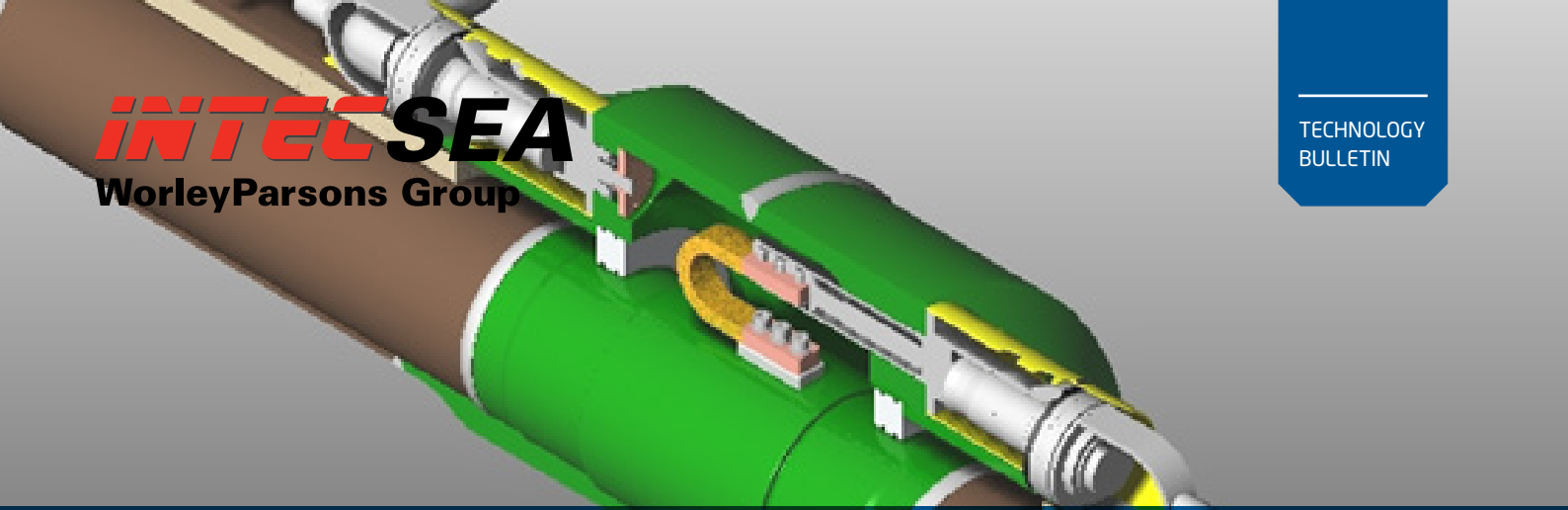
INTECSEA
WorleyParsons Group

TECHNOLOGY BULLETIN



To Heat or not to Heat:
Is Electric Flowline Heating an Option for my Application?

Customer Benefits

EFH Solutions Afford:

- Single Line Tiebacks for Marginal Fields
- Extended tie-back distances
- Unlimited No-Touch Time
- Hydrate / Wax Mitigation
- Hydrate / Wax Remediation
- Eliminate Pigging
- Active Thermal Management of Arrival Temperature
- Reduced Requirements for MEG, MeOH and LDHIs
- Eliminate Dead Oil Circulation and associated storage and pumping equipment on host facility

INTECSEA EFH solutions combine a matrix of flowline heating options systemically evaluated to establish the right flowline heating option for any given set of application metrics.

Introduction

INTECSEA understands the close connection between flow assurance and the need for electrical flowline heating (EFH). We evaluate each application against key drivers to define an optimized EFH or conventional solution. Drivers include:

- Fluid composition, Wax appearance temperature and Hydrate dissociation curve
- Operational philosophy:
  - Continuous EFH operation: single flowline, maintain arrival temperature, no pigging
  - Intermittent EFH operation: start-up, shut-in & no touch time
  - Trade-offs between EFH and historical flow assurance solutions (e.g., chemical injection for wax/hydrate management, insulation)
- Water depth, Flowline length and diameter
- Subsea cable and connector current and voltage capability
- Host facility requirements (turret, power, ullage)
- Technology Readiness Level

Services

- Evaluation of alternative EFH options, alongside conventional loop production systems
- Technology qualification services, from desk studies, to prototype design and test
- Assessment of supply chain, construction, installation, host interface, operation, and system reliability aspects
- Complete system design and performance prediction

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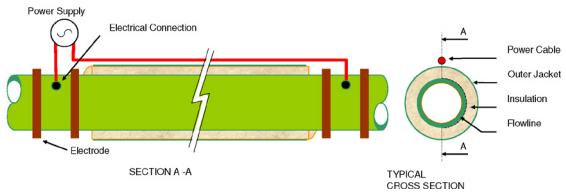
Flow Assurance answers the question of whether to heat or not to heat. INTECSEA understands the close connection between flow assurance and the drivers for electrical flowline heating (EFH).

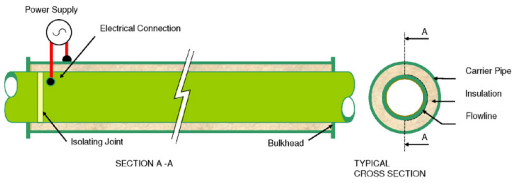
Open Loop DEH System

The flowline comprises a single pipe with thermal insulation. Electrical insulation is not required as the pipe and surroundings are at the same potential. A power supply is connected at both ends of the flowline. Electric current flows in the both pipe and surrounding seawater. Localized heating results from the proximity effect.



End-Fed Pipe-in-Pipe DEH

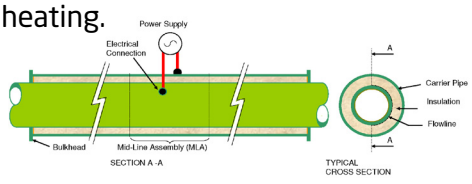
The flowline comprises two concentric pipes separated by a thermal and electrical insulating material. A power supply is connected at one end of the flowline. The concentric pipe construction promotes both skin and proximity effect heating.



Innovative hybrid induction / conduction DEH arrangements with significantly improved efficiency are in development at INTECSEA.

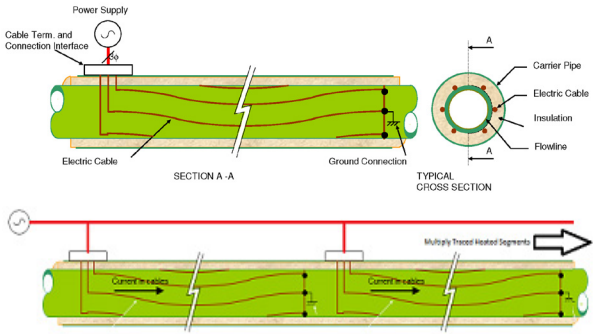
Centre-Fed Pipe-in-Pipe DEH

The flowline comprises two concentric pipes separated by a thermal and electrical insulating material. A power supply is connected at centre of the flowline at a Mid Line Assembly. The concentric pipe construction promotes both skin and proximity effect heating.



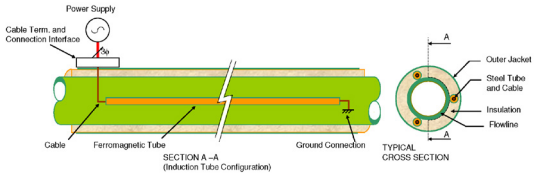
Cable "Heat" Tracing

A number of electrical cables are strapped to the side of the flowline. The resistance of the cables produces heat when a current is applied. The flowline is heated through thermal conduction. Single segment designs suitable for reeling and segmented arrangements for S-Lay / J-Lay available.



Induction Tube Heating

A steel tube containing a single core power cable is strapped to the side of the flowline. The supply current, flowing in the cable, induces eddy (heating) currents in the steel tube. The tube may also be used as the return conductor. Heat flows from the tube to the flowline through thermal conduction.



Publications

AOG Presentation 2013: To Heat or not to Heat, Is Electric Flowline Heating an Option for my Application?
Richard Voight

ATC 2012- 23732: Direct Electrical Heating (DEH) Provides New Opportunities for Arctic Pipelines
Rebecca Fisher Roth, Richard Voight, Duane DeGeer

Offshore Magazine 2011: EFH: Another arrow in the flow assurance quiver
Richard Voight

World Pipelines 2011: Go with the Flow
Richard Voight

DOT 2008: Direct Electric Flowline Heating - An Option That Should Not Be Ignored
Tom Choate and Richard Voight

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