

The most appropriate connector for riser applications

## What makes the SPO® Compact Flange the perfect choice

The Vector SPO® Compact Flange is a 100% static connection thanks to its metal-to-metal sealing system and bevelled flange face. Vector SPO® Compact Flanges are designed to be stronger than the pipe they are connected to (have better fatigue properties than the actual weld to the piping) and are a significantly smaller and lighter alternative to the ASME flanges. They are considered the most appropriate connector type for risers. The Vector SPO® CF is the only flange meeting the strict design requirements in DNV-OS-F201 (Dynamic Risers) and ISO 13628-7. A reliability evaluation report from DNV (DNV report 12FQG2F-6) concludes that the SPO® CF is considered amongst the best welded connections with respect to leakage probability.



## Customer Installations

### SPO® Compact Flanges on Snorre A TLP :

SPO® CF was the preferred connector for production and export risers for the Snorre A TLP. Riser installation started in 1991 and in total 1100 SPO® flanges have been installed on the risers for this platform. Sizes: 9 5/8" and 10 3/4". Each riser consists of 23 sections and HX sealrings were used.



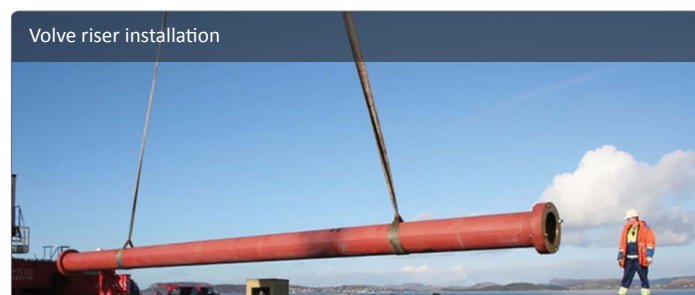
Snorre A TLP



Close-up of HX Sealring. For Riser application HX or IX sealrings can be used.

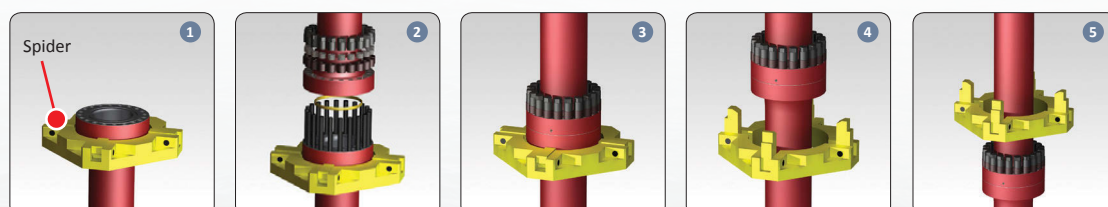
### Statoil Volve Field :

Statoil and main contractor Aker Solutions selected Vector SPO® CF for the risers on the Volve field. Each riser comprises of 8 sections – all joined using SPO® Compact Flanges with IX sealrings.



Vector SPO® CF installed on Volve risers

Typical procedure for installation of risers with SPO® CF



### SPO® main benefits

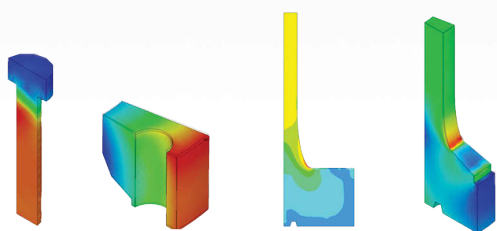
- **Smaller :**  
Save space up to 60% !
- **Lighter :**  
Save weight up to 82% !
- **More reliable :**  
Static, leakfree connection!

## Vector SPO® Compact flanges for flexible flowlines risers

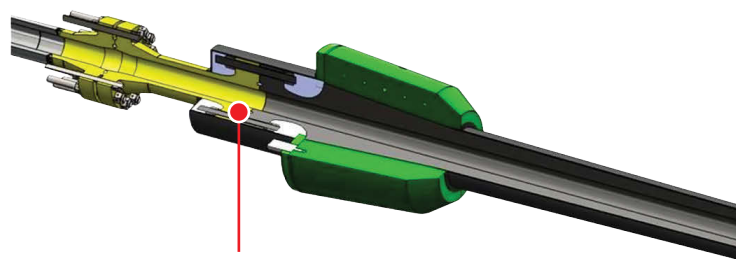
The first use of Vector SPO® Compact flanges on flexible flowlines and risers dates from the early 1990's, when they were installed on Saga's Snorre A and Hydro's Troll B project. Since then, compact flanges have been frequently used both on flexible risers and flexible flowlines. Vector SPO® CF is the end connection preferred by the world leaders within the field of flexible pipe and risers.

## SPO® Compact flanges used for titanium stress joints (RTI)

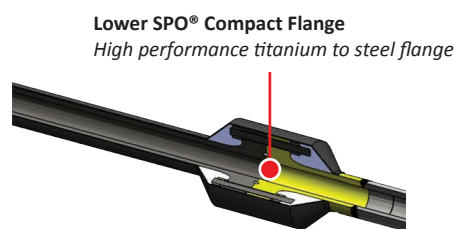
RTI Energy Systems, Inc is the world leader in design and supply of state of the art deep water and ultra-deep water riser titanium stress joints. RTI and Vector (SPO®), now Freudenberg Oil & Gas Technologies, have partnered on many projects since the mid 1990's. State of the art flanges used in combination with state of the art riser technology showcase Vector SPO® CF as one of the most reliable flanges on the market today.



The titanium stress joints are highly loaded with tension and bending moments. Strength and fatigue capacities are always documented using non-linear FEA.



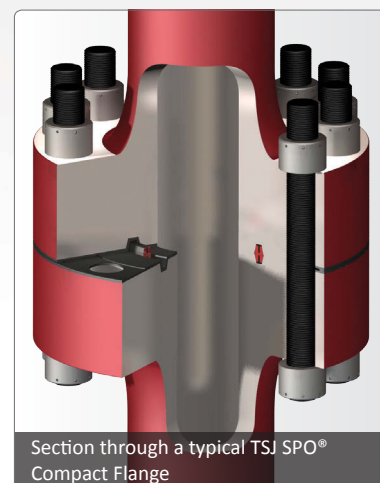
**Upper SPO® Compact Flange**  
High performance titanium to steel flange



**Lower SPO® Compact Flange**  
High performance titanium to steel flange



Flexible riser joint with SPO® Compact Flange (Gjøa)



Section through a typical TSJ SPO® Compact Flange

Courtesy of RTI Energy Systems Inc © 2010

### Vector SPO® Compact Flange in riser applications - some references

Client / Project	Year installed	Remark
Saga Petroleum – Snorre A	1991	1100 flanges, 9 5/8" & 10 3/4", HX-sealring, Water depth 309m
Conoco Norway – Heidrun drilling riser	1994	24" drilling riser in Ti5 material
Statoil – Heidrun Plateau	1999/2000	6", 10" and 16" risers, 280 bars, F65
Statoil – Aker Solutions - Volve	2007 - 2009	Various sizes, F65 with Inconel 625 overlay.
Talisman Energy – Claymore WI	2008	12" Swivel flanges, Cl 1500.
Dong – Aker Solutions – Trym	2010	Danish sector – tie-back to Harald
Petrobras – Technip USA – Cascade - Chinook	2010	The worlds first hybrid riser, design pressure – 10K.
Brynild – Aker Solutions – Lundin	2012	22" Drilling riser, F22 - 80ksi
Numerous projects where SPO® has been used for flexible riser projects	1991-2013	Partners: NKT, Technip (Coflexip), Wellstream
A number of projects where SPO® has been used for titanium stress joints	1995-2013	Partner: RTI Energy Systems Inc