

## **STATISTICAL METHOD TO REQUALIFY STEEL GRADES DURING CONVERSION OF TANKERS TO FPSO**

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### **ABSTRACT**

During ship life, operating conditions may change, tanker may be converted into FPSO, and flag requirements may be modified. Generally these modifications have few impacts on existing structures; flag requirements only rarely are to be applied retroactively. Nevertheless in some cases modifications of operating condition may induce considerable consequences, making in the worst cases impossible any reengineering. For example converting a common tanker, built with plain steel of grade A into an Offshore Floating Unit able operating in cold region, may require a grade change corresponding to a grade B. It is obviously meaningless to replace all material just because material certificates.

Steels used by shipyards have to fulfill Classification society's requirements dealing with mechanical strength; generally shipbuilding corresponds to a small part of steelmaker's production. For this reason steelmakers are reluctant to produce steels with mechanical properties corresponding exactly to the minima required. They generally deliver steels already in stock, with higher mechanical characteristics than required. In this case it can be taken advantage of this common practice. In order to demonstrate that the material fulfill the requirements of grade B it has been decided to adopt a statistic approach. At this stage there are two main issues, the first one is that it is needed to provide evidences that the actual material Charpy V characteristics fulfill the requirements of grade B; the second one is to provide these evidences with a minimum testing. To assess this

assumption a random check has been carried out. Different probabilistic model have been tested in order to check common approaches and probabilistic model based on physical considerations. In the paper the main assumptions for estimating the minimum Charpy value main assumption in the probabilistic models are recalled, the behavior of empirical sample is examined, the parameters of probability laws fitting the empirical distribution and definitely as accuracy of probability law parameters determination is not perfect with a finite number of specimens the uncertainty in the determination of parameters is taken into account with confidence limits.

According to the selected probabilistic model the minimum value corresponds to an acceptable probability of failure, taking into account the target confidence level, or is independent of any acceptable probability of failure and is defined with the same confidence level. At the end it is concluded that a random check with a data treatment assuming a random distribution of Charpy V test results distributed according to a Weibull probability law of the minimum allows providing evidences that with a sufficient confidence level the steel used for the considered structure fulfill the requirements of the new operating conditions.

### **INTRODUCTION**

The selection of steel grades for ship building mainly depends on the expected service temperature. When a tanker is converted into a FPSO, it is considered that the FPSO will stay on a production site; service temperature is linked with the