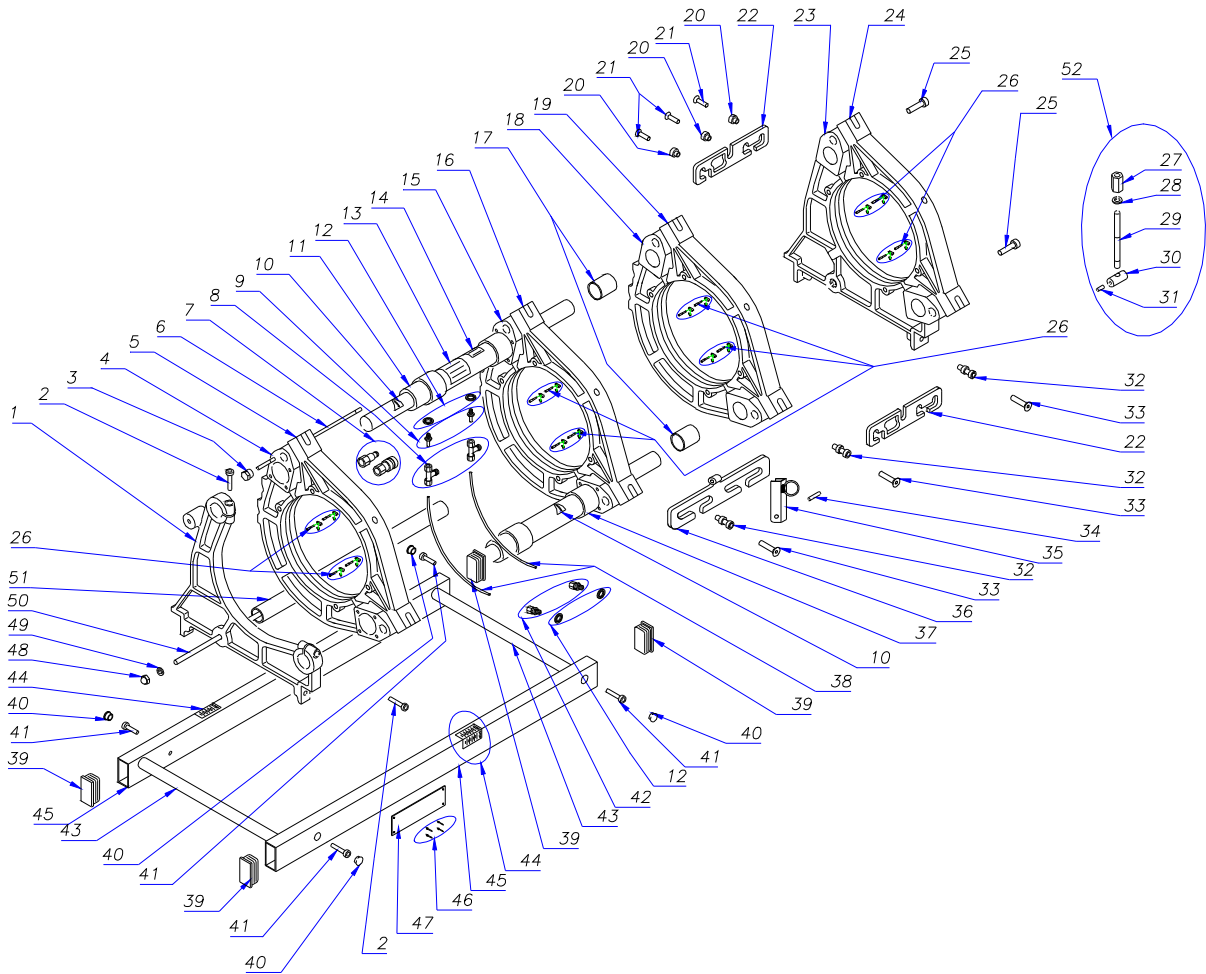


### 10.3 Hydraulic plan



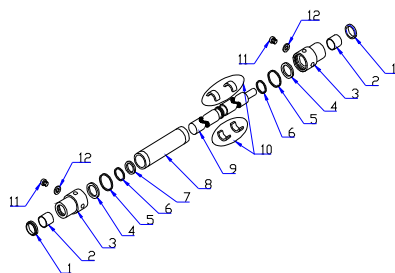
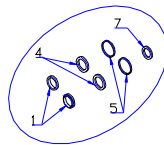
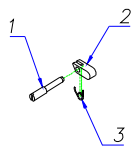
# 11. Exploded view and spare parts list

## PT 160 BASIC MACHINE

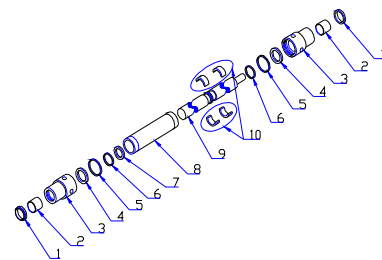


PT 160-200 GASKET KIT (1 cylinder)

PT 160 BEEP-BEEP SYSTEM



PT 160 UPPER CYLINDER

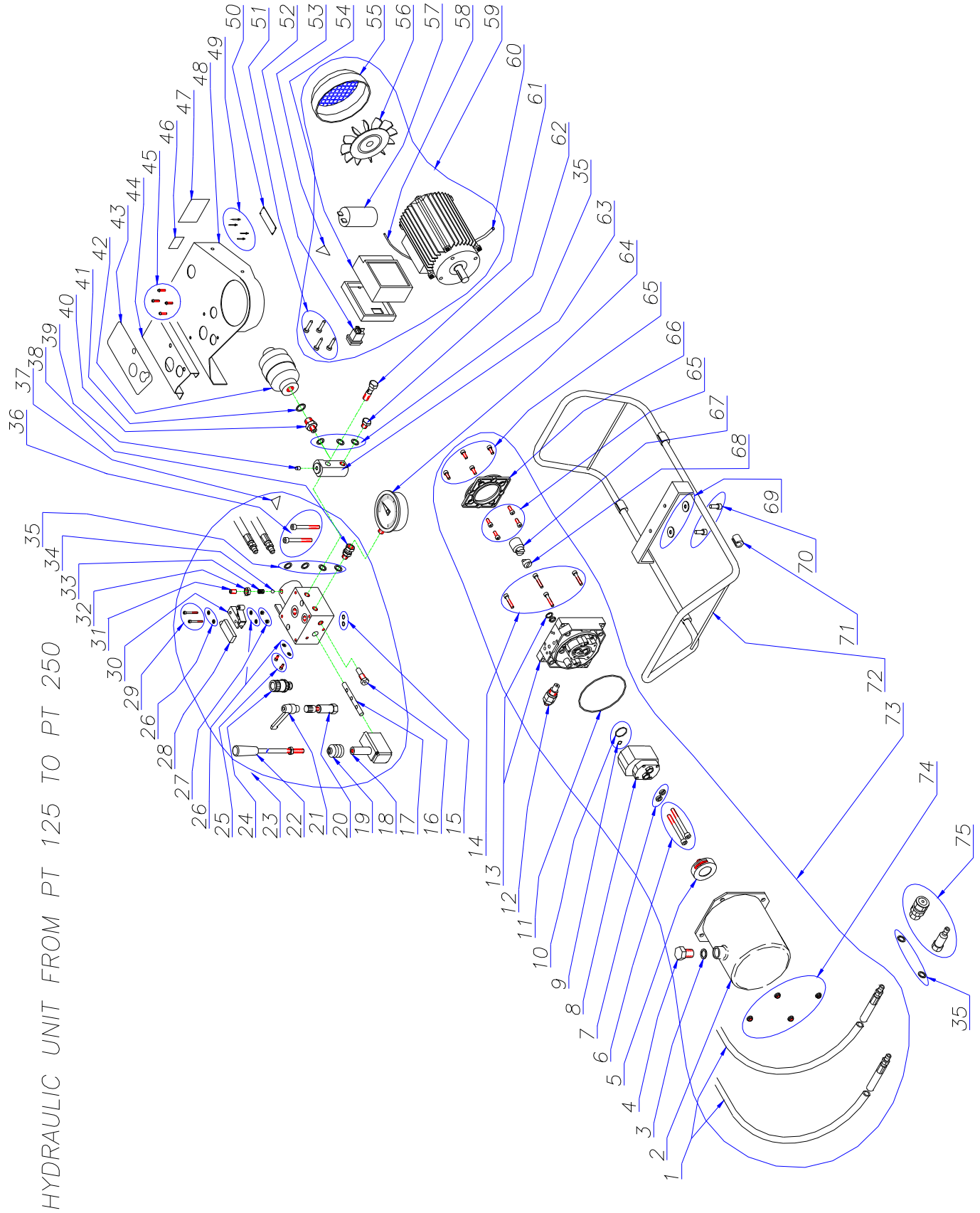


PT 160 LOWER CYLINDER

PT 160 Basic Machine , Code: PT160B				PT 160 Basic Machine , Code: PT160B			
Pos.	Code	Description	Qty	Pos.	Code	Description	Qty
1	PT160B01	side support	1	29	PT160B29	Tie rod closer	8
2	PT160B02	screw TCEI UNI 5931 8.8 8x35	2	30	PT160B30	Tie rod pivot	8
3	PT160B03	Nut fixing cylinder's tie rod	8	31	PT160B31	Screw STEI UNI 5923 45h 6x14z	8
4+5	PT160B04+05	first clamp (04+05)	1	32	PT160B32	Front nut for spacer	3
6	PT160B06	cylinder's tie rod	8	33	PT160B33	Screw TSPEI 5933 10.9 10x45z	3
7	PT160B07	quick coupling M/F 1/4	1	34	PT160B34	H. mirror disconnecting device pin	1
8	PT160B08	Tee fitting TN 96 10 LR	2	35	PT160B35	H.mirror disconnecting dev. hooker	1
9	PT160B09	Fitting TN 126 10 LR	2	36	PT160B36	H.mirror disconnecting dev. body	1
10	PT160B10	Danger label	2	37	PT160B37	Lower Cylinder	1
11	PT160B11	Upper Cylinder	1	38	PT160B38	Oil collector hose	2
12	PT160B12	washer bonded 1/4	4	39	PT160B39	Black plastic plug 60x30	4
13	PT160B13	Technical data label	1	40	PT160B40	Covers ABS 22X2	4
14	PT160B14	Serial no. label	1	41	PT160B41	Screw TCEI UNI 5931 8.8 8x16z	4
15+16	PT160B15+16	Second clamp (15+16)	1	42	PT160B42	Fitting TN 92 10 LR (1/4)	2
17	PT160B17	25.30 FB1 bush	4	43	PT160B43	transport pipe	2
18+19	PT160B18+19	Third clamp (18+19)	1	44	PT160B44	Stop limit label	2
20	PT160B20	Back nut for spacer	3	45	PT160B45	Ground support	2
21	PT160B21	Screw TSPEI 5933 10.9 8x30z	3	46	PT160B46	rivet tt UNI 9200 3x7 all	4
22	PT160B22	Spacer	2	47	PT160B47	ITS – TECNODUE label	1
23+24	PT160B23+24	Fourth clamp c/w support (23+24)	1	48	PT160B48	blind nut UNI 5721 8 m 10 z	1
25	PT160B25	Screw TCEI UNI 5931 8.8 10x40z	2	49	PT160B49	washer UNI 6592 m 10 z	1
26	PT160B26	Beep beep coupler system	16	50	PT160B50	Third bar tie rod	2
27	PT160B27	Nut tie rods	8	51	PT160B51	Third bar	2
28	PT160B28	Washer for tie rods	8	52	PT160B52	Complete tie rod kit	8

PT 160 Upper Cylinder , Code: PT160B11				PT160 Lower Cylinder , Code: PT160B37			
Pos.	Code	Description	Qty	Pos.	Code	Description	Qty
1	PT160B1101	Gasket GHK 308 25.0 33.6 5.328.0	2	1	PT160B3701	Gasket GHK 308 25.0 33.6 5.328.0	2
2	PT160B1102	25.30 FB1 bush	2	2	PT160B3702	25.30 FB1 bush	2
3	PT160B1103	Upper cylinder head	1	3	PT160B3703	Lower cylinder head	2
4	PT160B1104	Gasket I/GR 0250 NCR	2	4	PT160B3704	Gasket I/GR 0250 NCR	2
5	PT160B1105	O-ring 3150 NBR 70 2.62x37.77 (128)	2	5	PT160B3705	O-ring 3150 NBR 70 2.62x37.77 (128)	2
6	PT160B1106	Gasket ring	2	6	PT160B3706	Gasket ring	2
7	PT160B1107	Gasket E/GR 0300 NPS	1	7	PT160B3707	Gasket E/GR 0300 NPS	1
8	PT160B1108	Cylinder's housing	1	8	PT160B3708	Cylinder's housing	1
9	PT160B1109	Cylinder's stem	1	9	PT160B3709	Cylinder's stem	1
10	PT160B1110	Stopper ring	2	10	PT160B3710	Stopper ring	2
11	PT160B1111	Screw TCEI UNI 5931 8.8 6x10 z	2				
12	PT160B1112	Washer 6x12x1,5	2				

Beep Beep coupler system, Code: PT160B26				PT 160 Gasket kit, Code: PT160B37KT			
Pos.	Code	Description	Qty	Pos.	Code	Description	Qty
1	PT160B2601	Pivot for beep beep coupler system	1	1	PT160B3701	Gasket GHK 308 25.0 33.6 5.328.0	2
2	PT160B2602	Hook for beep beep coupler system	1	4	PT160B3704	Gasket I/GR 0250 NCR	2
3	PT160B2603	Spring for beep beep coupler system	1	5	PT160B3705	O-ring 3150 NBR 70 2.62x37.77 (128)	2
				7	PT160B3707	Gasket E/GR 0300 NPS	1

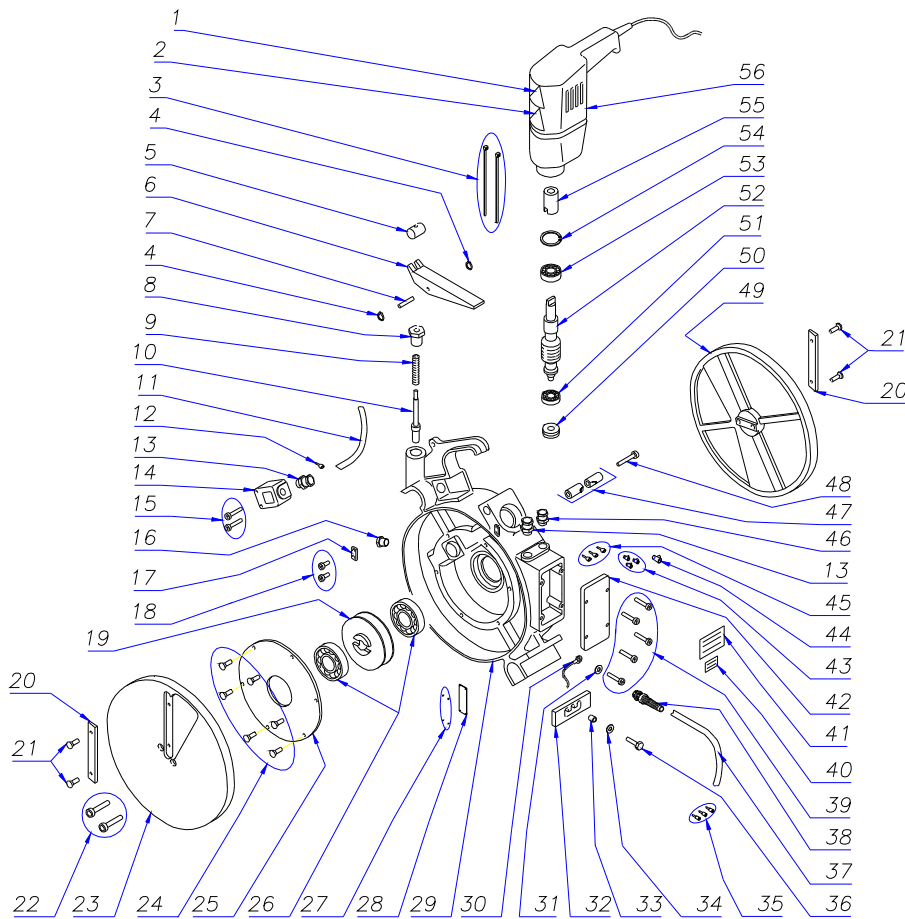


HYDRAULIC UNIT FROM PT 125 TO PT 250

PT 160 Hydraulic Unit , Code: PT160A				PT 160 Hydraulic Unit , Code: PT160A			
Pos.	Code	Description	Qty	Pos.	Code	Description	Qty
1	PT160A01	Hose R1T M 1/4 + FD 1/4 L=2500	2	39	PT160A39	Plug d. 8	1
2	PT160A02	Oil tank LT.1	1	40	PT160A40	Nipples M 1/4	1
3	PT160A03	washer 1/2	1	41	PT160A41	Washer 18X1.5	1
4	PT160A04	Plug 1/2	1	42	PT160A42	accumulator L 01/8 with 20 g. oil	1
5	PT160A05	Filter UP 100	1	43	PT160A43	Hydraulic unit control label	1
6	PT160A06	Screw TCEI uni 5931 8.8 8x85 zin	2	44	PT160A44	Carter for valves protection	1
7	PT160A07	Washer grower UNI 1751 m8 z	2	45	PT160A45	Screws TBEI 10.9 6X10 z	4
8	PT160A08	Gear pump PS-1/1.25 S	1	46	PT160A46	Serial number label	1
9	PT160A09	O-ring 2037 NBR 1.78x9.25 (012)	1	47	PT160A47	Technical data label	1
10	PT160A10	O-ring 3106 NBR 2.62x26.65 (121)	1	48	PT160A48	Carter	1
11	PT160A11	O-ring 4450 NBR 3.53x113.9 (246)	1	49	PT160A49	Rivet tt uni 9200 3x7 all	4
12	PT160A12	Max pressure valve FPMDC15P35	1	50	PT160A50	ITS - TECNODUE 80X25 label	1
13	PT160A13	Pump body HY 10 K3P0-01 1/4 BB	1	51	PT160A51	Screw TC CR UNI 6954 3.5X19 zin	4
14	PT160A14	Screw TCEI uni 5931 8.8 6x35 zin	4	52	PT160A52	light switch 16A + cap	1
15	PT160A15	O-ring 2056 NBR 1.78x14.00 (015)	2	53	PT160A53	Electric danger label	1
16	PT160A16	Check valve RPC 04 / 2.5 00 00	1	54	PT160A54	Box FMA 63 / 71	1
17	PT160A17	Distributor shaft TC2 dr. C0618	1	55	PT160A55	Fan cover MEC 71	1
18	PT160A18	Distributor block HD 104	1	56	PT160A56	Fan MEC 71	1
19	PT160A19	Lever protection HD 104	1	57	PT160A57	Condenser 20MF	1
20	PT160A20	By pass valve V03/M	1	58	PT160A58	Cable H07 RNF 2G1 TITANEX	0,35
21	PT160A21	Handle	1	59	PT160A59	Engine MEC 71 HP 0.5 B14 230V 4P	1
22	PT160A22	Distributor lever HD 104 L.185	1	60	PT160A60	Cable H07 RNF 3G1 TITANEX	3
23	PT160A23	Complete distributor TC2	1	61	PT160A61	Hollow screw	1
24	PT160A24	Pressure regulating valve VEN 06	1	62	PT160A62	Plug 1/4	1
25	PT160A25	Screw TCEI UNI 5931 8.8 4x10 z	2	63	PT160A63	Pressure gauge support	1
26	PT160A26	Washer UNI 6592 m 4 zin	6	64	PT160A64	Pressure gauge D.100 range 0-100 BAR	1
27	PT160A27	Nut UNI 7473 8 m4	2	65	PT160A65	Screw TCEI UNI 5931 8.8 6x16 zin	8
28	PT160A28	Plastic cap	1	66	PT160A66	Engine flange c.a. HP 0.33/0.5 FLCA71	1
29	PT160A29	Screw TCEI UNI 5931 8.8 4x35z	2	67	PT160A67	Joint HP 0.33/0.50	1
30	PT160A30	Microswitch ASITZ 7141	1	68	PT160A68	Pump joint g. 1 x 0.27 reinf.	1
31	PT160A31	Screw STEI UNI 5923 45h 10x14 z	2	69	PT160A69	Washer fl m 10x30x2,5 zin	2
32	PT160A32	Nut UNI 5589 8 m 10 zin	1	70	PT160A70	Screw TCEI UNI 5931 8.8 10x25 zin	2
33	PT160A33	Spring latch	1	71	PT160A71	Support 18-20	4
34	PT160A34	Ball 5/16"	1	72	PT160A72	Frame	1
35	PT160A35	Washer 1/4	9	73	PT160A73	Unit model HY10 130 complete	1
36	PT160A36	Screw TCEI UNI 5931 8.8 8x70z	2	74	PT160A74	Nut DIN 6923 8 m 6	4
37	PT160A37	Generic danger label	1	75	PT160A75	quick coupling M/F 1/4	1
38	PT160A38	Connector FT 299 44 M 1/4"	1				

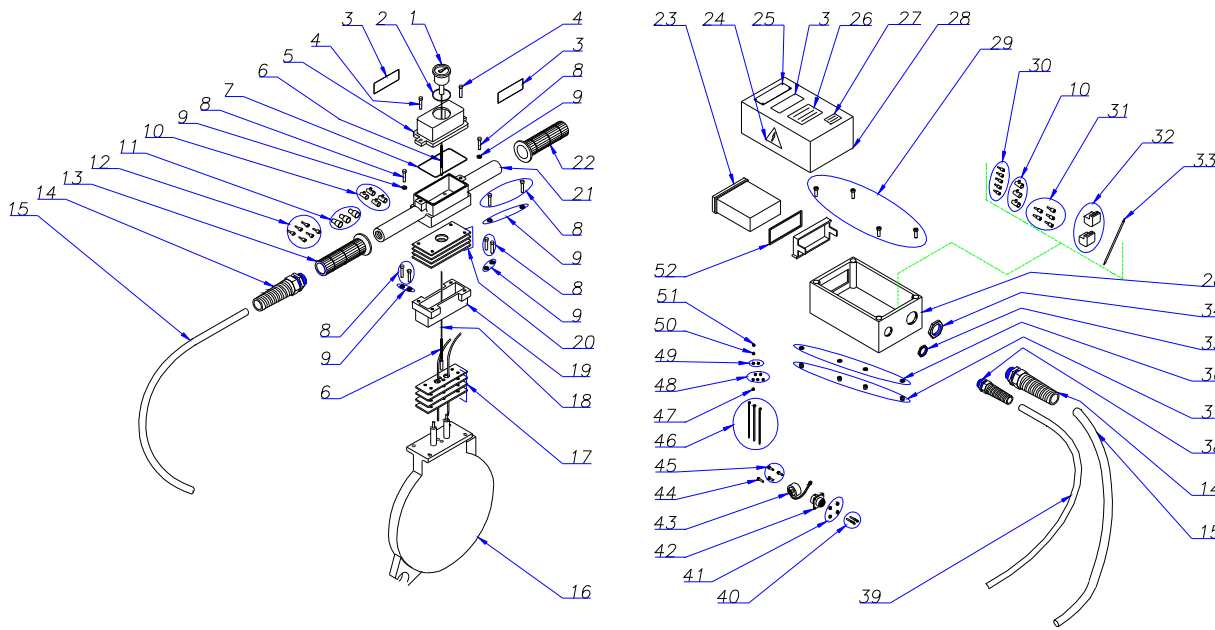


# PT 160 FACING TOOL



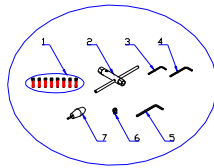
PT 160 Facing Tool , Code: PT160F				PT 160 Facing Tool , Code: PT160F			
Pos.	Code	Description	Qty	Pos.	Code	Description	Qty
1	PT160F01	Generic danger label	1	29	PT160F29	Facing tool body PT 160	1
2	PT160F02	Electric danger label	1	30	PT160F30	End connector M4	1
3	PT160F03	Plastic stub 142X3.6	2	31	PT160F31	Washer fl UNI m 4x12x1.5 zin	1
4	PT160F04	Ring UNI 7434 c70 4	2	32	PT160F32	Facing tool stopper	1
5	PT160F05	Bush	1	33	PT160F33	Screw spacer	1
6	PT160F06	Lever	1	34	PT160F34	Washer fl UNI m 5x15x1,5 zin	1
7	PT160F07	Pivot	1	35	PT160F35	Insulating pipe 1.5mm <sup>2</sup> P=10MM red	2
8	PT160F08	Nut	1	36	PT160F36	Screw TCEI UNI 5931 8.8 5x25 z	1
9	PT160F09	Spring	1	37	PT160F37	Cable H07 RNF 3G1,5 TITANEX	3,3
10	PT160F10	Facing tool stopper pivot	1	38	PT160F38	Cable stopper PG11	1
11	PT160F11	Cable H07 RNF 3G1	0,6	39	PT160F39	Screw TCEI UNI 5931 8.8 4x10 zin	5
12	PT160F12	Double insulating pipe 2x2.5mm <sup>2</sup> P=10MM blue	1	40	PT160F40	Serial no. label	1
13	PT160F13	Cable stopper PG11 163/11	2	41	PT160F41	Technical data label	1
14	PT160F14	Switch	1	42	PT160F42	Box cover	1
15	PT160F15	Screw TCEI UNI 5931 8.8 5x35 zin	2	43	PT160F43	Terminal mm <sup>2</sup> 2,5	3
16	PT160F16	Plug PG9	1	44	PT160F44	Terminal mm <sup>2</sup> 4	1
17	PT160F17	Cable holder 604 / 6	1	45	PT160F45	Double ins. pipe 2X1.5mm <sup>2</sup> P=8MM black	3
18	PT160F18	Screw UNI 6107 4.8 3x8z	2	46	PT160F46	Cable stopper PG9 163/9	1
19	PT160F19	Wheel for reducing gear	1	47	PT160F47	Stopper	1
20	PT160F20	2 holes blade	2	48	PT160F48	Screw TCEI UNI 5931 8.8 8x45 zin	1
21	PT160F21	Screw tspi UNI 6109 4x12 a2	4	49	PT160F49	Left disk	1
22	PT160F22	Screw TCEI UNI 5931 8.8 8x60	2	50	PT160F50	Bearing 51100	1
23	PT160F23	Right disk	1	51	PT160F51	Bearing 6002 ZZ	1
24	PT160F24	Screw TSPEI 5933 10.9 5x12 z	6	52	PT160F52	Screw for reducing gear	1
25	PT160F25	Flange	1	53	PT160F53	Bearing 6003 ZZ	1
26	PT160F26	Bearing 16008	2	54	PT160F54	Ring UNI 7437 c 70 35	1
27	PT160F27	Rivets tt UNI 7346 2,5x6,5 brass	4	55	PT160F55	Drill joint	1
28	PT160F28	label ITS - TECNODUE 80X25	1	56	PT160F56	drill B 5-813	1

# PT 160 HEATING MIRROR

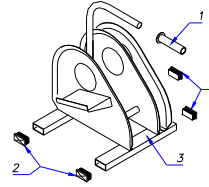


PT 160 Heating Mirror , Code: PT160T				PT 160 Heating Mirror , Code: PT160T			
Pos.	Code	Description	Qty	Pos.	Code	Description	Qty
1	PT160T01	Thermometer	1	27	PT160T27	Serial no. label	1
2	PT160T02	o-ring 2200 NBR 1.78x50.52 (033)	1	28	PT160T28	Thermostat box	1
3	PT160T03	Danger and compulsory label	3	29	PT160T29	Screw TC CR 7687 4.8 4x16 zin	4
4	PT160T04	Screw TCEI UNI 5931 a2 5x12	2	30	PT160T30	Yellow insulating pipe 1 mm <sup>2</sup> P=8MM	5
5	PT160T05	Thermometer holder cover	1	31	PT160T31	Red insulating pipe 1,5 mm <sup>2</sup> P=8MM	5
6	PT160T06	Insulating red pipe D.5 1.5V	0,2	32	PT160T32	3 studs terminal	2
7	PT160T07	O-ring 2400 NBR 70 1.78x101.32 (045)	1	33	PT160T33	Black flame retardant wire 1 mm <sup>2</sup>	1
8	PT160T08	Screw TCEI UNI 5931 a2 5x30	8	34	PT160T34	Nut ISO M25x1.5 CE	1
9	PT160T09	Washer grower UNI 1751 m5 z	8	35	PT160T35	Brass nut PG11 169/11	1
10	PT160T10	terminal mm <sup>2</sup> 2,5	7	36	PT160T36	Washer UNI 6593 m 4	4
11	PT160T11	terminal 4/6 mm <sup>2</sup>	3	37	PT160T37	Nut UNI 7473 8 m 4	4
12	PT160T12	Red cap for wire 2x1mm <sup>2</sup>	6	38	PT160T38	Cable stopper PG11	1
13	PT160T13	Handle with hole for cable st.	1	39	PT160T39	Cable H07 RNF 3G1,5 TITANEX	3,3
14	PT160T14	Cable stopper M25	2	40	PT160T40	Female terminal	4
15	PT160T15	Cable H07 RNF 7G1,5 TITANEX	3,3	41	PT160T41	Nut UNI 5588 m 3 brass	4
16	PT160T16	Heating plate PT 160	1	42	PT160T42	Connector UTG 012-8S	1
17	PT160T17	Gasket	4	43	PT160T43	Connector 8 pins	1
18	PT160T18	Probe PT100 2+2 wires	1	44	PT160T44	Screw TSPI UNI 6109 3x12 brass	1
19	PT160T19	Spacer	1	45	PT160T45	Screw TCI UNI 6107 3x10 brass	3
20	PT160T20	Gasket	4	46	PT160T46	Black plastic stub 99x2.5	3
21	PT160T21	Box	1	47	PT160T47	Ring 3.5 type 0	1
22	PT160T22	Rubber handle D. 30	1	48	PT160T48	Ring 3.5 type 1	5
23	PT160T23	Thermostat TLK38	1	49	PT160T49	Ring 3.5 type 2	2
24	PT160T24	Electric danger label	1	50	PT160T50	Ring 3.5 type 3	1
25	PT160T25	ITS - TECNODUE 80X25 label	1	51	PT160T51	Ring 3.5 type 5	1
26	PT160T26	Technical data label	1	52	PT160T52	Gasket for TLK38 thermostat 33X74	1

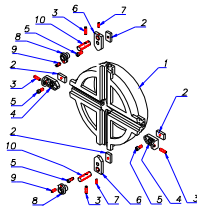
PT 160 TOOLS KIT



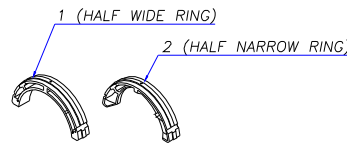
PT 160 SUPPORT FOR FACING TOOL AND H. MIRROR



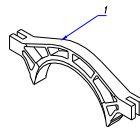
PT 160 STUB END DEVICE



PT 160 HALF RINGS REDUCTIONS



PT 160 SHORT SPIGOT FITTINGS CLAMP



PT 160 Stub Device , Code: PT160S				PT 160 Stub Device , Code: PT160S			
Pos.	Code	Description	Qty	Pos.	Code	Description	Qty
1	PT160S01	Plateau PT 160	1	6	PT160S06	Fixing stub end bracket	2
2	PT160S02	Cursor	4	7	PT160S07	Screw STEI UNI 5927 45h 5x8 zin	2
3	PT160S03	Screw STEI UNI 5927 45h 8x35 zin	4	8	PT160S08	Upper stopper	2
4	PT160S04	Bracket	2	9	PT160S09	Screw STEI UNI 5923 45h 8x20	2
5	PT160S05	screw TCEI UNI 5931 8.8 8x20 zin	4	10	PT160S10	Screw for fixing s.e. braket	2

PT 160 Tools kit, Code: PT160TK				PT 160 Tools kit, Code: PT160TK			
Pos.	Code	Description	Qty	Pos.	Code	Description	Qty
1	PT160TK01	Screw TCEI UNI 5931 8.8 6x60 zin	8	5	PT160TK05	Setscrew wrench 12.9 6	1
2	PT160TK02	Socket wrench	1	6	PT160TK06	Plug 1/2 for hydraulic unit	1
3	PT160TK03	Setscrew wrench 12.9 4	1	7	PT160TK07	Screw driver	1
4	PT160TK04	Setscrew wrench 12.9 5	1				

PT 160 Support, Code: PT160U				PT 160 Support, Code: PT160U			
Pos.	Code	Description	Qty	Pos.	Code	Description	Qty
1	PT160U01	Handle d.25-27	1	3	PT160U03	Support PT 160	1
2	PT160U02	Black plug 60x30	4				

PT 160 Half reduction			PT 160 Short spigot fit. clamp, Code: PT160G			
Pos.	Description	Qty	Pos.	Code	Description	Qty
1	Half wide ring av. sizes: 40,50,63,75,90,110,125,140mm		1	PT160G02	Short Spigot fittings clamp	1
2	Half narrow ring av. sizes: 40,50,63,75,90,110,125,140mm					

**This manual has been printed on December 2008**

The technical data and information contained in this manual can be changed without any notice