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## New concept of vibrating press with semi-dry demoulding by turning over: manufacturing of manholes & a large diversity of products – equipment commissioned in Reunion Island

Created in 1988 by Mr Pascal Leandri, the company Prefabeton, based on the island of Reunion in France, is specialised in precast concrete products designed for road works, building, construction and public works. Prefabeton has successfully ensured its leading position by investing in effective production equipment. The leading manufacturer within its area, Prefabeton has enlarged its products range over the years: slabs, pavers and kerbstones with high added value, blocks, vegetative retaining walls, manholes, gutters, rainwater scuppers and other concrete products designed for companies, craftsmen, municipalities and private individuals. In 1997, Prefabeton became the first company on the island of Reunion to obtain the standard called “NF” for its manhole range. This quality process is now applied to all its products, along with CE branding in order to provide its customers with certified products. The first collaboration between Prefabeton and Quadra was in 1999 when Prefabeton bought their first production unit with block machine. This long-standing client has recently commissioned the equipment manufacturer Quadra with a large-scale project: the manufacturing of solid products with semi-dry demoulding by turning over, through a fully-automated process. This production was originally ensured by its operators working on machine type vibrating tables or small rolover machines. The main production for which this new equipment was intended was the manufacturing of manholes and seating rings and extended to other products such as low walls, retaining building blocks, drainage channels and other products with suitable dimensions for the curing chambers.

Prefabeton was seeking a versatile and productive unit. Failing to find new equipment adequate for its requirements, Prefabeton was convinced by Quadra's competences in developing new processes, for which reason it asked them to study their project. The requirements were as follows: high productivity, high flexibility, high quality product and better working conditions for their operators. After the submission of a perti-

ment solution, Prefabeton, impressed by the technical features of the equipment, finally chose Quadra as partner. This equipment has many advantages that should be outlined:

- Supervised by two operators, this fully-automatic plant can manufacture from 20 to 30 cycles per hour, according to the products.

- Mainly dedicated to the manufacturing of manholes, this unit is versatile and designed for manufacturing a large range of products with semi-dry demoulding.
- This new equipment also meets the need for flexibility thanks to a mould changeover performed in less than 10 minutes and remote control by the operator in a safe area.



Fig. 1: Prefabeton, one of the leading manufacturers of concrete product on the Island of Reunion



Fig. 2: Examples of concrete products manufactured with the newly commissioned machine

- Elevated above the ground, no pit is required for setting up the machine
- Equipped with a turning platform, this vibrating press handles two moulds at once, which enables the filling and compacting operations to be performed simultaneously with the demoulding operation.
- Since the demoulding is achieved by turning over, no base pallet is necessary during the manufacturing process
- Finally, the verticalization of the curing provides a reduced footprint.

This plant consists of the following components:

- vibrating press with automatic mould filling,
- device for automatic drying template insertion,
- turning platform for handling moulds,
- gantry for moving and turning over the demoulding pallets,
- automatic trolley for conveying fresh products,
- automatic stacker crane for storing and destoring operation,
- cleaning robot

### Versatility and flexibility of production

Having manufactured its concrete products semi-industrially until now, Prefabeton decided to invest in a fully-automatic plant. The main requirements of this new investment were high versatility (multi-product solution), high flexibility and high production efficiencies. Dedicated to the manufacturing of manholes, this production unit is also designed for manufacturing any kind of products with semi-dry demoulding by turning over. Prefabeton is therefore able to produce manhole base units, drainage channels, concrete gutters, low walls, retaining walls, etc. with the same machine. The manufactured products have the dimensions 1200 x 1200 x 950 mm. The weight handled (product and mould) is 2700 kg, and the estimated weight of the final concrete product is 1000 kg.

When it comes to the flexibility of the machine, a quick and secured production changeover is necessary. In less than 10 minutes, this operation is remote-controlled by the operator located in the safety area. Like a traditional vibrating press, the manufacturing recipes are stored and the machine settings are then directly applied.

### State-of-the-art vibrating press: aerated, efficient and rational layout

This vibrating press is equipped with a one-piece heavy welded construction. This configuration facilitates access to the equipment as well as its cleaning and the maintenance, in addition to which no specific civil engineering work is required for installing the machine: no pit in the floor

The vibrating press is equipped with a hopper with anti-caking coating and extraction belt for continuously feeding the filling box with concrete. The quantity of concrete in the hopper is displayed on the operator interface and the settings are completed directly from the control desk.

The cylindrical filling box has a rotary screw, driven by motors, that allows quick and uniform filling. The filling of the mould is carried out by the simultaneous action of the rotation of the screw and the translation of the filling box in the longitudinal direction of the mould. The rotary speed of the screw and the filling box speed enable efficient mould filling. Continuous checking of the concrete quantity in the filling box is done by laser.



Fig. 3: Vibrating press with semi-dry demoulding by turning over

In addition, the vibrating press is equipped with state-of-the-art vibrating equipment. In fact, Quadra provides a vibrating table with modular force as well as electronic dephasing and varying frequency, which allows the modification of the vibrating features according to the kind of product manufactured. The settings are completed from the control desk and stored in the manufacturing recipes.

The vibrating force is variable from 0 to 27000 DaN according to the manufacturing steps. Two vibrators are clamped to the vibrating table and their speed is configurable according to the different type of manufacturing and different cycle steps (from 0 to 75 Hz).

In order to apply different vibrating features, two vibration modes are possible:

- a mode called "harmonic vibration": the mould is clamped to the vibrating table and both elements vibrate together.
- a mode called "vibration with choc": the mould is not clamped to the vibrating table. It receives the vibration from the table by shaking.

This modular vibration force allows optimal conditions for the moulding and the compacting of the concrete. This results in products of high quality.

**Operation performed simultaneously**

One of the main innovative features of this plant is its capability to run two operations simultaneously.

For this purpose the unit is equipped with a 360° turning platform. It allows the handling of 2 moulds all at once: setting one mould at the vibration station for the filling and the compacting and setting mould at the demoulding station. The filling and vibrating operation is therefore carried out while demoulding is in process in the other mold. Once the filling operation is done, the demoulding of the other mould is completed at once. The platform carries out a first 90° rotation. It moves the mould that has just been filled to the next station where a feeding device places a drying template in the mould. This operation is completed only if the product has an interlock executed by the tamper during the previous operation. For instance, in case of manhole products with base, no drying template is necessary. During this operation, the mould that has just been demoulded and is located on the opposite side of the drying template feeder is oiled to ensure that the next demoulding proceeds smoothly. This oiling operation is carried out by a trolley equipped with spray nozzles. These nozzles are located

above the mould and the flow of the spray is configurable.

When these two simultaneous operations have been completed, the platform carries out its second 90° rotation. The mould with fresh concrete is now at the demoulding station and the empty and oiled mould is at the filling station ready for a new cycle. At the demoulding station, a gantry for conveying demoulding pallets moves and places the pallets on the mould. The mould and the pallets are then clamped and turned over together.

This technique of demoulding by turning over avoids the use of a base pallet.

The concrete product is then demoulded on the demoulding pallet. An automatic trolley retrieves the pallet with the freshly demoulded product and carries its from the machine zone to the quality zone, accessible and secured for the operator. The operator has a complete cycle in which to check the product. The trolley moves to the next station, where the storage and retrieval machine recovers the pallets loaded with fresh products and places them in the curing rack.

**Vertical curing for high-level storage: minimal floor space**

This vertical and narrow storage solution has the advantage of having a reduced footprint. Holding between 128 and 180 pallets (according to the dimensions of the products), the curing racks are insulated and equipped with a ventilation and humidity control system that ensures consistent and uniform curing.

The automatic stacker crane places the pallets into storage and removes them again. Equipped with a fork, the storage and retrieval machine moves on a rail and is able to set down and pick up products everywhere in the curing rack without any track interruption.

The translatory and vertical movements of the stacker crane and the movement of the fork are remote-controlled. All movements can also be controlled manually with a remote control.

The stacker crane places the pallets loaded with fresh products in the racks and retrieves the pallets with dry products. Dry products are then removed by suitable handling equipment and are set down in the storage area or on the pre-storage conveyor.

**Automatic cleaning of the demoulding pallets and drying templates**

The drying templates are taken up by a 6-axis robot. This robot manipulates them in



Fig. 4: Automatic drying template insertion



Fig. 5: Gantry for handling demoulding pallets

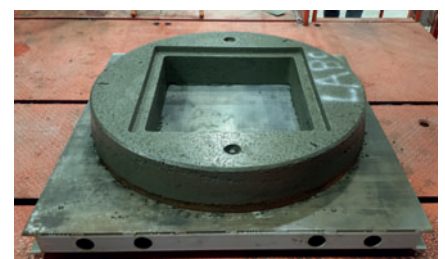


Fig. 6: Examples of demoulded products



Fig. 7: Automatic storage and retrieval machine

front of a rotary brush in such a way that all the faces of the template are cleaned. The drying templates are then stored in a rack with a capacity of 20 templates and returned to the manufacturing station for a new cycle.

The demoulding pallets are transferred by an automatic device to the cleaning and brushing station. The pallets are then forwarded automatically to the line for reuse.

**Plant supervision**

The plant is supervised by two operators. The work and safety conditions were taken



Fig. 8: Dry product conditioning

into consideration with a view to showing a significant evolution. A secured quality control station is located after the demoulding station and enables the operator to check fresh products. A second station is located on the palletisation side for conditioning dry products with remote-controlled and automated handling equipment.

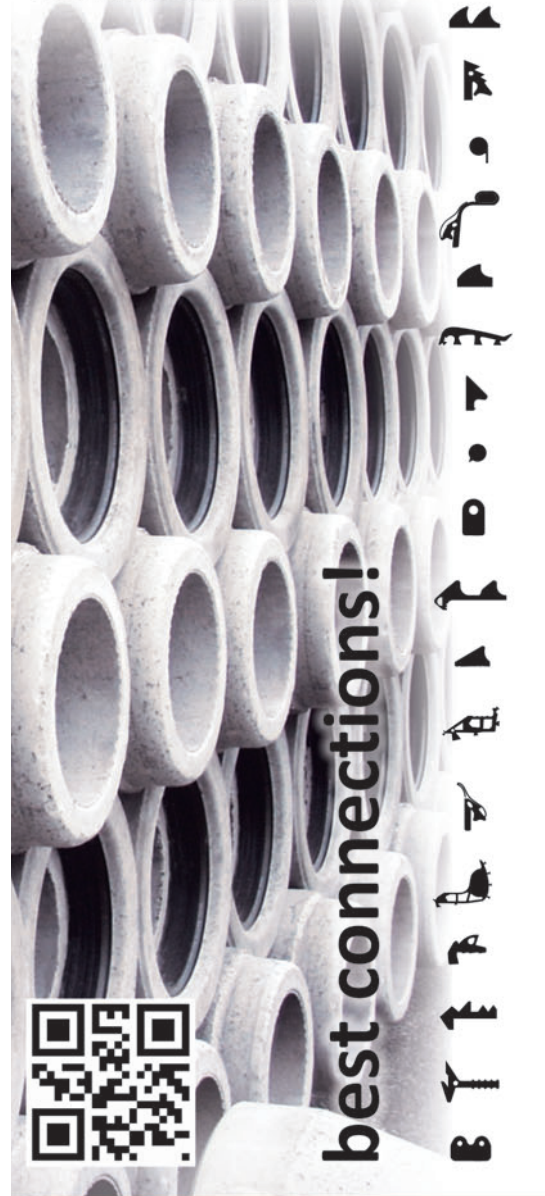
The machine is controlled by a PLC program. A touch-screen terminal allows easy adjustments and viewing of all manufacturing settings. The operator becomes a supervisor of the whole process. The comprehensive and modern automation software is fully developed by Quadra.



Fig. 9: 6-axis cleaning robot

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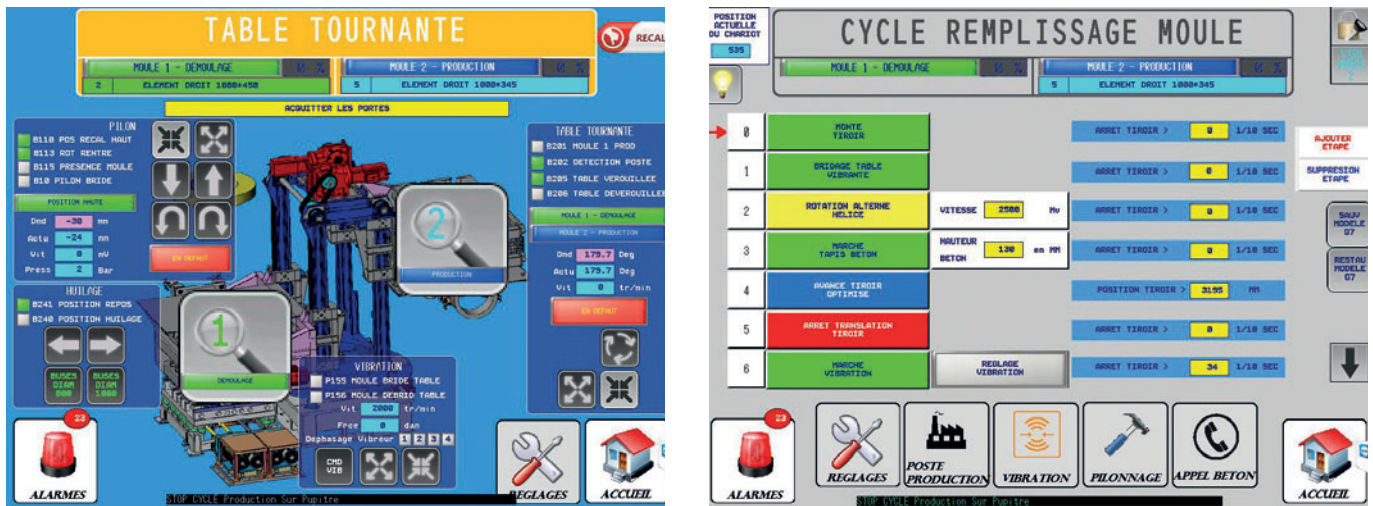


Fig. 10: The machine is controlled by a PLC program

**Conclusion: innovative vibrating press with turnover demoulding**

The manufacturer Prefabeton was once again fully satisfied with its collaboration with Quadra. In addition to the quality of the relationship since the beginning of the study, Prefabeton is particularly impressed by the advanced technical features of its new machine, which provides high flexibility and high production efficiencies. With this realisation, Prefabeton has optimised its investment and is thinking ahead to the future.

The commissioning of this innovative machine shows once again the competence of Quadra and its expertise in the development of new manufacturing processes.

Expert in automated process and vibrating systems and valued within the concrete industry for more than 25 years, Quadra has applied the high technology of its vibrating press to the manufacturing of manholes. This vibrating press with turnover device allows simultaneous operations in order to reduce cycle times and enhance productivity. The quality of the products is also a priority, since this new concept enables more time to be spent on the key steps of the manufacturing, such as filling and compacting. The equation between product quality and productivity that was seemingly paradoxical is now solved.

This vibrating press with turnover solution is evolutionary and progressive with different handling solutions. Quadra can therefore satisfy any customers' requirements.

**FURTHER INFORMATION**



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