International Journal of Offshore and Polar Engineering (ISSN 1053-5381)

Vol. 16, No. 1, March 2006, pp. 41–47

Commissioning 8000 Km of Subsea Pipelines

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Since 1985 Statoil has installed and commissioned approximately 8000 km of subsea pipelines in the North Sea. Among these are several of the world's largest offshore gas trunklines as well as some of the most complex subsea developments. Commissioning and pigging these pipelines represented several challenges, and the accumulated experience gained through successfully commissioning these pipelines has brought Statoil to the forefront of the pipeline industry. This article discusses several topics within pipeline commissioning and presents relevant field experience.

INTRODUCTION

The following topics are addressed:

- Commissioning concepts for single and multi-diam pipelines.
- Air drying of internally coated, export gas-quality pipelines.
- Dewatering of pipelines using hydrocarbon gas.
- Pig design for dual-diam pigging.
- Environmental aspects of commissioning operations.

These topics are explored and field experience from relevant projects presented. The article makes recommendations for future projects and elaborates on Statoil's commissioning concept for the next huge pipeline, the Langeled-project, the 1200-km pipeline from Norway to the United Kingdom to be commissioned in 2006-07. Fig. 1 shows the main pipelines in the North Sea.

COMMISSIONING CONCEPTS

Each pipeline project is unique and poses its own constraints and challenges regarding precomissioning and commissioning. Selecting an optimum concept for these operations is not a straightforward task.

Initially, the constraints and possibilities must be reviewed in order to establish the preferred pigging direction. For the initial flooding operation, availability of water of sufficient quality and quantity is normally the most important issue. For the dewatering and subsequent drying, 2 important issues decide the pigging direction: One is the preferred discharge location for the linefill water; the other, the medium available for propelling the pig train. The linefill water is normally treated with chemicals in order to minimize the risk of the pipeline's internal corrosion, and the environmental issues regarding discharge of this chemically treated water prove to be a very common constraint that dictates the direction of the pigging and dewatering operation.

If hydrocarbon gas is available at one end of the pipeline, this will normally be the preferred medium for propelling the dewatering pig train, especially if the requirement to the final transport dewpoint is moderate. A dewatering train comprising pigs separated by slugs of glycol and propelled by gas will dewater and gas fill the line during one operation. However, since hydrocarbon gas is involved, a high focus on safety and operation control must be maintained.

Received September 5, 2005; revised manuscript received by the editors March 16, 2005. The original version (prior to the final revised manuscript) was presented at the 15th International Offshore and Polar Engineering Conference (ISOPE-2005), Seoul, June 19–24, 2005.
KEY WORDS: Subsea, pipeline, commissioning, pigging.

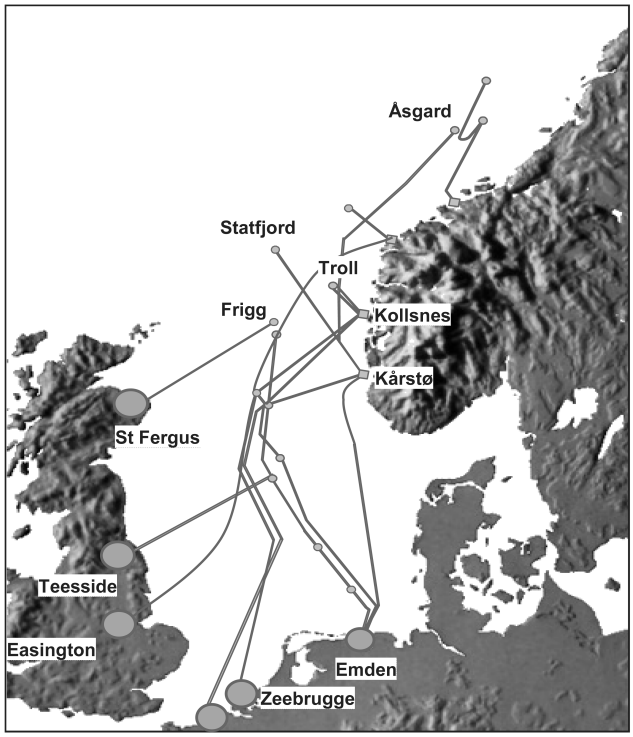

Fig. 1 Main pipelines in North Sea

If hydrocarbon gas is not available, or there are strict requirements on the transported gas dewpoint, compressed air from temporary compressors may be used to propel the dewatering pig train. The same compressors will later be used to dry the pipeline by continued purging of dry air through the line. The drawback with this method is that it requires a lot of compressors and high pressure for the big pipelines, especially where the pipeline crosses deep waters. On the other hand, the air drying has proved to be very efficient, and this will be elaborated on below. Following air drying, the line is normally inerted by injection of a slug of nitrogen, followed by hydrocarbon gas. Pigs are normally not used during the gas filling, due to a risk of high-speed excursions during pigging at low pressures.

Other, more project-specific constraints can be limited access or space for temporary equipment at one pipeline end; in some projects one end of the pipeline may even be terminated subsea, making access difficult and costly because of the use of divers in shallow waters or ROV technology beyond diving depth. Of