



OTC 18703

Smoothbore Flexible Riser for Gas Export

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This paper was prepared for presentation at the 2007 Offshore Technology Conference held in Houston, Texas, U.S.A., 30 April–3 May 2007.

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Abstract

This paper describes the development of a novel design of smoothbore riser for dry gas applications. It has been developed for use on the Statoil operated Åsgard field located about 200 kilometres off mid Norway.

Shortly after start-up of gas export from, what was then the world's largest semi-sub, Statoil's Åsgard B platform, a serious noise and vibration phenomenon was identified in the gas export system. This system consists of a manifold on the platform topsides connected to parallel flexible risers linked to a subsea Export Riser Base which feeds the gas into the 42" export pipeline to Norway. The noise, essentially a high pitched whistling, and resulting vibration, caused two fatigue failures of small bore piping fittings on the topsides manifold, leading to gas leaks on the platform. There were also concerns related to the subsea piping. The source of the noise, in this dry gas system, was related to vortex shedding of the gas flow past the internal carcass in the flexible risers.

Initially two roughbore risers were installed; this was subsequently increased to a total of four including one spare. The increase to three operating export risers had been planned from the start of the project to reflect increased export volumes from Åsgard. However, while it was now possible to manage the gas flow such that the noise and vibration was controlled, this could not be achieved without unacceptable pressure losses along the length of the flexible risers. This problem was related to longer term operation of the Åsgard Transport System as the export volume through it, and hence the required operating pressure, increased with the inclusion of export from new fields, such as Kristin.

After comprehensive work with export system monitoring, dynamic simulations, and assessment of alternative export arrangements, Statoil invited Technip to validate the concept of a flexible smoothbore structure for the Åsgard B gas export riser system. This paper describes the background for, and special measures implemented in, the design of the world's first smoothbore flexible riser for gas export. This design is such that noise from the risers is eliminated while, at the same time, a smoother internal bore significantly reduces the pressure losses along the riser, allowing the full potential of the Åsgard Transport System to be achieved. The first smoothbore gas export riser was installed, in late Autumn 2006, as a replacement for one of the existing standard roughbore risers.

Hence, the new application of smoothbore riser technology to the novel gas export riser design for Åsgard, gives several benefits;

- noise and vibration issues are eliminated,
- pressure losses are reduced and
- environmental benefits are achieved from the subsequent reduction in need for compression.

Description of Åsgard Field

The Åsgard field is operated by Statoil and lies on the Halten Bank in the Norwegian Sea, about 200 kilometres off mid-Norway. Viewed overall, it is the largest development on the Norwegian continental shelf with the world's largest set of subsea production installations, comprising a total of 55 wells drilled through 17 seabed templates.

The Åsgard A oil production ship arrived on the field on 8 February 1999 and became operational on 19 May. Gas production from the semi-submersible Åsgard B platform, see Figure 1, at the time the world's largest structure of this type, began on 1 October 2000.

The overall Åsgard development comprises:

- The development of the field itself in the Norwegian Sea.
- The 42" Åsgard Transport gas pipeline from the field to the Kårstø processing plant north of Stavanger.
- The Kårstø expansion project.
- The Europipe II gas trunkline from Kårstø to Dornum on the German coast.