TECHNOLOGY

# High Performance Pipe-in-Pipe

**PRODUCT OVERVIEW**

*Seven Oceans - one of Subsea 7's deepwater rigid reel pipelay vessels*


Subsea 7 has a long-established track record in the design, fabrication and installation of a range of high-quality, cost-effective rigid pipeline solutions, including flowlines, risers and bundles.

An ongoing technical development programme, allied to investment in new vessels and equipment, helps to ensure Subsea 7's position as a leading provider of rigid pipelay services globally.

Subsea 7 can now offer three categories of pipe-in-pipe design:

- standard thermal performance
- enhanced thermal performance
- electrically heat-traced flowline

The key advantages of having greatly increased thermal performance in a pipe-in-pipe solution compared to traditional wet insulation materials include:

- **enables longer tie-back distances in subsea well developments**
- **allows more satellite developments to be added to existing infrastructure**
- **single line tie-back delivers a lower cost of development**
- **increased cool down times allow longer shutdowns**
- **extremely efficient thermal performance (low U values).**

## APPLICATIONS

A key challenge of many new subsea developments is maintaining the appropriate product temperature within the pipeline infrastructure to avoid the formation of hydrates or wax resulting in a detrimental impact on flow assurance and possibly complete shutdown. To date the industry adopts two protective methods for the production pipeline in the form of a wet insulation coating or pipe-in-pipe.

Subsea 7's pipe-in-pipe solution offers customers the ability to design and build a cost-effective solution for new or brownfield projects.

## PRODUCT OVERVIEW

The pipe-in pipe product consists of the production pipeline being sleeved into an outer pipe with the annulus being maintained dry and filled with a high performance insulation material configured to meet the particular project thermal requirements.

The outer pipe is designed to withstand both the hydrostatic pressure dictated by the project water depth and the reel-lay operations.

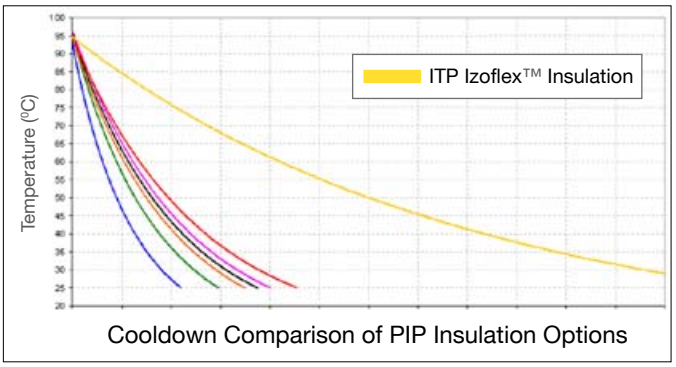
The inner pipe is conventionally located within the outer pipe by the use of centralisers clamped at discrete intervals along the inner pipeline. The inner and outer pipe sizing are designed as a single system to be installed by the cost-effective rigid reel-lay method.

## DEVELOPMENT PROGRAMME

Subsea 7's development programme has demonstrated that its in-house design models and discrete component details are fully validated by performing full scale bending trials on a range of pipe-in-pipe systems.

In addition, comprehensive trials have validated both the heat transfer models and a range of insulation material properties suitable for pipe-in-pipe applications.

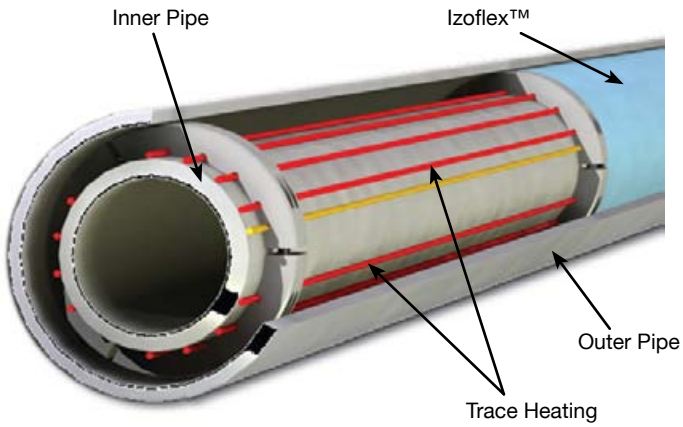
This performance is demonstrated below in a comparison of cool down times with various insulation options.




Cooldown Comparison of PIP Insulation Options

## ENHANCED THERMAL PERFORMANCE

In addition to its standard pipe-in-pipe configuration, Subsea 7 can offer an enhanced thermal performance pipe-in-pipe solution utilising the field proven ITP Izoflex™ insulation with reduced internal pressure, providing unequalled insulation, with U-values of 0,5 W/m2K or better easily attainable. The Izoflex™ compressive strength allows for the possibility of having no centralisers, thus further improving thermal and mechanical performance.




ITP INTERPIPE©

## ELECTRICALLY HEAT-TRACED FLOWLINE PIPE-IN-PIPE

The InTerPipe (ITP) developed electrically heat-traced flowline technology has demonstrated that it offers significantly enhanced flow assurance properties.

This technology builds on the already efficient passive insulation technology (with 'no-touch' times of 72 hours) to provide an active system to maintain the flowline above WAT or HAT, with a typical power consumption of 5-10 W/m for hydrate mitigation. The heat traced technology can be applied with all pipe metallurgies, at high temperatures and in permanent operation.

The technology has been qualified for reel-lay through a range of full-scale tests.

## TRACK RECORD

Subsea 7 has a proven track record in design, fabrication and installation of rigid pipeline systems, including pipe-in-pipe solutions, built up over many years. Since 1982 it has successfully completed over 60 pipe-in-pipe bundles in the North Sea.

ITP likewise have over 350km of its pipe-in-pipe technology deployed worldwide in water depths of up to 1500m.

## OTHER INFORMATION

Subsea 7 has an ongoing research and development programme to investigate further enhancements to thermal performance and electrical heating in its pipe-in-pipe solution.

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