WORLD PIPELINES®

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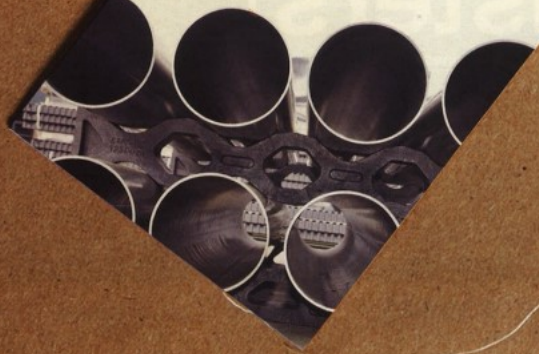
There is a large need for security in the international pipeline industry. During the transporting and storing of pipes, operators face many logistical challenges. In the supply chain there is a high margin for error, and conventional solutions are not necessarily the most efficient or the safest. Instead, a new breed of engineered solutions promises to offer ease-of-use, security and safe handling of 4 - 20 in. casing, drill and line pipes.




FRAGILE
HANDLE WITH CARE
Idsart van Assema, Chief Executive Officer, and Bernadet Gijsbers, Marketing Manager, Dhatec, the Netherlands, discuss new solutions for transport and storage of small diameter pipes.

Transporting and storing casing, drill and line pipes

Dhatec has developed a complete solution for safe, efficient and high quality transport and storage of pipes in the diameter range from 4 - 20 in. After the successful introduction of the transport equipment 'System88' in 2005 and the storage equipment 'Pipe Stop' in 2009, Dhatec now focuses on the smaller diameter range. System88 and Pipe Stop are designed for pipe diameters from 8 - 150 in. while the newly developed products aim at diameters from 4 - 20 in.

The Pipe Carrier Premium (Figure 1) is suitable for transport as well as storage. After three years of engineering it is finally possible to transport and store small diameter pipes with one system. Combined with the company's latest invention, Slide Stop, which is designed especially to secure the top layer of multiple pipes, it is now possible for tubes and pipes to be transported in a reliable manner.

For over 20 years, Dhatec Line pipe Logistic Solutions has been active as a supplier for pipe manufacturers, coating companies, transport companies and pipeline constructors. Besides products, the company provides advice and support for project management. All products are designed to maintain pipe and coating quality, increase efficiency and above all, enhance safety. This article elaborates on two new developments which, indicated by the key values, are designed to set new standards for transport and storage.

Carriers of constant quality

The new Pipe Carrier Premium (Figure 2), is made out of recycled low density UV stabilised black polyethylene (LDPE). This LDPE material is homogeneous with a constant quality. The material is extremely durable but still softer than pipe coating, making this carrier safe for coated pipes. Compared to traditional supports, benefits of this carrier include:

- 100% reliable transport and storage of small diameter pipes.
- Only five carriers cover the 4 - 20 in. range.
- Each pipe is stably nested.
- Safe for pipe and coating.
- Reusable.
- Resistant against all weather conditions.

Besides benefits such as constant quality material, the system is completely safe and efficient; fewer carriers are needed and the system can be used for more than one purpose.

Figure 1. Slide Stop is tensioned and Pipe Carriers hold pipes.

Meeting the demands of the 4 - 20 in. range

In addition to traditional solutions, where every distinct pipe diameter needed its own carrier, it is now possible to lower the numbers of carriers in a yard. Working with this new flex-design, one carrier can be applied for various diameters. Only five different Premium Carriers cover a diameter range from 4 - 20 in. This is more efficient and economic because fewer carriers are needed.

The different types are shown in Table 1.

Table 1. Five types of Pipe Carrier Premium

Type	Pipe diameter range (mm)	Pipe diameter range (in.)	Base Carrier weight/height	Mid Carrier weight/height
Pipe Carrier 6	114.3 – 204.2	4.500 – 8.000	11.5 kg/143 mm	12.0 kg/185 mm
Pipe Carrier 5	177.8 – 245.0	7.000 – 9.625	11.1 kg/141 mm	11.5 kg/182 mm
Pipe Carrier 4	219.1 – 306.3	8.625 – 12.000	11.7 kg/150 mm	12.5 kg/200 mm
Pipe Carrier 3	273.1 – 408.3	10.750 – 16.000	12.8 kg/165 mm	14.1 kg/231 mm
Pipe Carrier 2	355.6 – 508.0	14.000 – 20.000	16.1 kg/174 mm	18.4 kg/248 mm

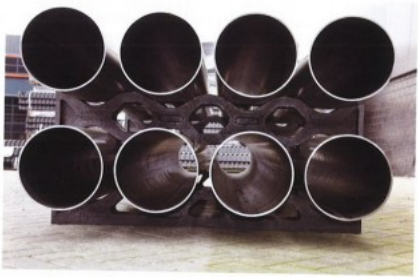


Figure 2. Pipe Carrier 4 holds four pipes.

Figure 3. Traditional wood carrier snaps rapidly.

The Pipe Carrier number refers to the quantity of recesses in each carrier. Dhatec engineers carefully considered the ideal division of sizes, which has resulted in five types. An overlap in the Carriers' range exists, so it is possible to use two different types for one diameter for optimal flexibility for line pipes, casing pipes and drill pipes.

Wedge shaped supports for stability and stress reduction in pipe

The Pipe Carrier Premium supports each pipe in a wedge shaped position. This theory was tested with earlier developments, and in this way the pipes are nested safely in the recesses. Finite element analysis shows almost four times less displacement and almost two times less stress compared to support on one point. To reduce the deformation and transit fatigue of pipes and increase the stability of the pipes, this distinctive technique is in use for all Dhatec's transport and storage systems.

Affecting the entire supply chain

In today's global pipeline industry pipes often have to be transported a long distance between the location of manufacturing to the

construction site. As a result pipes need to be relocated and stored multiple times for short or long periods. An engineered carrier solution adds value during the entire supply chain for both purposes.

Dhatec's system is ideal for storage since it will organise every storage site efficiently. To optimise for transport purposes, the company chose to use a length of 1225 mm for each carrier. Two carriers beside each other have a total width of 2450 mm, which makes them suitable for flatbed trailer transport. The entire trailer bed is in use, resulting in optimal loading configurations. Shipments can be prepared easily and forklift operators may even load and unload complete bundles.

Traditional dunnage versus engineered LDPE

Using wood, or other natural materials for pipeline logistics has in the past led to many severe accidents.

Pipe stacks are traditionally supported by sand berms, steel constructions or wood. These supports are usually not engineered resulting in high pressure on pipes, which can lead to damage and dangerous situations. Dhatec has tested and investigated the characteristics of wood (Figure 3) and discovered the following disadvantages:

- Invisible failures resulting in unreliable situations.
- Weather influences provide uncertainties.
- Very limited re-usability.
- Only suitable for one diameter since blocks are carved for one certain diameter.
- Nails and screws damage pipes and coating.

All these features result in an unstable and unsafe support as becomes visible in Figure 4. Dangerous situations for pipes and employees are not acceptable. Steel constructions and sand bags or berms can also be unreliable. Fortunately, these problems can be solved by using LDPE transport and storage solutions, which are engineered for safe handling of pipes. Dhatec is always working to develop safer, higher quality solutions and has the mission to replace all unreliable dunnage.

Figure 4. Unreliable: wood nerves determine strength.

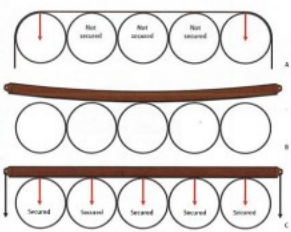


Figure 5. A: (problem) Multiple pipes in top layer cannot be secured with tie-downs only. B: (solution) Dhatec designed a curved load securing bar to secure pipes in the top layer. C: (solution) With tie-downs the bar is tensioned until it has straightened, resulting in a secured load.

Securing the top layer

Dhatec has invested in the problem of securing the top layer of pipes during transportation. Pipe loads are generally secured with tie-downs. These tie-downs press the pipe load on the trailer bed, which prevents it from shifting during transport. But when the top layer consists out of more than two pipes it is difficult to secure the pipes in the middle because the tie-downs do not exert sufficient securing force. Figure 5(A) gives a visual presentation of this problem. The red arrows represent the vertical load securing force; pipes in the middle do not receive this force.

Dhatec's engineers have found a solution for this problem by designing a load securing bar that grips onto the pipes in the middle. The bar, called Slide Stop, is pre-shaped in a calculated contour, which is curved like a banana (Figure 5(B)). When the Slide Stop is positioned on the pipes the ends of the beam will be equipped with tie-downs. When the tie-downs are tensioned the curve is pulled out of the Slide Stop, which results in a vertical load securing force on all pipes. In Figure 5(C) the black arrows represent the pulling force of the tie-downs which straightens the bar resulting in equal vertical load securing forces on all pipes as represented by the red arrows. The complete load is now properly secured.

Safe and easy in use

As demonstrated in Figure 5(B&C), pipes in the middle can be easily secured with the new Slide Stop. In addition, the load securing bar is equipped with a rubber anti-skid layer, which presses on the pipes without damaging the coating. Handles on top of the Slide Stop fit on any forklift in order to arrange for easy positioning on the top layer of pipes. The Slide Stop can be used in combination with Dhatec's transportation products 'System88' and the 'Pipe Carrier Premium'.

Figure 6. Predictible behaviour of engineered design.

Specifications tested in practice

The Pipe Carrier has been subject to a pressure test to check the design and theoretical calculations. To test maximum forces, destructive pressure tests have been applied, as demonstrated in Figure 6. Within a safety margin, maximum stacking height and maximum weight are calculated. Three carriers can easily handle a heavy load up to 36 t. The design reduces the weight per carrier to approximately 12 kg and therefore is easy to handle.

With the assistance of transport company Wagenborg, which arranged a truck and trailer, and Vallourec & Mannesmann, which arranged casing pipes with a diameter of 9⅝ in., the carriers have been tested in practice.

At the same time the Slide Stop was tested. With an excavator the pipes are pulled out of stack while measuring the pulling forces. With these forces and the friction factor it was possible to calculate the force created by the Slide Stop. The results of these tests show that all pipes in the top layer of the stack are secured.

Both designs, the Pipe Carrier Premium and Slide Stop proved themselves in practice and the new solutions are now in production.

Concluding remarks

The aim to improve efficiency and safety for the entire supply chain of the pipeline industry requires an innovative partner. With these new developments Dhatec prides itself in being such a partner. All of the company's products are designed to ensure the quality of tubes and pipes throughout the logistics process, from manufacturing to coating, transport, and storage until construction. This Dutch company provides project managers with advise on organising logistics for projects. Damage prevention and onsite safety are key. The latest developments Pipe Carrier Premium and Slide Stop set a new standard for logistic processes of small diameter pipes. With these two new designs Dhatec takes the next step in securing a safe and flawless delivery of casing, drill and line pipes.