FEA ON LEAKING FLANGE JOINT UNDER EXTERNAL LOAD

Flange: ASME B16.5 12" 900# flanges

Flange Joint Leaking: Joint No. C in picture

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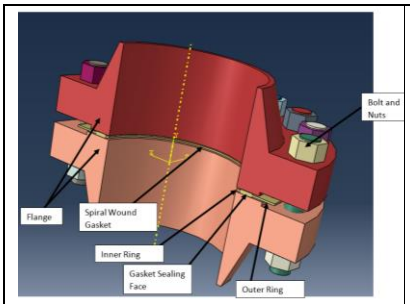
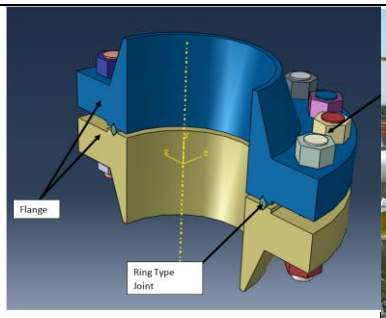
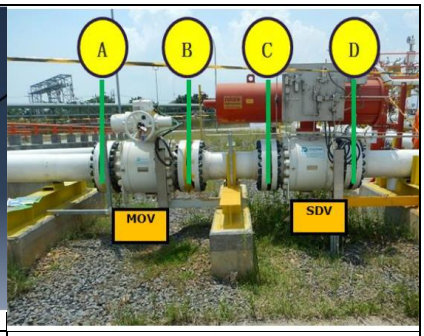
Location: Somewhere in Indonesia

Short Background:

A 12" HP Gas pipeline has a leak on a flange joint (12" 900# RF) at joint No.3. This joint is presently having a spiral wound gasket. Spiral wound gasket at high pressure and with high external load are not recommended by API.

The joint type recommended usually is Ring type joint(RTJ). The company may have selected the wrong design of joint and the joint leaked due to high differential soil settlement(external load). At present, to lower the leak, the plant is operating at reduced pressure and load along with a temporary clamp, as a temporary measure.

		
Pic of a Typical raised face gasket	**Pic of a Typical Ring type joint**	**Leaking at Joint C**

An opportunity is there in Feb 2019 to rectify, however, the shutdown window is small. A permanent solution is required urgently, so as to procure the long lead items before the shutdown. It will take minimum of 2month to get the high strength material at site from date of purchase order placement.

Two options are proposed by the technical team:

1. To change the flanges to Ring type joint(RTJ): This would require hot work modification at site to change out the high stress flanges with RTJ and machining of exsting valve flanges with RTJ grooves. This would also require longer shudown.
2. Use of Pekotek Type gasket: There is no hand calculation to verify this option selection and would rely fully on FEA model and vendor data.

Scope of this project:

To determine if the external load is causing the leak on the existing flange joint and investigate option 1 as a solution if required.

One of the proposed solution, may be to replace the gasket with RTJ type gasket, however would require hot works during a very short shutdown window. The external loads are high and needs to be checked to see if the existing joint will withstand the loads or modification are esstential. Pressure Equivalent and ASME section VIII div.1 hand calculation needs to be carried out for the proposed solution. Also, the solution needs to be confirmed by a FEA analysis as the solution is critical with the amount of modifications required at site and huge cost involved for the modification.

Data provided:

Max/min operating pressure: 100barg/0barg Max/min Temp: 60DegC/0degc Flange Details: Weld neck Flange 12" 900# to ASME B16.5 Gasket as per ASME B16.20: spiral wound gasket with SS and grafite filled(Flexitallic) RTJ : Choice to be Engineered.	**Material** (ASTM A694 Gr.65)Allowable as per MSS SP-44: SIZES 12-36 incl. MPa / ksi Longitudinal Hub Stress 205 / 30 Radial Flange Stress 140 / 20 Tangential Flange Stress 140 / 20 Average Stress 140 / 20 Bolt Stress (2½" and Smaller) 140 / 20 Bolt Stress (Larger than 2½ ") 140 / 20	**External Load at the flange:** $F_{Resultant}$ = 12,095N $M_{Resultant}$= 78,639N.m.

Proposed FEA Models: Use of Axisymetry 3D model and contact interaction.