Polyethylene Drainage and Sewage Manholes for Use with Large-Diameter Pipes

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In previous articles* I have dealt mainly with the benefits of plastic manholes which are now replacing the traditional concrete ones. I also described the salient benefits as follows:

- environmental protection and energy conservation
- easy and fast installation
- a significant reduction in the need for maintenance

Plastic manhole use is on the increase. The main production methods are:

1. rotational molding
2. injection molding
3. manual production by cutting and welding pipe parts

Why is the market demanding special manholes suitable for large-diameter pipes?

Most of the plastic manholes designed up until now have been mainly adapted to sewage lines, which use pipes with a relatively small diameter (100 – 400 mm). Most are smooth pipes – that is, smooth inside and out.

The drainage lines usually use large-diameter pipes (300 – 800 mm and up). Here corrugated pipes are mostly used. These pipes have a smooth inner layer with the outer layer being made up of furrows, which fully encircle the pipe.

This type of pipe has a significant advantage – its structure enables it to withstand heavy loads, and it has high ring stiffness. This feature allows a weight reduction of 30 – 40% without affecting the pipe's ring stiffness.

However, when using a corrugated pipe, special attention should be paid to the way in which the pipe is attached to the manhole.

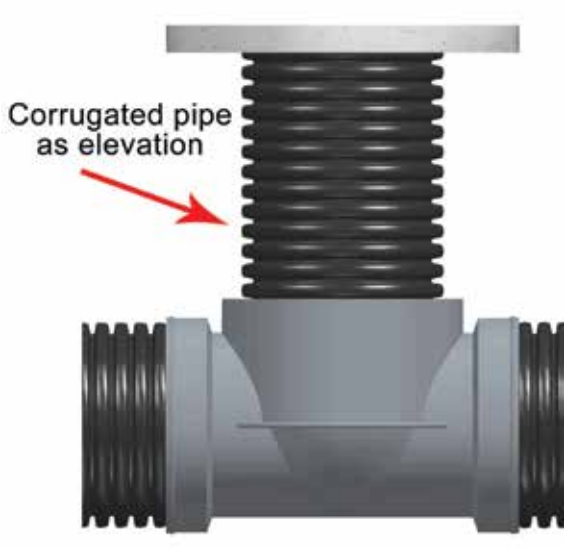

Image 1: Using corrugated pipe as elevation

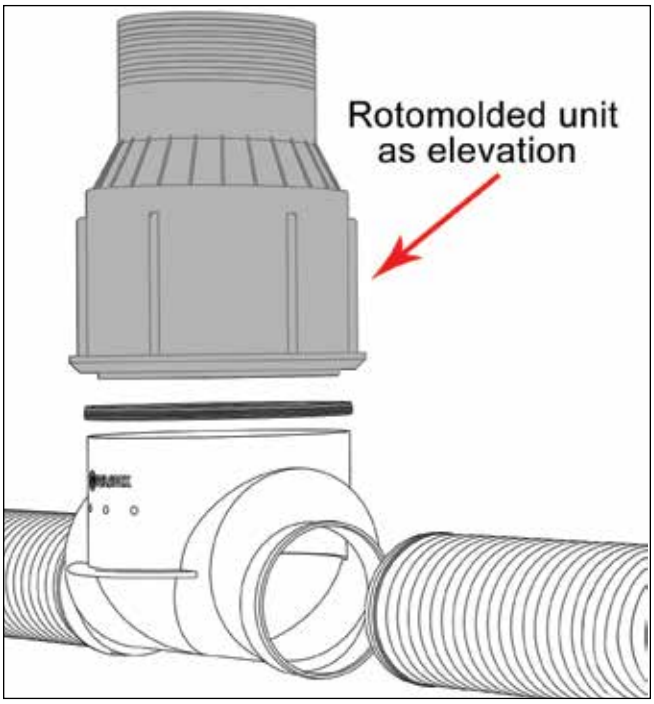

Image 2: Using rotomolded units as elevation

Paladex (www.paladex.com), which manufactures large-diameter corrugated pipes, approached me to collaborate in developing a plastic manhole compatible with the pipes they produce.

The main requirements for planning these manholes were:

- Design manholes compatible with corrugated pipes with a diameter of between 300 – 800 mm
- Allow for the pipe to be easily and quickly attached to the manhole without the need for welding
- Create a manhole structure having maximal strength, but weighing as little as possible, in order to save on raw material
- Design a mold to allow pipes with varying diameters to connect to the same manhole
- Build in versatility in order to use the same mold to change the height of the manhole relatively easily

There was an additional requirement to do this using two different methods:

1. To use a corrugated pipe to add height (Image 1)
2. To use units produced using rotational molding (elevation and upper units) (Image 2)

- Design a manhole structure to withstand heavy loads, according to strict requirements of EN13598 and ISO 13272 standards.
- Design a manhole with dimensions compatible with the

standard dimensions of a container, to allow optimal loading, in order to reduce transportation costs
- Design a parting line (PL) as simple as possible for easy opening during production
- Overcome the limitations of the rotational molding technology which make it difficult to produce high-precision parts

The Proposed Solution and its Implementation

Choosing the mold type: Despite the product's relatively complex shape, it was decided to produce a mold from sheet metal and not from aluminum as is normally required in similar instances. Despite the complexity, I prefer to use sheet metal for the following reasons:

1. Maintenance of the mold is less complicated. It is easier to make any necessary changes or repairs to the mold.
2. The price of the mold is usually cheaper.

- Structure of the manhole: The base structure of the manhole has been designed with a round bottom in order to achieve maximal mechanical strength and comply with the standards.
- Parting line: The PL design has a significant effect on product quality and ease of production. The idea is that the product can be easily removed from the mold during production (in order to save time and prevent the product from being damaged). The PL selected enables the mold to be opened in two parts only – the upper and the lower. The PL is produced by a rotary machine to enable the perfect and hermetic closure of the two parts.
- Pipe connections to the manhole: There are a number of methods for connecting the pipes to the manhole. The use of sockets was chosen as the fastest and most convenient method for connecting to the manhole in the field. The pipe (male) is fitted into the socket (female) using the seal supplied by the pipe manufacturer.
- Using parts produced by the rotary machine: In order to achieve maximal precision and an aesthetic shape to the product, I used many parts produced by a rotary machine.
- The mold producer selected works to a very high level. They have extensive experience.
- Flanges made by rotary machine were widely used: The versatility of flanges with screws enables the quick assembly and disassembly of the mold parts in order to alter the product as necessary.
- Dimensions and weight: The manhole structure is designed to reduce the diameter, wall thickness and product weight.

We achieved a product which met the standard tests, despite the manhole diameter had been reduced from 1,000 mm to 800 mm. The wall thickness was reduced from 12 mm to 10 mm. As a result, the weight was reduced by about 20%.

Despite the many design limitations – mainly emanating from the product's geometry – we managed to realize a product with an overall length of about 1150 mm, thereby enabling the insertion of 2 products into the width of the container.

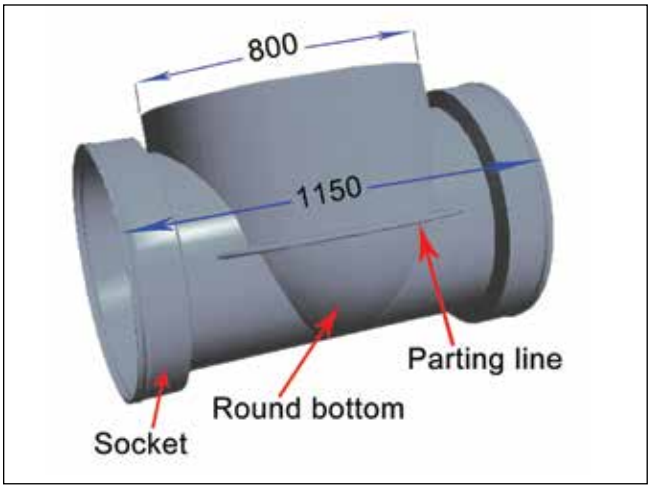

Image 3: The final PE product

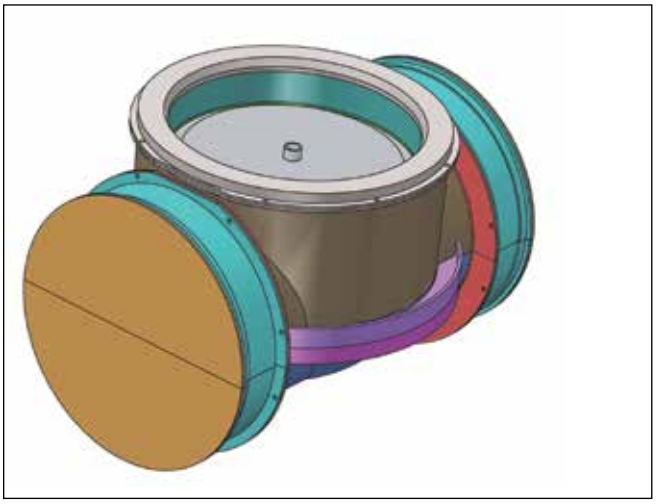

Image 4: The final Sheet metal mold

Summary and Conclusions

- We utilized the advantages of the rotation molding technology, enabling the production of complex shapes in one unit.
- We managed to find solutions and overcome this technology's limitations.
- The correct design enabled us to significantly reduce product costs, resulting from savings on raw material and transport costs.
- The end-product was exhibited at the IFAT 2018 Exhibition in Munich (www.ifat.com), which is an exhibition for environment, sewage and water treatment.
- The product received positive responses from potential users.
- The customer received orders for a number of projects.

References:

1. *Rotoworld*® volume XI issue 4 2015
2. *Rotoworld*® volume XIII issue 4 2017