Success against all odds: Excellent in-line inspection results despite formidable challenges

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Introduction

In 2007, ROSEN received a request from a major pipeline operator to inspect and evaluate the integrity of an offshore gas pipeline. This integrity assessment project posed significant challenges on three accounts. Firstly, the special properties of the gas line, notably its dual-diameter design (14"/18") with different wall thickness in the two sections, 5 D bends, and a number of subsea appurtenances such as check valves, tee junctions and reducers etc. all made for difficult navigation. Secondly, due to the location of the pipeline and the nature of the transport product, the consequences of a possible failure of inspection operations would have been severe, meaning that special precautionary measures had to be taken. Finally, as is often the case now, the operator was under pressure to maintain product flow during the entire safety assessment project. All these requirements called for careful planning, preparation, customized tool development and rigorous pre-inspection testing to ensure a safe and successful inspection run.

Project Phase 1: Defining the inspection requirements

Today only about 60% of the world's oil, gas and other product pipelines can be inspected with off-the-shelf In-Line Inspection (ILI) tools. Until recently, the remaining 40% of lines used to defy in-line inspection altogether and were therefore classified as "unpiggable". However, it is now possible to develop bespoke inspection solutions even for offshore pipelines with a number of challenging features such as multi-diameter design, low flow conditions and narrow OD ratios. The project presented in this article is a good example of customized developments, testing, and subsequent use of gauging and ILI tools taking into account specific asset features and client requirements. As a result, a line was made fully inspectable that would have been considered "unpiggable" a few years ago.

The goals of the first phase of this particular ILI project were as follows: to determine as precisely as possible the installation features of the pipeline, to obtain as much information as possible on the conditions within the gas line in terms of flow rates, temperature and pressure etc, to predefine the specifics of on-site activities and data evaluation and, finally, to outline a contingency plan allowing for unforeseen events during the inspection.

Using the available launcher and receiver documentation as well as on-site visit information, for example, ROSEN USA defined the launching (vertical) and receiving procedures. The details of these procedures subsequently served as a basis for the design and manufacture of the required equipment (transport frame, launching tube).

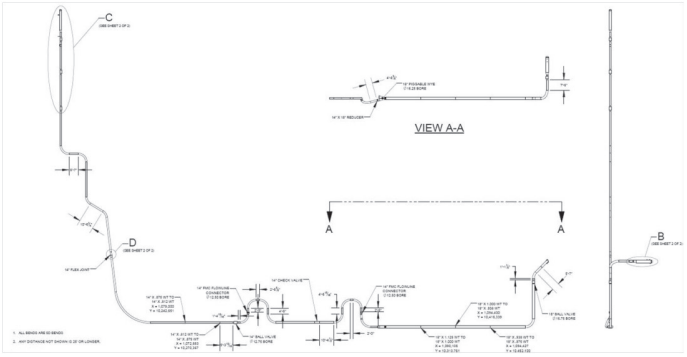

Figure 1: Overview of the 14"/18" gas pipeline. Many of its features posed great challenges to a smooth inspection run.

Project Phase 2: Developing customized in-line inspection tools for optimal results

Upon completion of the preparation phase, it was clear that ROSEN would have to design, develop and manufacture three multi-diameter tools for gauging, MFL and Extended Geometry inspection respectively and that these instruments would have to accommodate specific pipeline and operational requirements. The three main challenges posed to the design of these tools arose from:

1. Wide multi-diameter working range from about 300 mm to 415 mm (11.8" to 16.4")
2. A High internal pressure of 295 bar (4,277PSI)
3. A wye-piece passage.

Project Phase 3: Testing the newly developed ILI tools

With the completion of the tools, the project entered its third phase. The objective of this phase was to subject all developed components, finished tools and procedures to rigorous testing.

Figure 2: The 14"/18" test loop set up at the RTRC in Lingen, Germany, replicated all the important features and simulated the conditions of the pipeline to be inspected.