IFL® - InField Liner

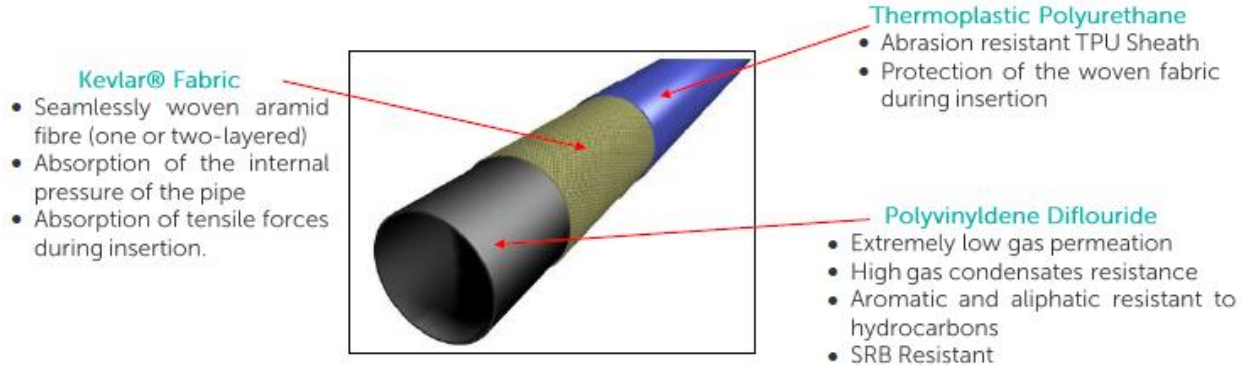
CORAL 2.0 TRT Tech Bulletin #1

IFL® - InField Liner
Pipeline rehabilitation solution for decommissioned pipelines

Technology Description

The IFL® liner is a flexible Kevlar® reinforced liner that can be pulled in over certain lengths in a single pull. Its specialized Polyvinylidene Flouride ("PVDF") inner layer is highly resistant to a wide range of hydrocarbon media at elevated temperatures of up to 110°C and depending on the diameter it can have a stand-alone burst capability of up to 120bar.

IFL® is built as a three layer system. The external diameter of the IFL® is designed to be tight fit to the host pipe at its design pressure. Each layer of the liner is 2mm thick, each serving a specific function that makes up the liner's structure.



Technology Usage

Rehabilitation of decommissioned pipelines, extending lifetime of existing pipelines of up to 30 years, cost effective solution comparing to carbon steel new pipeline installation.

Functionality/ Application Examples

IFL® was installed at PCSB SKO pipelines to eliminate internal corrosion – MIC (SRB), scale oxygen ingress & CO2 Corrosion.

Typical Installation Steps

Inserted and inflated to fit tightly to the existing carbon steel pipeline.

Liner Insertion and Termination

Limitations & Benefits

Limitations

Diameter range from 6” to 18” and lengths available up to 5km.

Benefit (qualitative)

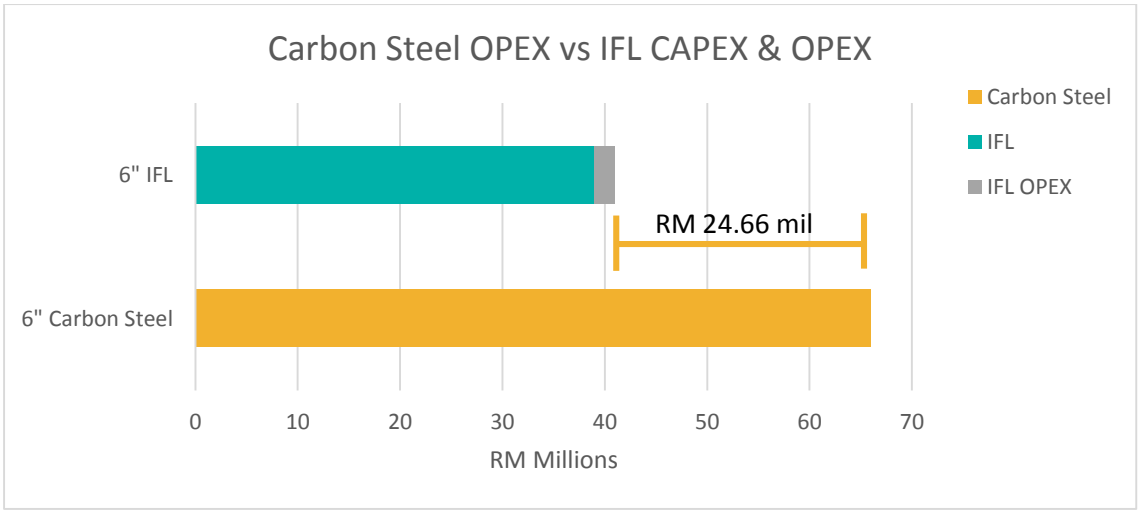
- Non-metallic material thus not susceptible to corrosion and scale has no tendency to stick on liner material
- No CI required

Simplified installation method with shorter period of time as compared to normal carbon steel pipeline replacement

Technical Advantages and Disadvantages of CS vs IFL™

Description	Carbon Steel	IFL
Major threat of failure	• Internal corrosion - MIC (SRB), CO2 corrosion, Oxygen ingress, Scale	• Non-metallic, not susceptible to corrosion; scale has no tendency to stick on liner material • Threat comes from mechanical/external damage
Additional Support facilities	• New Launcher/Receiver: additional Deck Space • Chemical Injection Skid • Routing for 5D bend	• From Hanger Flange/ABV upwards, to fully **utilize existing Topside facilities**
CI Requirement	• Yes	• No
Hookup Campaign duration	• 60 days, inclusive of pre-shutdown, shutdown and postshutdown of 45 days	• Estimated @ 25 days total
Installation Method	• Require Installation Barge	• Any workboat for transportation of liner & winch
Size Limitation	• Any size possible	• Smaller ID - Liner philosophy to be lined into existing pipe

Benefit (quantitative)



Note: Assumptions: Cost Overview duration is 20 years; values taken is as of 2015 without escalation factor.

a. OPEX for Carbon Steel for the next 20 years are estimated to be RM 70 mil.
b. OPEX for IFL for the next 20 years are estimated to be RM 4 mil.
c. Carbon Steel OPEX alone is more than the combines of IFL OPEX & CAPEX.

Certifications

IFL® product qualifications were undertaken in conformance with API 15, API 17 and NACE standards, by independent laboratories, while also being subject to third party inspection.

Contacts

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