

BONEX-SPIRAL TECHNOLOGY

1. Technical description

As a result of aging, higher loads due to changes in traffic and other effects as well as due to the pipe material and construction insufficiency, the sewer pipelines need to be renovated. Besides traditional reconstruction, trenchless reconstruction methods are gaining ground. More technologies are known, by which the reconstruction works can be accomplished in different ways up to the size, position, type of defects, etc.

The Bonex-Spiral method belongs to the so-called „pipe in the pipe” type of technologies. It means that a pipe of smaller diameter than the existing pipe will be pulled into the old pipe and the annulus between the new and the old pipe will be grouted by a special mortar.

1.1. Description of the Bonex-Spiral method

This method has been developed for the reconstruction of circular sewer pipelines. The plastic pipe which will be brought in to the existing pipe parallel with its production, will be produced by a special pipe winding machine.

For producing the liner pipe a PVC stripe is needed which has been developed for this purpose. The quality of the pipe produced by using the PVC strip is equal to the quality of HDPE sewer pipes available on the Hungarian market. Both the PVC material and the rubber sealing are chemical resistant. One side of the strip is smooth (this comes close to the inner surface of the existing pipe) while on the other side there are stiffening ribs in the form of a „T” (this is the outer side of the pipe to be produced). The shape of the edges of the strip and the rubber seals in it make it possible to form a continuous watertight pipe from the spirally winded strip.

The hard PVC strips — from which the new pipe is produced — exist in four different profiles:

- 50/5,5
- 60/7,5
- 90/9,5
- 140/14

where the first figure marks the width, the second one the thickness of the strips in mm.

Using these above 4 types of strips, it is possible to produce pipes of DN 180-540 mm.

Characteristics of the hard PVC:

- density: 1,4 g/cm³
- modulus of flexibility: 2500 N/mm²
- tensile strength: 45-55 N/mm²
- breaking expansion: 100%
- shock-resistance at 20 °C: without any break
- percentage of ashes: 3-4%

The primary and secondary rubber seals provide the sealing of the pipe wound from the strips.

The so-called primary sealing strip is compressed with the body of the profile by coextrudation, its material is a thermoplastic elastomere without any softeners.

Characteristics of the material (in the case of a diameter of 2,6 mm):

- colour: black
- density: 0,56 g/cm³
- mass of running meter 2,82 g/rm
- breaking expansion > 300 %
- Tensile strength: 2,31 N/mm²
- permanent deformation (22 h, 20°C) 25 %

The pipe-winding machine consists of two main parts:

- the winding machine and
- the driving gear

Additional equipments necessary for working with the machine:

- supporting block for the machine and the
- turntable

The pipe-winding machine is made in unit production and it produces a tube by winding spirally a plastic strip and by compressing its edges. The speed of the strip is ensured by two rollers with plastic housing, the closing of the strip edges by the lower roller.

A basket according to the diameter of the tube to be produced can be mounted at the bottom of the machine, this ensures the forming of the strip into a tube.

The driving gear consists of a hydraulic pump, an electromotor driving this pump and a steering/control gear/apparatus of the procedure.

The supporting block ensures the hanging up/suspension of the winding machine.

The block has got a load capacity of 1000 kg and is collapsible. The block has got 4 legs folded up from steel tubes and the legs are conneted by a „U”-shape

section on which a coach/truck can be moved. An electric elevator/lifting device mounted/fixed on the truck holds as well as moves the machine.

The turntable is an equipment suitable for turning/wheeling/rotating the plastic strip. The strip which is delivered in rolls on a pallet will be placed on the turntable welded from steel profiles, turnable around an axle, thus enabling a continuous charging/feeding of the strip during the procedure.

The hydraulic equipment driving the winding machine works under a pressure of 140 bar, the electric power is ensured by an electromotor of 11 kW.

The space between the old and the new pipe will be grouted by a special dry mortar either under pressure or in a gravitational way.

The production and the injection of the mortar is made with the help of the mortar mill M 400 MAI-PUMP.

The mortar mill is a portable/mobile equipment, its function is to mix the dry mixture with water and forwarding the ready-mixed mortar by a pump.

The mortar mill consists of a driving motor, a vibrator and a pump.

Main geometrical and technical data:

- width: 79 cm
- height: 104 cm
- mass: 240 kg
- mains voltage: 380 V/50 Hz, 25 Amper
- capacity of the driving motor: 6 kW/280 in case of a number of revolutions/speed of rotation of 1/min
- capacity of the vibrator: 3,125 kW/2800 in case of a number of revolutions/speed of rotation of 1/min
- capacity of the pump: 1,5 kW in case of transporting 16 l/min

The vibrator is driving the vibrating/shaking screen. The vibrating/shaking screen produces a homogeneous mixture.

The required quantity of mortar can be set by a rotameter.

The most important data of the machine:

$Q_{\max} = 40 \text{ l/min}$

$P_{\max} = 140 \text{ bar}$

$P = 11 \text{ kW}$

$n = 1450 \text{ l/min}$

Volume of the tank: 160 l

The driving gear can be remote-controlled electrically.

The main parts of steering

- potentiometer (0-10 V) for setting the speed of advancing
- a switch for changing direction
- emergency switch

1.2. Field of application

The pipe produced as described under 1.1. is thanks to the stiffening ribs and to the material of the strip a self-carrying pipe which will be applied first of all for the reconstruction of sewer pipelines but is suitable for application in any other fields as well. The stiffness of the pipe allows installment in an open cut, as well as application as a column formwork, ventilating duct, etc.

The permission for application of the Bonex-Spiral pipe reconstruction technology is registered under no. F-104 by the Hungarian Directory of Water Affairs.