

## **Independent testing performed on SPO Compact Flanges**

### **1. DnV report nos 90-3241 and 91-3156**

Test plan and test report for prototype testing of a 9 5/8" production riser compact flange connector for the "Snorre" TLP. This includes repeated make up break out and interchangeability testing, full length make up testing, fatigue testing, experimental stress analysis, static proof load testing under combined internal pressure bending and axial load, ultimate strength testing and elevated temperature testing.

### **2. DnV report nos 91-3193 and 91-2010**

Test plan and test report for prototype testing of a 24" oil export riser compact flange connector for the "Snorre" TLP. This includes repeated make up break out and interchangeability testing, full length make up testing, fatigue testing, experimental stress analysis, static proof load testing under combined internal pressure bending and axial load, ultimate strength testing and elevated temperature testing.

### **3. British Gas report R 4844**

This describes tests on a 30" class 600 SPO compact flange carried out at British Gas' test facility

### **4. DnV report no 91-3458**

This describes seven burst tests performed on SPO compact flanges by DnV.

### **5. DnV report no 94-3567**

This describes a gas test on a 4" class 1500 SPO compact flange.

### **6. DnV report no 96-3426**

This describes a fire test on a 10" class 1500 SPO compact flange.

### **7. DnV report no 96-3263**

Tests on SPO compact flanges with damaged seal surfaces and with repaired damages.

### **8. IKM report no 961010-02**

Report on an underwater repair pressure test for damage to seal surfaces.

### **9. Report from CALtec**

Report on measurement of water locking effect in an SPO compact flange for sub sea use.

### **10. DnV report no 96-3160**

Tests on bolt pre-tensioning equipment and methods for SPO compact flanges.

### **11. DnV report no. 97-3547.**

Reliability evaluation of SPO Compact Flange System. The report documents that the structural capacity and the reliability with regards to leak tightness is of the same order of magnitude as that of a girth weld.

### **12. Prototype test by DnV for revised type approval, DnV report no 98-3430**

To comply with new EU/EES requirements SPO's type approval was revised to provide a basis for CE marking. For this revised type approval an ultimate load test was performed on a 6" Class 1500 SPO CFS Compact Flange to verify the precision of non-linear FEM analysis. Completed June 1998.

### **13. DnV report no. 00-1008.**

Hydrostatic seal test, 16" SPO Compact Flange, Three-point Bending.

Hydrostatic pressure test + ULS and PLS load test of the 16" SPO CFS for Heidrun Gas Export Riser.