

Airborne
Oil & Gas



TCP DOWNLINE & JUMPER

Subsea Well Intervention

spoolable | fast deployment | corrosion resistant

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

Lightweight, high strength and corrosion resistant composite pipes provide cost and operational benefits in subsea well intervention 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. All layers are melt-fused together, ensuring a bond between layers that is as strong and durable as the base materials.

Especially in harsh offshore conditions, Airborne Oil & Gas' very robust downlines have proved to be one of the most important advantages compared to competitive products.



TCP end fittings are simple and reliable and can be re-terminated offshore. The rugged outer coating of the TCP pipe is repairable in offshore conditions. The smooth bore of the pipe with a surface roughness of 5 μm allows for superior flow rates and has an excellent resistance against abrasion. These heavy duty properties ensure a long service life.

By varying the orientation of these reinforcement layers the properties of the product can be changed from high tension-based to high flex-based. This allows us to offer a range of flexible, spoolable TCP conduits for Subsea Well Intervention, to be used on either compact or flexible deployment systems.

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The key applications for these systems are:

- Subsea light well intervention
- Plugging & Abandonment
- Pipeline pre-commissioning
- Dispersant & kill lines

The TCP Downline offers the following advantages:

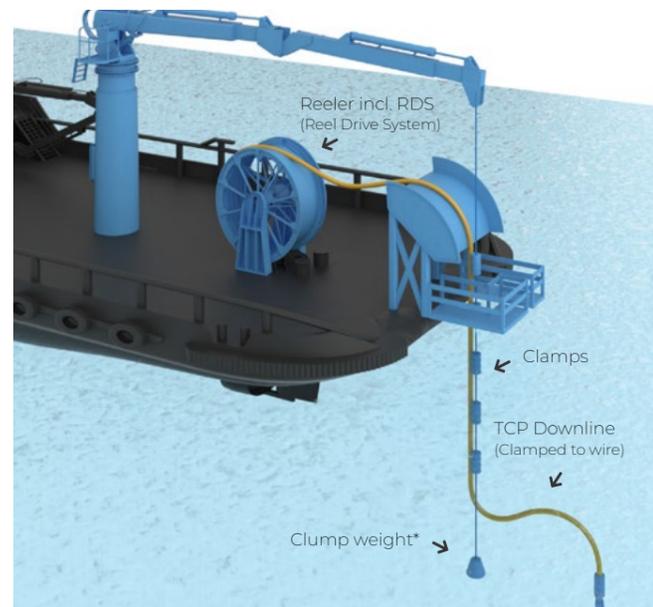
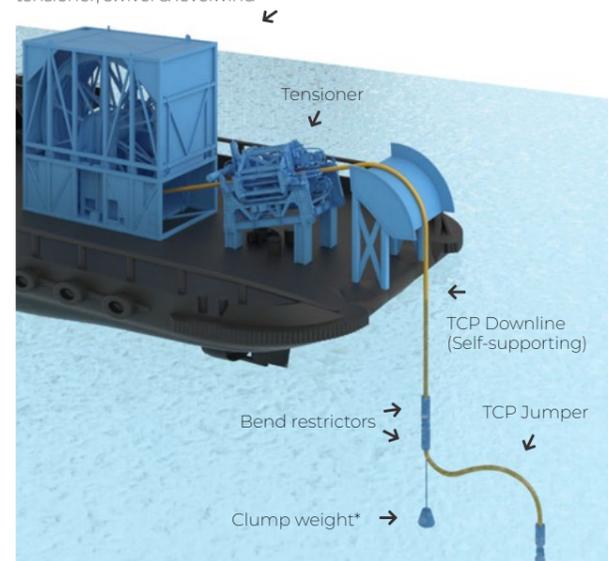
- Fast deployment to the required water depth
- One continuous pipe from surface to seabed without midline connectors
- Flexibility to run to any depth, while pumping through the conduit at rated pressure
- High internal and external pressure ratings including collapse resistance with vacuum capability
- Low cost per intervention: Multiple operations per year, for years, with one TCP Downline
- Superior fatigue life, supporting hundreds of deployments to maximum water depth

Downline Systems



Our experience with Self-supporting Downline systems delivered to a number of customers for various projects, and also the industry's demand for compact and craneable deployment systems, has led to the development of two types of downline systems:

Semi or fully enclosed reeler incl. power unit, tensioner, swivel & levelwind



*To ensure dynamic stability subsea, a clump weight is used during deployment.

Self-supporting Downline system

This free-hanging downline is a fully automated system which can be spooled off to the required water depth by simply pushing the button. The time required to reach 2500 m water depth is approximately two hours. This downline has a high-tension design and is usually operated with a flexible TCP jumper at the bottom and deployed using a tension controlled deployment spread. The downline is strong enough to activate the Emergency Quick Disconnect (EQD) if required.

Wire-clamped Downline system

This downline is clamped to a steel wire or cable to transfer the tension load. The clamps are manually installed during spooling off to the required water depth. Using a smart clamping technique the extra time required for installing the clamps is approximately 30 minutes per 1000 m water depth. Due to the high-flex design this downline can be operated using a compact reel with a reel drive system. This downline can also be used in harsh weather conditions.

Self-supporting Downline

Airborne Oil & Gas customers who have used the system on numerous deployments appreciate the light weight, the ease of use and the external pressure resistance, making it the preferred option to conventional systems, both technically and operationally. Operators further highlight the robustness of the product which allows quick deployments and recoveries compared to conventional systems.

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

Wire-clamped Downline

Wire-clamped TCP Downlines offer an even more flexible, light weight, yet robust conduit. Due to its low bending stiffness this conduit can be connected directly to the subsea structure without the need for a dynamic jumper. This wire-clamped conduit has a high internal and external pressure rating. The wire will activate the Emergency Quick Disconnect in case of vessel drift.

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

Deployment System

Depending on the type of downline (Self-supporting or Wire-clamped) and the customer's preferences, several deployment systems to operate the downlines are available. For self-supporting Downlines these include semi or fully enclosed reelers that feature an integrated power unit, tensioner (for constant tension), swivel and levelwind.

To enable operation of the system from a variety of available installation vessels, the deck layout and equipment arrangements are flexible and/or compact to accommodate both deployment of the downline over the side as well as from the moonpool while at the same time the required deck space is minimized.

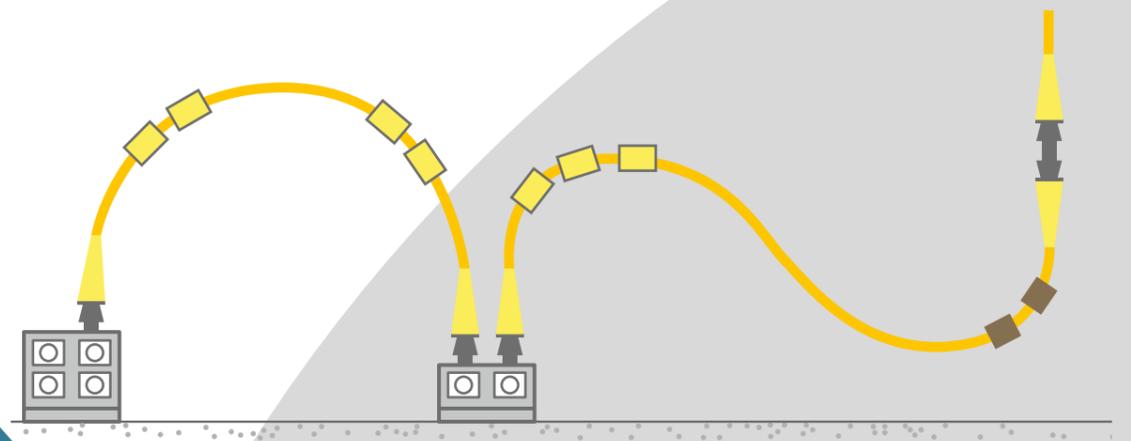
Wire-clamped Downlines are supplied on a reeler with a Reel Drive System interface and wire-clamps. All deployment systems are manufactured to the highest standards including DNV 2.7-1 and DNV 2.7-3.

Dynamic Jumpers

Airborne Oil & Gas' dynamic TCP Jumper connects the Self-supporting Downline or steel coiled tubing to the injection skid, wellhead or pig launcher. The TCP Jumper absorbs the heave motions of the vessel and is capable of withstanding high internal as well as high external pressures. The smooth bore allows for high flow rates and prevents plugging of the jumper during cementing operations. In case of vessel drift, the TCP jumper is strong enough to activate the emergency quick disconnect.

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
- Robust, yet easy to handle





Fast, Flexible and Safe Deployment

Our customers having used the system on numerous well intervention projects appreciate the robustness of the protective outer layer of Airborne Oil & Gas' TCP and the high flowrates that can be achieved.

With its high collapse resistance, this TCP Jumper will not only outclass HCR hoses; it is also the only high pressure, truly flexible composite jumper available in the market today. Airborne Oil & Gas' TCP Jumper is the jumper of choice for today's deepwater Riserless Light Well Intervention (RLWI) and Plugging & Abandonment (P&A) operations.

Product overview: Dynamic Jumper

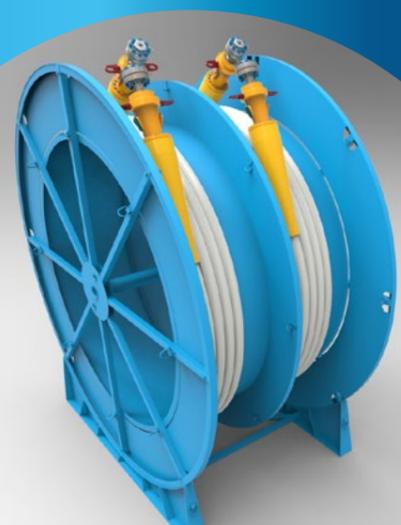
Internal Diameter	Maximum Pressure	Design Temperature	Maximum Water Depth	Storage Reel Barrel Diameter
1.5 inch	690 bar / 10 ksi	-20 - 60 °C	3048 m / 10000 ft	2.2 m / 7 ft 3 inch
2.0 inch	1034 bar / 15 ksi	-20 - 60 °C	3048 m / 10000 ft	2.5 m / 8 ft 3 inch
2.0 inch	690 bar / 10 ksi	-20 - 60 °C	3048 m / 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

Chemical compatibility

The conduits are used for the large majority of fluids and gases used in the Subsea Well Intervention industry.

Deployment

- One continuous length of downline, can be deployed to any depth
- No ballast or buoyancy to be attached during deployment (buoyancy on jumper pre-installed): fast deployment
- No spring effect (elastic energy) in downline



Track Record Downlines & (Dynamic) Jumpers

Airborne Oil & Gas has the world's largest track record in TCP, including for Subsea Well Intervention applications, with over 100 deployments, and counting.

Track Record (relevant selection)				
Delivery	TCP Description	Application	Client	End user / project
2011	2 x 4.5" downlines, 800 m	Trenching	AGR, Flexlife	Chevron
2012	3" downline, 2500 m + reeler	Pipeline pre-comm	Saipem	Guara & Lula, Sapinhua
2015	2.5" downline, 1600 m	Pipeline pre-comm	IKM / Subsea7	Statoil Astaa Hansteen
2015	2 x 2", 10ksi dynamic jumpers	P&A	Wild Well Control	Marubeni
2016	3" downline, 1500 m + spread	Acid stimulation	Shell	SNEPCo Bonga
2017	2" 10 ksi dynamic jumpers	Acid stimulation	Enpro / GE Oil & Gas	Tullow Oil Ghana

Qualification

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-ST-F119.

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 conduits 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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