Pipeline Bundles
Subsea 7 Installed Bundles

- Bundles completed 59 - 2008
- Longest Single Bundle Length 7449 Metres
- Heaviest Integrated Structure 465 tonnes
- Largest Carrier Pipe diameter 49.5 Inch
- Deepest North Sea Installation 350 Metres
- Shallowest North Sea Installation 42 Metres
- Longest Tow North of Wick 580 nautical miles
- Longest Tow South of Wick 360 nautical miles
What exactly is a “Pipeline Bundle?”
What can a Pipeline Bundle bring to you

Active control of thermal properties
Reduction of expensive alloy materials
Completion of fabrication and commissioning onshore
Installation by low stress methods
Installation without interrupting drilling activities
Low cost future development options
Reduced corridor for installation in congested fields
Thermal Management Philosophy

Passive Insulation

Thermal Management

Active Heating

- Wet
- Dry
- Electrical Heating
- Hot Water Circulation
  - Induction
  - Direct
  - SECT
  - Direct
  - In-Direct
# Thermal Management Requirement

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Wet Insulation</th>
<th>Dry Insulation</th>
<th>Active Heating</th>
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<tbody>
<tr>
<td>Low Reservoir Temperatures</td>
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<td>High Solid Deposition Temperatures</td>
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<td>Deep Water Depth</td>
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<td>Long Distance Tie-Back</td>
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<td>Long Cooldown Time Required</td>
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<td>Flexibility in Turndown Rates Required</td>
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<td>System Warm-Up Required</td>
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<td>Depressurisation Below Hydrate Temperature Not an Option</td>
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Passive Insulation System

Traditional wet insulation systems are limited to conductivity or ‘k’ values of between 0.2 and 0.3 W/mK.

Buoyancy effects & practical handling limit the overall thickness.

The overall heat transfer coefficient (OHTC) or U-value is limited to approximately 2 W/m²K.
Pipe-in-Pipe System

For U values < 2 W/m²K, dry insulation materials have to be used, such as polyurethane foam, mineral wool or aerogels.

U values of < 0.5 W/m²K can be achieved by creating a partial vacuum in the system or changing the annulus gas.
Hot Water Heating

The production flowlines are heated by dedicated hot water supply and return lines contained within the insulation layer, which is filled with a low pressure gas.

Lower Pumping Costs
Smaller Expansion Volumes
Simpler Design for Multiple Flowlines
Electrical Active Heating

- Direct Electrical Heating
- Induction Heating System
- Skin Effect Current Heating
- Electrical Heat Traced Flowline
Subsea 7 has invested extensively in R&D and developed in-house tools to predict thermal performance of the bundled system.
Towheads

40.16m

8.32m
Onshore Fabrication
Typical Tow Fleet Vessels
Bundle Ready for Launch
How to make 9000Te fly - Controlled Depth Tow Method (CDTM)

- Chains attached at regular intervals along the bundle.
- Ensures accurate weight control to approximately 0.5%.
- Weight of chain links on seabed is submerged weight of bundle.
- Chains can be easily cut by ROV to trim bundle for tow if required.
Controlled Depth Tow Method
What can a Pipeline Bundle avoid

Multiple installation campaigns
Heavy lift vessels for large manifolds
Specialist vessels
External coating of pipelines
Trenching and rockdumping
External coating of umbilical tubing
Hydrotesting and dewatering requirements offshore
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