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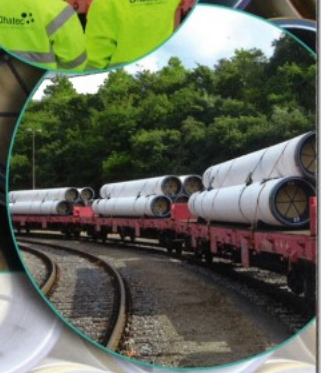

PERFECTION IN PIPE-END PROTECTION

Bernadet Gijsbers, Dhatec, the Netherlands, discusses how a new certification programme has set new standards in the industry, enabling a proper selection procedure for effective pipe-end protection.

Today, the supply chain of pipeline projects is global. Pipes can be manufactured in Japan, coated in the Middle East and installed onshore or offshore in Europe. In this global supply chain, quality loss to the pipe and coating can easily occur. The pipes are lifted, stored and transported multiple times before they are welded together to form a pipeline.

Dutch company Dhatec Line pipe Logistic Solutions is a manufacturer and supplier of high quality products which enable the flawless delivery of pipes from its production mill to the construction site (Figure 3).

Since 1992, Dhatec has developed products that prevent pipes and coating from quality loss during logistics. For pipe-end protection, Dhatec develops and manufactures different pipe closures and bevel protectors.

In the submarket of the supply chain, no quality standard is set. With the broad competition in this field of pipe protection, a variety of qualities are available. Cost attractive solutions are often poor quality and fail to protect the pipes effectively during the whole supply chain. The lack of a founded standard makes it impossible to establish the quality or poverty of a cap. This makes the selection of the right pipe-end protection and closure difficult

Figure 1. Dhatec plug with breathable membrane. These types of plugs withstand handling and transportation vibrations perfectly.

Dhatec Solution	Combined with Bevel Protector	Suitable for Hook Lifting	IP Rating	Dustproof	Waterproof	Clamping force [N]	Impact force [J] (no damage)	Impact force [J] (minimal damage)
Bevel Protection:								
Bevel Protector	N/A	✓	N/A	N/A	N/A	●●●●● 4.897	●●●●● 9.908	●●●●● 18.578
Plugs:								
PE Plug	✓	✓	IP-44	●●●●●	●●●●●	●●●●● 3.855	●●●●● 9.908	●●●●● 18.578
PVC Plug	✓	✓	IP-44	●●●●●	●●●●●	●●●●○ 2.394	●●●●● 9.908	●●●●● 18.578
Sheets:								
Fiber Film	✓	✗	IP-40	●●●●●	●○○○○	●●●●○ 2.453	●●●●● 9.908	●●●●● 18.578
PVC Sheet	✓	✗	IP-40	●●●●●	●○○○○	●●●○○ 1.991	●●●●● 9.908	●●●●● 18.578
EPDM Sheet	✓	✗	IP-40	●●●●●	●○○○○	●●●●○ 3.205	●●●●● 9.908	●●●●● 18.578
Caps:								
Recessed Cap	✗	✓	IP-44	●●●●●	●●●●●	●●○○○ 1.315	●○○○○ 495	●○○○○ 991
Flexible Cap	✗	✗	IP-44	●●●●●	●●●●●	●○○○○ 530	●○○○○ 495	●○○○○ 991
PE Cap	✗	✗	IP-44	●●●●●	●●●●●	●○○○○ 726	●○○○○ 495	●○○○○ 991

Figure 2. Pipe closure selection table: making the best selection for pipe-end protection and closure.

Figure 3. Task environment: line pipe supply chain.

for project managers. The testing performed under the supervision of TÜV, however, provides a clear overview of the performance of available pipe-end protection solutions and makes the selection of the best product easy.

Three tests to establish performance

Dhatec aims to position itself as the number one supplier when it comes to quality and highly specialised pipe-end protection products. In order to achieve this, Dhatec has set up a certification programme with the well-known, independent underwriters company TÜV-Nord. Dhatec and TÜV have determined a test programme in which three different tests are conducted. The tests are performed in order to distinguish the performance of the different available solutions.

The first test is designed to establish how strong the pipe closure solution or bevel protector is when clamping itself to the pipe-end. A high clamping force is needed to guarantee that the bevel protector or pipe cap will not fall off the pipe during logistics due to temperature fluctuation, wind load or hook lifting. The test was designed so that weights pulled on the product on the pipe. By adding weights, the point at which the specific pipe-end solution was pulled out of the pipe-end was found. The results range from as high as 500 kg pulling load on a bevel protector, to only 50 kg pulling load on a simple pipe cap.

The second test was done to establish the level of water and dust resistance of the different pipe closure solutions. Tests are performed according to the norm IEC 60529 and result in a certain IP classification. To keep the pipes in good condition during storage and transport, it is necessary to decide to which degree the pipe needs to be protected. Is some degree of dust and water in the pipe allowed? Or is it necessary to seal the pipe completely against rain and dust? This test resulted in high IP-44 classifications but also in IP-40 classifications where water can get into the pipe.

The third test was done to establish to which degree the solution protects the pipe-end against impact forces. As well as bevelled pipes needing protection against damage, unbevelled pipes and offshore weld preparations need to be protected against excessive damage. An offshore impact test tower was used to drop a weight of 505 kg from various heights until damage was found on the pipe-end. Differences in results range from drop heights as high as 3.75 m for combinations with the steel bevel protector to as low as 0.1 m for simple pipe caps.

All test results have been displayed graphically in a table in order to easily distinguish the level of protection offered by each solution. This enables project managers to select the best solution for their project.

Figure 4. Bevel protector combined with PE plug.

Figure 5. Bevel protector and sheets, economically attractive for short-term storage.

The ideal pipe-end protection

As shown in Figure 2, a selection of Dhatec solutions were tested and certified by TÜV. Divided in four categories, advantages and disadvantages of each product were identified.

Bevel protection

Dhatec's bevel protectors provide the best possible pipe-end protection of any bevelled pipe. The design is based on a steel ring with a buffer zone combined with a clamping clip. The bevel protector can be supplied in a reusable or non reusable model. Different materials such as steel, zinc plated steel and stainless steel are commonly used to meet with the pipe qualities or project requirements. Impact forces that frequently occur during transportation and handling of pipes are absorbed by a rounded buffer zone. When pipe-ends are straight, the bevel protector can be customised to a 85° angle, which still provides a buffer for impact forces. The strong clamping system is designed to withstand vibrations during all transport and handling procedures.

The pipe-end protection product is made based on the exact diameter and wall thickness of the pipe, with an accuracy up to a tenth of a millimetre. At the same time, the design allows absorbance of large pipe diameter tolerances of +2/-2 mm. With different lengths of clamping clips, even larger tolerances or differences in wall thickness can be covered and the same bevel protector can be used with a plastic plug for pipe closure. The full circumference of the pipe-end is protected by this ingenious design.

Application of the bevel protector is efficient and takes less than one minute. Even on stacked pipes, this solution is easy to apply as it fits on the inside of the pipe. For larger diameter pipes, a processing tool that acts as a third hand can be used. The solution is placed in the pipe-end by one simple push. The bevel protector expands and forces itself strongly against the internal pipe surface by installing the clamping clip.

During the tests, the advantages of the bevel protector were identified. TÜV reported the high resistance against removal with an average force of 4.897 N. In addition, the high quality solution showed no damage when a 505 kg weight was dropped from an impact tower when 9.908 J was measured. During the test period, only minimal damage became visible at 18.578 J.

Besides a proven high quality solution for pipe-end protection, the bevel protector can also be used as a sealing ring. Combined with different types of plugs, sheets and other types of pipe closure, it protects against dust, dirt, debris, rain and other weather or environment influences.

Plugs

For effective pipe-end protection and pipe closure, the bevel protector can be combined with a variety of materials. Dhatec tested two types of plugs that need to be used with a bevel protector, one made of polyethylene (PE) and the other made of PVC. Both types can be customised based on pipe measurements and project requirements. A wide range of PE plugs are available in standard and non-standard sizes. A design for extreme conditions to meet up with different climates is a standard option. The PVC cap can be made with each required depth and for any diameter and wall thickness. This results in the optimal choice for lower quantities and non-standard sizes.

Recently, Dhatec extended its pipe closure programme with a new generation of plugs. This high quality plug (Figure 1) is designed with a breathable membrane. The micro-porous membrane keeps water, dust, debris, rain, ice and snow from entering the pipe. On the other hand, the membrane allows water to evaporate from the pipe.

Based on the company's experience, Dhatec believes the bevel protector and plug combination to be the best possible solution. Together with TÜV, the plugs were tested. The IP-rate for both plugs resulted in IP-44, the highest result during these tests. Dhatec considers this IP-rate sufficient to be dust and waterproof for the purpose of the pipeline industry. A bevelled pipe, used for the impact test, showed no damage with 9.908 J and minor damage at 18.578 J, due to the combination with the bevel protector. During the last test, the PVC plug demonstrated a clamping force of 2.394 N. The PE plug illustrated the best combination with 3.855 N against cap removal.

Sheets

Alternative for plugs, different types of sheet are often used for pipe closure. This type of closure is a cost saving solution,

especially suitable for short-term protection. Three different sheets (EPDM, PVC and fibre film) were subject to testing.

Due to the difficulty of sealing the pipe-end with sheets, these products cannot be considered waterproof. However, all sheets performed well in regards of dust resistance, particles >1 mm could not enter the pipe, resulting in a rate of IP-40 for the three types of sheet.

Similar to the combination with plugs, the sheets and bevel protectors could handle the same impact forces without any shown damage at 9.908 J. Again, minor damage was registered at 18.578 J. Larger differences are shown looking at the resistance for cap removal; while the EPDM sheet and bevel protector show a clamping force of 3.205 N, the fibre film has a slightly lower resistance against removal (2.453 N). The PVC sheet showed the least clamping force (1.991 N) of all considered products with bevel protector.

Caps

Ultimately, three types of caps were tested to their limits; a recessed cap, a flexible cap and a PE cap. Although these types of closure do not protect the bevelled pipe-end, they are economically attractive solutions and are often chosen due to their price and wide availability. Solutions in the caps category all share the benefit of easy application and removal, within seconds the caps can be applied onto a pipe. A recessed cap offers an extra advantage by being suitable for hook lifting.

All types of caps showed an IP-44 rating during the tests. The resistance against water and dust proves that they function well closing off pipes. Because of the lack of absorbance for impact forces, minor damage was shown at 991 J (1/20th of the protection with the bevel protector). The distinction between the caps becomes clear with the resistance against cap removal. In this test, the recessed cap had the best results with 1.315 N, a bit more than a third of the force of bevel protector and plug. The PE cap and flexible cap show less clamping force with respectively 726 N and 530 N.

With the TÜV reports, Dhatec can present the benefits and disadvantages of the various types of closure. For better customer advise, Dhatec created the pipe closure selection table (Figure 2). With this tool, Dhatec can provide its customers with a good comparison of the various options.

Perfection in protection

With the TÜV certifications, Dhatec has set a new standard for pipe closure. The certification programme has enabled a proper selection procedure for the right protective solution for each individual project. The results can be matched with pre-determined requirements for pipe and coating. As a set of standards is now available, project managers are able to choose the right pipe-end protection/closure and include this important feature in the first project scope. Because Dhatec has shown and proven the functionality of each product, thorough choices aimed on specific circumstances, such as climate, duration of storage, type of pipe and coating, can be made based on solid results. With the certificates, Dhatec differentiates itself from its competitors and is in line with its goal to position itself as the number one supplier when it comes to quality and highly specialised pipe-end protection products. With the new generation of plugs, Dhatec shows its continuous drive to improve the pipe closure possibilities that lead to higher standards regarding quality control of pipe and coating.