ABSTRACT

Subsea camera is an important facility for offshore engineering in deepwater, whose shell structure is designed and analyzed with the DBA (Design by Analysis) method for its high external pressure. Both the plastic collapse and buckling collapse analyses are carried out with the finite element method. Several types of analyses which are introduced in ASME BPV Code VIII-2 and EN13445 are done to get the collapse pressure. Elastic and elastic-perfectly plastic material models are used. The allowable pressure loads are compared by adopting the design factors in ASME and EN13445. The results show that the long and short shell buckling theory is not suitable for this kind of shell. ASME limit-load plastic collapse and elastic-plastic buckling collapse methods are recommended for the design.

KEY WORDS: Subsea; shell structure design; finite element method; plastic collapse; buckling collapse.

NOMENCLATURE

$E$ : elastic modulus
$\mu$ : Poisson’s ratio
$n$ : instability wave number

INTRODUCTION

As the offshore oil exploration reaches deeper water, development of general equipment which is widely used in deepwater exploration becomes an important field for the offshore industry. For example, during the offshore pipe-laying procedure, ROV that is equipped with subsea cameras is always applied to investigate the shape and position of pipe under water to guarantee the continuity and safety of the process. In addition, after the offshore pipe laying has been finished, ROV is also needed to inspect and test the external surface of the pipeline with subsea cameras. Therefore, subsea cameras play an important role in offshore oil exploration. The shell structure of the subsea camera in deep water must resist to very high external water pressure and the material selection and structural design is one of the key problems in the design of the subsea camera. In the US, a kind of subsea camera that can be used in six thousand water depth (Sidus Solutions, 2010) has been developed, which is shown in Fig. 1.

Fig. 1 Sidus (2010) subsea camera in deep water