OIL STATES *HydroTech®* Products

Subsea Pipeline Technology

ISO 9001

Swivel-Ring Flange

Facilitates bolt-hole alignment

The HydroTech Swivel-Ring Flange permits rotation of an outer ring around a hub to allow easy alignment of its bolt holes with those of a mating standard flange.

Swivel-Ring Flanges can be designed for any size and pressure rating to meet applicable dimensions and gasket types of any recognized flange specification, such as ASME B16.5, API 6A or MSS SP-44. Nonstandard Swivel-Ring Flanges can also be custom-designed for certain applications; for example, applications involving large pipelines may incorporate features such as hub face profiles to aid axial alignment and Teflon rings between the SRF ring and hub to reduce rotational friction.

Swivel-Ring Flanges are available from stock in diameters from 4 inches through 24 inches, in both 600 and 900 ANSI ratings. Oil States HydroTech has manufactured Swivel Ring Flanges in sizes up to 42-in. OD.

Design Specifications

Swivel-Ring Flanges meet the requirements of *API 6H* and are designed in accordance with *ASME Pressure Vessel Code, Section VIII, Division 2*, unless otherwise specified, and applicable sections of the flange specification to which it will mate.

Ordering Information

Please provide the following information on any purchase order or request for quotation:

- Nominal pipe size
- Pipe wall thickness or bore
- Pipe grade
- Design rating
- Specification of mating flange

3-inch through 24-inch Swivel-Ring Flanges are kept in inventory, in a wide range of ANSI and MSS ratings.

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Beware of under-designed Swivel Ring Flanges

At a glance, Swivel-Ring Flanges look much like standard weld-neck flanges, but that similarity can lead to trouble. There are critical differences that must be addressed when engineering SRFs. In a weld-neck flange, the flange and hub are one piece; in an SRF, the rotating flange and hub are separate.

Typically, 'lightweight' SRFs have a flange ring of the same thickness as a standard weld-neck flange and are easy to spot. In other cases, however, a hub that is too thin can be obscured by a thick flange ring, or the flange might be thicker than a standard weld-neck flange, but is still not capable of carrying the bolt and gasket loading.

Deflection of the flange ring and hub is the typical failure mode of under-designed "lightweight" swivel-ring flanges.

Stresses in both the flange ring and the hub of an SRF are higher than in a conventional weld-neck flange. Unless the design criteria account for these higher stresses, the flange ring and/or hub can fail. The typical failure mode is deflection (dishing) of the flange ring, resulting in a 'lift-off' force in the RTJ gasket. Increasing the bolt loading will not correct this condition and can cause catastrophic failure. One such failure resulted in a diver fatality.

No clear industry standard for SRFs

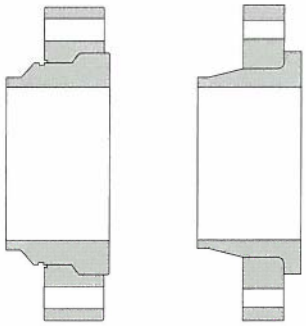
Unfortunately, there has been no clear industry standard for SRFs and, as a result, there is a wide disparity in design criteria used by SRF manufacturers.

ANSI B16.5 is acceptable for weld-neck flanges, but it is not applicable to SRFs because it specifies only the number and size of bolts the gasket to be used, and the minimum thickness of the hub.

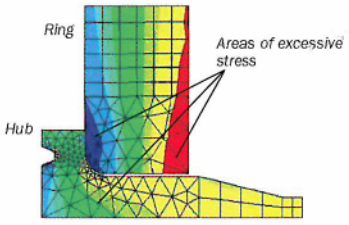
Even using ASME can be misleading. It treats SRFs as 'non-standard flanges' and applies rules for 'Loose type' flanges. Unfortunately, these rules, from 1938, provide no guidance for determining longitudinal, radial, or tangential stresses in the hub portion of an SRF. Article AD-100 (b) does, however, state, "When complete rules are not provided for a vessel or vessel part…a complete stress analysis of the vessel or vessel part shall be performed…".

We have performed a complete stress analysis on several sizes of lightweight SRFs, including 6-inch 900 Class, 8-inch 900 Class, 12-inch 600 Class, and 20-inch 900 Class SRFs.

The figure at right shows scale illustrations of a 10-inch, 600 Class lightweight SRF and a properly designed SRF of the same specifications. The difference in flange and hub thickness is clear. For the lightweight SRF, the flange is the same thickness as a standard 10-inch, 600 Class weld-neck flange. In fact, many of these under-designed SRFs use a bored-out weld-neck flange or blind flange for the rotating ring. Strict compliance with ASME codes will produce a flange thickness as much as twice that of a standard weld-neck flange. The HydroTech SRF weighs 295 lb, compared to the "lightweight" SRF, which weighs only 195 lb.

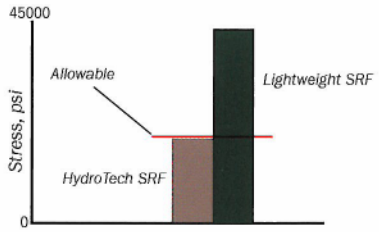


A scaled comparison of 10-in./600 ANSI SRFs clearly shows the design differences. Both the ring flange and the hub of the "lightweight" SRF are undersized.

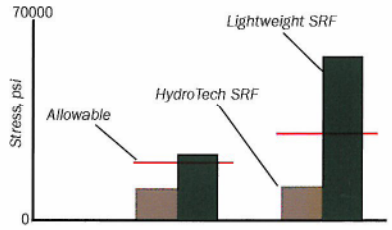


Finite Element Analysis of a "lightweight" SRF of the same dimensions as a standard weld-neck flange.

These lightweight SRFs fail even the basic ASME calculations. As shown in the graphs, the flange ring stress in the tangential mode is more than double the ASME allowable. The hub also fails in both the longitudinal and the radial stress mode. These weaknesses cause the flange ring to deflect as it is tightened and ultimately lead to catastrophic failure if additional load is applied.



Rotating ring tangential stress comparison



Hub longitudinal and radial stress comparison

What to do

1. Specify that the vendor must confirm full ASME design compliance. *Note: specifying an ANSI pressure class does not guarantee an ASME-compliant design.*

2. Specify that a vendor's proposal must include scale drawings with critical dimensional data.

3. Purchase only from approved, pre-qualified vendors.