

Thermoplastic Composite Pipe

An alternative for velocity strings

Introduction

The variety of operations for which Coiled Tubing is considered now is greater than ever before. Where Coiled Tubing traditionally featured mainly in well intervention & well servicing type of operations, now Coiled Tubing is seriously being considered for many well side-track drilling programmes.

For most well interventions the coil is used as a means to apply circulation (stimulation, well cleaning), drive down-hole equipment or enter highly deviated wells for logging purposes for example.

Today, steel Coiled Tubing is used for velocity strings as a low-cost solution. Using steel for velocity strings however has a number of drawbacks; this paper addresses those drawbacks and proposes a thermoplastic composite pipe as alternative.

Challenges

Steel Coiled Tubing often is used for velocity strings; especially strings that are near the end of their normal working string end-of life are used widely. Some aspects limit their success:

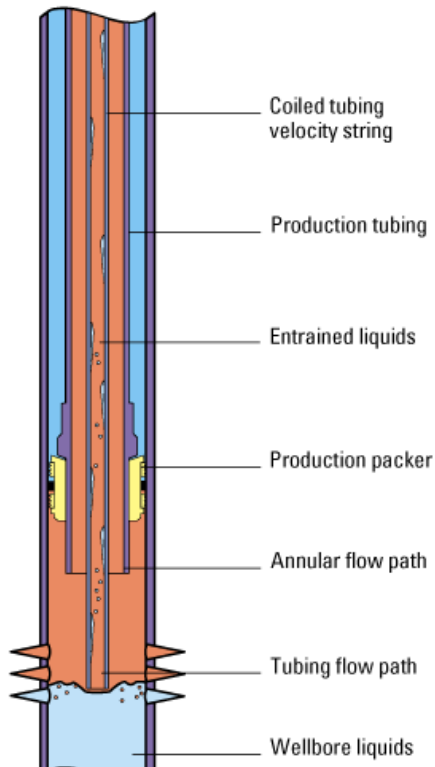
1. Working string Coiled Tubing is designed for short operations, rather than long service lives in well conditions. This makes steel Coiled Tubing prone to corrosion.
2. Friction losses are high due to the rough surface area of the coil, especially if retired stock is used. This reduces the effect of the velocity string, which is the primary function.



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Perfect bonding: fibre reinforcement welded onto liner, resulting in collapse resistant tubing



Generic velocity string arrangement

3. Corrosion being an issue in normal conditions, these are aggravated in CO₂ and sour conditions. This requires more inspection and larger risk of losing the coil.

Solutions

Airborne Composite Tubulars proposes to apply Thermoplastic Composite Pipe (TCP) as alternative to steel in the application of velocity strings. This alternative to steel CT presents the following unique advantages:

1. The technology developed by Airborne consists of melt-fusing fibre reinforced thermoplastic tapes onto a thermoplastic liner. In this process, a fully-bonded solid wall structure is created, covered by a coating of the same thermoplastic compound. This offers the following benefits:
 - a. High collapse rating as the liner is reinforced by fibres.
 - b. Good spoolability due to the ductility of the thermoplastic material used and avoidance of micro cracking issues.
 - c. Long service life due to absence of any rapid gas decompression issues.
2. The liner has lower surface roughness, reducing pressure drop and improving flow conditions.
3. High chemical resistance and service temperature rating, depending on the materials chosen.
4. Greater toughness and superior impact resistance.

Thermoplastic material is more ductile, thereby showing high impact tolerance. A second aspect related to the toughness and ductility is the superior residual strength characteristics of thermoplastic materials. This is essential especially in down hole applications where contingency is a requirement. Thirdly, the ductility of the thermoplastic material allows the coil to be plastically deformed, which is a requirement for regular fishing tools.



Airborne's in-house pressure test facility



TCP Production Line



TCP Bending Fatigue Rig

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Feasibility

The industry has seen developments in the area of Composite Coiled Tubing in the past 10 years. These developments were based on a brittle thermoset matrix system rather than a ductile thermoplastic system as proposed by Airborne. Airborne has selected the thermoplastic matrix system as opposed to thermoset in order to resolve the issues encountered with the thermoset composite systems.

Production

Airborne's current production line capability extends to continuous pipe systems up to 3.5 inch OD using Glass & Carbon fibres and PE, PP, PA & PVDF polymer materials to provide the optimal solution for each application.

More information

Airborne is committed to the successful introduction of thermoplastic composite coiled tubing in the Oil & Gas industry through material research, knowledge development on industry specific requirements and fit for purpose designs, yielding technically and economically viable solutions. Other industry applications developed are Flowline, Production Riser, Service Intervention Line, High Pressure Hose and various specialty projects on a confidential basis.

Airborne Composite Tubulars is part of the Airborne Group of Companies that has a reputation in providing various industries with high-end composite designs and products.

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