OUR WORK

ROLLER CHUTE

Head Office: PDL Solutions (Europe) Ltd

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PDL ENGINEERS SUPPORTED A WORLD LEADER IN SUBSEA UMBILICAL SOLUTIONS TO ASSESS THE SUITABILITY OF A NEW DESIGN OF ROLLER CHUTE

PDL is a global provider of exemplary engineering design and analysis consultancy services. Our engineering capabilities mitigate risk, shorten development timescales and reduce development costs.

PDL engineers supported a world leader in subsea umbilical solutions to assess the suitability of a new design of chute for the installation of umbilicals. The new roller chute was designed with the intention of reducing friction when installing umbilicals.

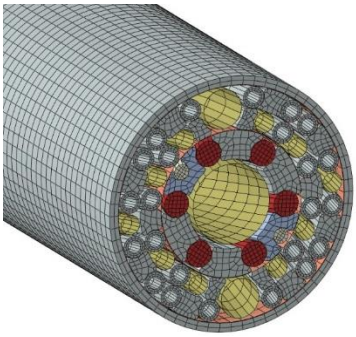

Figure 1: One of the umbilicals assessed

THE ENGINEERS WERE RESPONSIBLE FOR CONDUCTING DYNAMIC 3D FINITE ELEMENT ANALYSIS (FEA) ON A RANGE OF UMBILICAL DESIGNS

PDL engineers spent a number of weeks working on-site in the North East, supporting the client's Research and Development team. The engineers were responsible for conducting dynamic 3D finite element analysis (FEA) on a range of umbilical designs, using the Abaqus software package. The purpose of the analysis was to determine whether the deformation and stresses in the umbilical components was within acceptable limits when the umbilical was wrapped around the new chute design under tension.

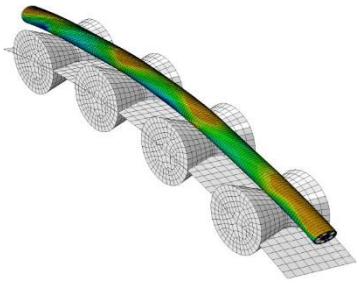

Figure 2: Stress in the umbilical sheave under load

Once the base system had been replicated, a range of environmental conditions were applied to the model using input Marcos. Irregular wave theory (JONSWAP), was used to run multiple analyses accurately modelling North Sea storm conditions and to capture the tensions in the system. To order to reduce run time and estimate a design life for the system, 1, 10

Two umbilicals were initially assessed, one relatively small and stiff umbilical, the other a significantly larger design. The first contained a number of steel tubes of varying sizes and power

THE ANALYSIS WAS RUN IN THREE LOAD STEPS, SO AS TO MOST ACCURATELY REPRESENT THE REALITY OF THE PROCESS

cables, the second contained a greater number of tubes, power cables and additionally fibre optic cables. For each umbilical, a 3D model was created, with the components helically wound in opposing directions on the two internal layers. The rollers were created initially as rigid surface bodies, and later as solid models including a compliant elastomeric coating.

In order to be able to determine the damage experienced within the steel tubes, 'spiders' or weak springs were used at every element along the length of each tube, so that the ovality could be determined. Due to the limiting ovality being the residual ovality, 2D analysis was conducted to determine the loaded ovality which corresponded to the limiting residual ovality.

The analysis was run in three load steps, so as to most accurately represent the reality of the process. Firstly, a pre-tension was applied, then the umbilical was wrapped around the rollers under constant tension, before the end tension was ramped up to failure. The purpose of doing this, was to determine the limiting end tension on the umbilical, based upon the damage limits of the contained tubes.

PDL engineers undertook several analysis developments in order to ensure that the design of the rollers was suitable for use and would not cause damage to the tubes contained within the umbilicals.

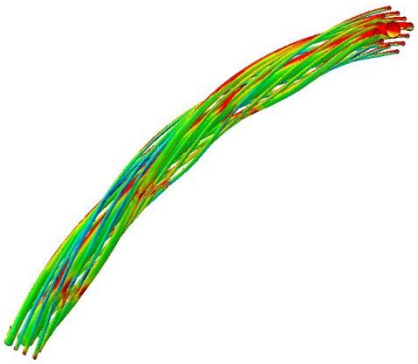

Figure 3: Stress in the tubes under tension

For further information regarding PDL's engineering capabilities please email: solutions@pdl-group.com or phone our head office.