

**AN EXTENSION TO “ALLOWABLE DESIGN FACTOR” METHOD FOR FREE SPAN
CALCULATION OF SUB SEA PIPELINES**

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ABSTRACT

Using the design factors is a traditional method in solid mechanics design. This method is still also the base of some design standards in the world [1,2]. In this paper, a modification has been performed to traditional Von Misses stress check method for the calculation of sub sea pipeline free spanning.

The DNV OS F101 which is a well known standard for sub sea pipelines has been used for calibration [3]. A spread sheet type program for free span calculation has been developed for “Force Model” which facilitates the evaluation of the free span length based on the latest DNV proposed method as well as traditional Von Misses stress check. The method statement is the calculation of maximum allowable sub sea pipeline free span, by DNV proposed method and consequently evaluation of allowable stress to result the same free span length in Von Misses traditional method. The design factors which are the Stress Factors (SF) will be calculated by the ratio of existing equivalent Von Misses stress to yield strength of the pipeline material (f_y).

ASSUMPTION

There are a lot of parameters to be considered in the free span calculation. For calibration purposes, as mentioned above, the following assumption has been set:

- 1- Internal pressure is greater than external pressure; hence the equation 8.23, D800 of section 8 of DNV OS F101 applies [3].
- 2- The pipeline is on the seabed.
- 3- Water depth is 40 m and wave height and period 11.7 m & 11.0 secs respectively. For wave characteristic calculation, the Airy Wave theory has been used.
- 4- The water current of 1.5 m/s at surface and 0.5 m/s for sea bed have been considered. The power equation of (1/7) has been used for current profile calculation.
- 5- The water temperature has been considered 13 °C.
- 6- Pipeline material selected is API 5L X52.
- 7- The sub sea pipeline is assumed to be in operating condition.
- 8- The sub sea pipeline considered is “restrained”.
- 9- The study has been performed for two safety classes: “high” and “normal” as defined in section 2, C800 of DNV OS F101 [3].