

The image features a large blue circular graphic on the left side, containing the company logo. The background is a photograph of an industrial construction site. In the foreground, a long, bright yellow pipe is laid out on a metal track. Several workers in safety gear are visible, some standing near the pipe and others further back. In the background, there are large concrete structures, possibly part of an offshore platform or a large storage tank, and various pieces of equipment and materials scattered around the site.

**Airborne**  
Oil & Gas

## **THERMOPLASTIC COMPOSITE PIPE: THE FIELD PROVEN, LOWEST COST PIPE FOR DEMANDING SUBSEA OILFIELD APPLICATIONS**

Airborne Oil & Gas

lightweight | flexible | corrosion resistant





## Airborne Oil & Gas

In today's oil & gas industry, cost reduction is key to maintain profitable and sustainable production. Airborne Oil & Gas' Thermoplastic Composite Pipe (TCP) technology offers the industry a game changing, new range of products that provides the solution for lower capital and lower operational cost for operators, contractors and service providers.

We manufacture flowlines, spools and risers for production applications, and jumpers and downlines for intervention applications. As our proven track record shows, our products reduce cost in procurement, installation and operation as well as maintenance and inspection.

Today, Airborne Oil & Gas is the first company to have certified and qualified TCP products, including design methods and production process in accordance with the new DNV standard for TCP, DNVGL-ST-F119. Airborne Oil & Gas has the world's largest field track record in TCP, with TCP in operation in all our applications around the globe, except risers. With industry partners, we are developing and qualifying the TCP Riser for ultra deepwater application.

## Thermoplastic Composite Pipe Technology

The Thermoplastic Composite Pipe developed by Airborne Oil & Gas features a solid pipe wall, constructed from glass or carbon reinforcement fibres and thermoplastic polymeric materials. The unique, certified and proprietary manufacturing process results in a fully bonded composite pipe structure, with the fibres fully embedded within the polymer matrix and ensuring the strongest interface possible between the different pipe layers.

Our approach builds on a fundamental understanding of the design, materials and production of our TCP products and of all load cases during deployment and operation. This allows us to predict the product's behaviour during all operational circumstances, and always provide the most fit for purpose material solution depending on the application. Today, we use glass and carbon fibres and PE, PA12 and PVDF polymers.

### The benefits at a glance:

- No corrosion, excellent chemical resistance
- Light weight, reducing top tensions and transportation cost
- Long length per spool, reducing installation cost
- Smooth inner bore combined with high external pressure rating
- High internal pressure rating
- Flexibility

We have case studies and project references available. Contact us for more information.



Glass – HDPE  
65 °C / 150 °F



Carbon – PA12  
80 °C / 176 °F



Carbon – PVDF  
121 °C / 250 °F



## TCP Flowline

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 a consideration and corrosion mitigation measures, such as inhibitor injection is something of the past. This reduces operational expenditure significantly.

Our TCP Flowline is delivered in long, spooled lengths on standard offshore reels, enabling cost effective transport and allowing for horizontal installation lay methods using small existing vessels such as Multi Purpose Vessels.

### 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 horizontal lay or surface tow method
- Lowest total installed cost and total cost of ownership ("Totex")

The TCP Flowline is qualified under DNV, API and by multiple operators. 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.

## TCP Jumper Spool

Subsea spools are used as interface between flowlines, risers, manifolds and wellheads and need to absorb dynamic and static loads and displacements. Conventional steel spools are often complex 3D structures and come with a number of design, installation and operational challenges.

One of the most prominent issues and main cost driver is the metrology to establish the final jumper geometry. In addition, the manufacturing time of a conventional steel spool is typically adding 2 months to the project critical path, resulting in longer time to first oil.

The TCP Jumper Spool is our answer to these challenges; the TCP is flexible and can absorb significant installation tolerances, pipeline expansions and dynamic riser motions. Therefore, accurate metrology is not required, leading to lower installation cost, shorter time frames and less risk for the overall project.

### The TCP Jumper Spool offers the following advantages:

- No metrology required
- Manufactured and terminated at required lengths, or in long lengths to be cut and terminated on site
- Significantly more tolerance in length than rigid pipe
- No complex geometry to weld and insulate
- No buoyancy required on most designs
- Reduced transport and installation costs
- Can be coiled down on deck or on reels
- More pipe can be transported in a single mobilization
- Lower specification of vessel
- Multiple methods of deployment
- Direct over-boarding via VLS/HLS
- Conventional with less complex spreader bar
- Reduced barge / transport vessel costs, more jumpers per mobilization

## Jumpers On Demand

The TCP Jumper Spool 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 terminate End Fittings are shipped separately, ready to be terminated onsite at short notice by Airborne Oil & Gas 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

## TCP Riser

Deepwater risers connect wells on the seabed at water depths of sometimes more than 3000 m, with the production facility floating at the surface. The challenges associated with the use of deepwater risers are large vessel payloads, complex riser layouts and associated high procurement and installation cost. Corrosion, fatigue and flow assurance further increase the design difficulties.

The TCP Riser is lightweight, able to cope with high internal and external pressures and features superior chemical resistance. It can be used for highly corrosive fluids and gases, including high contents of CO<sub>2</sub> and H<sub>2</sub>S.

In particular, the TCP Riser allows for simple riser configurations that otherwise would not be possible. In the free hanging catenary configuration using TCP, the top tensions are low, well within the riser and end fitting capacity and without added buoyancy.

Compared to conventional risers, the TCP Riser does not require any buoyancy modules and is lighter, reducing installation cost dramatically while still reducing the weight at the floating platform.

### The TCP Riser offers the following advantages:

- No corrosion, capable of handling high CO<sub>2</sub> and H<sub>2</sub>S
- Low top tension, higher allowable topside payload
- Simple free hanging catenary configuration, less components & interfaces
- Lower installation cost
- Superior fatigue properties

To meet the challenging conditions of deepwater risers, Airborne Oil & Gas is developing a superior TCP Riser based on carbon fibre in a PVDF polymer matrix with an integrated weight coating. Today, we are executing a comprehensive qualification program in Brazil, supported by our partners.







## TCP Dynamic Jumper

The requirements for high pressure rating, maximum flexibility, high collapse resistance and high flowrate are the unique challenges that are set by our clients for dynamic jumpers used in deep water applications. When pumping acids, or plugging a well, sub-hydrostatic pressures may occur. Having a collapse resistant jumper may prove essential to complete the operation without damage and delay.

Another industry requirement is the wish to replace conventional, small bore Flying Leads with products that have a considerably longer design life.

For this purpose we developed the TCP Jumper, available from stock: a high collapse resistant flexible jumper with a smooth bore allowing operations in water depths exceeding 3000 m, delivered within weeks.

### The TCP Jumper offers the following advantages:

- Spoolable with small Minimum Bend Radius
- High burst and collapse capabilities (3000 meter water depth)
- Smooth bore with very low friction loss
- Allows cement pumping
- Capable of handling vacuum at rated depth
- Able to disengage emergency quick disconnect
- Can be re-terminated in the field
- Tough, yet smooth outer layer
- Impervious to corrosion
- Chemical resistant
- Qualified under DNVGL-ST-F119
- Robust, yet easy to handle

## TCP Downline

Well stimulation leads to improved production efficiency at lower cost. Well intervention is proven to be the most cost effective method to maximise recovery ratios. Where subsea well intervention has been lagging behind, our TCP Downline and Jumper provide the fluid connection to the wellhead at lower cost per intervention.

The TCP Downline combines burst and collapse resistance with low weight, smooth bore and spoolability. This allows our clients to perform well intervention and well stimulation jobs faster, with higher flowrates, and more efficient pipeline pre-

commissioning. The lightweight, high strength TCP Downline can be deployed without using buoyancy elements. This results in considerable vessel time savings of up to 24 hours per deployment.

### The TCP Downline offers the following advantages:

- Highest internal and external pressure ratings
- High flowrate – smooth bore
- Fast deployment, reducing total time per operation
- Simple end fittings that can be fitted within hours
- Suitable in harsh offshore conditions
- Superior fatigue life, supporting hundreds of deployments to maximum water depth

Product Overview: Dynamic Jumper				
Internal Diameter	Maximum Pressure	Design Temperature	Maximum Water Depth	Storage Reel Barrel Diameter
1.5 inch	690 bar / 10 ksi	-20 - 60 °C	3048 m / 10000 ft	2.2 m / 7 ft 3 inch
2.0 inch	1034 bar / 15 ksi	-20 - 60 °C	3048 m / 10000 ft	2.5 m / 8 ft 3 inch
2.0 inch	690 bar / 10 ksi	-20 - 60 °C	3048 m / 10000 ft	2.6 m / 8 ft 7 inch
2.5 inch	690 bar / 10 ksi	-20 - 60 °C	3048 m / 10000 ft	3.6 m / 11 ft 10 inch
3.0 inch	345 bar / 5 ksi	-20 - 60 °C	3048 m / 10000 ft	4.2 m / 13 ft 10 inch

Product Overview: Self-supporting Downline			
Internal Diameter	Maximum Pressure	Design Temperature	Storage Reel Barrel Diameter
2.5 inch	345 bar / 5 ksi	0 - 50 °C	7.0 m / 22 ft 11 inch
3.0 inch	345 bar / 5 ksi	0 - 40 °C	9.2 m / 30 ft 3 inch

Product Overview: Wire-clamped Downline			
Internal Diameter	Maximum Pressure	Design Temperature	Storage Reel Barrel Diameter
2.0 inch	690 bar / 10 ksi	0 - 60 °C	3.8 m / 12 ft 6 inch
2.5 inch	690 bar / 10 ksi	0 - 60 °C	4.6 m / 15 ft 1 inch
3.0 inch	345 bar / 5 ksi	0 - 60 °C	5.4 m / 17 ft 9 inch

Notes: Downlines are available in two designs: Self-supporting Downlines (high tension) and Wire-clamped Downlines (high-flex).



# Track Record, End Fittings and Manufacturing

## Track Record

Airborne Oil & Gas has pioneered the development of Thermoplastic Composite Pipe, and introduced it to the Oil & Gas industry. As such, we have always been at the forefront of creating acceptance in the market place, initiating the creation of the new standard DNVGL-ST-F119, and building track record.

To date, we have supplied TCP around the globe for crude production, gas lift, methanol and chemical injection in the applications of flowlines, spools, jumpers & downlines. We have many records including the world's first TCP for hydrocarbon service, and the deepest operating TCP in 2140 meters water depth.

Contact us for more information on our track record or visit our website.

## End Fittings

Our end fitting design excels in simplicity. Due to the fully bonded construction of our TCP products there are no individual reinforcement layers that require complicated termination.

Instead, it relies on proven mechanical clamping and sealing methods, which allow termination at any length, both in the field and in our manufacturing facility.

In addition, we can supply all relevant ancillary items, such as bend restrictors, bend stiffeners, buoyancy modules, etc.

## Manufacturing

Airborne Oil & Gas' manufacturing facility is based in IJmuiden (Port of Amsterdam), The Netherlands. The manufacturing facility has direct sea access and our spoolable TCP products can be loaded directly on our clients' vessels. The quay has a length of 330 m with a water depth of 9.5 m.



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