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## Developments in Watertight Integrity on Floating Offshore Installations

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### Abstract

The hurricane seasons in 2005 and 2004 have highlighted the need for a better understanding of flooding hazards and the associated requirements for internal and external watertight integrity on mobile offshore drilling units and floating production installations. The American Bureau of Shipping has made significant changes regarding subdivision and watertight integrity to the ABS MODU Rules since they were first published in 1968, and is in the process of studying further changes for both MODUs and production installations. The relevant requirements as of 2006 are discussed, along with proposed modifications based on lessons learned in the Classification of the latest generation of MODUs, spars, tension leg platforms, and semisubmersible production installations including observations from the recent hurricane seasons. The proposed changes are aimed at limiting water ingress and preventing progressive flooding, and they address issues such as controls and alarms for watertight doors and hatches, protection of external ventilation openings, locations and types of valve controls, and measures for ensuring watertightness of penetrations for cables and ventilation.

### Introduction

The Rules and Guides of the American Bureau of Shipping (ABS) have been applied in the design and construction of many offshore drilling units and production installations, particularly in the United States Gulf of Mexico. In addition to their use in Classification of these facilities, they are specifically referenced by, or share common background and requirements with, the United States Code of Federal Regulations<sup>1</sup> (CFR) as the relevant design and construction standard to be applied in association with registering an installation under the United States flag or when applying for a Certificate of Inspection (COI) to operate on the U.S. Outer Continental Shelf (OCS).

The principal documents from the standpoint of hull structure and stability are the *Rules for Building and Classing Mobile Offshore Drilling Units*<sup>2,3</sup> (also known as the MODU Rules), the *Rules for Building and Classing Steel Vessels*<sup>4</sup> (SVR), and the *Guide for Building and Classing Floating Production Installations*<sup>5</sup> (FPI Guide). There are numerous additional Rules, Guides, and Guidance Notes which are referenced therein.

The requirements for stability, ballasting, and watertight and weathertight integrity have been taken mainly from the MODU Rules to date.

### Stability Criteria

The first stability criteria for Mobile Offshore Drilling Units (MODUs) were published in the ABS MODU Rules in 1968. This was a significant step as stability requirements for ships had typically been contained in statutory regulations rather than Classification Rules.

The MODU stability criteria have evolved to the present day while retaining the separation between specific requirements for column stabilized, self elevating units, and surface units due to the differing stability characteristics of each type. The column stabilized unit is usually a semisubmersible but may also refer to a submersible (bottom sitting) unit in its afloat mode. Self elevating unit stability is for the jackup unit while in transit. The surface unit requirements are applicable to ships and barges.

There are two conditions for which stability calculations were to be presented: intact and damage.

### Intact Stability

For the intact case, an assumed environmental effect equivalent to a 100 knot wind was applied in the 1968 MODU Rules. Stability criteria from this point onward have used wind as the representation of environmental force since it is easily calculated and applied.

Under the influence of the 100-knot wind, a minimum excess righting energy had to be demonstrated over the wind heeling effect; this was expressed as an "area ratio" under the righting and heeling moment curves. The measure of external watertight integrity was the non-immersion of any unprotected opening within the range of the righting energy required to meet the excess energy requirement. This was referred to as