



T H I N K  
C R E A T E  
A U T O M A T E

C A T A L O G U E



# GEARBOX ASSEMBLY LINE

## MAIN FUNCTION

Assemble gearbox.



## DESCRIPTION

**Some stations of this line have been carried out with the following duties:**

- Automatic positioning thru 90 degrees of gearbox holding adapter. Such operation is carried out by means of an anthropomorphous robot provided with pneumatic pick-up gripper.
- Distribution thru two linear vibrators and automatic tightening of 8 screws retaining gearing housing to gearbox thru robots provided with power runners. Before assembly and tightening, manipulation robot picks up adapter with component for deposit off line on work table which rotates differential.
- Distribution thru two linear vibrators and automatic tightening of 11 screws retaining gearing housing to gearbox thru robots provided with power runners.
- Automatic assembly of balls and springs in gearbox. Automatic plugs tightening thru power runner. Automatic distribution of balls and springs thru cup feeder. Automatic distribution of plugs by means of cup feeder

and linear vibrator.

- Automatic marking and label application on gearbox of information received by PLC thru serial dialogue. Automatic greasing of primary shaft splined part by means of a pneumatic grease supply system. Automatic protection plug assembly on primary shaft thru pusher piston and pneumatic gripper for plug deformation.

Between several stations, transfer of adapter and gearbox group occurs thru pallet line.

Inside each station, handling of adapter and gearbox group is automatically carried out by manipulator robot provided with single or double pneumatic pick-up gripper.

## SPECIFICATIONS

### ASSEMBLED PARTS

gearing housing to gearbox retaining screws, ball, spring, plug, primary shaft protection plug

### POWER SUPPLY

Voltage: 400 Vac (three-phase + ground)

Frequency: 50 Hz

### PART TRANSFER SYSTEM

- By means of manipulation robot (inside each station)
- On pallet line (between several stations)

### PNEUMATIC POWER SUPPLY

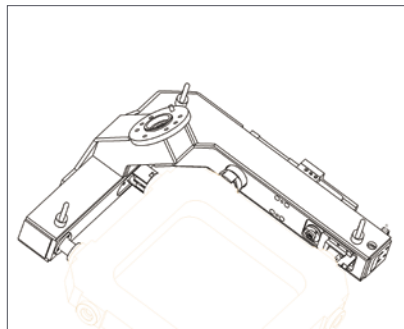
- Operating pressure: 5 bar
- Hourly consumption: 2,5 Nm<sup>3</sup>/h (op. 999.2)
- 30 Nm<sup>3</sup>/h (op. 1220)
- 40 Nm<sup>3</sup>/h (op. 1250)
- 40 Nm<sup>3</sup>/h (op. 1260)
- 4,5 Nm<sup>3</sup>/h (op. 1310)
- 2,5 Nm<sup>3</sup>/h (op. 1410)
- 4 Nm<sup>3</sup>/h (op. 1510)
- 4 Nm<sup>3</sup>/h (op. 1730)
- 15 Nm<sup>3</sup>/h (op. 1780 )

### SAFETY GUARDS

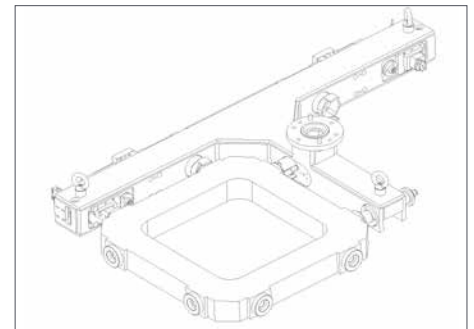
- Fixed type protections
- Moving type protections provided with a interlock device
- Moving units covering guards
- Emergency push-buttons.



Adapter and gearbox group



Adapter pick-up grippers

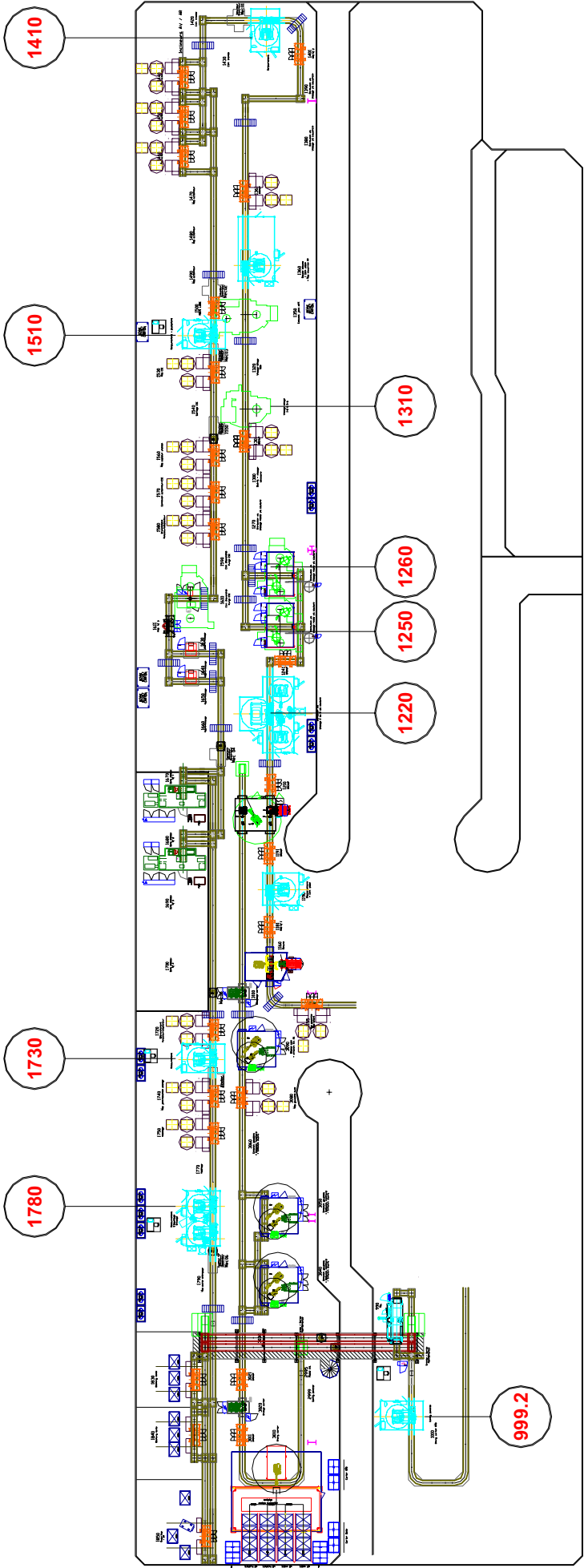


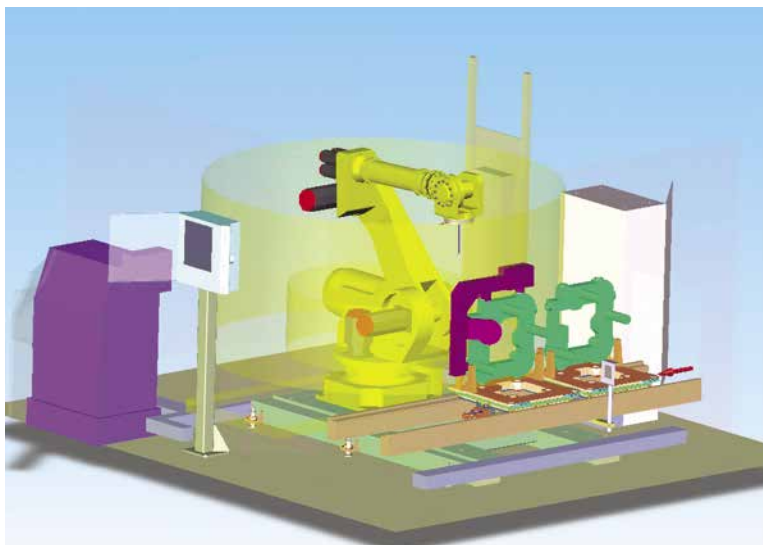
## LIST OF STATIONS

STATION	DESCRIPTION	TIPOLOGIA
999.2	Adapter positioning station Automatic	Automatic
1220	Gearing housing to gearbox retaining station Automatic	Automatic
1250	Gearing housing to gearbox retaining station Automatic	Automatic
1260	Gearing housing to gearbox retaining station Automatic	Automatic
1310	1-2, 5-6 and reverse ball holder unit assembly and tightening station Automatic	Automatic
1410	Gearbox and adapter group positioning station Automatic	Automatic
1510	Gearbox and adapter group positioning station Automatic	Automatic
1730	Gearbox and adapter group positioning station Automatic	Automatic
1780	Station for marking, labelling + primary shaft splines greasing + plug fitting	Automatic



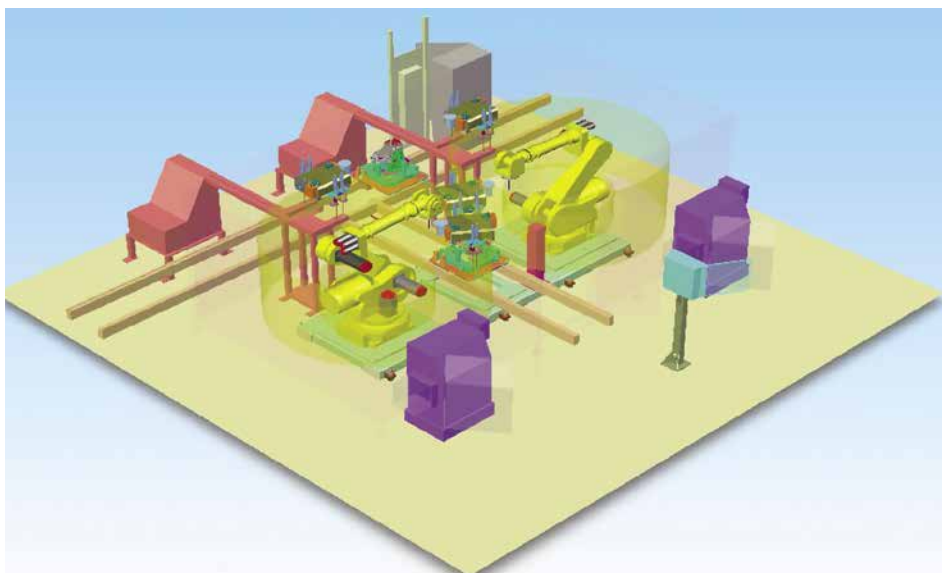
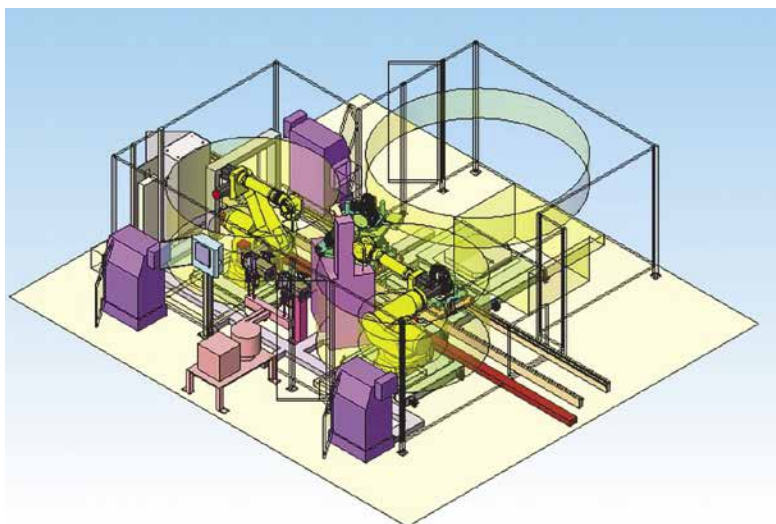
STATIONS DIAGRAM





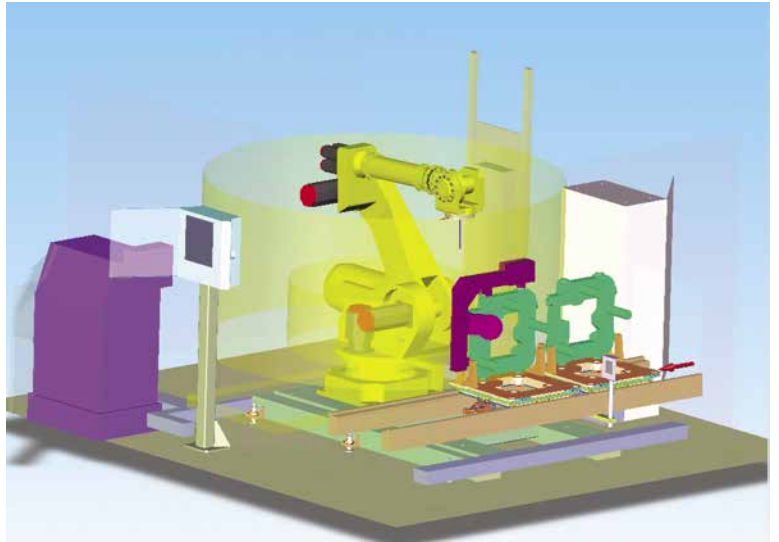
OP. 999.2 - ADAPTER POSITIONING STATION

OP. 1220 - GEARING HOUSING TO GEARBOX  
RETAINING STATION

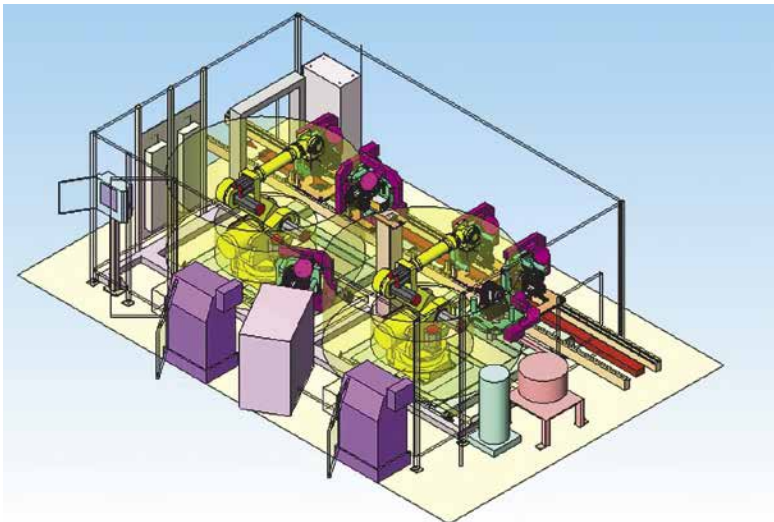


OP. 1250 & OP. 1260 - GEARING  
HOUSING TO GEARBOX RETAINING  
STATION

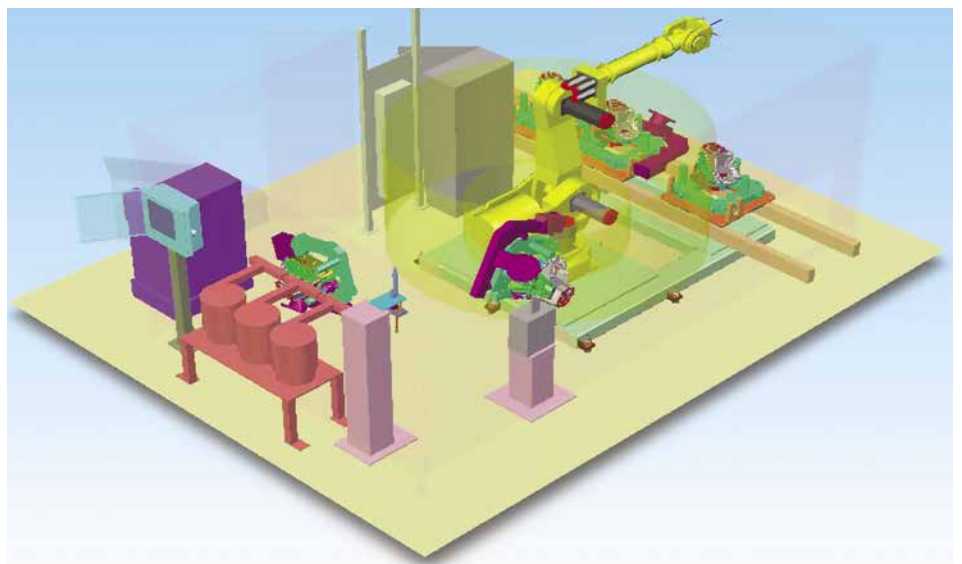
OP. 1410, OP. 1510 & OP. 1730 - GEARBOX AND  
ADAPTER GROUP POSITIONING STATION



OP. 1780 - STATION FOR MARKING, LABELLING  
+ PRIMARY SHAFT SPLINES GREASING + PLUG  
FITTING



OP. 1310 - 1-2, 5-6 AND REVERSE  
BALL HOLDER UNIT ASSEMBLY AND  
TIGHTENING STATION







# ENGINE FLYWHEEL ASSEMBLY LINE

## MAIN FUNCTION

Assemble the flywheel to the engine, through calibrated tightening of 6 screws.



## DESCRIPTION

The flywheels are loaded/unloaded by means of fork trucks in the buffer bays of the working line, into special containers, while the engines are feeding from the working line. By means of an electromechanic gantry, equipped with dedicated gripper, the flywheel is taken up from the container and laid down to the pallets of the interlocking line; there, the flywheel is properly positioned and integrated with a big washer and n°6 screws.

The auxiliary conveyor system, consisting of 4 configuring paths, transfers the flywheel to the picking-up zone.

An automated gantry takes the flywheel up from the pallet, moves to a preset position in face of the engine, and then rotates its gripper through 90°. The flywheel, oriented towards the angular positioning dowel of the driving shaft, is then secured loose by 6 screws, which are partly tightened by the air-powered nutrunners mounted on the gripper.

The engine with its flywheel arrives at the station dedicated to the calibrated tightening of the above mentioned n°6 fastening screws, which are then definitely tightened by powered nutrunners, with 43 Nm driving torque.



## SPECIFICATIONS

**WORKING CYCLE**  
SEMI-AUTOMATIC

**PART TO BE ASSEMBLED**  
ENGINE FIRE 8 V

## ELECTRIC POWER SUPPLY

Voltage: 500 V a.c.

Frequency: 50 Hz

## CYCLE TIME

OP. 790: 12 sec

OP. 820: 16,8 sec

OP.830 : 16,8 sec

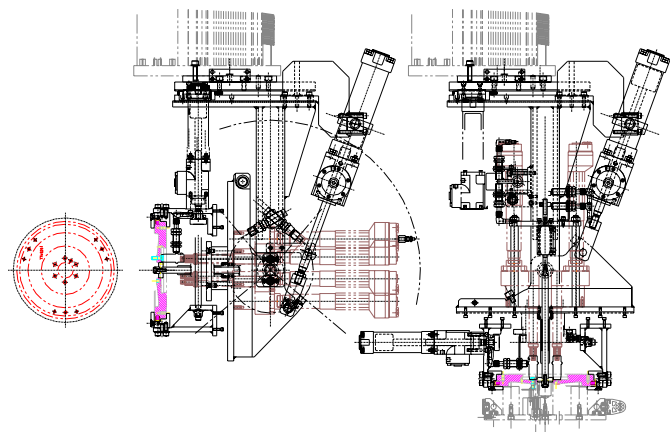
## AIR SUPPLY

At 5 bar operating pressure

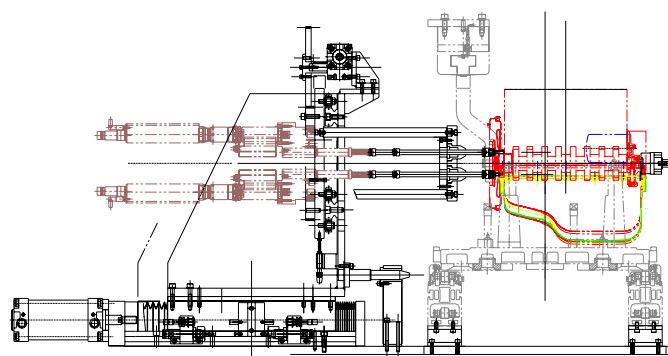
## PART TRANSFER SYSTEM

With pallets, on roller line

## OP 820 - PARTIAL TIGHTENING



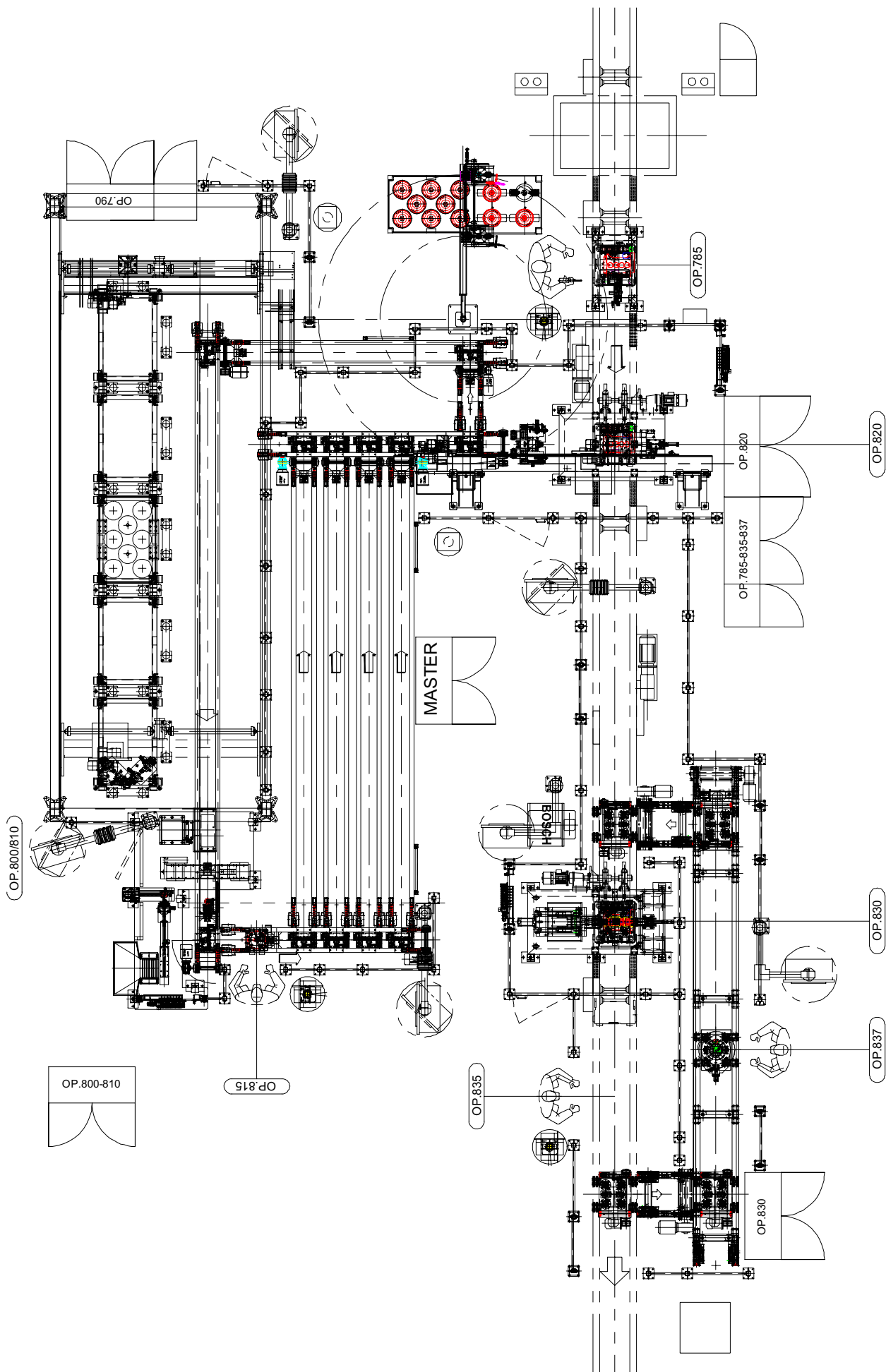
## OP 830 - FINAL TIGHTENING



## LIST OF STATIONS

STATION	DESCRIPTION	TYPE
790	Flywheel picking-up from container and laying-down to the pallets of the interlocking line	AUTOMATIC
800	Angular orientation of the flywheel	AUTOMATIC
810	Move and assembly of 1 washer to the flywheel (1200 only); blowing feed of 6 screws, which are then inserted to the flywheel	AUTOMATIC
815	Backup op. 790, 800, 810	BACKUP
820	The flywheel, previously oriented and complete with 1 big washer and 6 screws, is picked up by the automated gantry from the pallet feeding out from the 4-path store (paths may be reconfigured). The gantry moves to in face of the engine, its gripper turns 90° and then the flywheel, with orientation towards the angular positioning dowel of the driving shaft, is assembled and partially fastened with 6 screws.	AUTOMATIC
785	Backup op. 820	BACKUP
830	Calibrated tightening of 6 screws for complete fastening of the flywheel	AUTOMATIC
835	Backup op. 830	BACKUP
837	Phase A - Pallet distribution with sorting of rejects in the repair zone through Statec reader Phase B - Display of failures stored in the memory upon the previous operations; manual repair Phase C - Re-entering of pallet with repaired assembly to the main line	REPAIR

STATIONS DIAGRAM







# CYLINDER HEAD ASSEMBLY LINE - OP. 40

## MAIN FUNCTION

- Valve seats and guides lubrication.
- Intake and exhaust valve seats and guides insertion in cylinder head.
- Cylinder head marking.



*The line*



*Cylinder head - Mercury Marine Motor*

## DESCRIPTION

Station 40 mainly consists of an arc-welded base supporting pneumatically controlled horizontal slide by means of cylinder for components transfer during load and unload phases.

Cylinder head lubrication and marking points are located beside load / unload station.

Such base carries a two-axes portal provided with part pick-up gripper, equipped with clamping brackets, supports and centralizers.

Gripper permits part angular positioning during work phases.

Mobile frame is fixed on portal for support of 2 Promess opposed presses, with force and position control.

Two supports are fixed on base respectively for valve seats and valve guides insertion fixtures.

Valve seats and guides supply is through Koeberlein supply systems.

## SPECIFICATIONS

### ASSEMBLED PARTS

Valve seats, valve guides

### ELECTRIC POWER SUPPLY

Voltage: 400 V (three-phase + ground)

Frequency: 50 Hz

### AIR SUPPLY

Operating pressure: 6 bar

### LUBRICATION SYSTEM

Lubrication power unit capacity: 15 l

### PART TRANSFER SYSTEM

Horizontal slide, two-axes portal

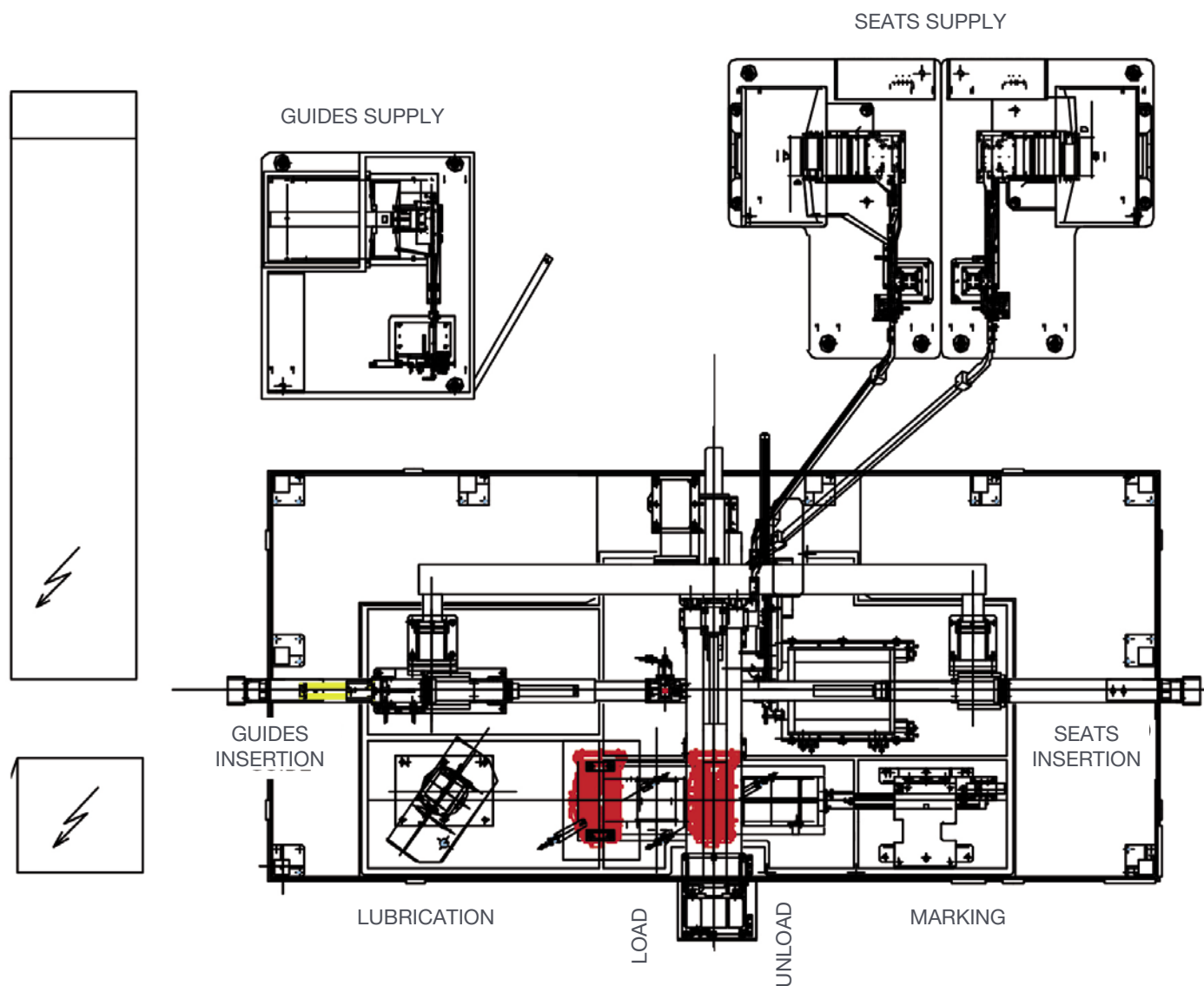
### SAFETY GUARDS

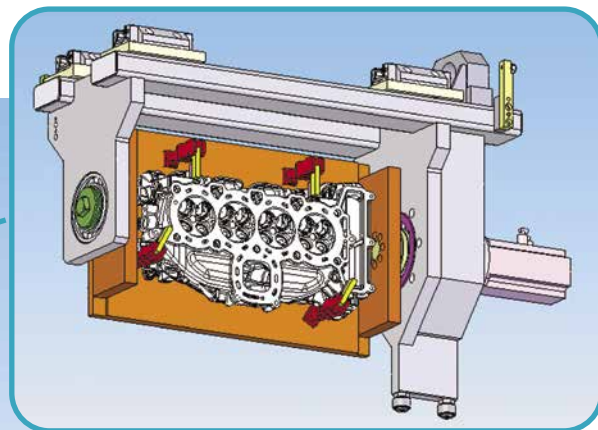
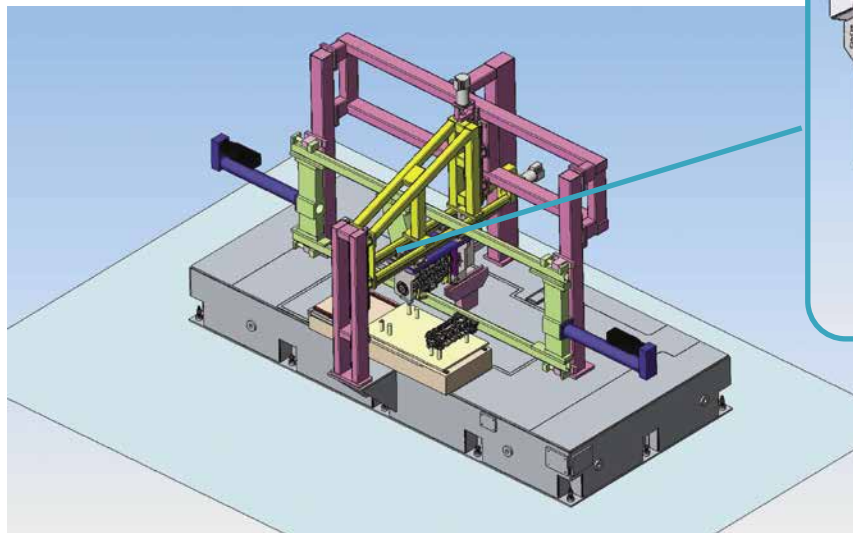
- Fixed type protections
- Moving type protections provided with a interlock device
- Moving units covering guards
- Emergency push-buttons.

## LIST OF STATIONS

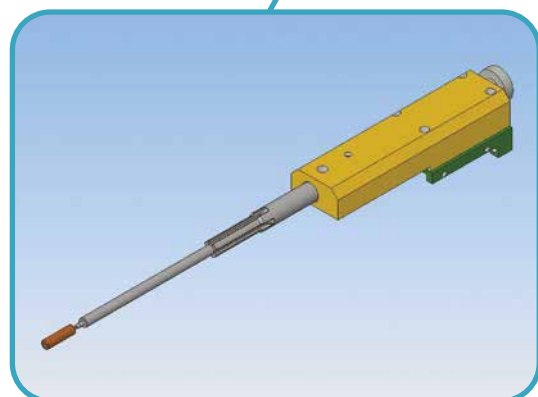
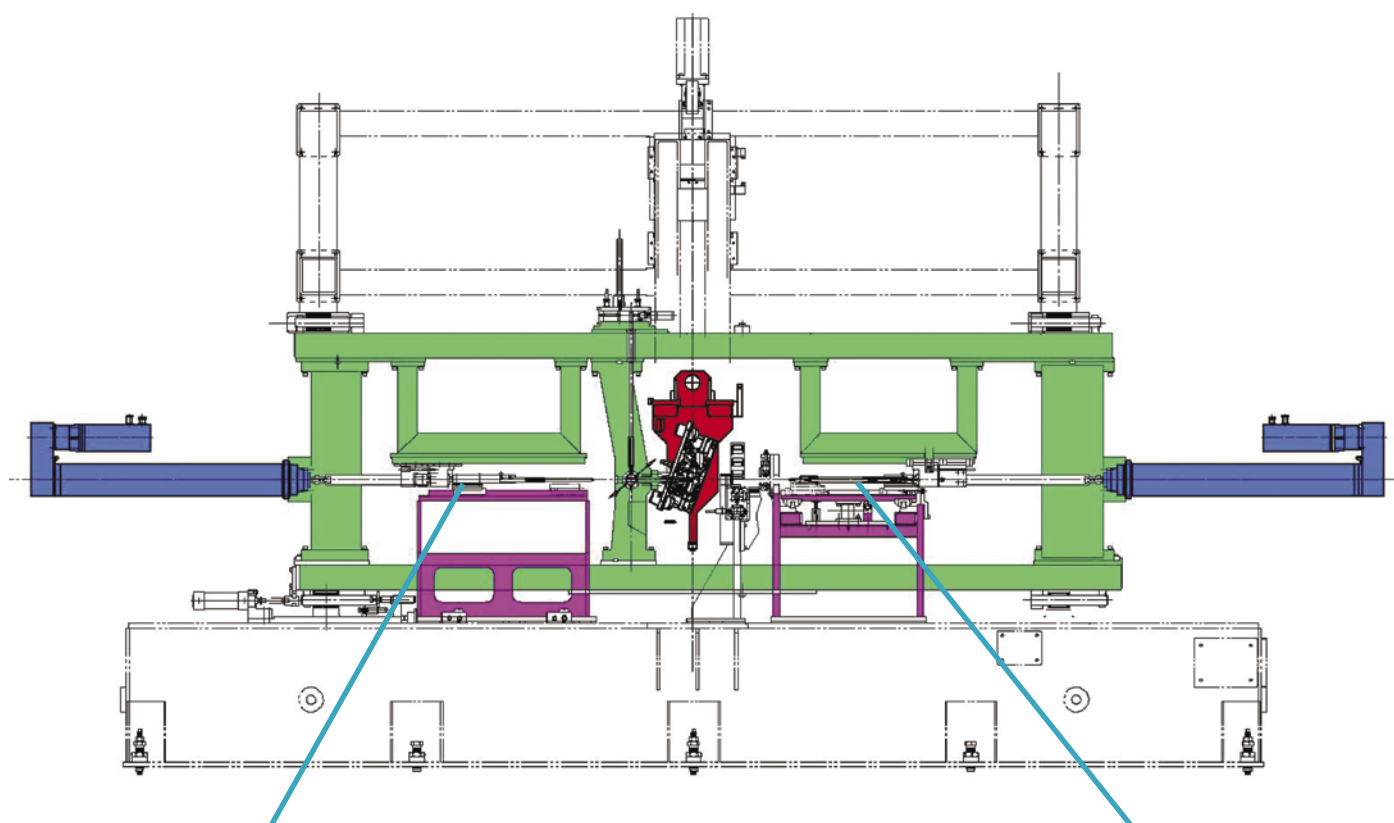
STATION	DESCRIPTION	TYPE
40	Load / unload	AUTOMATIC
40	Lubrication	AUTOMATIC
40	Valve seats insertion	AUTOMATIC
40	Valve guides insertion	AUTOMATIC
40	Marking	AUTOMATIC

## STATIONS DIAGRAM

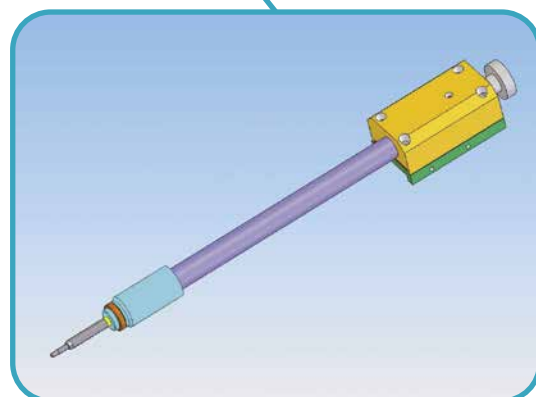




*Part pick-up gripper*



*Valve guides insertion fixture*



*Valve seats insertion fixture*





# BRAKE PADS GRINDING MACHINE

## MAIN FUNCTION

Automatically grind the brake pads of the friction material side.



## DESCRIPTION

The brake pad grinding machine is a self-contained machine, substantially consisting of an electrowelded steel bed, where the following is fixed:

- One worktable suitable for translation of brake pads;
- One working unit consisting of a power spindle, which the grinding wheel is coupled to.

Loading and unloading of the brake pads to be ground are carried out by means of two units, mounted on the worktable and including suitable pneumatic actuators, used to control the displacement and rotation of the pick-up units.

The pad picking-up units are fitted with appropriate electromagnets.

## SPECIFICATIONS

### SPEED

The speed of the worktable where the brake pads are sliding may be adjusted function of the loading manipulator speed.

### LOADER

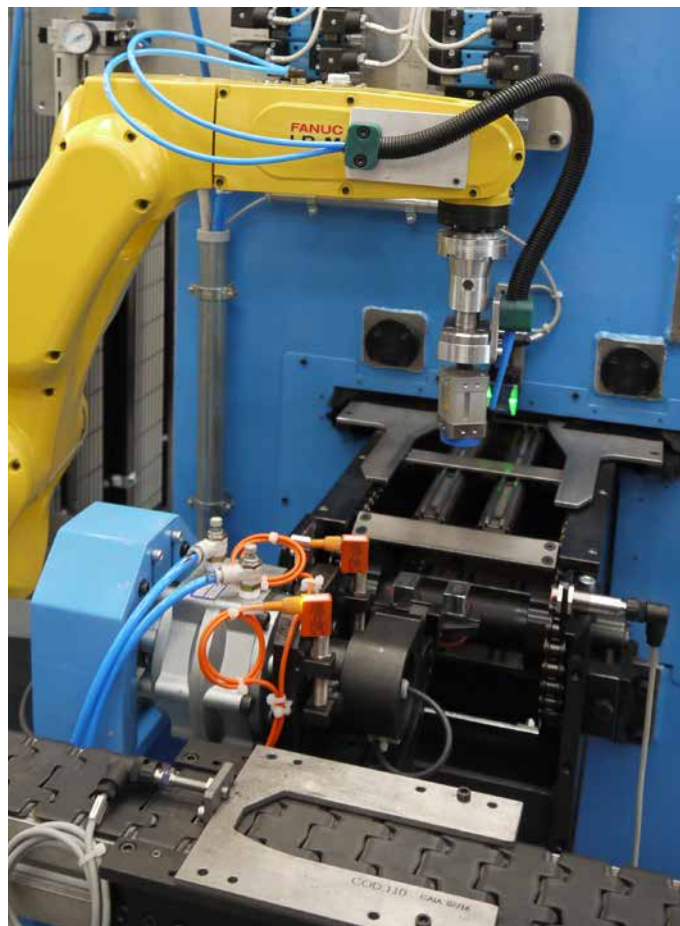
- A - capacity 550 pcs/h.
- B - capacity 850 pcs/h.

The grinding head unit includes the following main components:

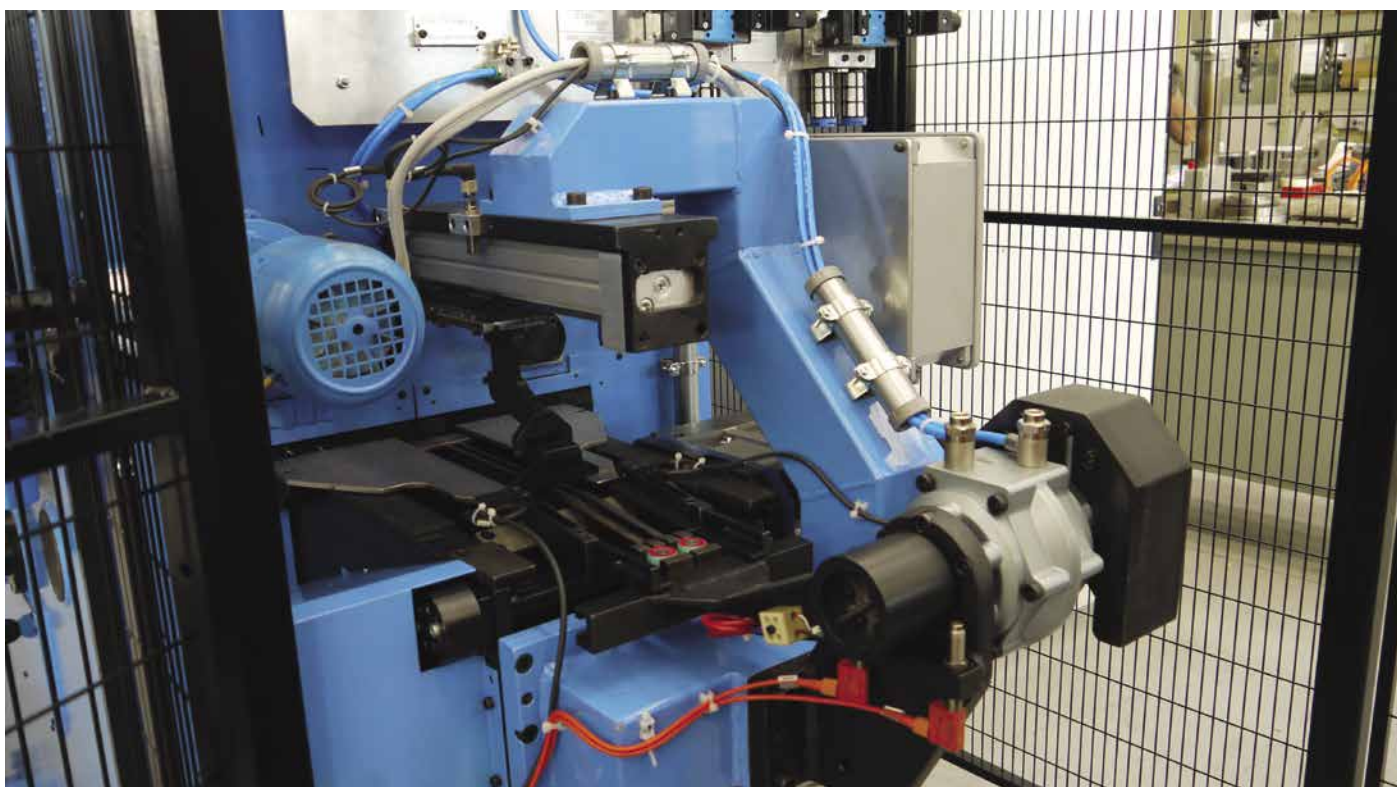
- Head slide running on round bars and fixed to the frame of the bed unit;
- Floating plate, constrained to the hinging plate by means of 2 pins, where the head coupling plate is fixed;
- Power spindle "Omlat", 2-pole, 380 Volts, secured to the head coupling plate, where the diamond wheel has to be mounted;



Loader A



Loader B (Robot)

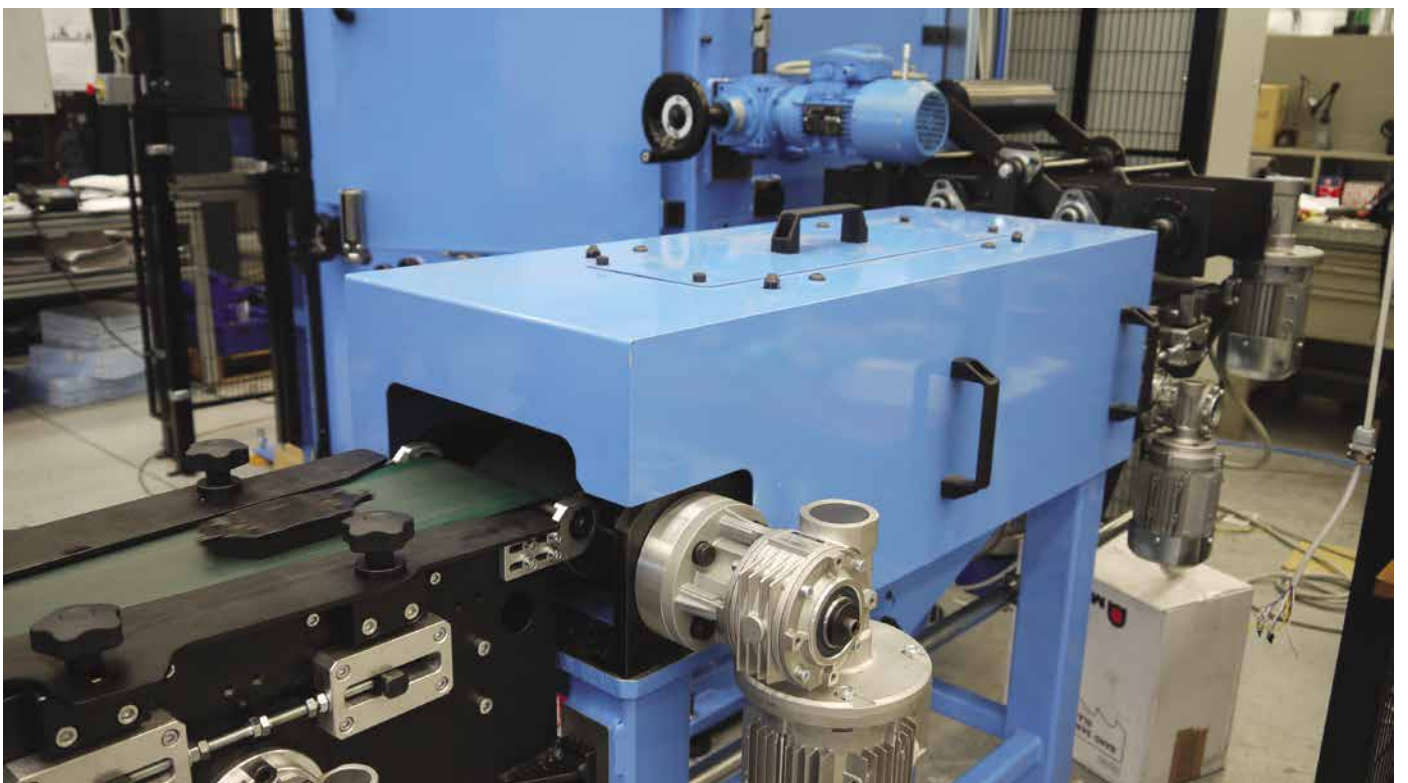


Unloading tipper





*Machine inside – Grinding head and cutting arrangement*



*Unloading tipper*

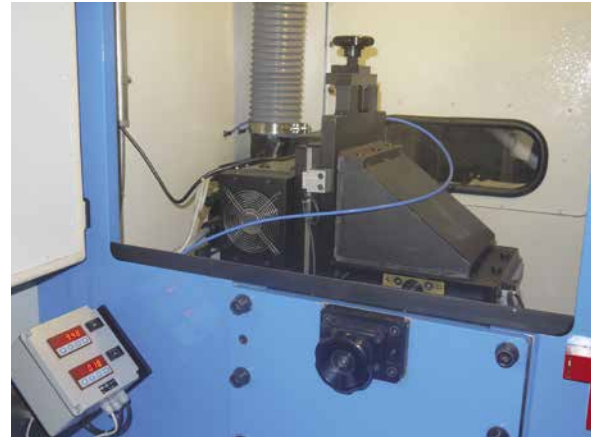




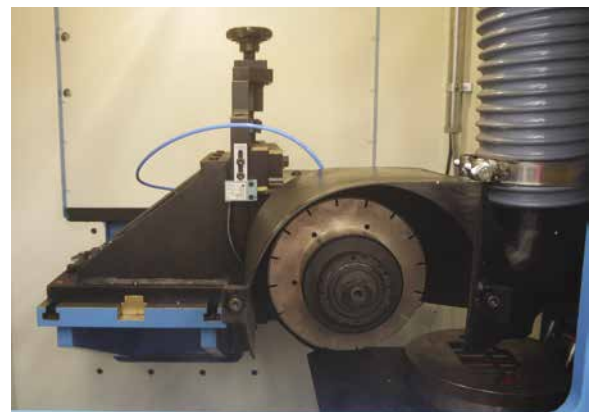
# BRAKE PADS CUTTING MACHINE

## MAIN FUNCTION

Carry out parallel and oblique cuts on the brake pads and it is also possible to machine the “J” bevels on the brake pads by fitting a specially shaped wheel and positioning the cutting head in the desired position.



*Combined system for adjusting the position of the electric head*



*Cutting head with adjustable height*

## DESCRIPTION

The brake pads cutting machine is a single-component system consisting essentially of a welded steel base on which are fixed:

- a working bench suitable for shifting brake pads;
- a controlled axis, the one for angular positioning of the brake pad;
- working unit, consisting of a spindle fitted with a cutting disc.

The brake pads are loaded manually by the operator onto a special dedicated template, depending on the kind of pad, with metallic support on the bottom, in order to be loaded on the machine in the exact cutting position. The pads are locked by means of special electromagnets.

To change type a special mask is required for each type to be machined, consisting of a disc shaped like the pad, and appropriately connected for fast positioning on the fixed electromagnets support.

The pads are unloaded manually by the same operator.

## SPECIFICATIONS

### WORKING CYCLE

- pad manually loaded in specific template;
- brake pad locked with the aid of the electromagnet;
- door closed– translation authorized;
- translation of linear table towards the cutting head;

- machining (cutting)
- linear table returns to starting position, passing under the cutting head again;
- door opened- electromagnet unlocked;
- pad unloaded manually;

### PRODUCTIVITY

3 pcs per minute

(Productivity valid only in case the operator loads / unloads and starts cycle 4 ").

### GRINDING HEAD

The grinding head group consists of the following main parts:

- combined system with horizontal and a vertical slide with the possibility to be angularly adjusted with maneuvering handwheels.

- ability to view the position of the head by magnetic readers or with tachometers.
- Electric spindle "HSD" 4-pole - 8.1 kW - 380 V, attached to the faceplate of the head, on which to mount the diamond wheel;

The work area of the electric head is closed and isolated in a suitable compartment maintained in depression so as to allow aspiration of powders.

The angular position of the element will be managed by the Megatorque Motor NSK system including manual programming keypad.



*Examples of machining*

# MULTI-PURPOSE BEVEL-GRINDING MACHINE

## MAIN FUNCTION

Carry out parallel and radial bevels of the brake pads, and possibly as a first operation, if necessary, grind the horizontal surface of the pad.



*Combined system for setting of the electric grinding head position*



*Electric grinding head*

## DESCRIPTION

The multi-purpose bevel-grinding machine for laboratory use is a self-contained system, substantially consisting of an electrowelded steel bed, where the following is fixed:

- One worktable suitable for brake pad transfer
- One working unit consisting of a power spindle, which the grinding wheel has to be coupled to.

The brake pads are manually loaded by the operator to a suitable template, dedicated to that specific pad

typology, with metal support on the bottom and so positioned as to be loaded onto the bevel-grinding machine in the right position.

The pads are locked by suitable electromagnets.

When the pad type has to be changed, a template corresponding to the pad type to be machined has to be used; it consists of a disc having the same shape as the pad, properly fitted for a rapid positioning on the fixed support holding the electromagnets.

The brake pads are manually unloaded by the operator.



## SPECIFICATIONS

### WORKING CYCLE

- Manual loading of the brake pad onto a matching template
- Pad locking by means of electromagnets
- Linear table translation towards the grinding head
- Machining (bevel on one side of the pad)
- Return of the linear table to the starting position by feeding again underneath the grinding wheel
- Manual unloading of the brake pad
- Once the whole brake pad lot is machined, the pad template has to be turned by 180° in order to chamfer the pad on the opposite side; then the above-mentioned steps are repeated.

### PRODUCTIVITY

3 pcs per minute

(This output rate may be confirmed only on condition

the operator loads/unloads the workpiece and starts the cycle within 4").

### GRINDING HEAD

- Combined system consisting of one horizontal and one vertical slides, with angle adjustment possibility by means of handwheels;
- Possible head position visualization through magnetic readers or revolution counters;
- Power spindle "Omlat", 2-pole, 380 Volts, secured to the head coupling plate, where the diamond grinding wheel has to be mounted.

The electric head working area is closed and insulated in a suitable pressurized zone, vacuum held to assure dust suction.



*Brake pad on process*



*Item to be machined*



*Item machined*

# SURFACE AND BEVELS GRINDING | FOG200

## MAIN FUNCTION

Perform grinding of friction surfaces, parallel and radial chamfers of brake pads.



## DESCRIPTION

The **FOG200** robotic grinding machine possesses an innovative concept for friction surface grinding, in that, in this operation, the gripper attached to the robot's wrist with the pad to be machined attached is clamped in the work station and the tool i.e., the grinding wheel sliding on special precision guides under the pad performs the flattening of the friction surface.

This system allows for greater precision of parallelism and flatness of the ground surface.

The **FOG200** is a machine placed inside an safety cabin equipped with dust extraction hoods. It consists essentially of an electro-welded steel base on which the following are fixed:

- a Yaskawa 6-axis robot for gripping and processing brake pads
- a group composed of an electric head on which the grinding wheel is inserted to carry out planing and chamfering
- a group composed of an electric head on which the grinding wheel is inserted to perform "J" bevels and cuts
- an automatic jig changing unit



- an automatic gripper changing unit
- a brake pad dosing unit.

The brake pads that feed the machine all arrive at the same location through a conveyor, which feeds the robot via an automatic dosing unit.

A single pad is released from the dosing unit, transported by the conveyor and landed on a jig.

The robot picks up and clamps the brake pad by a suction cups system and by a pneumatic gripper, moves to the plane grinding position, then subsequently to the stations dedicated to chamfers and cutting.

Based on the recipe previously set by the operator on the panel, the robot performs the necessary machining operations.

## SPECIFICATIONS

### CYCLE / SEQUENCE OF OPERATIONS

- Release the pad by the dosing unit

#### Work sequence



Gripper that pick up the pad



Smoothing of the pad surface



Chamfering of the edges

- Locking the pad into the robot gripper using suction cups and gripper fingers
- Moving the robot gripper and clamping into the unit for grinding the plane
- X-axis working stroke with the grinding wheel on board for plane grinding
- Moving the X-axis to the defined position to enable the execution of radial, tangential bevels
- Parallel movement of the robot to the working area dedicated to bevels
- Bevel execution (bevel on one side)
- Possible 180° rotation of the robot wrist for chamfer execution on the other side
- Possible movement of the robot toward the unit for execution of J-bevels and cuts
- Movement of the robot toward the conveyor
- Drop the pad onto the conveyor.

### PRODUCTIVITY

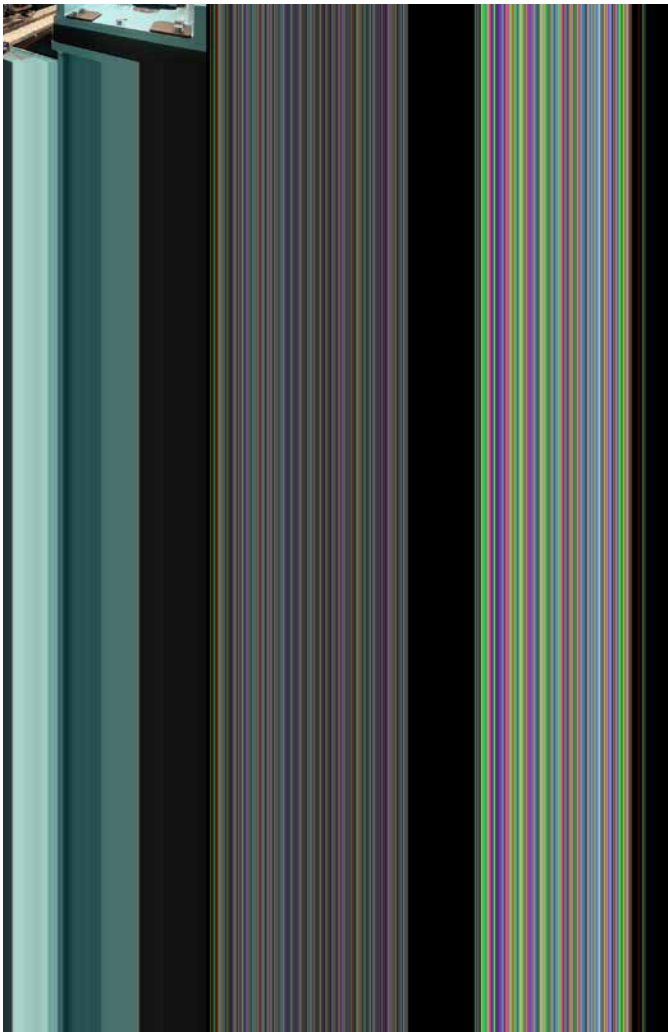
Varies according to brake pad characteristics.



Item to be machined



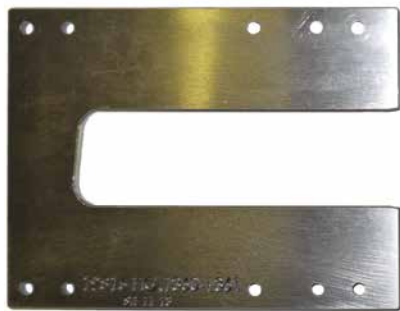
Item machined



*Gripper - jig change*



*Gripper change*



*Type change kit*



## OPTIONAL

The pad type change involves changing the pick-up jig and robot gripper. The latter operation is done automatically by processing robots.

The gripper and jig are previously loaded manually in special locations outside the booth safely with the machine being processed, and it is the robot that, via a quick coupler deposits the gripper and jig of the previous type and picks up the gripper and jig of the type of pad to be made.

The gripper pick-up assembly (type change) , for each type of tablet is composed of the following parts:

- Stop jig on conveyor
- Suction cup holder block
- Right and left jaw

In the working areas of the grinding wheel there are a system of hoods so that dust can be extracted.



# ROBOTIC CHAMFERING MODULE

## MAIN FUNCTION

Perform parallel and radial bevels of the brake pads.



## DESCRIPTION

The robotic chamfering machine is a machine inserted at inside a safety protection cabin, equipped with dust extraction hoods. It is essentially composed of an electro-welded steel base on which are fixed:

- a FANUC robot with 6 axis for gripping and machine the brake pads;
- a unit composed of an electric head on which is inserted the grinder for chamfering;
- a dispensing unit for brake pads;
- preparation for the electric head to cut the brake pads

The brake pads which feed the machine all arrive in the same position through a conveyor, which, through an automatic dispenser, feeds the robot.

A single pad is released from the dispenser and stops on a template.

The robot picks up and locks the brake pad by means of a suction system and a pneumatic gripper.

According to the recipe previously set by the operator on the operator panel the robot chamfers the pad.



## SPECIFICATIONS

### CYCLE / SEQUENCE OF OPERATIONS

- the pad is released by the dispenser;
- the pad is locked in the robot's gripper by suction pads;
- the robot moves the gripper towards the grinder;
- chamfering (chamfered on one side);
- the robot rotates the wrist 180° to chamfer the other side;
- the robot moves towards the conveyor;
- the pad is released onto the conveyor;

### PRODUCTIVITY

10/20 pieces per minute

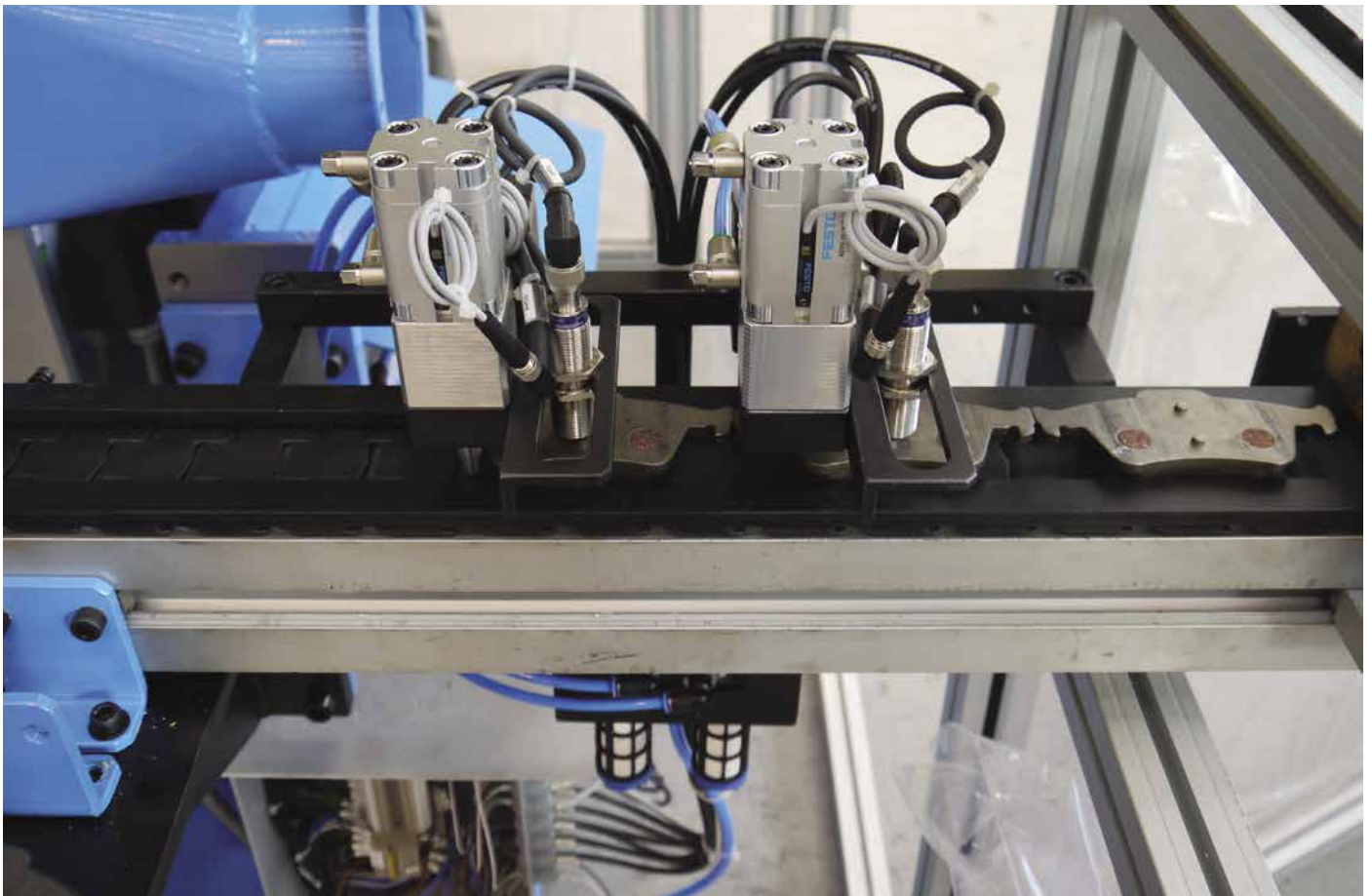
(Productivity is based on the characteristics of the brake pads).

### THE GRIPPER GROUP

The gripper group (change type), for each type of pad is composed of the following parts:

- Template for stopping on the conveyor
- Suction support block
- Right and left Jaw

The working area of the grinding wheel is closed in a hood in order to allow the aspiration of dust.



*Brake pads dispensing group*



*Item to be machined*



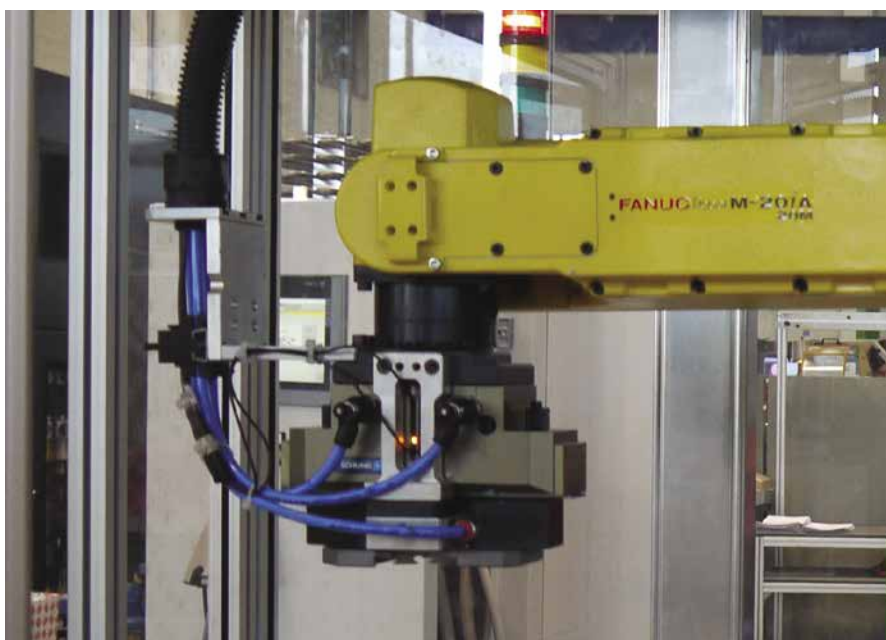
*Item machined*





*Pads stopping template*

*Kit for changing type*



*Pads gripper*



# ELECTRICAL SCORCHING MACHINE 1 WORK TRACK

## MAIN FUNCTION

Scorch the friction surface of the brake pads.



## DESCRIPTION

The operating sequence starts by dosage of the brake pads by means of suitable pneumatic cylinders mounted on a loader.

Afterwards, the brake pads are dragged to a hot-plate unit, to be then compressed by a thrust unit.

Once the cylinder reaches the setting pressure and exerts the preset force onto the brake pad during the preset time period, function of the pad type on process, the first scorching phase is performed.

The brake pads, already submitted to the first treatment, are then conveyed to the cold-plate station in order to be cooled; finally, their starting parallelism is restored.

The finished brake pads are unloaded by means of an out-feeding chute.

The scorching machine is equipped with control devices, so as to make it a multi-purpose machine suitable to accept any kind of brake pad; the pad limit dimensions is the only requirement to this purpose.

## SPECIFICATIONS

### WORKING CYCLE AUTOMATIC

**IN:** brake pads entering the machine by means of a manually filled loader.

**OUT:** automatic unloading of brake pads by means of an out-feeding chute.

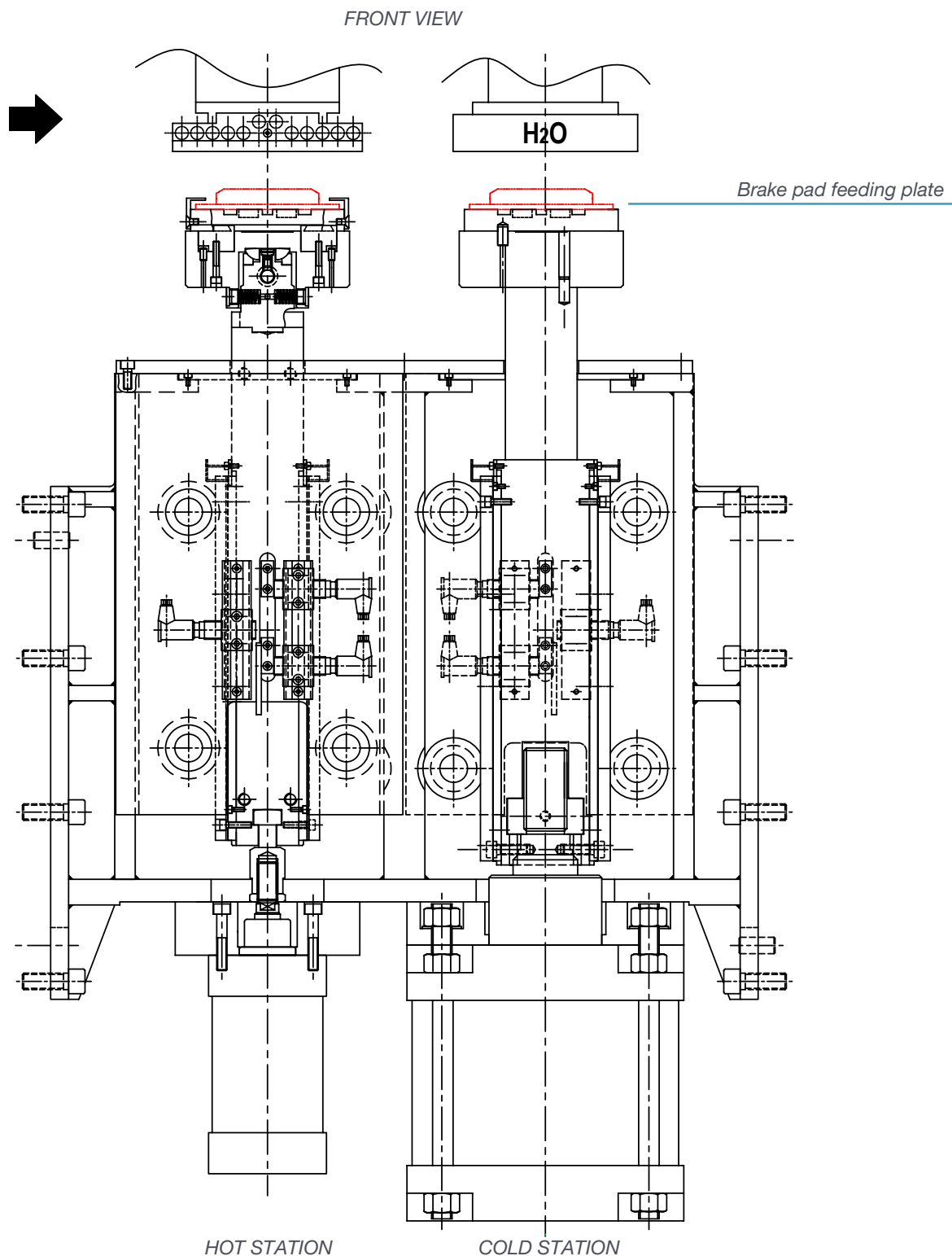
The cycle time is conditioned by two factors: the first one, that may be quantified in 5 seconds, is featured by the pad transfer and lifting up from the hot-plate station towards the coldplate station; the second factor is constrained to the pad sizes, therefore also to the duration time of the scorching operation, usually ranging from 30 to 60 seconds.

$$T_{\text{tot}} = T_1 + T_2 = 5 + 30 = 35 \text{ sec.}$$

### HOURLY OUTPUT

~ 103 pcs/hour (at 100% efficiency).

## DIAGRAM

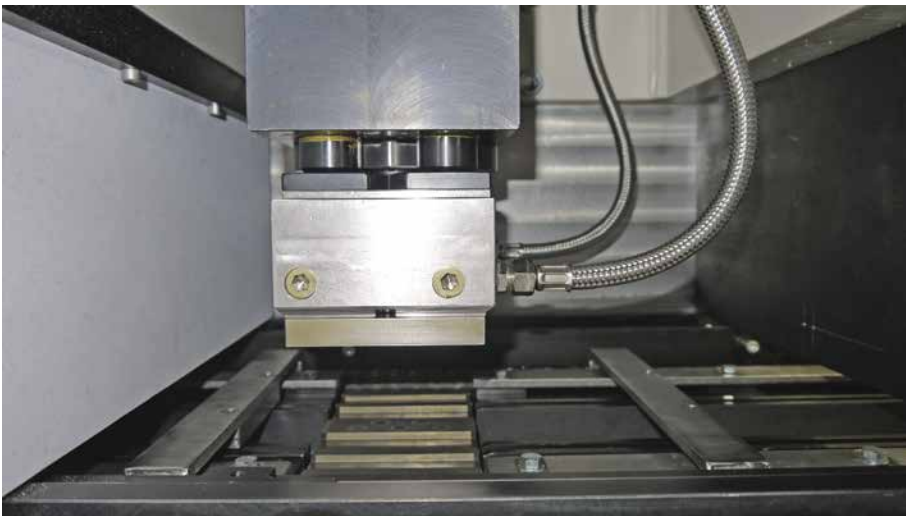




#### **HOT STATION**

*Operating pressure of plates: from 1000 to 4000 N.*

*Working temperature of plates: 750° C (adjustable).*



#### **COLD STATION**

*Working temperature of plates: 25° C (obtained by circulating industrial water inside the plates).*

*Operating pressure of plates: from 5000 to 29000 N.*



*Machined pads*

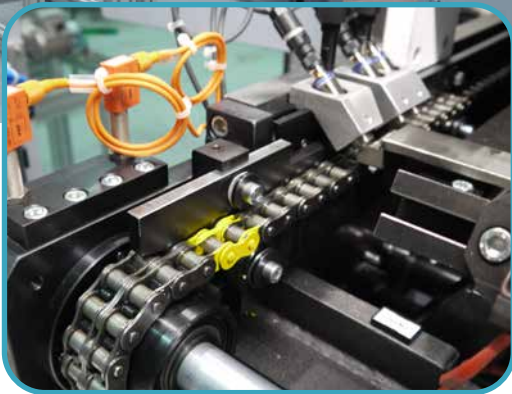




# ELECTRICAL SCORCHING MACHINE 2 WORK TRACKS

## MAIN FUNCTION

Scorch the friction surface of the brake pads.



## DESCRIPTION

The operating sequence starts by dosage of the brake pads by means of suitable pneumatic cylinders mounted on a loader.

Afterwards, the brake pads are dragged to a hot-plate unit, to be then compressed by a thrust unit.

Once the cylinder reaches the setting pressure and exerts the preset force onto the brake pad during the preset time period, function of the pad type on process, the first scorching phase is performed.

The brake pads, already submitted to the first treatment, are then conveyed to the cold-plate station in order to be

cooled; finally, their starting parallelism is restored.

The unloading of the finished elements is automatic and is carried out through the relative tipper.

A conveyor conveys the brake pads to the cooling tunnel, so that at the end the brake pads can be recovered at a temperature of around 35-40 ° C.

The scorching machine is equipped with control devices, so as to make it a multi-purpose machine suitable to accept any kind of brake pad; the pad limit dimensions is the only requirement to this purpose.

## SPECIFICATIONS

### WORKING CYCLE AUTOMATIC

**IN:** brake pads entering the machine by means of a manually filled loader.

**OUT:** automatic unloading of brake pads by means of an out-feeding chute.

The cycle time is conditioned by two factors: the first

one, that may be quantified in 5 seconds, is featured by the pad transfer and lifting up from the hot-plate station towards the coldplate station; the second factor is constrained to the pad sizes, therefore also to the duration time of the scorching operation, usually ranging from 30 to 60 seconds.

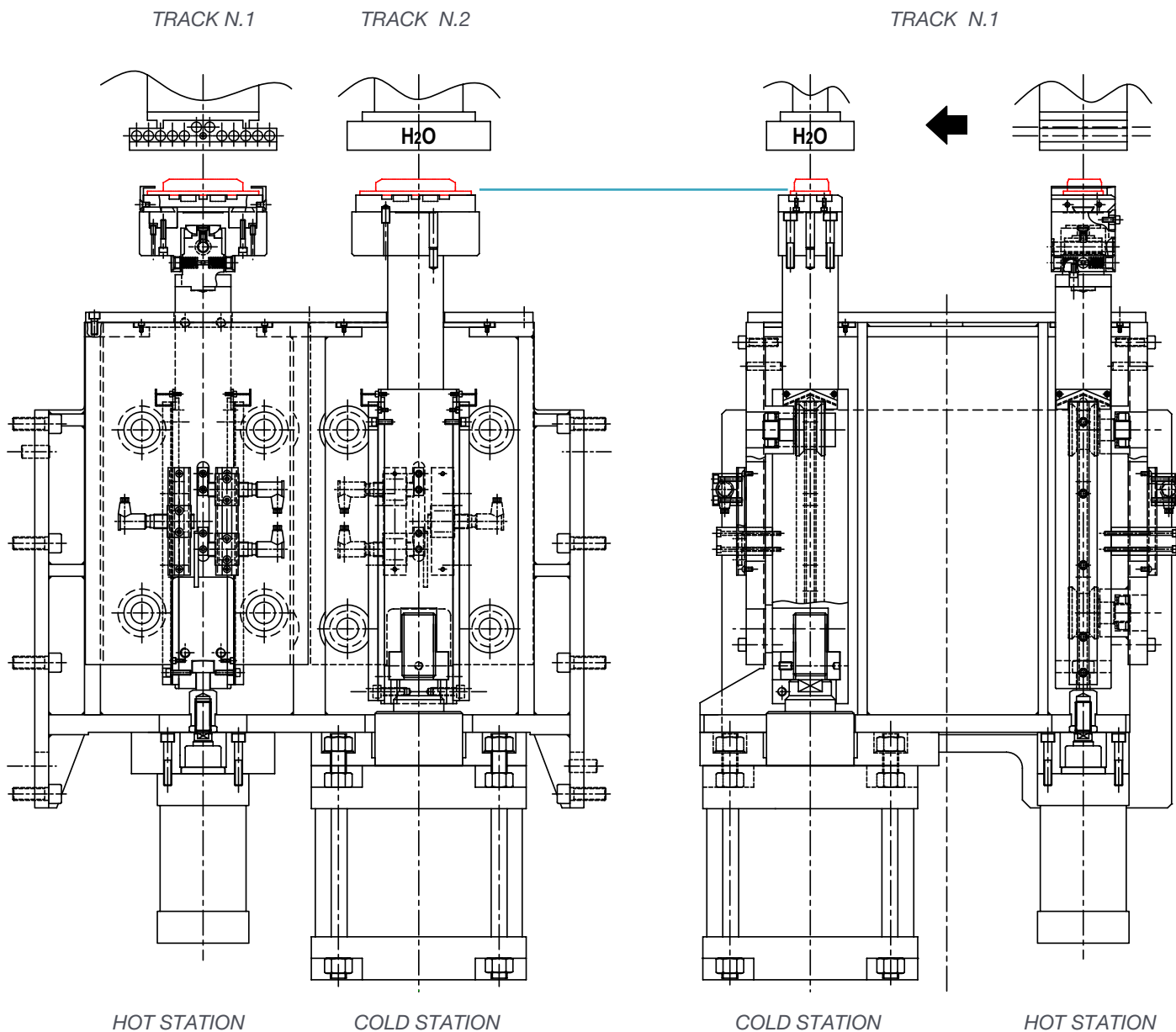
$$T_{\text{tot}} = T_1 + T_2 = 7 + 30 = 37 \text{ sec.}$$

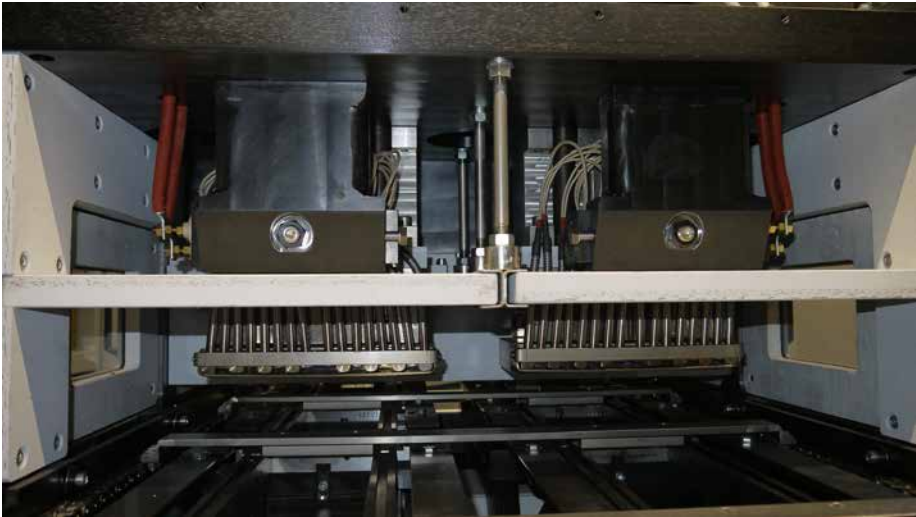
### HOURLY OUTPUT

~ 103 pcs/hour

(at 100% efficiency), for each track, so 206 pcs/hour.

## DIAGRAM

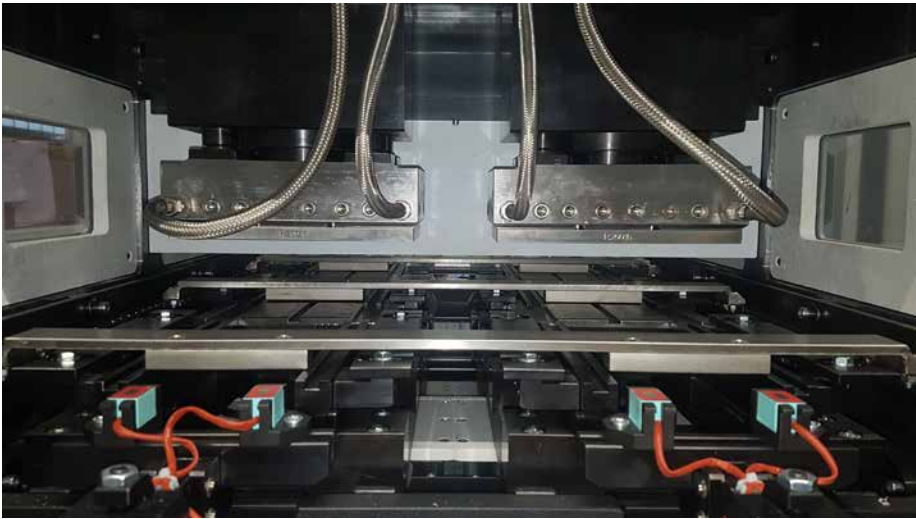




**HOT STATION**

*Operating pressure of plates: from 1000 to 4000 N.*

*Working temperature of plates: 750° C (adjustable).*



**COLD STATION**

*Working temperature of plates: 25° C (obtained by circulating industrial water inside the plates).*

*Operating pressure of plates: from 5000 to 29000 N.*



*Machined pads*

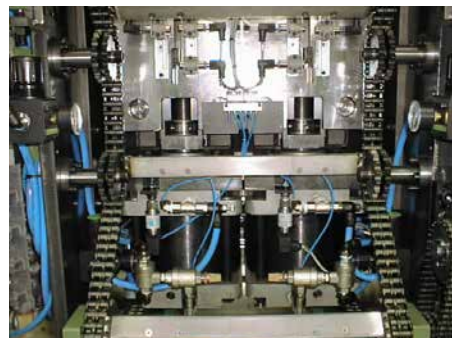
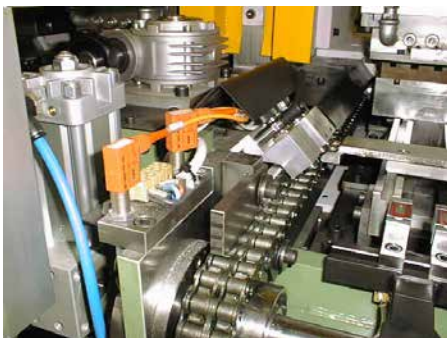
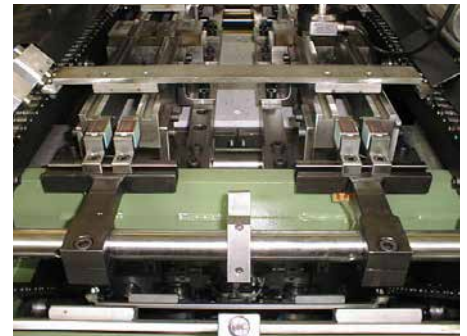




# SCORCHING MACHINE 8 WORK TRACKS

## MAIN FUNCTION

Carry out the scorching treatment on the friction surfaces of the brake pads.



## DESCRIPTION

The sequence of operations starts with the feeding of brake pads toward special stops, for buffering; then brake pads are positioned on the working surface by a tilter unit.

Next, the brake pads are drawn onto a hot-plate unit, where a pushing unit compresses them and the first scorching step is performed; in the second step the brake pads, already submitted to the previous treatment, are conveyed to the cold-plate station, where the pads are cooled and their original parallelism is restored.

The finished parts are automatically unloaded to the exit conveyor belt.

The machine is also equipped with setting controls,

which make it universal and therefore suitable to accept any type of brake pad; it is only necessary to know the part size limits.

## SPECIFICATIONS

### WORKING CYCLE AUTOMATIC

**IN:** automatic brake pad feed on loading conveyor belt.

**OUT:** automatic brake pad unloading through exit conveyor belt.

The cycle time is conditional upon two factors: the first factor, quantified in 5 seconds, is characterised by

the sorting of brake pads feeding from the hot station towards the cold station, while the second factor depends on the brake pad sizes, therefore on the time required for the scorching operation, normally ranging from 30 to 60 seconds.

$$T_{tot} = T_1 + T_2 = 7 + 30 = 37 \text{ sec.}$$

(in 35 seconds, the machine can work simultaneously n°8 brake pads)

#### HOURLY OUTPUT

~ 778 pcs/hour (at 100% efficiency).

#### HOT STATION

Operative temperature of plates: 750° C (adjustable).

Operating pressure of plates: variable between 1000 N and 4000 N.

#### COLD STATION

Operative temperature of plates: 25° C (obtained by circulating industrial water inside the plates).

Operating pressure of plates: variable between 5000 N and 29000 N.

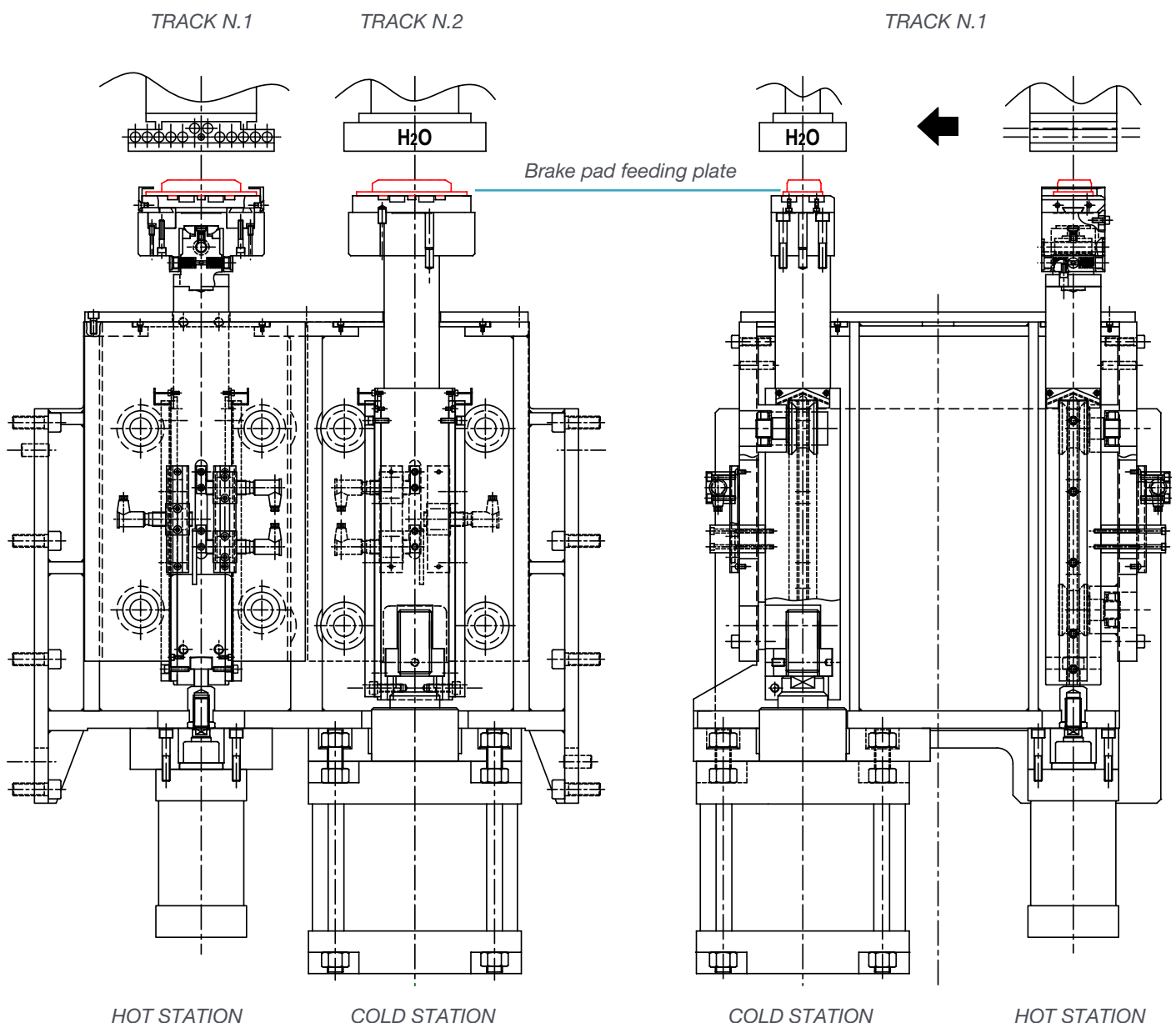
#### FUNCTIONING PLANT

Overall dimensions on the ground: 5200 x 4550 x h 2400 mm, weight: ~ 8000 Kg.

#### SAFETY GUARDS

Structure consisting of extruded aluminium alloy section bars, oxidised, and steel wire net gratings, provided with n°8 openings, fitted with safety microswitches with positive lock, equally distributed on the front and rear sides of the machine, in order to have direct access to the 4 working modules.

## DIAGRAM



## WORKING BRAKE PAD SIZES

LENGTH	min [mm]	60
	max [mm]	180
WIDTH	min [mm]	30
	max [mm]	70
THICKNESS	min [mm]	15
	max [mm]	30
MATERIAL	special friction mix	



*Machined pads*

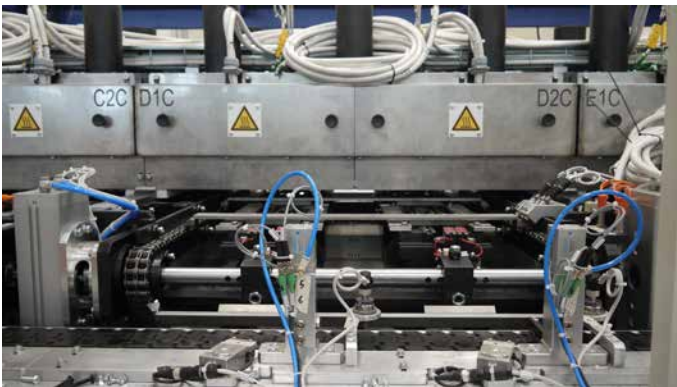




# SCORCHING MACHINE 10 WORK TRACKS

## MAIN FUNCTION

Carry out the scorching treatment on the friction surfaces of the brake pads.



## DESCRIPTION

The sequence of operations starts with the feeding of brake pads toward special stops, for buffering; then brake pads are positioned on the working surface by a tilter unit.

Next, the brake pads are drawn onto a hot-plate unit, where a pushing unit compresses them and the first scorching step is performed; in the second step the brake pads, already submitted to the previous treatment, are conveyed to the cold-plate station, where the pads are cooled and their original parallelism is restored.

The finished parts are automatically unloaded to the exit conveyor belt.

The machine is also equipped with setting controls,

which make it universal and therefore suitable to accept any type of brake pad; it is only necessary to know the part size limits.

## SPECIFICATIONS

### WORKING CYCLE AUTOMATIC

**IN:** automatic brake pad feed on loading conveyor belt.

**OUT:** automatic brake pad unloading through exit conveyor belt.

The cycle time is conditional upon two factors: the first factor, quantified in 5 seconds, is characterised by

the sorting of brake pads feeding from the hot station towards the cold station, while the second factor depends on the brake pad sizes, therefore on the time required for the scorching operation, normally ranging from 30 to 60 seconds.

$$T_{tot} = T_1 + T_2 = 7 + 30 = 37 \text{ sec.}$$

(in 35 seconds, the machine can work simultaneously n°10 brake pads)

#### HOURLY OUTPUT

~ 973 pcs/hour (at 100% efficiency).

#### HOT STATION

Operative temperature of plates: 750° C (adjustable).

Operating pressure of plates: variable between 1000 N and 4000 N a 6 bar.

#### COLD STATION

Operative temperature of plates: 25° C (obtained by circulating industrial water inside the plates).

Operating pressure of plates: variable between 5000 N and 29000 N a 6 bar.

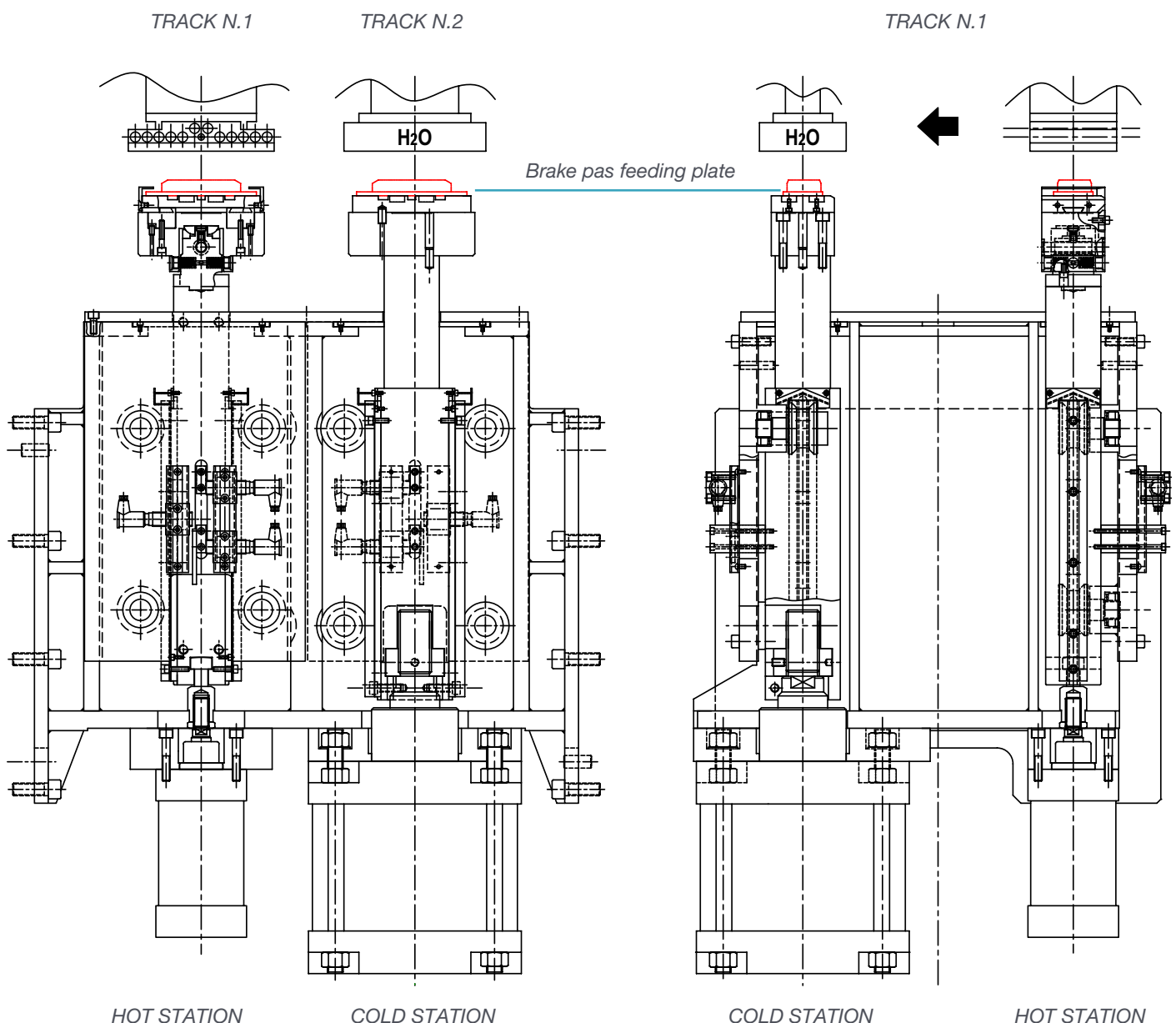
#### FUNCTIONING PLANT

Overall dimensions on the ground: 6500 x 2400 x h 2100 mm, weight: ~ 15000 Kg.

#### SAFETY GUARDS

Structure consisting of extruded aluminium alloy section bars, oxidised, and steel wire net gratings, provided with n°10 openings, fitted with safety microswitches with positive lock, equally distributed on the front and rear sides of the machine, in order to have direct access to the 4 working modules.

## DIAGRAM



## WORKING BRAKE PAD SIZES

LENGTH	min [mm]	60
	max [mm]	220
WIDTH	min [mm]	30
	max [mm]	110
THICKNESS	min [mm]	15
	max [mm]	30
MATERIAL	special friction mix	



*Machined pads*





# LINEA MONTAGGIO SHIM E RIVETTATURA

## MAIN FUNCTION

Carry out the shim assembly and brake pad riveting operations according to the customer's specifications



## DESCRIPTION

### The main features of the line are:

- Pallet frame to support the transporter and machinery present in the line.
- Chain conveyor with flights for brake pad tending, with "Bonfiglioli" gearmotor and inverter for speed management, brake pad loading robot, manual shim assembly stations 1 and 2 with photoelectric barrier safety, electromechanical press1 - electromechanical press2 - free station for future pad printing press or stamping machine, riveting1 - riveting2 - brake pad unloading robot and loading onto the exit conveyor.
- Brake pad loading station with robot with 600 mm stroke, 6 kg capacity.
- Station 1 for manual shim assembly on the brake pad support.
- Station 2 for manual shim assembly on the brake pad support.
- Kistler electromechanical press  $F=4000\text{kg}$ , complete with internal piezoelectric load cell and plate with electrical resistances for a temperature of  $150^{\circ}$ .
- Free POSTION for future pad printing press or stamping machine.
- Baltec RNE 231 type orbital riveter installed on an orthogonal table with controlled X-Y registration axis system.
- Brake pad unloading station with robot with 600 mm stroke, 6 kg capacity.
- Brake pad exit belt conveyor.
- Upstream of the finishing line there is a galvanized steel plate slat conveyor complete with pneumatic cadencer for brake pads.
- An automatic flaming device is provided on board the galvanized steel slat conveyor Teca-Print FLG201
- Line management software PLC with recipe commands on the operator panel.

## SPECIFICATIONS

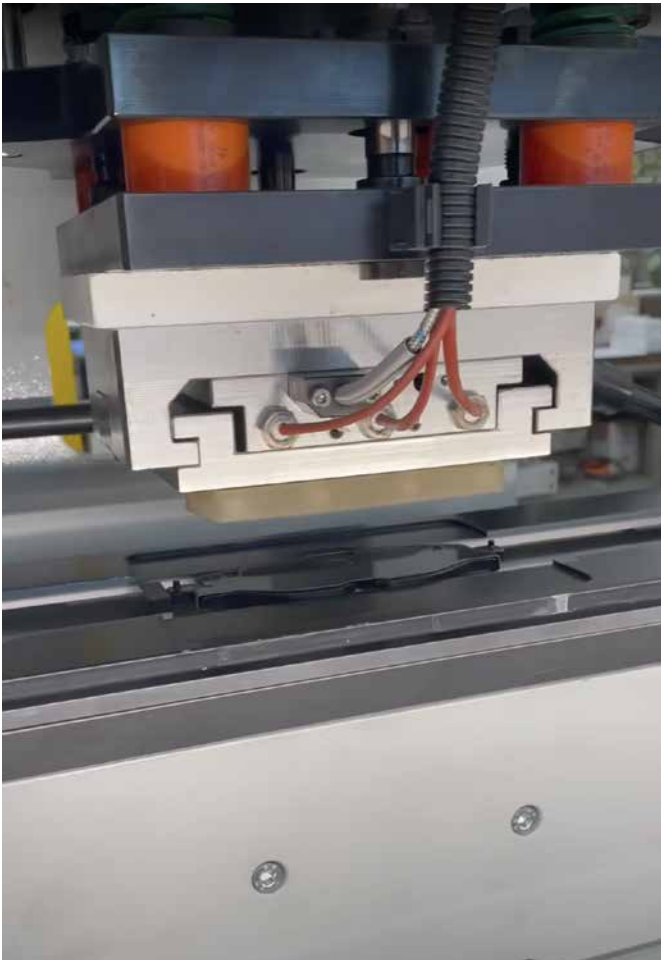
### CYCLE / SEQUENCE OF OPERATIONS

4”

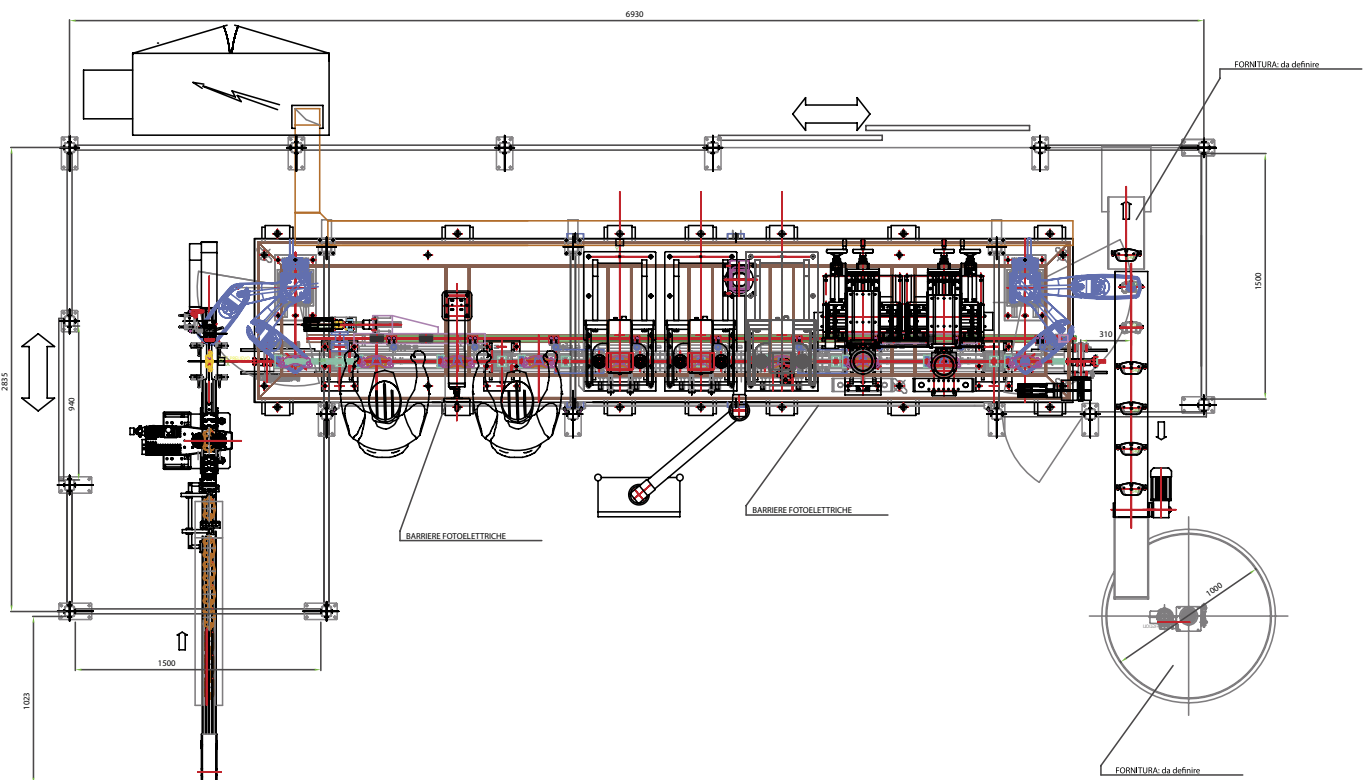
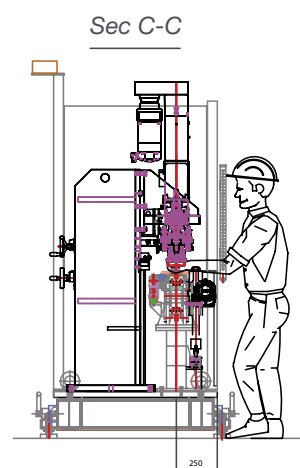
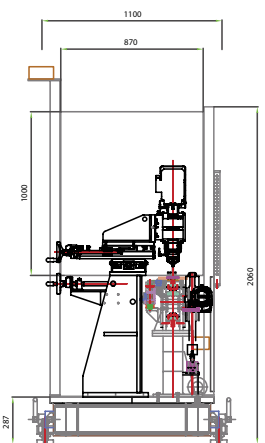
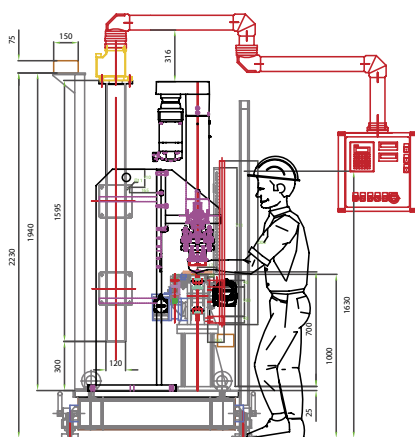
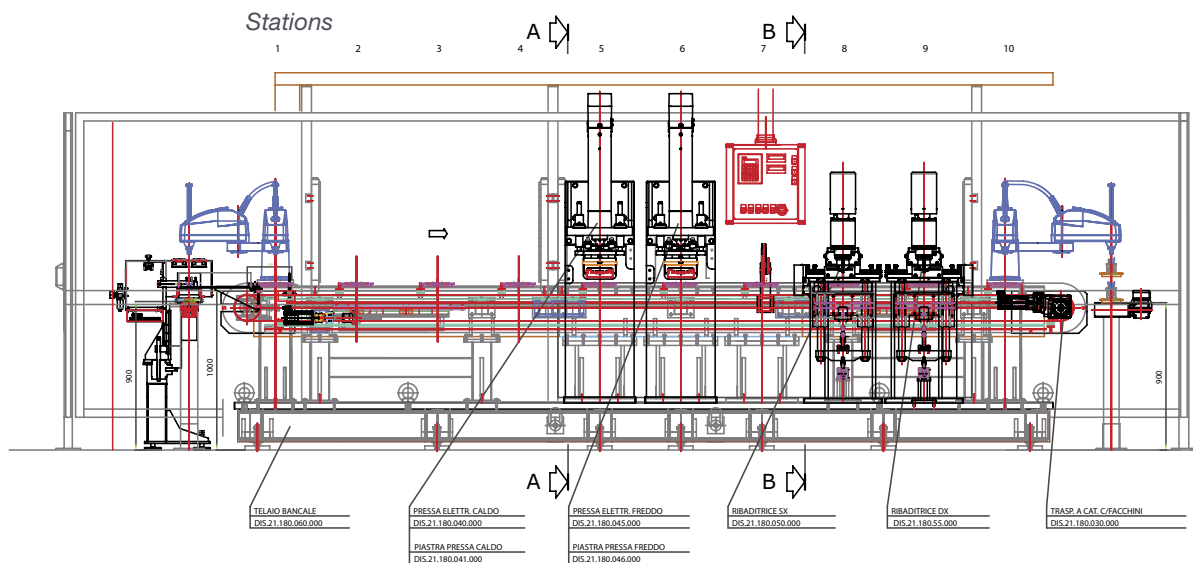
#### WORKING CYCLE

- STATION 1 = collection of the brake pad, previously subjected to the flaming treatment using the automatic Teca-Print device, on board the galvanized steel plate slat conveyor and deposit of the brake pad with a Fanuc scara robot on the finishing line conveyor.
- STATION 2 = manual assembly of the shim on the brake pad in position on the chain conveyor with flights.
- STATION 3 = manual assembly of the shim on the brake pad in position on the chain conveyor with flights.
- Advance translation of the brake pads towards the subsequent stations.

- STATION 4 = vertical pressure with electromechanical press  $F=4000$  kg. of the shim with interface with plate with electrical resistances for temperatures of  $100^{\circ}$ .
- STATION 5 = vertical pressure with electromechanical press  $F=4000$  kg. of the shim with interface with plate with electrical resistances for temperatures of  $100^{\circ}$ .
- STATION 6 = free for future pad printing press or stamping machine.
- STATION 7 = riveting of pin 1 on the brake pad.
- STATION 8 = riveting of pin 2 on the brake pad.
- STATION 9 = brake pad unloading with Fanuc scara robot and deposit on exit belt conveyor.
- STATION 10 = belt conveyor for the exit of processed brake pads.



# DIAGRAM







# PLATE DRILLING AND TUBE INSERTION MACHINE

## MAIN FUNCTION

Machine purpose is as follows:

- Drilling of 10, 5, 4.1 mm diameter holes on NBY support by means of inclined drilling units fixed to machine base.
- Brushing carried out before and after holes previously drilled through horizontal double-spindle units fixed to machine base.
- By means of hydraulic fitting, tube insertion in 4.1 mm diameter hole of NBY support. Tubes to be assembled is performed through circular vibrator. Before reaching drive-in position, tube is deformed by hydraulic cylinders.



NBY support

## DESCRIPTION

Plate drilling and tube insertion machine is a single-block system mainly consisting of an arc-welded steel base carrying an indexing table with component clamping fixtures, 5 machining units, drive-in unit, load / unload station.

Components load and unload phases are automatically carried out by a 2-opposed arms rotary manipulator, which picks up NBY supports from conveyor for deposit on indexing table surface.

Manipulator also performs NBY support unload from machine for deposit on conveyor.

## SPECIFICATIONS

### ASSEMBLED PARTS

Tube

### POWER SUPPLY

Voltage: 380 V (three-phase + ground)

Frequency: 50 Hz

### PNEUMATIC POWER SUPPLY

Operating pressure: 6 bar

### HYDRAULIC SYSTEM

Hydraulic power unit capacity: 160 l

### LUBRICATION SYSTEM

Lubrication power unit capacity: 2,7 l

### COOLING AND WASHING SYSTEM AND PART TRANSFER SYSTEM

Indexing table, conveyors

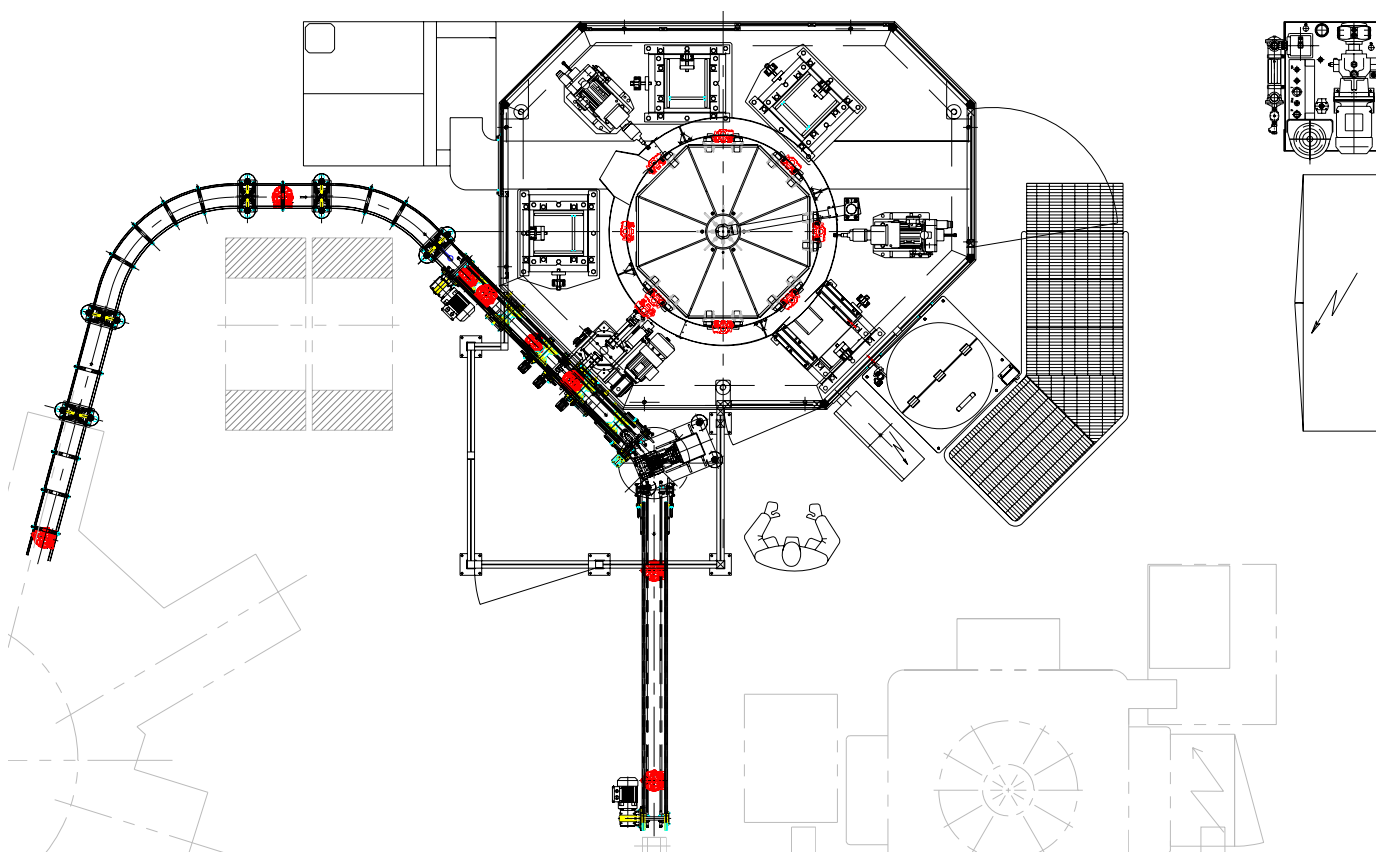
### SAFETY GUARDS

- Fixed type protections
- Moving type protections provided with a interlock device
- Moving units covering guards
- Emergency push-buttons.

## LIST OF STATIONS

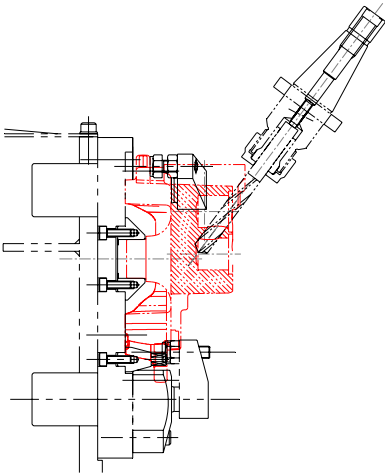
STATION	DESCRIPTION	TIPOLOGIA
1	Load / unload	Automatic
2	Drilling of 10 mm diameter hole	Automatic
3	Brushing of 10 mm diameter hole	Automatic
4	Drilling of 5 mm diameter hole	Automatic
5	Drilling of 4.1 mm diameter hole	Automatic
6	Brushing of 5-4.1 mm diameter holes	Automatic
7	Tube drive-in	Automatic

## DIAGRAM

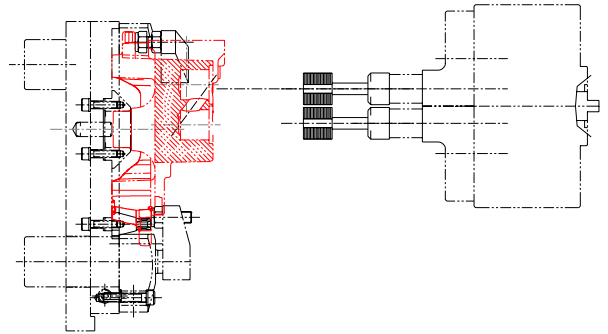


## STAZIONI

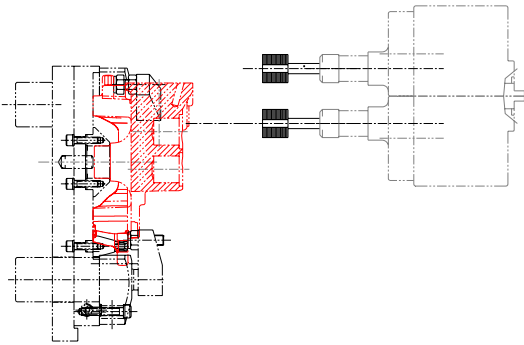
STATION 2 – DRILLING OF 10 MM DIAMETER HOLE



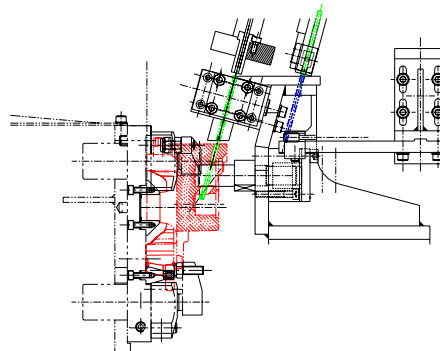
STATION 3 - BRUSHING OF 10 MM DIAMETER HOLE



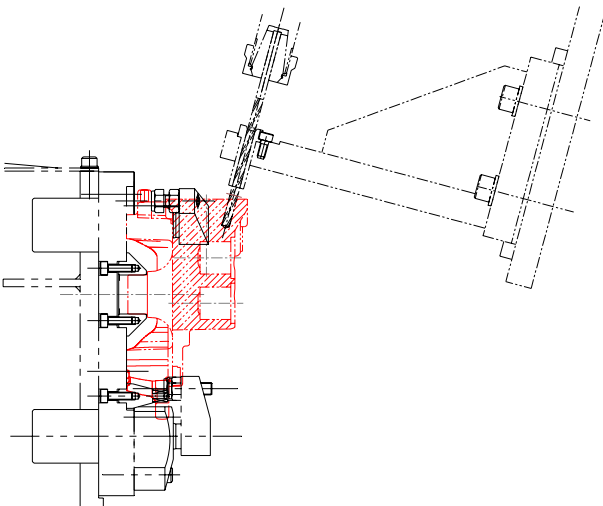
STATION 4 – DRILLING OF 5 MM DIAMETER HOLE



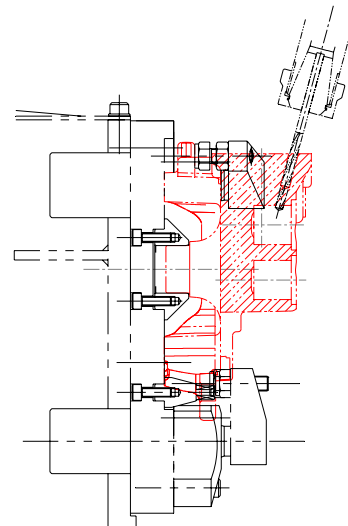
STATION 5 – DRILLING OF 4.1 MM DIAMETER HOLE



STATION 6 – BRUSHING OF 5-4.1 MM DIAMETER HOLES



STATION 7 – TUBE DRIVE IN







# GRINDING MACHINE FOR VALVE PLATES EMT - EMX

## MAIN FUNCTION

Carry out the automatic grinding of intake and exhaust valve seats in two types of valve plates, namely valve plate EMT type and EMX type. The machine processes two plates simultaneously, performing the same operation on each plate.



## DESCRIPTION

The Valve Plate Grinding Machine is an enbloc assembly, essentially consisting of an electrowelded steel base, where the following equipment is mounted and secured:

- Loading store, on the framework of which is installed a double loader for vertical staking up;
- Two rotary tables for transfer of workpieces;
- Cross table, consisting of a structure where two slides are installed. Slides are superimposed and run on a horizontal surface, acting on 90° axes (X, Y);
- Two plate lifters equipped with double mechanism for vertical lifting;
- Grinding assembly for grinding of exhaust valve seats, including two units running on a couple of vertical guides, where a slide carries a pendulum-type grinding tool;
- Transfer unit, consisting of a pair of pick-up fingers, air-powered;
- Grinding assembly for grinding of intake valve seats, including two units housed in a framework;
- A pair of vertical guides, for running of the grinding spindle slide;
- Unloading store consisting of an removable double loader for vertical stacking;
- Every loader is provided with a quick-release level to be manually replaced.

## SPECIFICATIONS

### MACHINED PARTS

EMT – EMX type plates

### ELECTRIC POWER SUPPLY

Voltage: 380 V (3-phase + GND)

Frequency: 50 Hz

### PNEUMATIC SUPPLY

Operating pressure: 6 bars

### SPINDLE LUBRICATION SYSTEM

Power Unit capacity: 1.8 liters

### SPINDLE COOLING SYSTEM

Power Unit capacity: 4 l

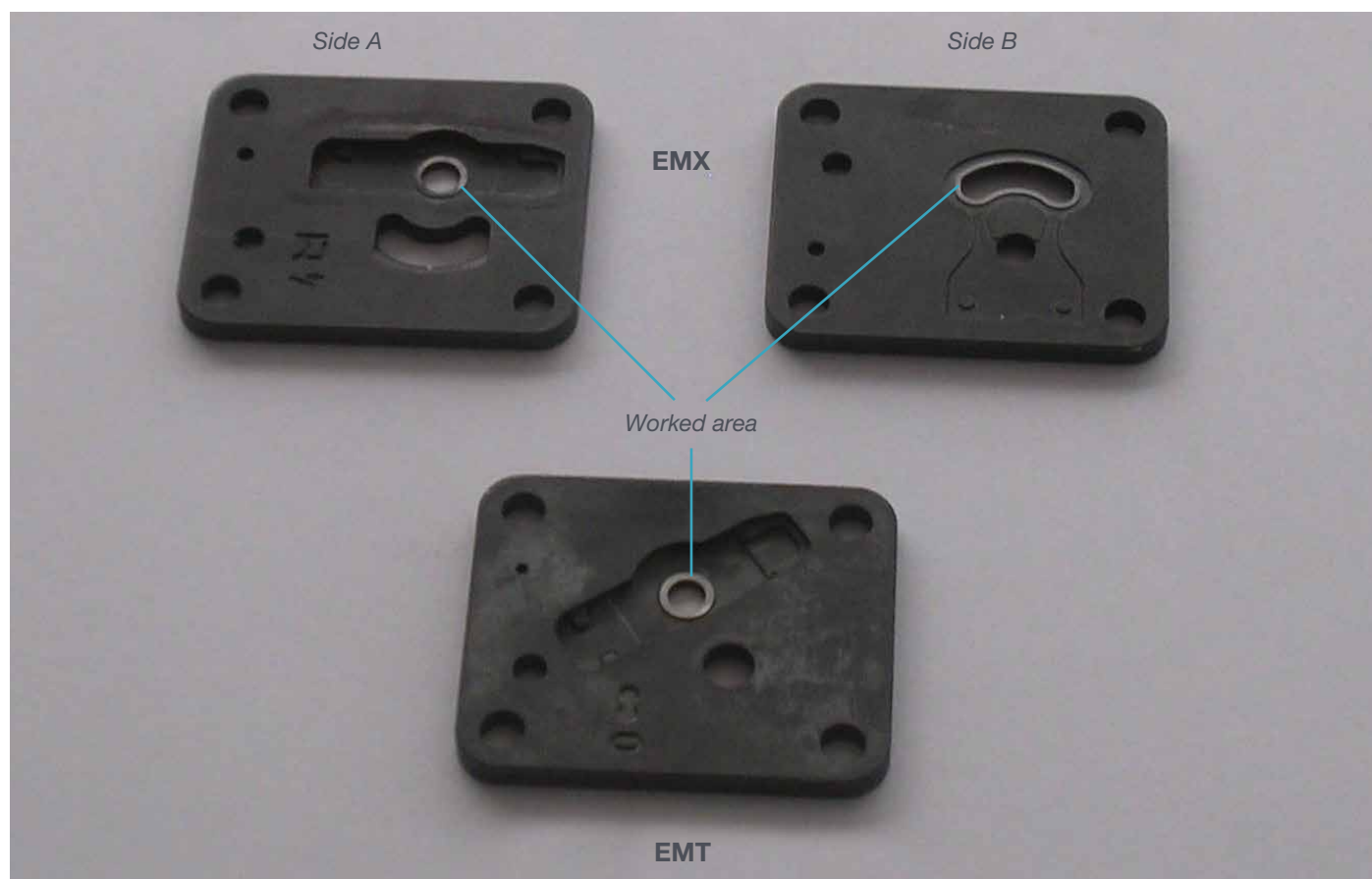
### WASHING AND COOLING SYSTEM

Installed

### PART TRANSFER SYSTEM

Rotary Tables

## EMX - EMT



Machined part. EMX type (both sides A= exhaust valve seat, B= intake valve seat) and EMT type (one side only)

# MACHINE FOR CUTTING & MILLING ALUMINUM HINGES

## MAIN FUNCTION

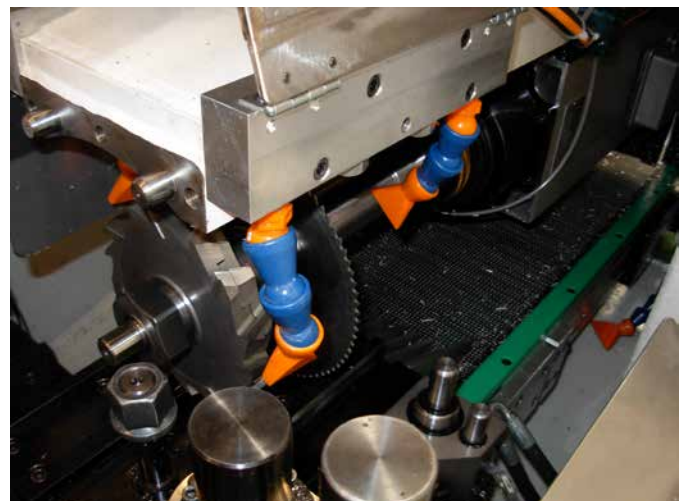
Obtain from two 4 m long extruded aluminum profiles, by cutting and milling, some particular pieces with pre-established length and shape.



## DESCRIPTION

This special machine for aluminium hinge cutting and milling is a self-contained system, substantially consisting of an electrowelded steel bed, where the following components are fixed:

- An adjustable roller line for loading of aluminium extruded sections, consisting of an aluminium framework where a set of idle rollers are mounted;
- A carriage unit with mobile vice, the adjustable stroke of which is software-controlled;
- An adjustable fixed vice unit;
- A cutting and milling heat unit, software-controlled;
- A finished parts unloading conveyor belt;
- A chips belt filter unit.

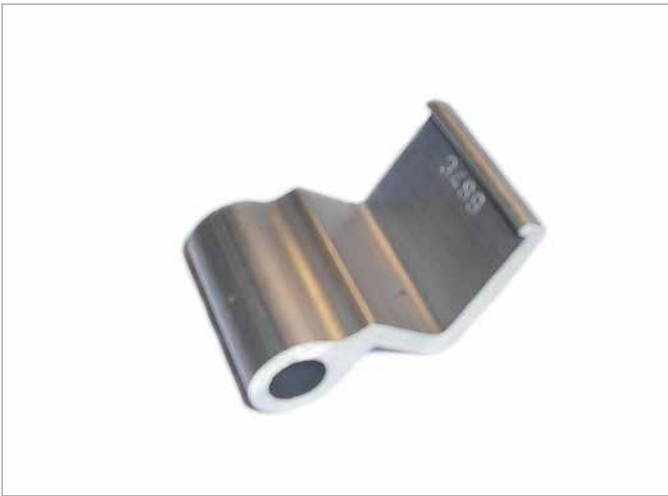


*Detail of cutting and milling spindle*

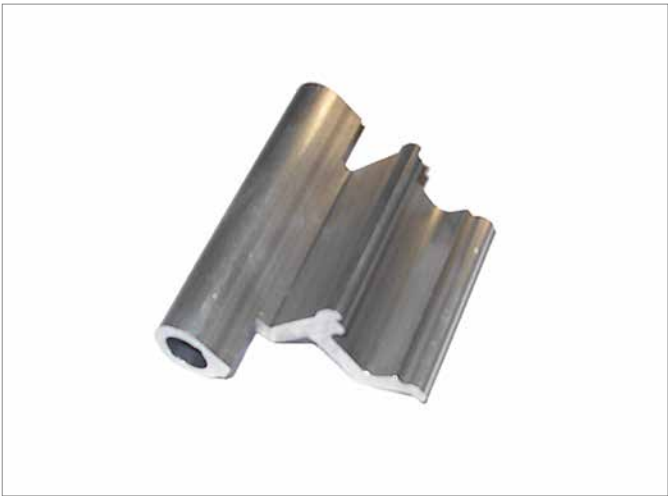




*Aluminium extruded sections before the machining process*



*Machined part. Cutting and stamping operations*

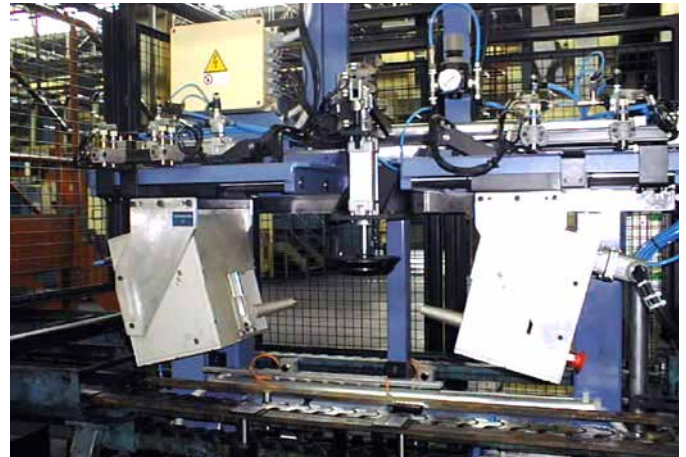


*Machined part. Cutting and milling operations*

# SPECIAL MICRO-PUNCHING MACHINE

## FUNZIONE PRINCIPALE

Is to carry out a special double marking operation, called micropunching, in two positions, 180° from each other, on the brake disk cap band, i.e. on the external surface of the zone where the brakes are attached to the hub of the vehicle.



*Centering device and micropunching units*

## DESCRIPTION

This special machine has been designed and built to identify and mark four different types of brake disks.

The machine is provided with a centering device that lowers onto the brake, clamps and identifies it, thus allowing two side micropunching units to mark the relevant alphanumeric sequence on the cap band.

On one side of the brake-disk cap band, the first micropunching unit (facing it) will carry out the following markings:

- an emblematic/schematic marking,
- the logo,
- a sequence of automatically updating digits indicating the production date and shift.

On the opposite side, the second micropunching unit marks its pertaining part of the cap band with a sequence of digits and letters indicating to the minimum thickness of the disk, in inches and millimetres.

## SPECIFICATIONS

**WORKING CYCLE**  
AUTOMATIC

**IN:** feeding on an existing conveyor belt.

**OUT:** unloading to an existing conveyor belt.

### TYPES OF MACHINED BRAKE DISKS

4 Types: Ø 227, Ø 254, Ø 257, Ø 260.

The machine can be set up for any type of disc.

**CYCLE TIME**

~ 20 sec. (12 sec for the proper micropunching operations, and 8 sec dedicated to the part handling).

**FUNCTIONING SYSTEM**

Overall dimensions on the ground: 1250 x 1000 x h 1800 mm, weight: ~ 500 Kgs.

**MARKING SYSTEM**

N° 2 micropercussion markers TIPOMATEC MM-2.

**INSTALLED POWER (whole system)**

~ 3 kW.

**SAFETY GUARDS**

Structure consisting of iron square section tubes (40 x 40 mm), 4 mm thick, complete with wire net grating (4-mm diameter wire).

N°2 access doors, one on the machine front face and one on the back, both with two hinged wings, equipped with safety microswitches with positive lock.

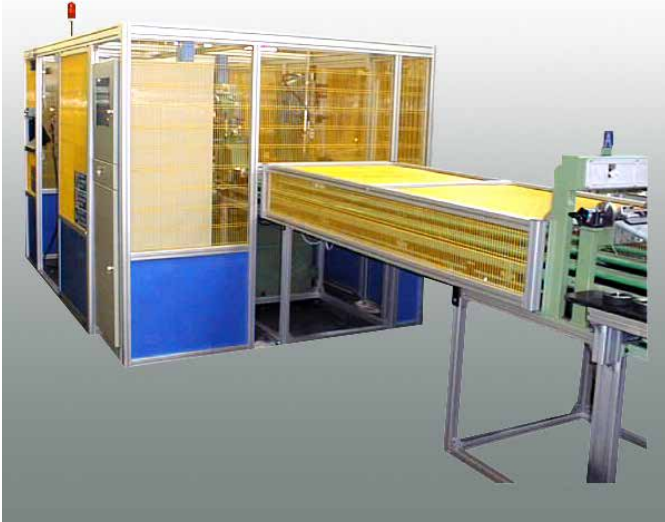
**TIPOMATEC MM-2 TECHNICAL FEATURES (micropercussion markers)**

Marking unit	GME – 78
Electronic unit	ELE – 78
Air pressure supply	0.6 MPa (6 bar)
Max air consumption at 6 bars	70 litres/min.
Supply mains	(220 V o 110 V)
Max. consumption	300 VA
Printing tip (material)	90° Widia tip, tapered
Marking time	100 linear mm / sec.
Working area	70 mm x 80 mm
Elementary feeding pace	1/10 mm
Max. stroke of the printing tip	10 mm
Tip vibration frequency (adjusted according to the tip material)	7000 shots/ min.

# FINAL PISTON TESTING STAND

## MAIN FUNCTION

Testing and selection of piston types having diameter between 110 and 150 mm.



*Tested part*

collection of the worked parts.

## DESCRIPTION

On inspection, the workpieces are manually loaded by the operator to the loading conveyor belt at the entry to the system, to be then transferred by the same belt to the machine inside and afterwards to STATION 1 (Piston self-centering and orienting station) towards STATION 4 (Marking station).

The working cycle is completed by the final unloading of the part to exit conveyor belts.

When the pistons get near STATION 1, they are taken up by a loading manipulator, which transfers them from the entry conveyor belt towards the above STATION 1. Here, pistons are positioned and clamped by a special orienting device.

Once the testing is complete, a linear transfer unit, equipped with 4 grippers, handles the pistons parallel to the part feeding direction, moving them through the following stations: STATION 2 (Measuring), STATION 3 (Weighing) and STATION 4 (Marking).

According to the sizes measured and marked on each piston, an unloading manipulator directs the tested parts to one of the three (3) exit conveyor belts, depending of their pertaining class, i.e. Class A, Class B or Class S (S is for rejects).

Downstream each conveyor belt, there is an operator in charge with the manual unloading of the pistons, who every time pushes up one of the three (3) hatches for

## SPECIFICATIONS

**WORKING CYCLE**  
AUTOMATIC.

**IN:** manual loading of pistons on to the entry conveyor belt.

**OUT:** automatic unloading of pistons from 3 exit conveyor belts.

**TIPE OF TESTED PISTONS:**  
Pistons having diameter between 110 and 150 mm.

**CYCLE TIME**  
~ 15 sec.

### OPERAZIONI ESEGUITE SUI PISTONI

STATION 1: pistons self-centering and orienting,

STATION 2: the following measurements are carried out on the pistons:

- Ellipse selection and centering,
- Check of the skirt middle part,
- Check of groove 2,
- Check of the cast iron groove,
- Check of the collar,
- Check of the pin hole,



- Check of quadrature,
- Check of axis-1 height,
- Check of axis-2 height,
- Check of temperature,
- Check of combustion chamber.

STATION 3: piston weighing,

STATION 4: piston marking with measurement identification code.

### **FUNCTIONING PLANT**

Overall dimensions on the ground: 8550 x 3600 x h 2000 mm, weight: ~ 4500 Kgs

### **INSTALLED POWER (WHOLE SYSTEM):**

~ 3 kW.

### **SAFETY GUARDS**

Central machine casing protected by a fence of extruded aluminium alloy section bars, anodised, integrated by panels, 3 mm thick, and steel wire net grating mounted on the above-mentioned section bars; complete with n°2 sliding openings in the front and rear side respectively, equipped with safety microswitches with positive lock.

The exit conveyor belts are protected by a fixed guard of extruded aluminium alloy sections, anodised, integrated by steel wire net gratings mounted on the above-mentioned section bars, protecting the out-feeding pistons.

# TENSILE AND COMPRESSION TESTING BENCH

## MAIN FUNCTION

Carry out tests of various kinds of devices, for which it is necessary to extrapolate the elastic characteristics in terms of force as a function of moving or other factors.



*Tested part*

## DESCRIPTION

This test bench can also be used for tensile and compressive stress tests, useful e.g. for checking and calibration of load cells. However, it has several fields of application, as:

- Tests of shock absorbers,
- Tests of dampers,
- Fatigue tests of various components,
- Tests for the calibration of force transducers,
- Measurement of specimen hysteresis,
- Measurement of spring features,
- Cyclic life tests.

## SPECIFICATIONS

**WORKING CYCLE**  
AUTOMATIC.

### FUNCTIONING PLANT

Overall dimensions on the ground: 1540 x 850 x h 3131 mm, weight: ~ 3000 Kgs.

### PERFORMANCES AND FEATURES OF THE SELF-BRAKING ELECTRIC MOTOR

Poles: 4.  
Power rating: ~ 1.8 kW - 1400 r.p.m.  
Rated torque: 1.25 kgm  
Breakaway torque: 2.6 kgm.

### MAX. LOAD APPLICABLE TO THE TENSILE AND COMPRESSION TESTING BENCH

~ 300 kN (30 tons).

### COLUMNS FOR VERTICAL SLIDING OF THE MOBILE CARRIER

Number: 4,  
Diameter: 100 mm.  
Length: 2375 mm.

### SAFETY GUARDS

Structure consisting of aluminium extruded section bars, anodised, and lexan panels, 5 mm thick, entirely surrounding the test bench and protecting its upper part, its internal part where the tests are carried out, and its lower part housing the hydraulic equipment and electric controls.

On the structure front side there are respectively n°1 door for access to the testing zone (upper part) and n°1 door for access to the electric and hydraulic components (lower part); every opening is controlled by safety microswitch with positive lock.



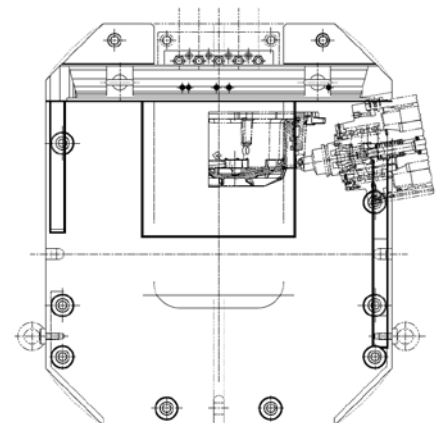
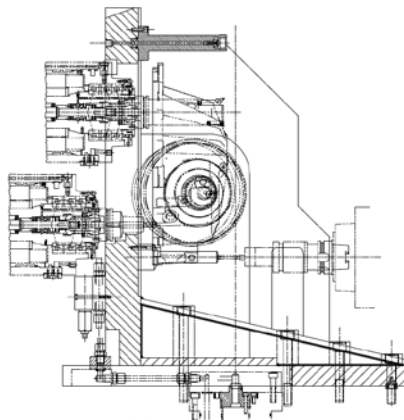
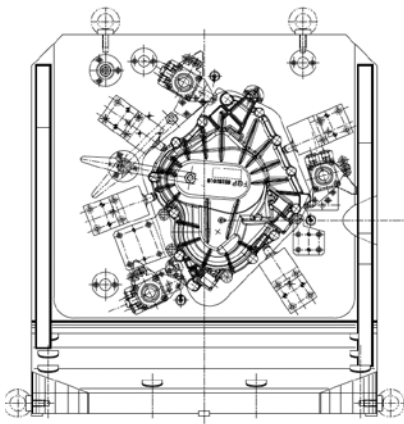
# WORKING FIXTURE

## MAIN FUNCTION

This is a special work fixture used to centre and clamp the transmission housing (gearbox).



*Machined part*



## DESCRIPTION

These fixtures are installed on a line where specific machining centres, called 1G Modules, carry out certain machining operations on parts properly clamped by the fixtures.

The operator takes the transmission housings by hand and rests them vertically on the ("L"-shaped) supporting angle on the fixture.

Here some special centering devices called "Olive" locate the part that, by means of n.º3 hydraulically-operated clamping brackets, is then firmly clamped to the structure for the machining by the 1G modules.

After machining, the operator unclamps the machined transmission housing and manually unloads it for transfer to the following workstations.

## SPECIFICATIONS

**WORKING CYCLE**  
AUTOMATIC.

**IN:** manual part loading.

**OUT:** manual part unloading.

**TYPE OF WORKPIECE**  
Transmission housing FGP OPEL – ASPERN.

**CYCLE TIME**  
~ 4 sec. (part clamping by the fixture only).

**FUNCTIONING SYSTEM**  
Overall dimensions on the ground: 665 mm x 665mm x h 735 mm.  
Weight: ~ 405 Kg.





# BED PLATE MACHINING ASSEMBLY

## MAIN FUNCTION

Carry out two operations: cutting off risers and surface milling the Bed Plate G.M. L850



## DESCRIPTION

This machine can operate over three steps: first, the part is handled by a COMAU anthropomorphic robot that transfers it from the entry conveyor belt to station A, rotating it by 180°.

This station is equipped with a fixture that clamps the Bed Plates and overturns them by 95°. A milling disk, mounted on a platen, which is driven by an electric motor, removes the risers from the surface of the workpiece, on the side opposite to the cylinder block fixing side.

On a second step, the robot takes the Bed Plate up again; then, it rotates the workpiece by 180° and transfers it from fixture A onto the idle fixture, which is located halfway between stations A and B.

The intermediate idle fixture is necessary to cut down the overall cycle time of the machine and to speed up the robot loading and unloading operations on to the fixtures. It also makes it possible to take full advantage of the COMAU unit throughput, since combining speed and precision in the various movements, the unit is able to keep all three of the machine working fixtures fully loaded.

The third and last step is the positioning of the Bed Plate on station B. After the robot takes it from the idle fixture, it transfers it to the right and loads it onto fixture B.

In the same way as for station A, the fixture clamps the Bed Plates and turns them by 95°, to bring them to the correct milling position; here a second moving platen, driven by another electric motor, approaches the workpiece and mills the cylinder block fixing surface by means of 2 cutters, installed assembled on the same platen.

Once this third step is complete, fixture B brings the Bed Plates to horizontal position, and there they are grasped the last time by the robot grippers, overturned by 180° and transferred to the exit conveyor belt.

The exit conveyor belt guides the individual Bed Plates out of the machine, where an operator unloads them by hand.

## SPECIFICATIONS

**WORKING CYCLE**  
AUTOMATIC.

**IN:** Manual feed to the entry conveyor belt.

**OUT:** manual unloading to the exit conveyor belt.

**CYCLE TIME**  
Hourly output at 100% efficiency = 140 workpieces.

## FUNCTIONING SYSTEM

Overall dimensions on the ground: 12450 x 9700 x h 3400 mm.  
Weight ~25000 Kg.g.

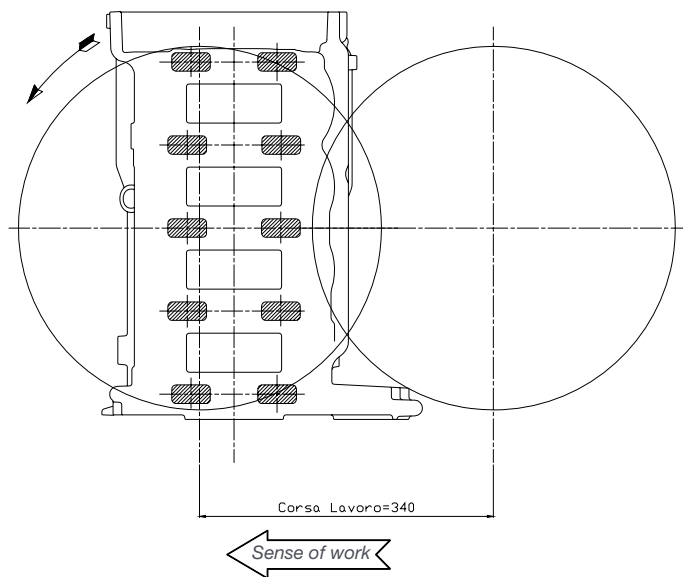
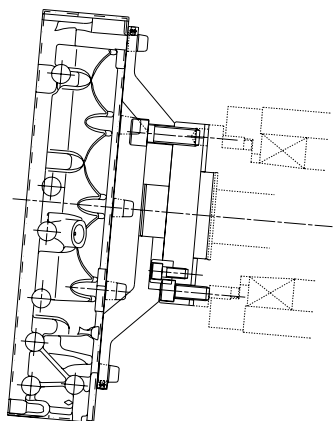
## INSTALLED POWER

~ 190 Kw.

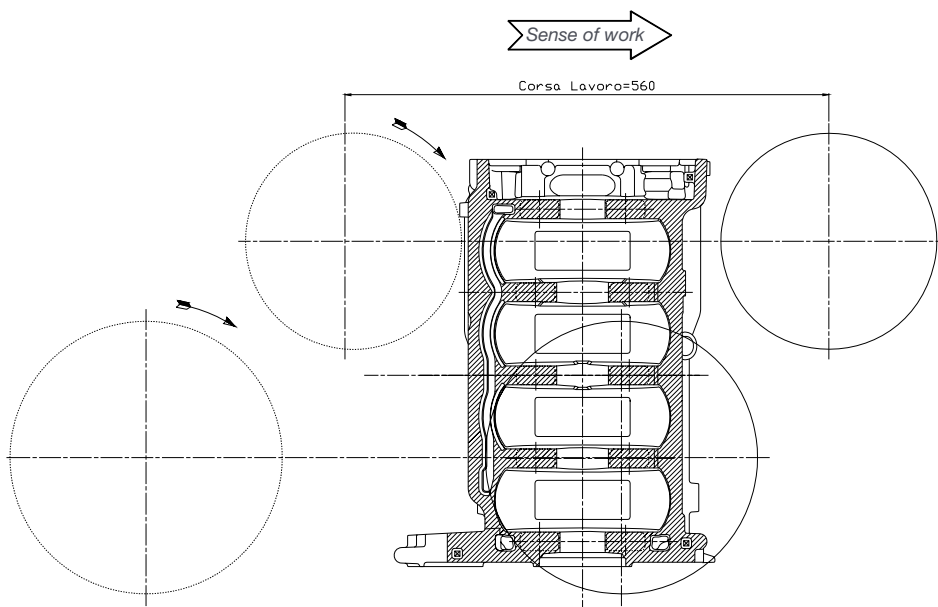
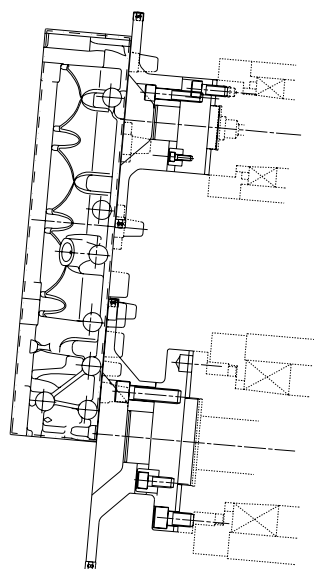
## SAFETY GUARDS

Soundproof cabin closed on seven sides (ceiling included), with n°4 doors for access to the working zone

## DIAGRAM



STATION A: cutting and milling disk

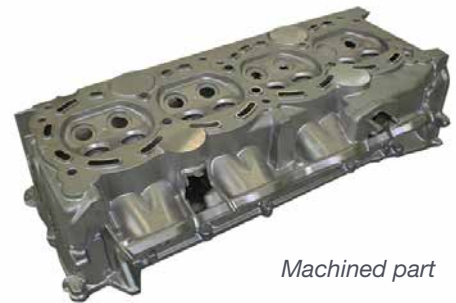


STATION B: cutting and milling disk

# CYLINDER HEAD MACHINING ASSEMBLY

## MAIN FUNCTION

Carry out two machining operations, cutting off risers and milling the R.H.-L.H. cylinder head of the Nissan V8.



*Machined part*



*Machined part*

## DESCRIPTION

An entry conveyor belt transfers the parts into the machine, where a pick-up with two jaws transfers them to the working fixture.

The fixture is equipped a tilting support, provided with special hydraulic devices on the supporting surface, which clamp the cylinder heads received from the pick-up, tilt them by 95° and bring them to a position for the two cutters installed on the machine.

The cutters are driven by two electric motors, secured to a platen, and their longitudinal movements produce the milling paths, intended respectively for cutting off the risers, and surface milling the cylinder head.

The platen, driven by an electric motor connected to a ball screw, slides on the machine bed by means of guides.

Once machining is performed, the fixture turns over the cylinder head and brings it horizontal again; then, the head is released to allow the pick-up to draw it.

Finally, the machined cylinder head is transferred by the pick-up to the exit conveyor belt and guided out of the machine, where an operator shall unload it by hand to conclude its cycle.

## SPECIFICATIONS

**WORKING CYCLE**  
AUTOMATIC.

**IN:** loading on the entry roller conveyor belt, manual.

**OUT:** unloading to exit roller conveyor belt, manual.

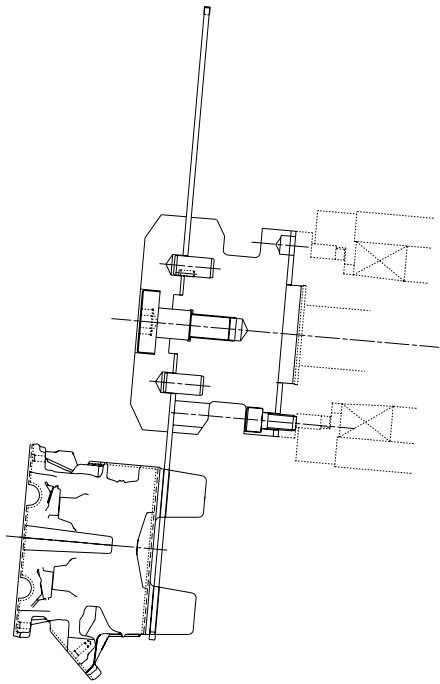
**CYCLE TIME**  
Hourly output at 100% efficiency = 92 workpieces.

**FUNCTIONING SYSTEM**  
Overall dimensions on the ground: 10000 x 4560 x h 4050 mm.  
Weight: ~10000 Kgs.

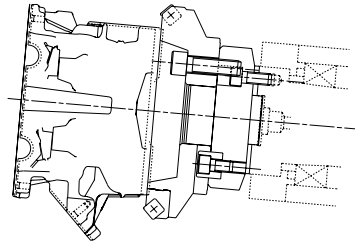
**POTENZA INSTALLATA**  
~ 80 Kw.

**SAFETY GUARDS**  
Soundproof cabin closed on five sides, with n°3 doors for access to the working zone.

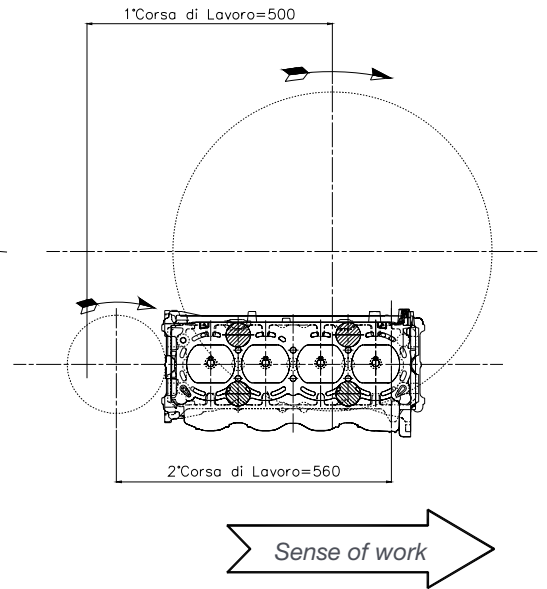
## DIAGRAM



*Cutting disk*



*Milling disk*

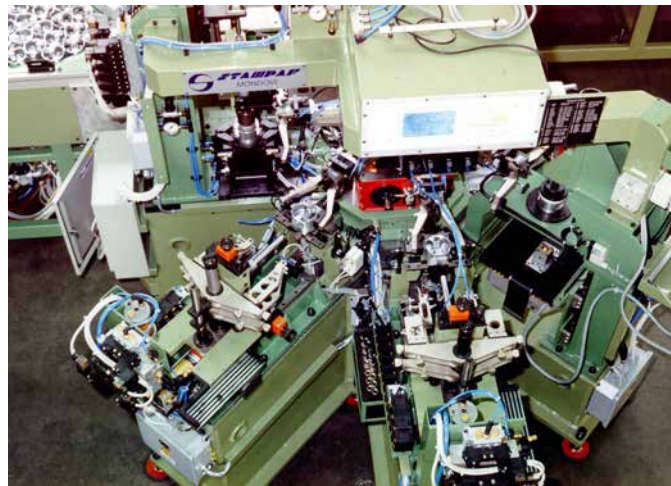
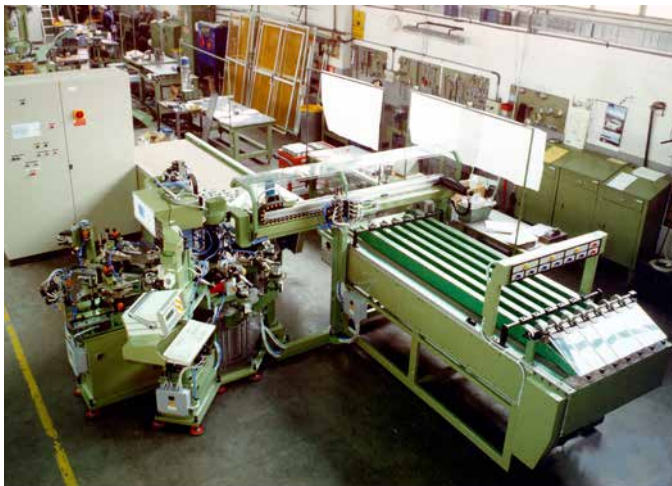




# SPECIAL PISTON CHECKING MACHINE

## MAIN FUNCTION

Check and select pistons, for use in the automotive industry.



## DESCRIPTION

The pistons are placed at random on the entry conveyor belt by an operator, then a special driving belt, mounted crosswise to the belt feed direction, directs the parts toward STATION N°1, where they are buffered, ready to be picked up.

Next, a special device, called a 7-gripper rotary transfer unit, rotates clockwise by 45° and transfers the individual pistons to the 6 workstations of the machine.

Starting from STATION N°1, the transfer unit handles the individual pistons until STATION N°6, where the pistons, that have concluded their inspection cycle, are marked.

Then, the pistons are evacuated by a controlled-axis transfer bar, which directs them into the respective selection channels on the exit conveyor belt (according to the results from the checking performed).

It has been decided that the checking operations had to be carried out through 3 STATIONS, rather than just one, because of the overall dimensions of the parts: the small dimensions of the parts would not physically permit the arrangement of the various measuring devices on a single station, as such arrangement could have jeopardized the accuracy of the testing results.

However, the use of a rotary transfer unit insures a good handling speed between the different stations, therefore also an overall cycle time meeting the customer's requirements.

## SPECIFICATIONS

### WORKING CYCLE

AUTOMATIC.

**IN:** manual feed of pistons on loading conveyor belt.

**OUT:** unloading of manually sorted pistons from the unloading conveyor belt.

### TYPE OF CHECKED PISTONS

Pistons with diameter ranging from 70 to 110 mm.  
Length of parts ranging from 60 to 120 mm.  
Material: aluminium.

### CYCLE TIME

~ 12 sec.

### HOURLY OUTPUT

~ 300 pcs/hour (at 100% efficiency).

### OPERATIONS CARRIED OUT ON THE PISTONS

STATION 1: buffering of pistons,

STATION 2: self-centering and orienting of pistons,

STATION 3: the following measurements are carried out on the pistons:

- check of shell upper part diameter,
- check of collar,
- check of squareness angle,
- check of piston squareness and faceting,
- check of valve seats.

STATION 4: the following measurements are carried out

on the pistons:

- Ø check of ellipse selection and centering,
- check of the pin hole Ø,
- check of shell middle part Ø,
- check of groove Ø,
- check of height, axis 1,
- check of height, axis 2,
- check of temperature.

STATION 5: piston weighing,

STATION 6: piston marking with identification code.

### **FUNCTIONING PLANT**

Overall dimensions on the ground: 8550 x 3600 x h 2000 mm, weight: ~ 4500 Kgs.

### **INSTALLED POWER (WHOLE SYSTEM)**

~ 3 kW.

### **SAFETY GUARDS**

Central machine casing protected by a fence of extruded aluminium alloy section bars, anodised, integrated by panels, 3 mm thick, and steel wire net grating mounted on the above-mentioned section bars; complete with n°2 sliding openings in the front and rear side respectively, equipped with safety microswitches with positive lock.

The exit conveyor belts are protected by a fixed guard of extruded aluminium alloy sections, anodised, integrated by steel wire net gratings mounted on the above-mentioned section bars, protecting the out-feeding pistons.

# DYNAMOMETER

## MAIN FUNCTION

Measure the functional characteristics of motor-vehicle brakes through a simulation of what usually happens on road, the use of parking brake included.



*Tested part*



*Tested part*

## DESCRIPTION

Moreover, it measures the static and dynamic friction coefficient of the brake pad material.

The variables that may be set at the cycle start or while the cycle is in progress, in order to run the above mentioned functions, are:

- Inertia of motor vehicle (preset at cycle start).
- Speed of motor vehicle (variable while cycling).
- Braking intensity (variable while cycling).
- Ventilation rate (variable while cycling).
- Loading on the parking brake.
- Torque applied for static and dynamic friction measurement.

The measured characteristics are:

- Braking torque.
- Brake temperature.
- Parking brake torque.
- Static and dynamic friction.

## SPECIFICATIONS

**WORKING CYCLE**  
AUTOMATIC.

### TYPE OF TESTED BRAKES

Brakes assembled to motor vehicles in the following configurations:

- a) classic assembly, brake disk and shoe, after construction of interfacing flanges,
- b) assembly of the vehicle hub, complete with brake disk and shoe, after construction of interfacing flanges,
- c) assembly complete with motor vehicle suspension, within the limits set by the dynamometer dimensions and features.

### FUNCTIONING SYSTEM

Overall dimensions on the ground (electric cabinet and overhead channels): 7500 x 2000 x h 2350 mm, weight: ~ 12000 Kgs.

### INSTALLED POWER (DRIVING ENGINE)

Steady torque till 841 r.p.m.: 1798 Nm.

Steady-state power from 841 to 2500 r.p.m.: 175 kW.

Minimum torque available for inertia simulation (at 2500 r.p.m.): 669 Nm.

### AVAILABLE INERTIA (RANGING FROM 9 KGM2 MINIMUM UP TO 209 KGM2)

Basic inertia, built up by all of the always present rotating components: 15.2 kgm<sup>2</sup>.

### VARIABLE INERTIA, BUILT UP BY N°4 FLYWHEELS TO BE MECHANICALLY SWITCHED ON AND OFF: 187.5 KGM2, BROKEN DOWN AS FOLLOWS:

- a) n°1 volano con inerzia: 12.5 kgm<sup>2</sup> ,
- b) n°1 volano con inerzia: 25 kgm<sup>2</sup> ,

- c) n°1 volano con inerzia: 50 kgm<sup>2</sup> ,
- d) n°1 volano con inerzia: 100 kgm<sup>2</sup> ,
- e) inerzia simulata dalla copia del motore: +/- 6.25 kgm<sup>2</sup>.

**MAXIMUM SPEED FOR ROAD TEST SIMULATIONS**  
2500 n/min.

**MAX. TORQUE MEASURED FOR ROAD TEST SIMULATIONS**  
5000 Nm.

**MAX. APPLICABLE TORQUE FOR STATIC AND DYNAMIC FRICTION MEASUREMENT AND PARKING BRAKE TESTS**  
4000 Nm (160 bars on hydraulic motor).

**MAX. ANGLE OF ROTATION FOR STATIC AND DYNAMIC FRICTION MEASUREMENT TESTS AND PARKING BRAKE TESTS**  
360°.

**MAX. LOAD APPLICABLE TO THE PARKING BRAKE CONTROL CABLE**  
2000 N.

**MAX. STROKE OF THE PARKING BRAKE CONTROL DEICE**  
50 mm with position control + 50 mm overtravel.

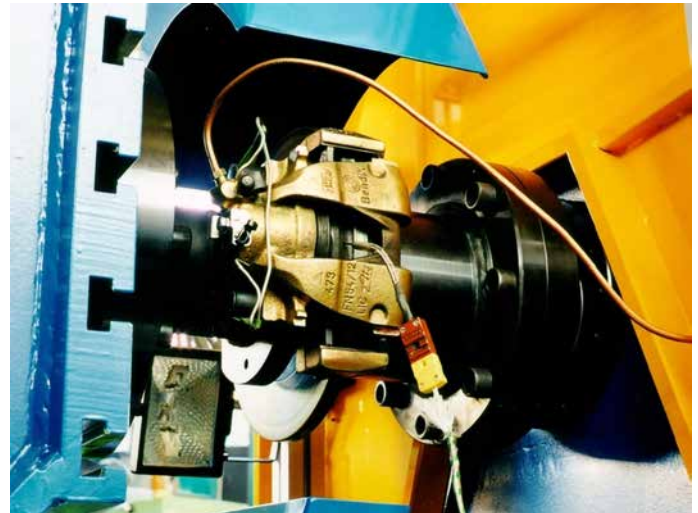
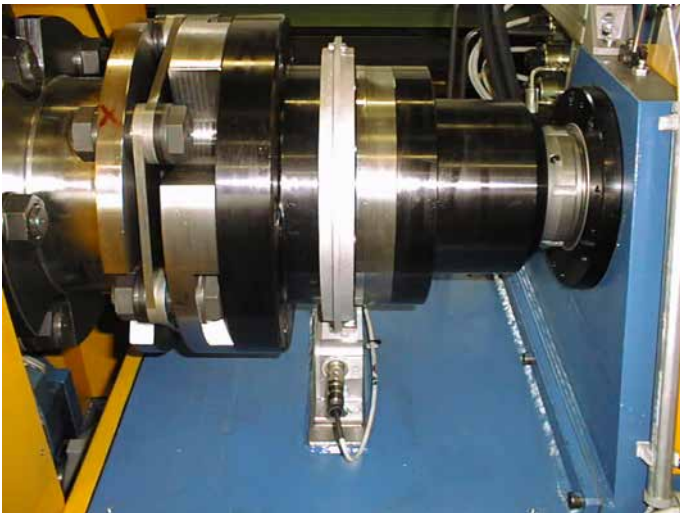
#### **SAFETY GUARDS**

In the brake testing area: fixed and movable (sliding) guards made of sheet metal, provided with safety microswitches with positive lock.

In the torquemeter area: fixed sheet-metal guards.

Inertia flywheel set: movable guards (gull-wing opening) made of sheet metal and provided with safety microswitches with positive lock.

For protection of the clutch connecting the drive unit the flywheel set, some fixed safety guards of sheet metal are installed.



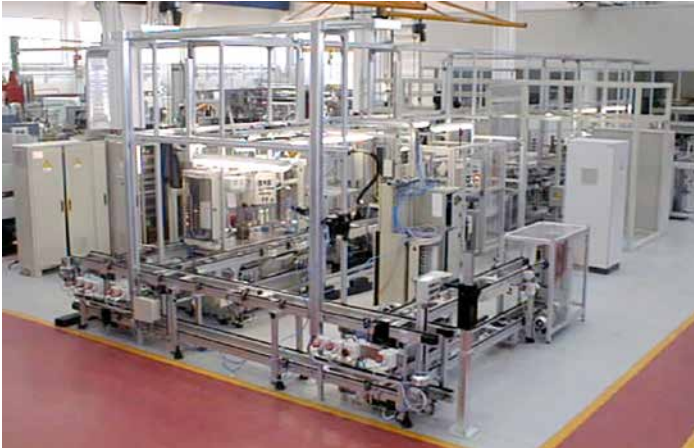
*Torquemeter unit and brake testing area*



# SEMI-AUTOMATIC OIL FILLING AND TESTING LINE

## MAIN FUNCTION

Fill with oil and carry out various manual and automatic tests on the NBU – NE compressors



*Tested part*

## DESCRIPTION

The line consists of a transport system, where the parts being tested feed on overlaying two-level conveyor belts.

The parts are carried in the line by means of pallets that, feeding on the upper-level conveyor belts, transfer the compressors to the different stations, whereas the lower level of the conveyor belts is used to re-enter the pallets that have reached the end of cycle.

To speed up the operations, there are two tracks arranged alongside each other, a right-hand one and a left-hand one, making it possible to operate simultaneously on two parts, thus increasing the number of products tested in the preset time.

The line consists of 23 working stations, identified by their assigned Operations, indicated with the “Op” code, followed by an incrementing number including two or three digits, which identifies the proper testing stations and the automatic or manual working stations.

## SPECIFICATIONS

### WORKING CYCLE SEMI-AUTOMATIC

**IN:** manual loading to transport system.

**OUT:** manual unloading from transport system..

### TYPES OF TESTED COMPRESSORS Compressors type NBU and NE.

### CYCLE TIME

~ 9 sec.

### LIST OF WORKING STATIONS

- Station\_1: OP\_10 Manual part loading operation.
- Station\_2: OP\_20 Protective cap removal operation.
- Station\_3: OP\_30 Part labelling operation.
- Station\_4: OP\_40 Tube straightening operation.
- Station\_5: Station 1 - Automatic parts distribution.
- Station\_6: Station 2 - Rotation 1.
- Station\_7: OP\_50 Weighing 1.
- Station\_8: OP\_60 Oil filling operation.
- Station\_9: OP\_70 Weighing 2.
- Station\_10: OP\_80 Plugging in service tube.
- Station\_11: OP\_90 Running in and stiffness check operation.
- Station\_12: OP\_100 NBU testing operation.
- Station\_13: OP\_110 In-Jet Operation.
- Station\_14: OP\_120 NE manual testing operation.
- Station\_15: Station 3 Rotation 2.
- Station\_16: OP\_130 Manual reject repairing operation.
- Station\_17: Station 4 Part recovery.
- Station\_18: OP\_140 Plugging-in operation.
- Station\_19: OP\_150 Exhausting operation.
- Station\_20: OP\_160 Weighing and visual checking operation.
- Station\_21: OP\_170 Manual final repair operation.
- Station\_22: OP\_180 Manual part unloading operation.
- Station\_23: Station 5 Empty pallet final rotation.



## FUNCTIONING SYSTEM

Overall dimensions on the ground: 20760 x 7575 x h 4000 mm.

## SAFETY GUARDS

The structure is provided with protections only in the following zones, facing the individual Working Stations, namely:

- conveyor belts in the zones of pallet elevators/ lowerators: aluminium and lexan guards, complete with access doors,
- OP\_30: aluminium and lexan guards, complete with access doors,

- OP\_90: aluminium and lexan guards, complete with access doors,
- OP\_100: aluminium and lexan guards, complete with access doors,
- OP\_110: aluminium and lexan guards, complete with access doors,
- OP\_120: soundproof cabins surrounding the entire tracks on the left and right hands, not communicating with each other and each one provided with one opening to allow the operator to enter the cabin.

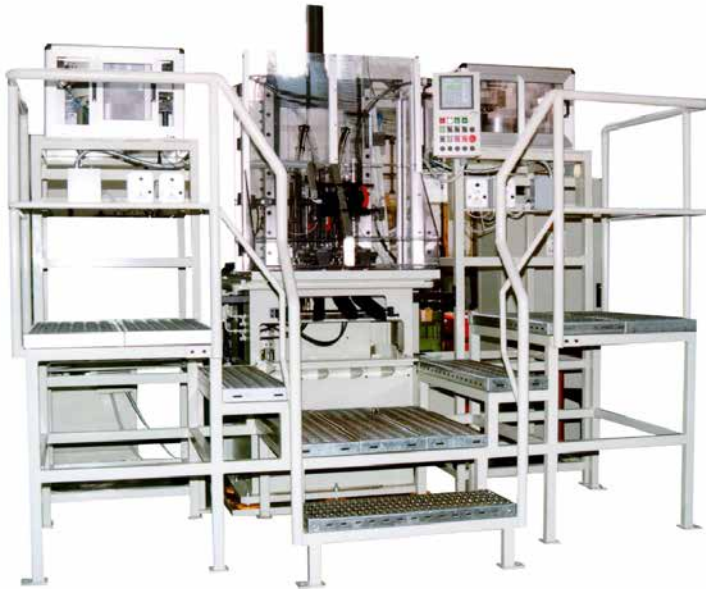


NBU - NE Compressors Testing Stations

# VERTICAL BROACHING, HYDRAULIC-POWERED

## MAIN FUNCTION

Broach the connecting rod-bearing cap mating surfaces.



*Finished part*



*Finished part*

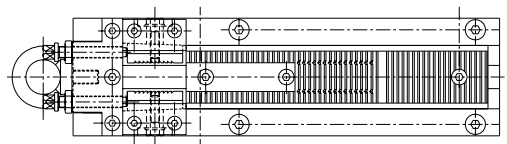
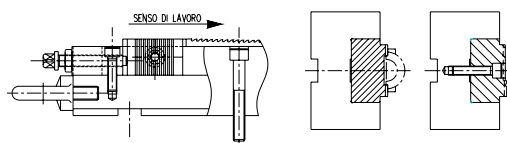
## DESCRIPTION

This machine can work two (2) types of connecting rods with relevant bearing cap. The work pieces (No. 2 connecting rods + No. 2 bearing caps) are simultaneously hand-loaded by the operator to special cartridge belts; afterwards they are pushed, located and

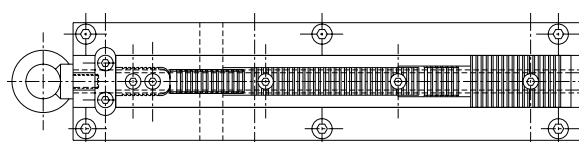
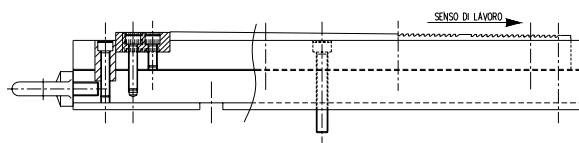
clamped in position by the operator, and then machined by broaching tools working with vertical reciprocating movement.

Finally, once the machining is complete, the machine unloads the finished parts separately into suitable collection boxes, to be then taken out by the operator.

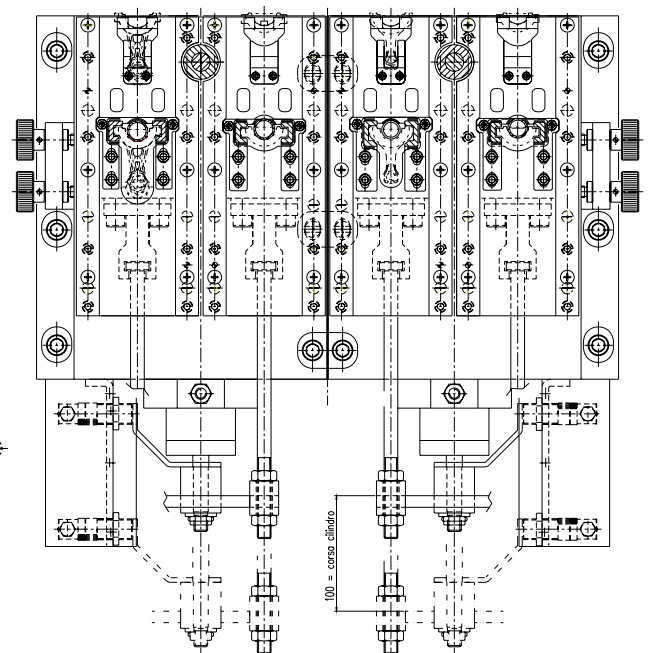
## DIAGRAM



BEARING CAP BROACH HOLDER



CONNECTING ROD BROACH HOLDER



LOADING AND CLAMPING FIXTURE

## SPECIFICATIONS

### WORKING CYCLE

#### AUTOMATIC

**IN:** connecting rod and bearing cap loading to cartridge belt, manual.

**OUT:** connecting rod and bearing cap unloading to chute, automatic.

### WORKPIECE TYPES

- a) Bearing caps.
- b) Connecting rod shanks.

### CYCLE TIME

18 sec.

### HOURLY OUTPUT AT 100% EFFICIENCY

400 conn. rods + 400 bear. caps. (Note: the machine is

capable to work simultaneously No. 2 connecting rods and No. 2 bearing caps per cycle.).

### FUNCTIONING SYSTEM

Overall dimensions on the ground: 3500 x 2750 x h 3010 mm, weight: ~ 2500 Kg.

### INSTALLED POWER

~ 10 kW.

### SAFETY GUARDS

The whole front perimeter of the machine is guarded to avoid any accidental human intrusion to the working area.

The guarding system includes one guard and one roller protection running with the slide between the internal and external slideways (R.H./L.H.).

The guard consists of aluminium extruded square sections and lexan panels.

# SPECIAL CAP DRIVING MACHINE

## MAIN FUNCTION

Drive the caps into the intake muffler of the compressor motor mounts.



Machined part

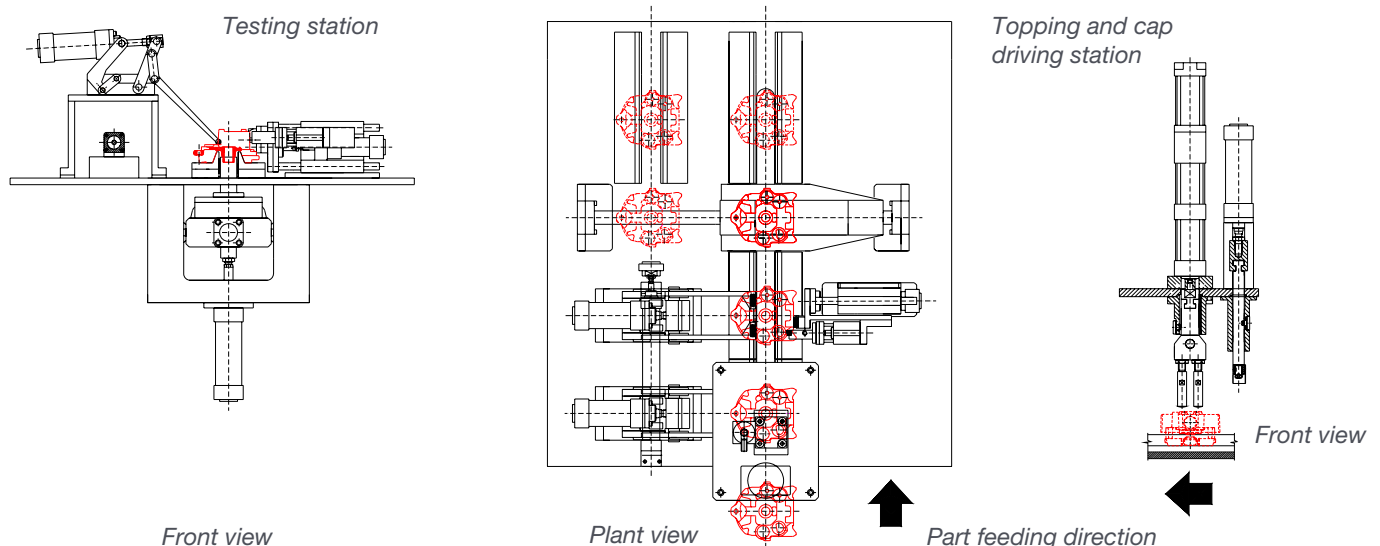
## DESCRIPTION

The motor mounts are transferred by an entry conveyor belt to the working zone, where a part detecting device signals their arrival and stops them; a system consisting of a slide mounted in the lower part of the machine, then transfers them to a position where they can be clamped by special stops, machined, checked, and finally sent to

the right-hand or left-hand track on a trolley.

The parts are properly distributed between the right-hand track and the left-hand track, depending on whether they have passed the checks and can continue in the production cycle, or they are to be rejected because they do not meet the specified requirements.

## DIAGRAM



## SPECIFICATIONS

### WORKING CYCLE

AUTOMATIC.

**IN:** manual loading to entry conveyor belt.

**OUT:** automatic unloading onto next line.

### CYCLE TIME

9 sec.

### FUNCTIONING SYSTEM

Overall dimensions on the ground: 3200 x 1250 x h 2200 mm, weight: ~ 450 Kg.

### INSTALLED POWER (ABSORBED BY MOTORS)

~ 500 VA.

### SAFETY GUARDS

Structure consisting of aluminium square sections and lexan panels, with n°2 safety openings, one on the front wall and one on the back, both equipped with safety microswitches fitted with positive lock.



# SPECIAL PLATE SUPER-FINISHING MACHINE

## MAIN FUNCTION

Carry out the surface super-finishing of the compressor valve plate to remove grinding swarfs.

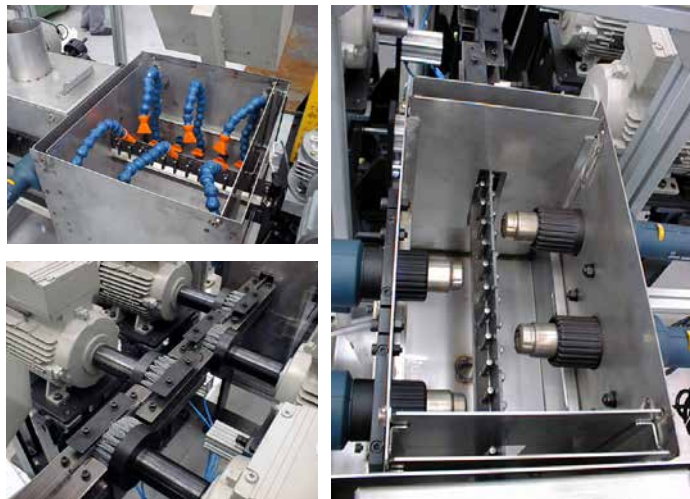


Plate Washing, Drying and Super-finishing Units

## DESCRIPTION

The machine has been equipped to process three different types of plates, loaded manually by an operator onto a specific loading magazine, which slides crosswise as to the feeding direction of the plates inside the machine.

When the plates reach a pushing device, they move forward on guides that convey the parts to the various super-finishing stations inside the machine, where the surfaces are washed and dried, before the brushing.

Finally, a special unloading unit channels the finished plates onto the unloading magazine, where an operator unloads them manually from the machine.

## SPECIFICATIONS

**WORKING CYCLE**  
AUTOMATIC.

**IN:** manual feeding to the loading magazine, on entry.

**OUT:** manual unloading from the unloading magazine, on exit.

### TYPES OF MACHINED VALVE PLATES

Valve plate for NBU compressors,  
Valve plate for NB compressors,  
Valve plate for NE compressors.

**CYCLE TIME**  
~ 4 sec.



Finished part

## HOURLY OUTPUT

~ 900 pcs/hour.

## OPERATIONS CARRIED OUT ON THE VALVE PLATES

- UNIT 1: plate washing,
- UNIT 2: plate drying,
- UNIT 3: plate super-finishing.

## FUNCTIONING SYSTEM

Overall dimensions on the ground: 4100 x 1450 x h 2000 mm, weight: ~ 1200 Kgs.

## INSTALLED POWER (WHOLE SYSTEM)

~ 10 kW.

## SAFETY GUARDS

The safety fence consists of a structure of aluminium square section bars and lexan panels; it has n°6 sliding doors, of which two are on the front side of the machine, two on the back and two on the machine sides. Every opening is fitted with safety microswitch with positive lock.

In the machine loading area, in particular close to the warehouse, a photoelectric barrier is installed to protect the personnel and avoid any accident or injury. In fact, it was not possible to protect this area with a fence or safety guards, which would have hampered the normal carrying out of manual loading operations. operazioni manuali di carico, si è provveduto a installare un'opportuna barriera fotoelettrica di sicurezza per impedire danni accidentali agli operatori addetti.

# AUTOMATIC LINE FOR HINGE MACHINING

## MAIN FUNCTION

Carry out the sequential machining of one type of frame flange hinges and one type of wing flange hinges, having different centre distance and length, by working on blank bars, 6 metres long that are loaded in sequence on a specific conveyor capable to hold up to 10 bars on full load condition.



*Machined part*

## DESCRIPTION

The machine runs its working cycle in fully automatic mode, except for the bar loading that, as already explained, is carried out by an operator.

The loaded bars then reach position, moved by a special pusher: here they are marked with their identity code, then clamped and cut off.

The hinges, cut from the blank bar, are then loaded on to the working fixture by a Scara robot equipped with a gripper finger.

The four fixtures installed on the rotary table of the machine are square (90°) to each other, so as to feed the four STATIONS of the machine.

In fact, the table rotates clockwise to move the fixtures, therefore also the hinges clamped thereon, to the three working stations:

- STATION 2
- STATION 3
- STATION 4, dove le cerniere subiranno le opportune lavorazioni.

Once the cycle is complete, the fixture returns to the loading position, where the insertion of a new hinge to be machined causes the unloading of the hinge, which has finished its cycle.

The hinges are removed on a conveyor belt.

## SPECIFICATIONS

### WORKING CYCLE AUTOMATIC.

**IN:** manual bar loading to loader unit.

**OUT:** automatic unloading to the finished hinges removing device.

### TYPE OF MACHINED HINGES

- a) Wing Flange Hinge.
- b) Frame Flange Hinge.

### CYCLE TIME

- Cycle time, hinge type a): 12 sec.
- Cycle time, hinge type b): 14 sec.

### MACHINING OPERATIONS CARRIED OUT ON HINGE TYPE A)

- STATION 2  
drilling of n°2 holes, 8.2 Ø, in the hinge foot by means of double-spindle units,
- STATION 3:  
external drilling of dimple in the hub M6 (Ø 5/Ø 6.2) and chamfering of n°2 holes, 8.2 Ø, previously carried out in STATION 2,
- STATION 4:  
tapping of the hole M6 in the hub.

## MACHINING OPERATIONS CARRIED OUT ON HINGE TYPE B)

### STATION 2:

drilling of n°2 holes (8.2 Ø /13.5 Ø) in the hinge foot by means of horizontal double-spindle unit, and n°2 spot facings, 26Ø, 2.5 deep,

### STATION 3:

chamfering of n°2 holes, 8.2 Ø, previously drilled in STATION 2,

### STATION 4:

tapping of n°2 side holes in the hub M 18x1.5, 14.5 deep.

## FUNCTIONING SYSTEM

Overall dimensions on the ground: 11580 x 6130 x h 2600 mm, weight: ~ 13000 Kgs.

## INSTALLED POWER (WHOLE SYSTEM)

~ 17 kW power spindles.

~ 3 kW strainer.

~ 0.3 KW hydraulic power pack.

## SAFETY GUARDS

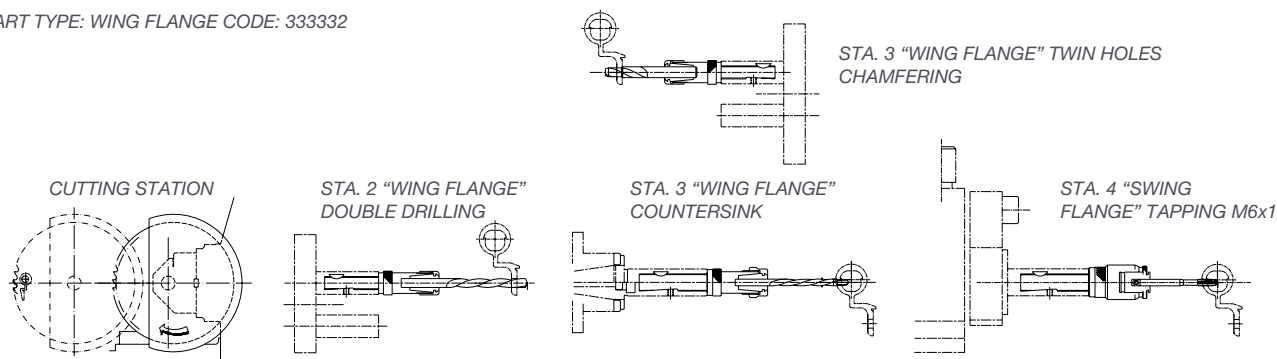
In the hinge machining area: extruded aluminium alloy section bars, anodised, with lexan panels, 3 mm thick, and n° 6 doors equipped with safety microswitches with positive lock.

In the bar loading area: n° 4 protection casings, semicircular, of sheet metal, side lexan side guards, rear structure consisting of extruded aluminium sections, anodised, and steel wire net gratings mounted on the above section bars, complete with n°1 opening.

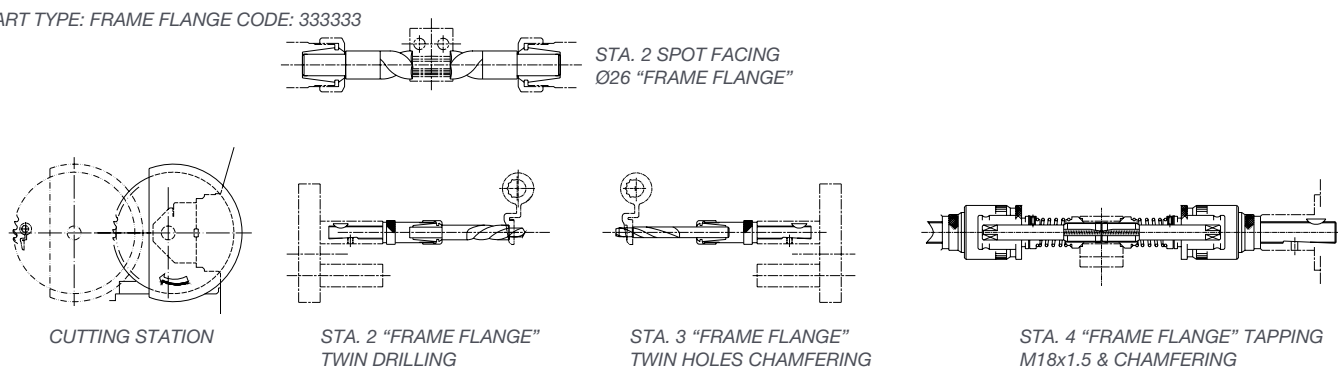
In the hinge unloading area: structure consisting of extruded aluminium section bars, anodised, and steel wire net gratings, mounted on the above sections, complete with n°3 openings.

## DIAGRAM

PART TYPE: WING FLANGE CODE: 333332



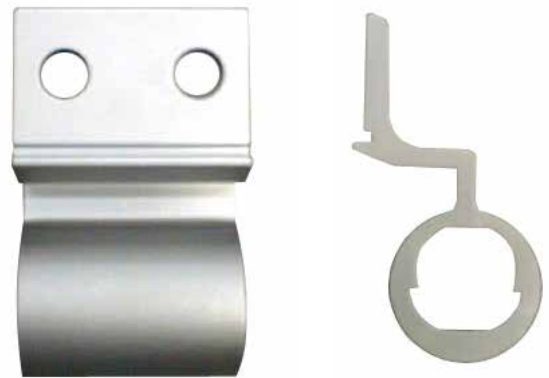
PART TYPE: FRAME FLANGE CODE: 333333



# SPECIAL MACHINE WITH ROTARY TABLE

## MAIN FUNCTION

Carry out sequential work on frame wing and door wing hinges with different center distances and variable lengths.



*Machined part*

## DESCRIPTION

In particular, the machine can clamp the blanks on two fixtures located side by side (FIXTURE A and FIXTURE B), mounted on the perimeter of a rotary table. The rotary table starts its anti-clockwise rotation and it positions the hinges on three fixed working stations, secured to the machine base and offset by 90° to each other.

Each station includes special units capable to carry out the following operations: HORIZONTAL and VERTICAL DRILLING, HORIZONTAL SPOT FACING, HORIZONTAL DRILLING WITH MULTIPLE-HEAD, TAPPING, and HORIZONTAL CHAMFERING.

For each hinge, the complete machine cycle provides for two machining steps: first, the blank is manually placed by the operator on fixture A, to undergo a first machining sequence through the three above-mentioned stations; then, when the workpiece returns to the starting station 1, it is manually unloaded from fixture A and reloaded, still by hand, on to fixture B to undergo another machining step.

Finally, the part is released from the fixture and removed from the machine.

## SPECIFICATIONS

**WORKING CYCLE**  
AUTOMATIC.

**IN:** manual feed of hinges, in STA. 1 (Fixture A/B).

**OUT:** manual unloading of hinges, in STA. 1 (Fixture B).

### CYCLE TIME

Cycle time per Wing Flange hinge: 12 sec.

Cycle time per Frame Flange hinge: 12 sec.

### MACHINING PERFORMED ON WING FLANGE HINGE

STATION 2A (fixture "A"): drilling of n°2 holes, 11 Ø, in the hinge foot,

STATION 3A (fixture "A"): drilling in the hub, 5 Ø /6.2 Ø,

STATION 4A (fixture "A"): tapping of hole M6x1 in the hub, carried out in STATION 3A,

STATION 4A (fixture "A"): countersink of n°2 holes, carried out in the hinge foot, in STATION 2A,

STATION 2B (fixture "B"): drilling, 4.5 Ø,

STATION 3B (fixture "B"): spot facing, 7.3 Ø, of the hole drilled in STA. 2B.

### MACHINING PERFORMED ON FRAME FLANGE HINGE

STATION 2A (attrezzo "A"): foratura n°2 fori Ø 11 nel piede della cerniera,

STATION 2A (attrezzo "A"): lamatura Ø 26 da un lato del mozzo della cerniera,

STATION 4A (attrezzo "A"): svasatura n°2 fori, eseguiti in STATION 2A, nel piede della cerniera,

STATION 4A (attrezzo "A"): maschiatura M18x1.5 da un lato del mozzo della cerniera,

STATION 2B (attrezzo "B"): foratura Ø 4.5,



STATION 2B (attrezzo "B"): lamatura Ø 26 da un lato del mozzo della cerniera,

STATION 3B (attrezzo "B"): lamatura Ø 7.3 del foro eseguito in STATION 2B,

STATION 4B (attrezzo "B"): maschiatura M18x1.5 da un lato del mozzo della cerniera.

### FUNCTIONING SYSTEM

Overall dimensions on the ground: 6850 x 4300 x h 2500 mm, weight: ~ 10000 Kgs.

### INSTALLED POWER (WHOLE SYSTEM)

~ 16 kW power spindles, ~ 3 kW strainer, ~ 0,3 KW hydraulic power pack.

### SAFETY GUARDS

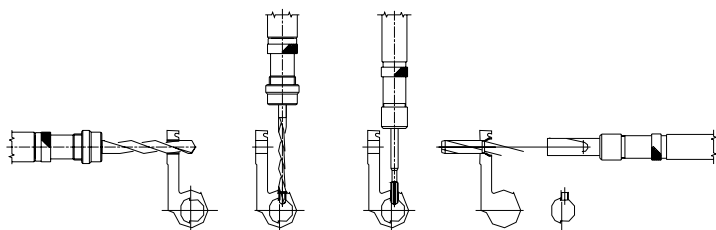
Guards consisting of aluminium section bars and lexan panels, properly surrounding the entire machine in order to prevent from any accidental access to the moving parts of the machine during its normal operation.

The brushing is fixed where no maintenance or worktype change activity is required; any way, n°8 doors are provided throughout the lateral and rear perimeter, electronically controlled by as many safety switches with positive lock.

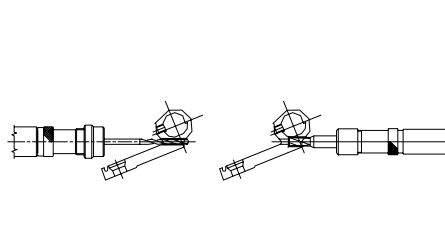
The front face of the machine is free from brushing, in order to facilitate the hinge loading and unloading operations; however, a photoelectric barrier has been provided for the sake of safety.

## DIAGRAM

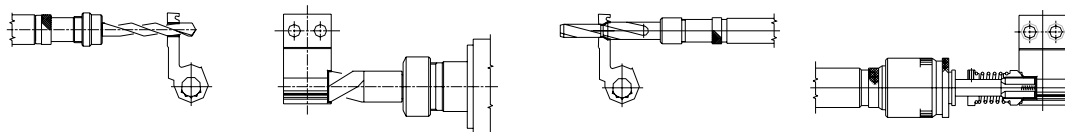
WING FLANGE MACHINING ON FIXTURE "A"



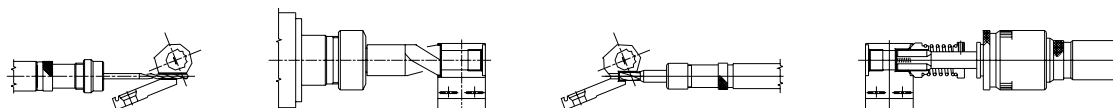
WING FLANGE MACHINING ON FIXTURE "B"



FRAME FLANGE MACHINING ON FIXTURE "A"



FRAME FLANGE MACHINING ON FIXTURE "B"



# LIFT-OFF HINGES MACHINING PROCESS

## MAIN FUNCTION

Carry out aluminium lift-off hinges starting from extruded aluminium bars, 6 to 6.5 m long, suitably cut off by the machine during the working cycle.

*Machined Part*



## DESCRIPTION

The operator manually loads a pair of bars (male and female) onto the entry conveyor, where they are automatically fed into the machine.

In the first step, 4 slots are punched (n° 2 on the male hinge and n°2 on the female hinge), with subsequent countersink of the 4 slots by means of a twist drill.

Once the bars have been positioned and clamped, the SAVIO logo (requested by the customer) is stamped to the lower part of the hinge, i.e. on the same side as the previously performed countersink operations.

Afterwards, a special unit engraves the hinge identification codes.

In the last step of the route, the bars are cut off, while the finished hinges are feeding out on the exit conveyor belt.

## SPECIFICATIONS

**WORKING CYCLE**  
AUTOMATIC.

**IN:** manual feed of bars to the entry loading conveyor.

**OUT:** automatic unloading of finished hinges on to exit conveyor belt.

**TYPE OF HINGES ON PROCESS**  
Lift-off hinge, Male and Female Flanges.

**CYCLE TIME**  
2.64 sec/piece.  
Hourly output: 1363 pcs/h.  
Parts machined from the bar: 121 minimum.

**FUNCTIONING SYSTEM**  
Overall dimensions on the ground: 9300 x 2800 x h 2720 mm, weight: ~ 1900 Kg.

## INSTALLED POWER (WHOLE SYSTEM)

~ 17 kW.

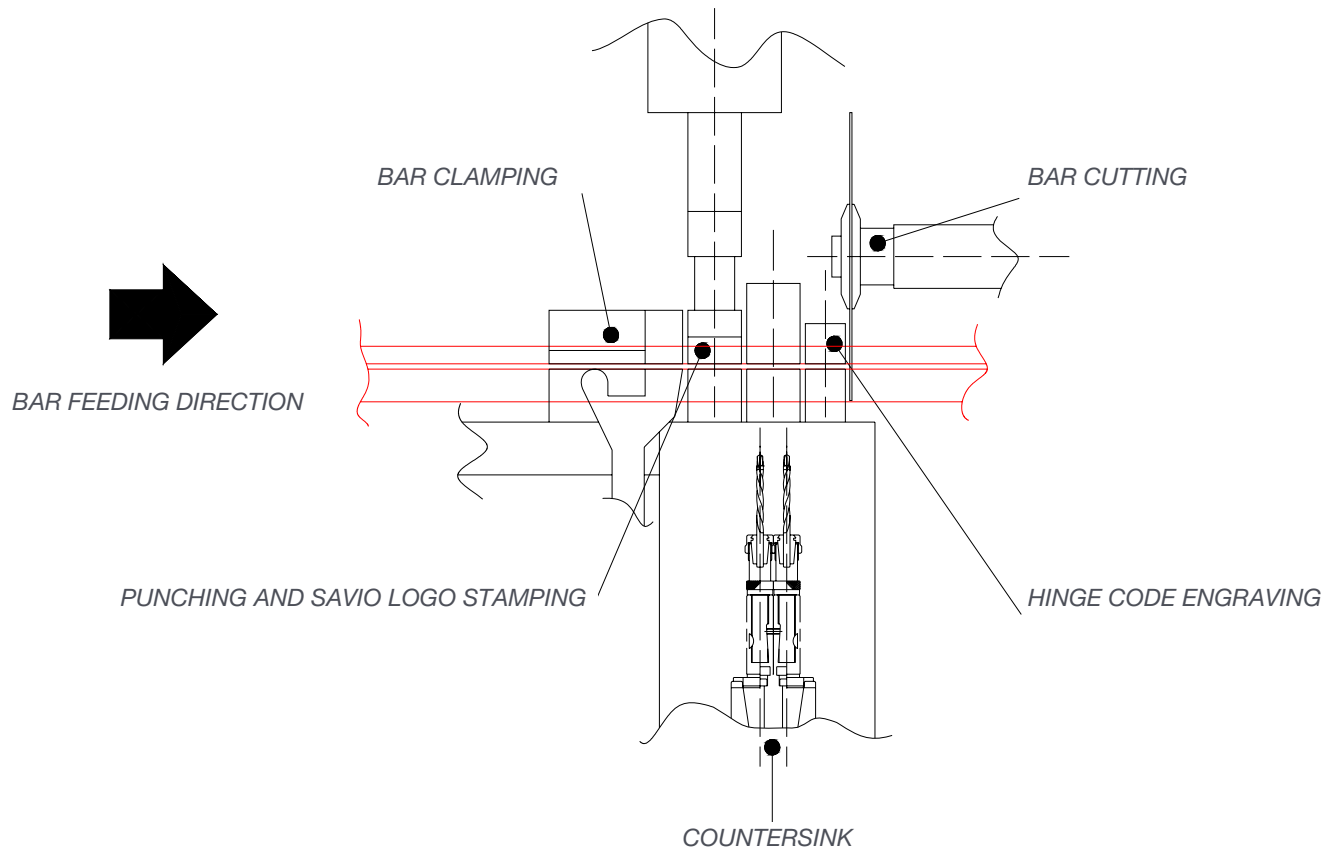
## SAFETY GUARDS

Soundproof cabin, closed on five sides, suitable for full disassembly and complete with sheetmetal telescoping panels.

Telescoping panels of press-formed and treated plate, with dampening rolled sections and deadening materials.

On two sides of the structure, there are n°2 sliding openings, while on four sides of the structure there are n° 5 portholes with burglarproof laminated glass.

## DIAGRAM



# CYLINDER HEAD ASSEMBLY ISLE

## MAIN FUNCTION

- Manual valves assembly and spark plugs pre-tightening in cylinder head suitably located on tilting fixture.
- Automatic spark plugs tightening.
- Automatic combustion chambers tightness check.
- Automatic assembly of the following components on valve axis: washers, exhaust springs, intake springs, half rings, couplings, intakecup, exhaust cup.



## DESCRIPTION

Components are assembled by means of SMA special unit. SMA mainly consists of brushless motor for horizontal movement (X), of brushless motor for vertical motion (Y) and grippers unit including 5 tools for components assembly on cylinder head.

Components to be assembled are supplied thru circular vibrators and linear feeders.

Cylinder heads load and unload phases are automatically performed by manipulation robot.

## SPECIFICATIONS

### ASSEMBLED PARTS

Valves, spark plugs, washers, exhaust springs, intake springs, half rings, couplings, intake cup, exhaust cup.

### POWER SUPPLY

Voltage: 400 V (three-phase + ground)  
Frequency: 50 Hz

### PNEUMATIC POWER SUPPLY

- operating pressure:  
6 bar
- momentary consumption:  
8 Nm<sup>3</sup>/h (op. 130)  
8 Nm<sup>3</sup>/h (op. 132)  
20 Nm<sup>3</sup>/h (op. 133)
- hourly consumption:  
0,1 Nm<sup>3</sup>/h (op. 130)  
0,1 Nm<sup>3</sup>/h (op. 132)  
2,5 Nm<sup>3</sup>/h (op. 133)

### PART TRANSFER SYSTEM

By means of manipulation robot

### SAFETY GUARDS

- Fixed type protections
- Moving type protections provided with a interlock device
- Moving units covering guards;
- Abstract barriers for presence check in work area;
- Emergency push-buttons







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