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Three years reliable and innovative pipe production in a new Italian production plant

Three years ago, the owners of the well known Italian concrete block and pipe manufacturing company Ovoidaltubi started a new company named Area. With the help of BFS/Casagrande, a permanent improvement of the production tech-

nology and after sales service has been achieved. The activities of the Braganti family, owners of Ovoidaltubi and Area, and their experience in the manufacturing of concrete pipes date back roughly one century.

The history of the German company BFS looks back at more than twenty five years, during which it has developed concepts for production machinery and turn key factories for the manufacture of concrete products. During the past five years this was strongly supported by the knowledge and capability of the Italian company Casagrande, particularly in the field of prestressed concrete pipes and poles.

This paper describes the design, supply, erection and start up of a economically and technically reliable, fully automated production plant for the manufacturing of:

- High quality reinforced concrete pipes by means of the roller head compaction technology in a diameter range of DN 300 to 1200 mm, with lengths up to 3000 mm
- high quality reinforced concrete pipes and manholes by means of vibro-press technology in a diameter range of DN 1000-3600 mm

The total machinery was installed in one building, subdivided in three main sections:

- Radial press pipes production with the BFS/ Casagrande machine Souveraen
- Vibro-press pipes and manholes production with the BFS/ Casagrande machine Jumbo
- Reinforcement cage production with two automatic MBK welding machines

A state of the art computer system controls the fully automatic demoulding process, storage and handling of moulds, and transport of pipes and base pallets in the pipe production area, using innovative handling concepts and control solutions.

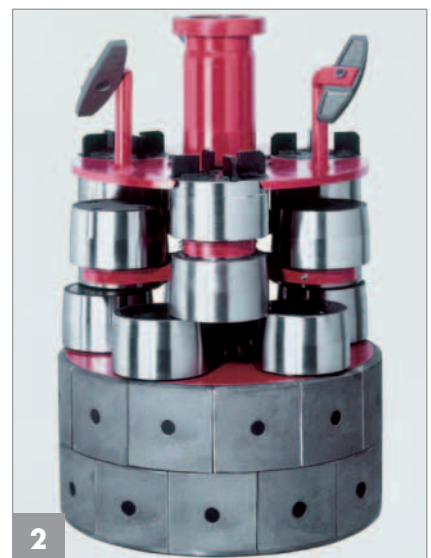
The BFS Souveraen pipe machine

The roller head pipe machine Souveraen is designed and manufactured in the German workshop of BFS on the basis of a new concept that incorporates efficiency, flexibility, production reliability, noise minimization, repeatable machinery adjustments, and a specially designed BFS compaction tool. These concepts have already been confirmed in the several machines supplied by BFS but were once more underlined by the particularly high level of cooperation with the AREA client.

Fig.1 presents a view of the Souveraen machine. The core piece of this production system is the patented counter rotating compaction tool. The roller-head technology of four layers of rollers guarantees the absence of non-compacted areas, even when different mix designs are used (Fig. 2). Due to the counter rotating movement, the reinforcement cage is completely embedded in the concrete and the twisting of the cages is minimized. All parts of the pipe are completely compacted. The high moulding pressure guarantees full and reliable embedment of the longitudinal and radial spiral reinforcement. The smoothness achieved on the inner pipe surface, applied with just one application of the roller head, is of remarkable quality. The reliably high production speed of the roller head guarantees a very high



Souveraen production facility



BFS roller-head equipment for compaction of the fresh concrete

productivity of the machine. The high product quality and guaranteed reproducibility of the process requires the manufacturing working cycle to be precisely controlled. The fully automated cycle is therefore supported and memorized by means of an integrated process control system based on the most up to date Window software. The information storage includes all positions and production set-ups for the related nominal widths and the data stored in the memory of the system can be called up automatically at any time. In this way, precise reproducibility is ensured after every change in product size. The Souveraen machine is equipped with a strong steel structure frame and a

tely adjusted. The electro-hydraulic control of all movements and positioning takes place by means a position measuring device. The concrete hopper is internally lined with a special anti-adhesive coating that ensures continuous concrete feed to the machine reducing the cleaning time of the machinery to a minimum.

The inside of the bell section of the concrete pipe is carefully smoothed by means of a special turning device and, if an integrated seal is requested, the seal is perfectly embedded in the concrete. In addition, manufactured surfaces are absolutely plane and pipes are produced to a precise length (+/- 2.5 mm). The freely sup-



Destacking robot

containing the fresh product is taken over by a loading robot (demoulding robot), transported to the demoulding area and immediately demoulded (Fig.3).

The speed of the robot is set according to the dimension of the pipes and can reach up to 150 meter per minute. The empty moulds are immediately returned to the machine, ready to be used in a new working cycle. The timing of the whole working cycle is fully controlled by a centralized computerized system in accordance with the requested guaranteed productivity. After a period of natural curing, which can be replaced by an installed innova-



Demoulding area for the pipes

precise guidance for all longitudinal and rotary movements.

The newly developed electromechanical dual drive of the main shaft operates with low noise and can be precisely and infini-



ported rotating top pallet also contributes to the close tolerances. In addition it must be mentioned that, due to the high level of control of the pressing tools, the risk of cage twisting is mostly avoided. Following to the manufacture of the pipe, the mould



Destacking cart





Steel pallet handling

five system for accelerated steam curing if required, a second loading robot (destacking robot, Fig.4), fully coordinated within the working cycle by means of the centralized computer system, takes over the cured pipes and transports them one after the other to a specially designed destacking area (Fig. 5, 6), where the steel base pallets are disjointed from the pipe and transferred to the brushing and cleaning equipment. The same destacking robot picks up the finished pipes from the destacking area and places them on a motorized cart. The cart transfers the pipes to the outside stand-by area before

they are moved to the storage yard. The destacking robot immediately returns to be used in the next production cycle. The two roboters can operate simultaneously without a stop in the production cycles.

The cleaned steel base pallets are automatically transferred along the side of the shed to the automatic oiling equipment or to the temporary storage area (Fig. 7). Finally, they are moved to the machine where a robot-cart (Fig.8) takes the cages prepared by the automatic caging machine (supplied by Maschinenfabrik MBK, Germany, Fig.9) and puts it on the base pallet, which is ready to receive the mould that is coming back with the demoulding robot. A storage area for the steel base pallets has been installed along the transfer path of the pallets in order to reduce the time for the adjustments of pipe diameters when requested.

The supplied Souveraen 1230 is adjusted to reach a production output of 38 pipes/hour (DN 300 mm), 21 pipes/hour (DN 1000 mm), or 14 - 20 pipes/hour (DN 1200). However, the maximum temporary production easily reaches the 10% more. A view of the storage area shows the facilities and the range of different pipes produced by Area (Fig. 10, 11).

Vibro press machine Jumbo R Duo

Also the vibro press Jumbo R Duo was completely designed and manufactured in the German workshop of BFS (Fig.12 a-b) on the basis of a start of the art concept

that results in efficiency, flexibility (production of reinforced and non reinforced pipes, jacking pipes, pre bed pipes, box culverts manholes, and base manhole), and production reliability. The machine has been designed to manufacture maximum diameters of 3600 mm and maximum lengths of 2500mm (for box culverts, max. dimensions are 3000 x 3000 mm, if required). The Jumbo R Duo allows alternative production cycles of two different products or equipment sizes, allowing a reliable increase of the daily production. For the exact feeding of concrete for non-cross-circular products (i.e box culverts, ovoid pipes), the innovative contour regulation enables the automatic computerized feeding of concrete to every corner of the mould.

The Jumbo R vibration system is worthy to be pointed out. One central vibrator, with several vibrator units (depending on the pipe length) attached to it, gives an intense and continuous compaction to the fresh concrete during the filling phase.

For several years, BFS/Casagrande has used central vibrators type V230 and V506 with the following 7advantages:

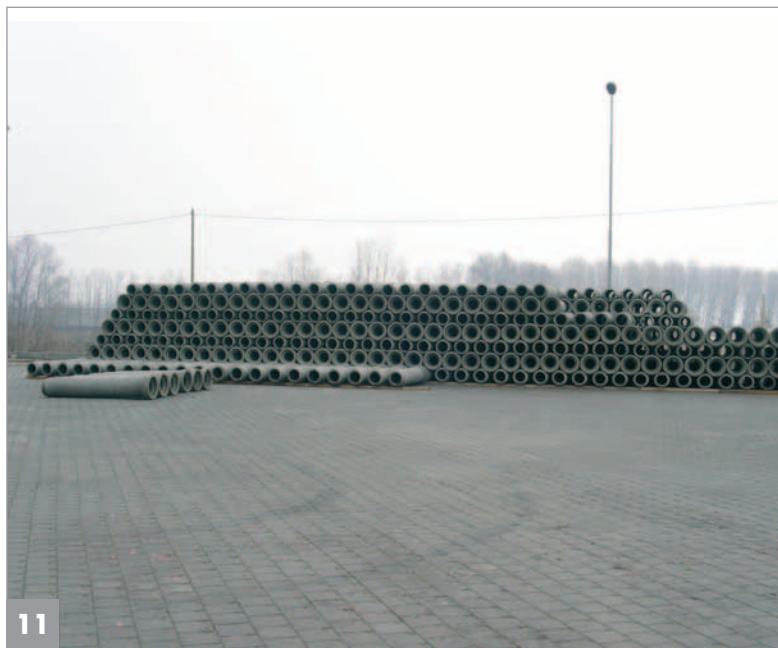
- Hydraulic quick clamping system in each vibrator for fast conversion
- Modular construction systems for vibrator units for production of different lengths and reliable adaptability to the products
- Reliably controlled vibration forces



Cart for reinforcement cages



Production of reinforcement cages



Transport to the storage area

- Easily adjustable vibration (amplitude and compaction force)
 - Optimization of the concrete quality by means of a frequency converter or frequency regulator
 - Reliable and easy maintenance with automatic grease lubrication
 - Solid vibration cross with quick clamping system
- The Jumbo machine can use the Fintec system, which gives a perfectly formed and exact length finish of the spigot. The oscillating pressed steel spigot forming ring is maintained on the top of the product until the end of the curing phase,

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Souveraen. Neverending Production.

The highest possible production quality with minimum staff: Only one machine operator produces top quality concrete and reinforced concrete pipes according to international standards - depending on the machine type with a nominal value range of 250-2.000 mm.

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12a



12b

The vibro press Jumbo R Duo, made by BFS

ensuring a very reliable smooth spigot and contour avoiding additional reworking of the finished product (Fig. 13). Finally it is interesting to consider the innovative laser-feed control system installed on the Jumbo machine, which controls the perfect distribution of the exact amount and level of the concrete. In this case the machine performance is of special interest. At the Area production plant, the following production of 2500 mm effective length pipes are guaranteed with one production pit (the second one is foreseen for manholes bases manufacturing): 30

pipes/shift (DN 1500 mm), 24 pipes/shift (DN 2000 mm), or 20 pipes/shift (DN 2500 mm).



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The oscillating pressed steel spigot forming ring is maintained on the top of the product until the end of the curing phase

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