

The background of the slide features a large circular cutout showing an offshore oil rig. Two workers in red safety suits and white hard hats are visible on the rig's deck, working near a large yellow mechanical component. The rig's structure is composed of yellow pipes and metal beams. The sky is blue with some white clouds. The Airborne Oil & Gas logo is positioned in the upper left corner, with the word 'Airborne' in a large, white, sans-serif font and 'Oil & Gas' in a smaller, white, sans-serif font below it. The logo is set against a blue background with a grid of small white dots.

Airborne
Oil & Gas

TCP FLOWLINE

Thermoplastic Composite Pipe

lightweight | high strength | corrosion resistant

Airborne Oil & Gas is the world's first and leading manufacturer of fully bonded, Thermoplastic Composite Pipe.

The lightweight, high strength and corrosion resistant composite pipes provide cost and operational benefits in subsea production & oil field service applications.

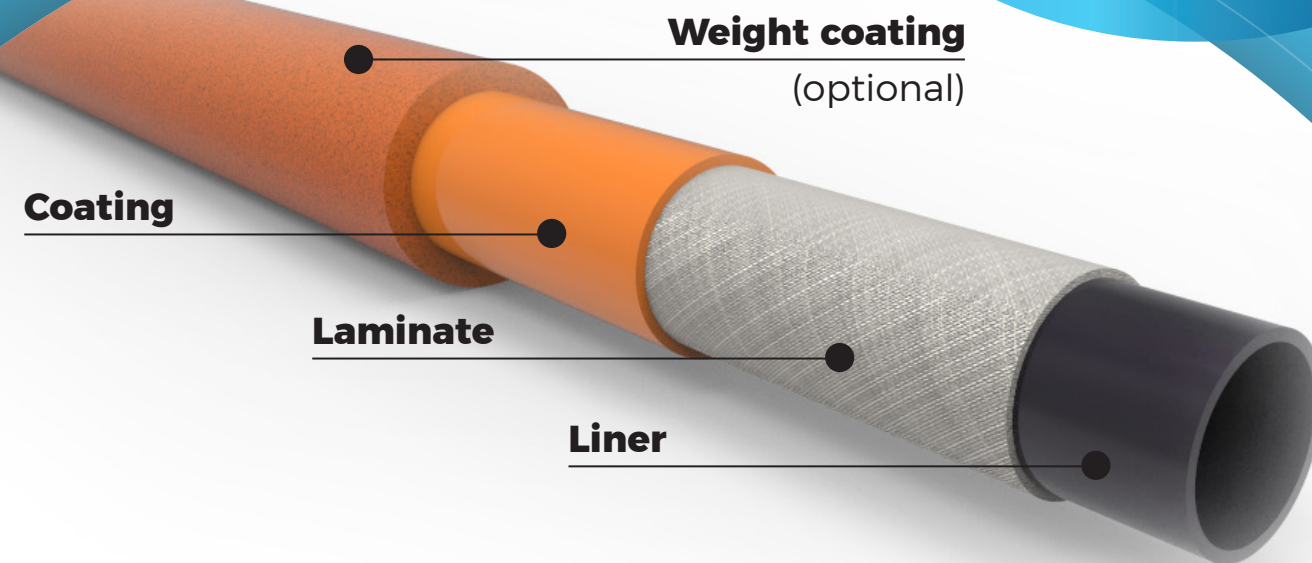
Excel in simplicity

The Thermoplastic Composite Pipe (TCP) developed by Airborne Oil & Gas excels in simplicity. The solid wall consists of an inner liner, thermoplastic composite reinforcement layers and an outer coating. Optionally, a weight coating can be applied to ensure long term on-bottom stability. All layers are melt-fused together, ensuring a bond between the layers that is as strong and durable as the base materials.



TCP FLOWLINE

lightweight | high strength | corrosion resistant



Costs associated with the prevention of metallic corrosion or replacement of affected subsea flowlines are a serious threat to profitable operation of new and existing assets.

With the introduction of our non-metallic, fully bonded TCP Flowline, corrosion is no longer an issue. This reduces the operational expenditure dramatically. Our TCP Flowline is manufactured in long, spoolable lengths, reducing installation cost significantly, even compared to carbon steel.



The TCP Flowline offers the following advantages:

- No corrosion
- Flexible and spoolable
- High internal and external pressure ratings
- Smooth bore - fully piggable
- Simple, reliable and field-mountable end fittings
- Low U-value compared with steel pipe
- Continuous lengths of 3,000 to 6,000 metres depending on diameter and pressure rating
- Quick installation by reel lay or surface tow method
- Lowest total installed cost and total cost of ownership

The flowline is developed for offshore use in shallow and deep waters and is designed for oil field conditions with exposure to seawater, sweet and sour hydrocarbon mixtures and oil field chemicals.

To meet pressure and temperature requirements, the TCP Flowline is optimised by using the right materials for the job. This includes glass or carbon fibre reinforcements, and polymers including PE, PA12 and PVDF.

TCP Flowline specifications:

- Inner diameters ranging from 4, up to 7.5 inch (8 inch NPS)
- Internal pressures up to 690 bar (10,000 psi)
- Water depths in excess of 2,500 metres
- Temperatures from -20 °C up to 121 °C (-4 °F up to 250 °F)
- Spoolable lengths up to 3,000 m for 7.5 inch, smaller diameters at longer lengths



Glass - HDPE
65 °C / 149 °F



Carbon - PA12
80 °C / 176 °F



Carbon - PVDF
121 °C / 250 °F

TCP Flowline End Fittings & Installation

The solid pipe wall enables the use of simple end terminations that can be made up within hours at any location in the world. The proven clamping method avoids having to terminate individual reinforcement layers and can be applied at any point on a pipe. The flowline can be terminated (essentially, cut to size) offshore, permitting small I-tube diameters and providing the ability to adapt the final length offshore.

Various flange & material options

The end fitting consists of a metal composite interface and a client-specified flange. Flange systems available today include API, ANSI and compact flange / hub connectors. We supply in a variety of materials including carbon steel, 316 stainless steel, super duplex and Inconel. All our end fittings can be equipped with ancillaries, such as bend restrictors or bend stiffeners.

END FITTINGS

flexible | terminated within hours | field proven

Threaded connection

Sleeve

Seals

Pipe

Stem

Wedges

The TCP Flowline can be buried (trenched/covered by rock berm) or un-buried. In cooperation with installation contractors, Airborne Oil & Gas has developed methods to efficiently provide on-bottom stability and protection.

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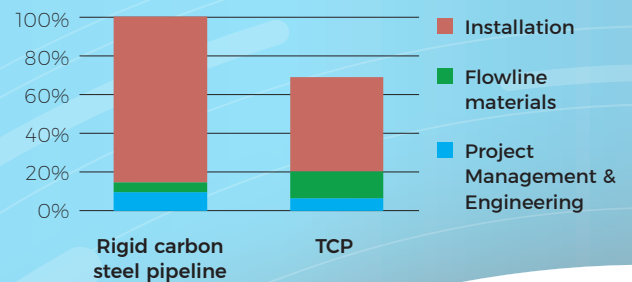
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As-installed Cost Reduction

Actual cost reductions achieved with TCP Flowline differ from project to project. For a typical in-field flowline, the cost distribution between materials, installation and general project cost (PME) are shown in the figure below for both carbon steel and TCP Flowline.

In the example shown, a tie-in of 3 km, a cost reduction of 30 % is achieved with TCP Flowline compared to basic carbon steel. Comparisons against more exotic metal grades such as a high grade Corrosion Resistant Alloy (CRA) increase this saving even more.

Installation cost-Rigid Steel vs. TCP



Qualification

Today, Airborne Oil & Gas 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-RP-F119. Furthermore, the TCP Flowline is qualified under API RP 15S and by multiple operators.

Manufacturing

Airborne Oil & Gas' manufacturing facility is based in IJmuiden (Port of Amsterdam), The Netherlands. The manufacturing facility has direct sea access and our TCP Flowline 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.



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