PUNCHMASTER

TECHNICAL DOCUMENT

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CONTENT

1 Description

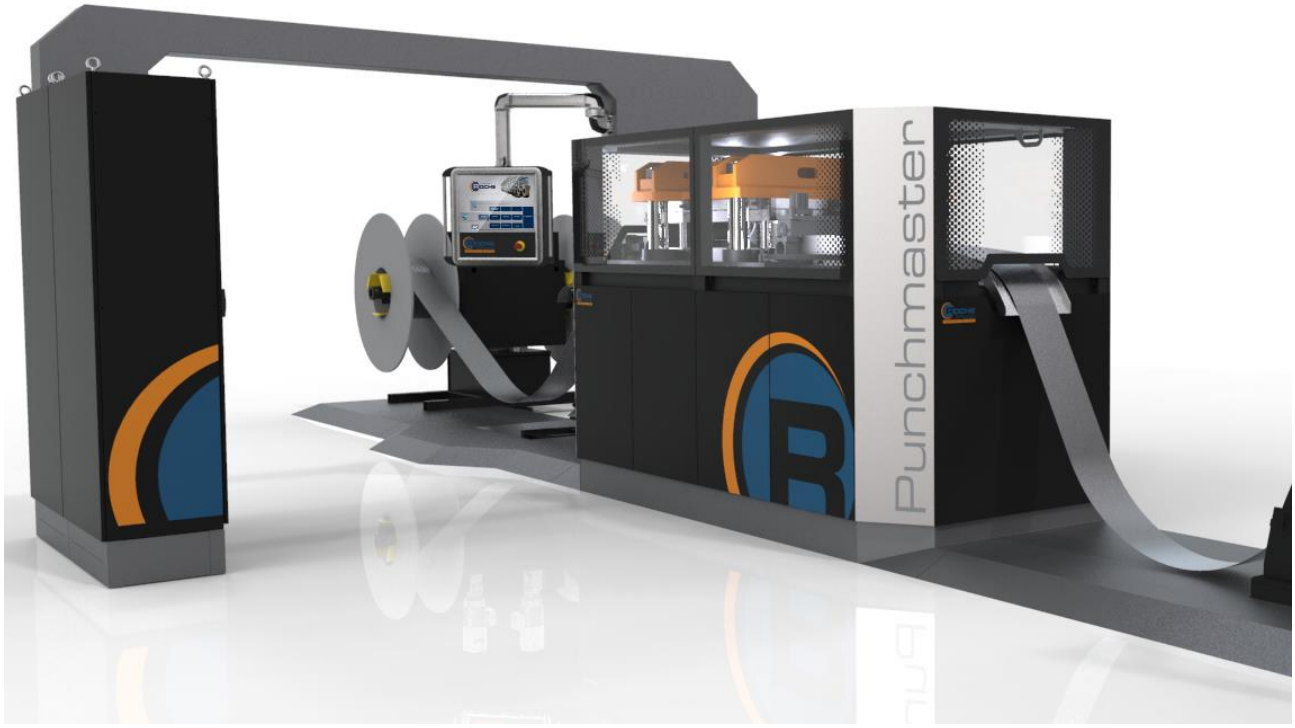
Our PUNCHMASTER line is dedicated to high speed production of punched lead grids for both automotive and industrial batteries.

The whole line was designed to fit the following specifications:

- Lead strip thickness from 0.72mm to 1.2mm
- Lead strip width up to 350mm
- Production capacity of max 500 grids/min (for 144mm grids)
- **No lubrication on the grid**

The line includes (see layout S002180-LAYOUT):

- The vertical double decoiler designed for large strip
- The **PUNCHMASTER** including strip feeder and sound enclosure
- The vertical double encoiler



2 PUNCHMASTER line features

2.1 Vertical double decoiler

The decoiler is designed according to a vertical model. It includes:

- One fixed part fitted on the ground and a turret part able to change the full coil in operation. It is changed by means of a foot pedal.
- 2 x 3 jaws mandrels
- 2 gear boxes with motor brakes and overload friction on the driving shafts
- Loading of the coils are done by a suitable crane (crane not furnished)

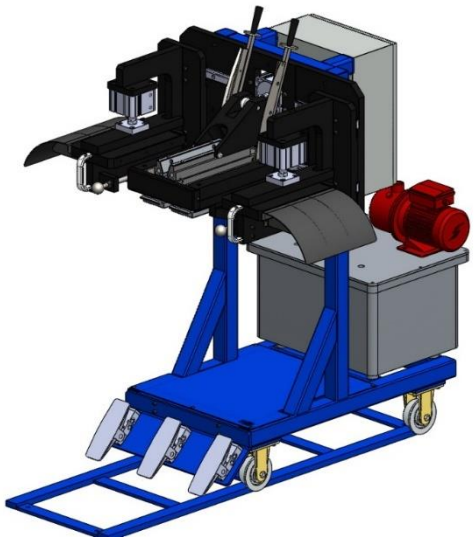
Characteristics

- Double strip coil (2 x 3000 Kg) able to receive two coils of wide lead strip
- Adjustable decoiling speed by means of a variable frequency controller
- Loop control with ultrasonic sensor
- Only local control panel, all the equipment is included in the central operator panel
- **C E** standards

2.2 Hot joining welder

The hot joining welder is designed to quickly weld strip after strip to insure the continuity of the process even in the paster. It includes:

- Large double heating table suitable for 300mm strip
- Double zone temperature regulation
- Pneumatic cylinders for strip pressing controlled by foot pedals to improve the operator ergnomics
- Linear guide to ensure perfect alignment for welding
- 2 manual shears for perpendicular cutting of both side
- Low profile frame to save space
- Hot welding with welding wire tin alloy
- Wheel to remove the welder from the strip line
- Cooling by closed water circuit
- **C E** standards



2.3 Vertical Encoiler with tensioning system

The double encoiler is designed according to a vertical model.

It includes:

- Two mandrels for dual stock reel
- One fixed part fitted on the ground and a turret part able to change the full coil in operation. It is change by means of a foot pedal.
- 2 x 3 jaws mandrels
- 2 gear boxes with motor brakes and overload friction on the driving shafts
- Loading of the coils are done by a suitable crane (see above)
- Pneumatic pressing arm
- Mesh tensioning rollers with guiding rings

Characteristics:

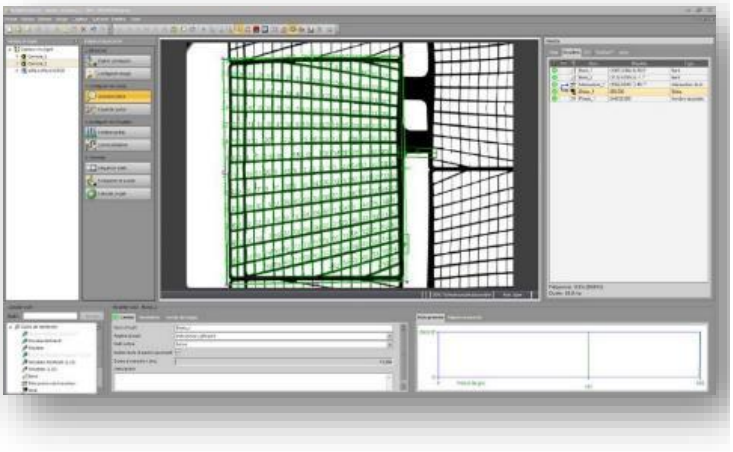
- Double strip coil (2 x 900 Kg) able to receive 2 bobbins (avoids downtime of production)
- Adjustable coiling speed by means of a Variable Frequency Controller
- Loop control with ultrasonic sensor
- Only control panel (all the equipment is included in the line panel)
- **C E** standards

2.4 Camera control – Quality process improvement

Last innovation from Ateliers ROCHE, the camera is getting your grids production in a new era of quality.

Positioned just after the tab-blanker, the camera is monitoring:

- Broken wires
- Broken punch



Specifications:

- Acquisition time: 1 ms
- Field of view: 350 x 300 mm
- Local display

2.5 PUNCHMASTER

2.5.1 Main features

The PUNCHMASTER is a 4-column press with all the mechanics under the punching tooling. The complete PUNCHMASTER is set on isolation press mounts.

In the lower part, the frame carries a crankshaft guided on bronze bushes. The crankshaft drives 2 eccentrics connected to the lower beam trough connecting rods. Four vertical columns connect the lower beam to the upper beam.

The crankshaft is controlled by a clutch-brake and a flywheel activated through press safety valves.

The tool is fitted on the upper part of the frame and the tool shutting is triggered by the upper beam. The upper plate of the tool is adjustable through a wedge system to allow the blanking adjustment (by screw and ratchet). Hydraulic clamping cylinders ensure the connection with the upper ram.

A hydraulic device protects the press against overload. The frame features a chute to evacuate the scrap material and a tool centring key. The lower beam features 4 counterbalancing pneumatic cylinders.

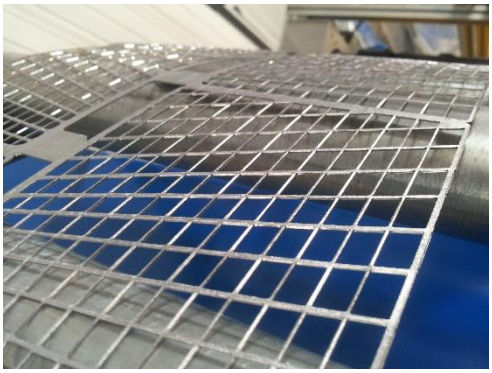
2.5.2 Characteristics

Nominal power ..... 1250 kN
Stroke ..... 35 mm
Variable rate ..... 150 up to 250 Strokes/min
Motor with Inverter ..... 22 KW / 400 V
Tool overall dimensions ..... 1000 x 425 x 300 mm
Output speed ..... **up to 36 m/min**

2.5.3 PUNCHMASTER overall dimensions

Length..... 3200 mm
Width ..... 1500 mm
Height ..... 2400 mm
Approximate weight ..... 12000 Kg

2.5.4 Scrap



After blanking, the lead scraps fall down in an internal guide outside the frame. The standard solution features a scrap conveyor that brings the scrap to a temporary storage rack installed near the PUNCHMASTER. The final configuration of the scrap conveyor could be modified according to your needs.

2.5.5 Protection

The PUNCHMASTER is completely protected by means of a sound enclosure which is an integral part of the press. It affords a maximum protection for the operator within a minimum of space.

The lower part is composed of mobile panels, allowing easy and fast intervention on the machine. These panels are lined with glass-fibre reinforced rock wool sheets, greatly reducing the sound level.

The upper part is composed of a protection panel with polycarbonate panels, and a mobile cover powered by gas actuators. This part affords an efficient control of the process while protecting the operator (Safety height 2 m).

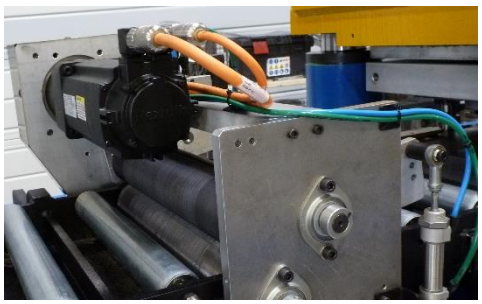
All the mobile parts are controlled by safety sensors.

2.5.6 Lubrication of the PUNCHMASTER

The PUNCHMASTER lubrication system is centralised with a timing program. The actuation of the lubrication pump is performed by an adjustable timer. The level of the oil tank is electrically monitored and defects are read by the PLC.

The lubricant is continuously filtered and recycled.

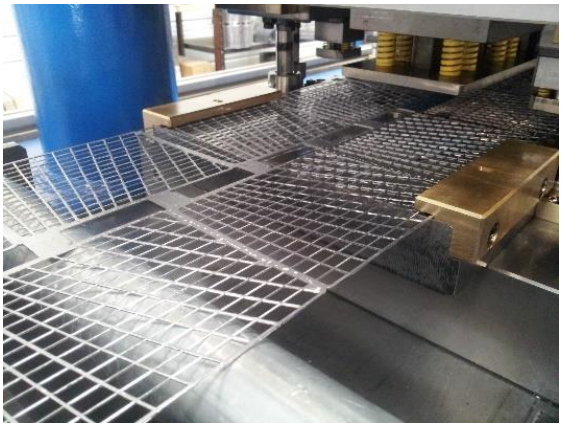
2.5.7 Push-pull Strip feeder



A specific strip feeding system has been developed specially for the PUNCHMASTER. It consists of 2 servo-motors with rollers located at the inlet and at the outlet of the tooling performing a push-pull feeding of the press. Low inertia rollers and a high performance brushless servo-motors provide a very accurate position of the strip between each stroke. The strip feeder synchronisation with the press is made with a cam.

The pitch of the strip feeder is set on the operator touch panel according to your grid design and automatically adjusted in real time by our strip feeding system. This ensures the most accurate positioning between each stroke while avoiding the operator to adjust the pitch regarding the strip thickness.

2.6 PUNCHMASTER Tooling



The PUNCHMASTER tooling is a progressive die tooling suitable to punch in 6 steps the lead strip up to punched mesh including the lug profile and wire reshaping upon request. The length of the tooling includes a total of 6 steps where the plates are punched 2 by 2.

The punching process is entirely done without any lubricant.

In case of different plate design, the tooling is easily exchangeable as all the needed equipment are already implemented into the PUNCHMASTER (hydraulic clamping, rollers and console).

The tooling is designed in 3 cassettes allowing a quick exchange of only one part of the tooling thus reducing the cost of spare parts to be kept in stock.

2.7 Electrical equipment

The whole synchronization of the line is done through ultrasonic sensors between each machinery.

The electrical equipment controls the decoiler, the encoiler, the PUNCHMASTER, the intercommunication with the line, the chute and all the defects.

One 19” HMI touch panel fitted near the PUNCHMASTER controls the complete process including defects and maintenance mode.

The strip feeder servomotor is controlled by the PLC with tooling protection.

2.7.1 Tonnage monitoring

Each columns features a tonnage sensor enabling to measure in real time the load distribution on the punching tooling and along the working cycle. The HMI could display data during tooling commissioning.

Algorithms have been integrated into the PLC to provide real time tooling checks, warning and alarms.

2.7.2 Press survey

Our PLC integrates continuous survey of each press components (hydraulic unit, pneumatic valves, bronze bush, etc…) in order to detect any possible failure and schedule the preventive maintenance operations.

2.7.3 Production data

The HMI embeds production data information (current production speed, daily/monthly/yearly production, etc…) that could be provided to customer level 2 using Ethernet connection.

2.7.4 Tele maintenance

The line features tele maintenance devices enabling our team to connect to the line upon request and provide remote services.

2.7.5 Power

- Mains: 3 phases, 380 V up to 415 V, 50 Hz, with neutral and ground.
- Total consumption is 50 KW.
- Control 24 VDC,
- Air consumption is 1 m3 per hour, 6 bars, connections 2 x ½ “

2.7.6 Material

- Electrical equipment: SIEMENS
- Protection for main equipment: IP 65
- Pneumatics: BOSCH REXROTH
- Sensors : HBM, IFM, SIEMENS
- PLC : SIEMENS
- HMI : 15” touch panel
- **CE** standard

2.7.7 Operation of the line

All the operations are performed from the operator touch panel and the bimanual buttons.

There are 2 operation modes:

Jog mode (bi manual)..... ..Single stroke cycle
Auto mode..... Automatic running of the complete line