Strohm

Thermoplastic **Composite Pipe**

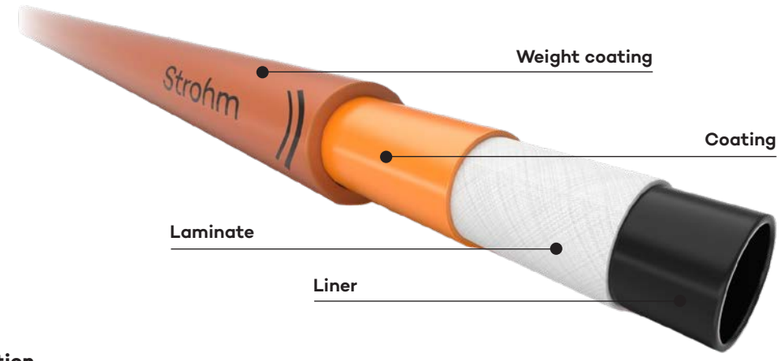
TCP Jumpers & Jumpers On Demand

Strohm is the **world's first and leading manufacturer** of Thermoplastic Composite Pipe (TCP)

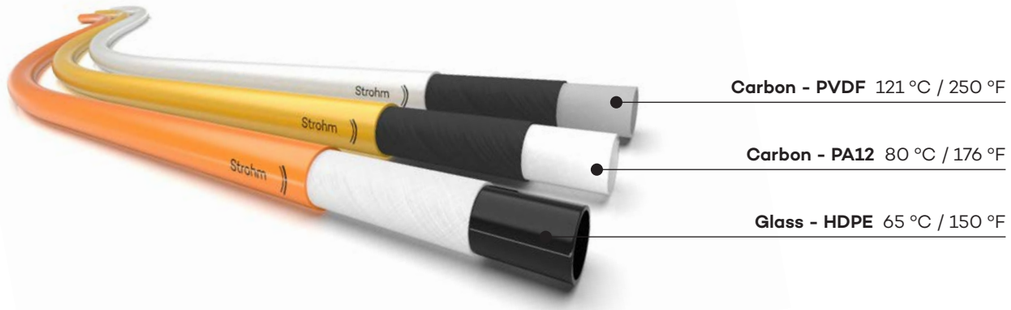
Located in The Netherlands, Strohm delivers a range of TCP products for the global subsea market, including flowlines, risers, and jumpers. TCP is a flexible, lightweight, high strength and corrosion resistant alternative to conventional flexible pipe and steel tubulars.

TCP Design: lightweight, flexible and corrosion resistant

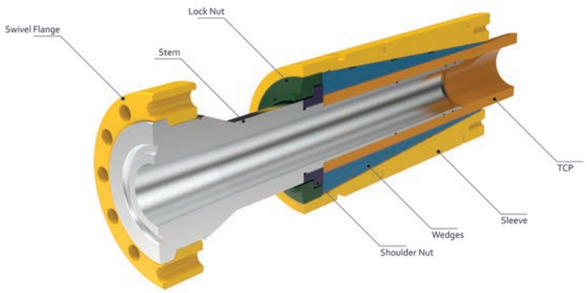
An extruded plastic liner is over-wound with polymer impregnated fibre tapes and melt fused using Strohm' propriety production technology and know-how to form a single fully bonded pipe wall structure.



TCP Material Selection
Material selection is a key element to the flexible and fit for purpose cost savings for TCP. The optimal material, design and fibre lay-up is used to yield the best pipe solution for each project and each application. TCP is developed for, and has track record on full wellstream hydrocarbon service, gas lift, water injection, methanol injection and chemical injection.



The TCP is terminated by means of steel End Fittings, the simplicity of this highly engineered design allows the greatest flexibility in connection selection and terminating ease. End Fittings can be installed onsite, including offshore, within a matter of hours.



TCP Jumper

The TCP Jumper range of products are designed to connect manifolds, wells and pipeline terminations together. The lightweight, flexible design provides a robust cost-efficient long-life solution for this application.

The lightweight design reduces the transferred loads to subsea equipment allowing for reduced sizing of subsea structures.

TCP Jumper can be used for hydrocarbon service as well as gas lift and water or methanol injection, and can be fitted with appropriate insulation.

Design range of TCP Jumper
- Up to 7.5" ID
- Up to 1034 bar / 15 ksi
- Up to 121 °C / 250 °F
- 3,000 m+ Water Depth
- Collapse Resistant
- All common flange types

TCP Jumpers Improve
- Cost reduction
- Schedule risk mitigation
- Award to deployment times
- Emergency response rates
- Design life
- Installation vessel choice
- Installation methodology options

TCP Jumpers Eliminate
- Complex geometries
- Complex spreader bars
- Metrology
- Buoyancy / VIV strakes
- Excessive transport requirements
- Large vessel foot-prints
- Large loads on subsea structures

Onsite termination of TCP - a true strength

TCP gives the user the option to terminate the TCP Jumper outside the point of manufacturing if required. This gives much more flexibility for projects and avoids long waiting times for fabrication, metrology and welding of conventional technologies.

All pipes are shipped from the point of origin, fully Factory Acceptance Tested and ready to terminate with the equipment to perform the termination onsite.

The simplicity of the highly engineered End Fittings for TCP allows termination onsite or offshore when required. Timing to install the End Fitting can range from 8 to 12 hours, depending on the size of the End Fitting. Strohm is the only manufacturer with this option and proven track record of terminating onsite in remote locations. The termination procedure can be completed in the horizontal or if required in the vertical position.

Jumpers On Demand

The TCP Jumper offers the option of having a length of TCP readily available near site, reducing schedule risk and cost.

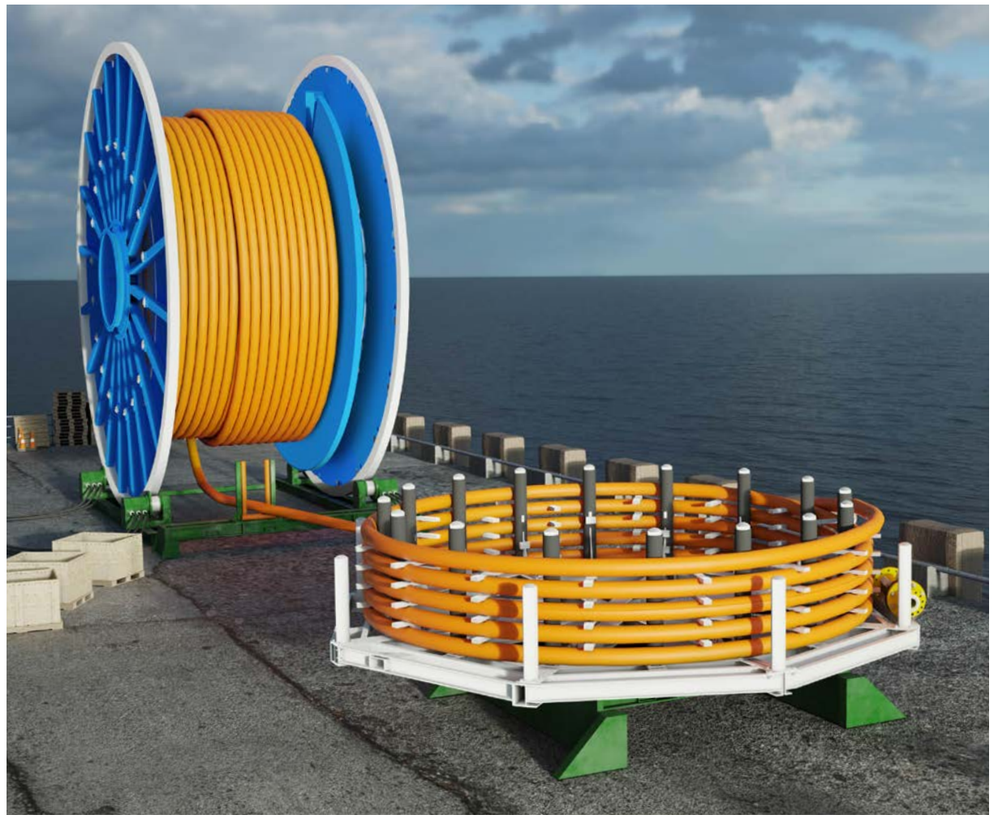
Clients can take advantage of a single pre-agreed continuous design shipped on a reel that can be spooled off to the required length, when and as required. Our simple and quick to install End Fittings are shipped separately, ready to be terminated onsite at short notice by Strohm technicians or by our clients' own trained and qualified personnel.

The Value Proposition of Jumpers On Demand

- De-risk and fully own the schedule
- Take advantage of volume cost optimizations
- Logistics costs reduced, simplified and known
- Ready to deploy in days not months
- Rapid response or emergency replacement

Qualification
Strohm is the first company to have certified and qualified the design methods and production process in accordance with the new DNV standard for TCP, DNVGL-ST-F119.

Manufacturing
Strohm' manufacturing facility is based in IJmuiden (Port of Amsterdam), The Netherlands. The manufacturing facility has direct sea access and our spoolable TCP systems can be loaded directly on our client's vessels. The quay has a length of 330 m with a water depth of 9.5 m.



Field Service Group

The Field Service Group (FSG) is responsible for all activities outside of the manufacturing plant in IJmuiden, The Netherlands and offers a variety of services and client onsite support from offshore witnessing to full scale onsite Jumpers On Demand termination campaigns.

The FSG reports directly to the CEO of Strohm and is made up of a dedicated team of experienced onsite and offshore specialists, supplemented by key members of the manufacturing team during differing mobilizations covering all aspects of away from base operations.

The FSG is responsible for the estimating, planning and execution of all away from base activities working alongside the delivering project managers and pipe completion experts to ensure a seamless handover and onsite support campaign.

From mobilizing a single technician to witness or provide coating repair standby services to the full team mobilizations for multiple jumper onsite terminations under the Jumpers On Demand procurement model.

The FSG also plans and provides solution for specialist projects, such as termination offshore, thus bringing the unique ability to reduce the size and weight of J-tubes required for platform landing as an example. Other specialist projects such as pre-installation of the TCP within the J-tube prior to installation of the entire assembly to highlight the multiple cost saving opportunities TCP and termination of End Fittings in the field can bring to client projects.

FSG Onsite Termination of TCP End Fittings

The unique ability of Strohm's TCP to be terminated onsite provides multiple advantages for the client, from the removal of the need for metrology while still meeting installation schedules, for fast-track projects, for offshore pull-in's, for the Jumpers On Demand projects.

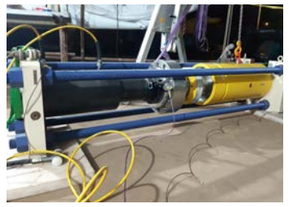
The End Fitting of TCP is a track proven robust and simplified design allowing for the installation in the horizontal or vertical anywhere in the world where the space and services such as power and water for testing is available.

Onsite Termination - The Main Steps Overview

1. Spooling from reel to pallet/reel & cut to required length

2. Liner machining

3. End sealing



4. End fitting 3.0 installation

5. Hydrotesting (SAT)

FSG Jumpers On Demand

The jumpers on demand model of delivery is the supply of long lengths of TCP typically delivered on a reel to the client's mobilization or other fabrication site. From there the Strohm FSG team is mobilized to execute the campaign of spooling out, cutting and terminating multiple jumpers from the length of TCP supplied on the delivery reel to prescribed lengths

This method takes advantage of volume raw material purchases, flexibility in schedules, can remove need for metrology and provides an emergency or fast-track method for jumper delivery. To date Strohm have been awarded over 95 jumpers of varying lengths from 24m to 338m each via this method spread across 5 projects across the globe.

FSG Offshore and Support Services

The FSG technicians and engineers are available to mobilize to the installation campaign to support operations in varying roles and disciplines.

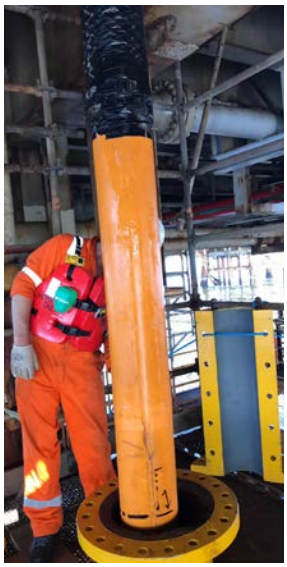
Most common is the "witness & coating repair" function. This role onboard the vessel is to support the installation team in handling and manipulating the pipe to ensure design constraints are met, to advise on any management of change requirements and to be available in the event of any required coating repairs if damage occurs during the handling phase. These technicians are also very well versed in the installation of ancillaries such as Ballast Modules, Bend Restrictors

Additional roles, such as onboard analysis support where there is any potential need for this to ensure no lost time during operations if plans or events change, other roles such as more dedicated and experienced installation engineers to support and integrate with the vessel team.

It is also possible to terminate offshore, post pull-in, onboard installation vessel and as an emergency repair scenario.

FSG Special Projects

A variety of specialized project services or additional services are available, one such project that has seen replication across multiple clients is the termination in the vertical.



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