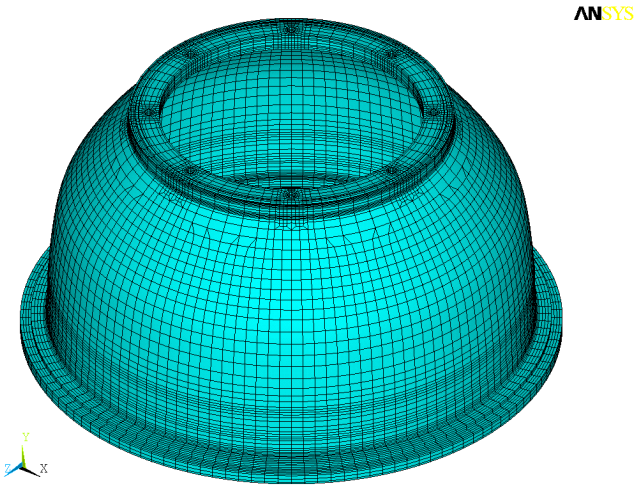
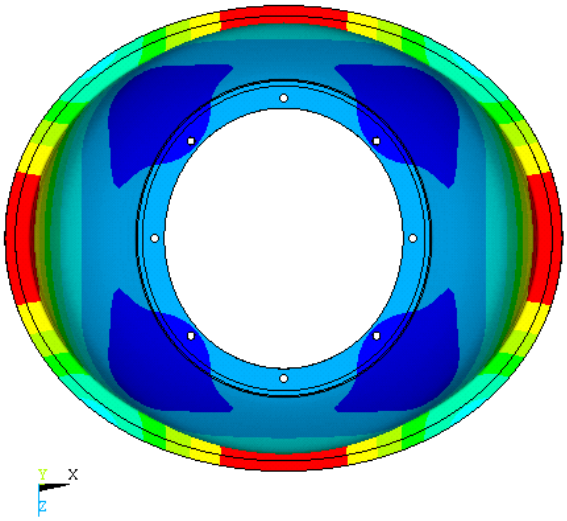
LIMIT LOAD ANALYSIS OF DRY MATING SKIRT

To meet the requirements of most design codes, submarine equipment subject to external pressure needs to be built to tight dimensional tolerances so as to ensure a safe margin against buckling. FCL have carried out several assessments on subsea equipment which, for various reasons, have failed to meet the specified dimensional tolerances and have therefore required special consideration to prove the adequacy of the designs.

One example of this type of assessment involved a submersible dry mating skirt which, because the form of the forging supplied to manufacture the item made it impossible to attain the required hemispherical geometry, had to be machined to an alternative shape with a radial deviation of approximately 11mm from the true spherical form at a location approximately halfway around the hemisphere.





As the proposed departure from the true form was in excess of design code dimensional tolerances, it was decided that non-linear buckling analyses should be carried out to establish the structural behaviour of the skirt. This was achieved by undertaking a series of analyses using ANSYS finite element software, starting with a linear eigenvalue bifurcation instability buckling analysis to establish an appropriate mode shape for application of a further imperfection corresponding to the specified machining tolerance of +/-0.8mm and, culminating with a non-linear buckling analysis, using material specific stress-strain data, to establish the limit load of the structure.

The work demonstrated that, despite the need to introduce a significant radial deviation from the true spherical form, the skirt was able to withstand an external pressure of approximately 2.5 times the required external test pressure, enabling a concession to be granted which allowed use of the supplied forging to manufacture the skirt.

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