

The ABS Underwater Rules

Insight into how they change with the times

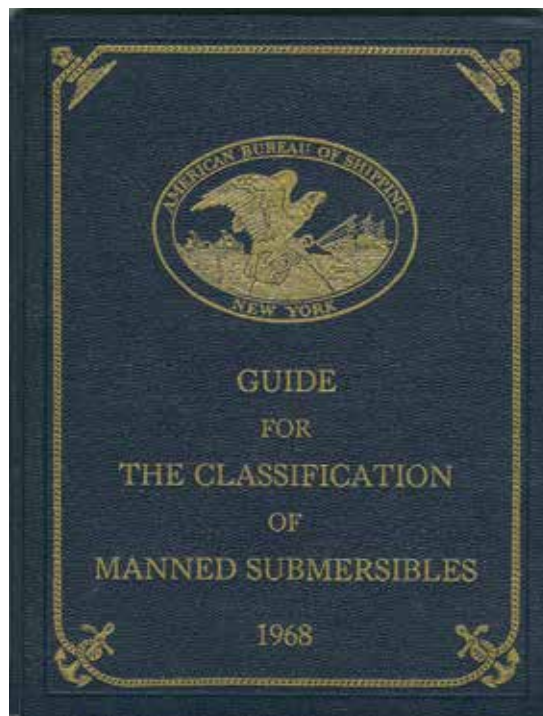
BY ROY THOMAS

The American Bureau of Shipping (ABS) *Rules for Building and Classing Underwater Vehicles, Systems and Hyperbaric Facilities*, commonly known as the Underwater Rules, are the primary ABS rules for classification of underwater units. These underwater units include manned submersibles, lock-out submersibles, diving systems, atmospheric diving suits, remotely operated vehicles (ROVs), autonomous underwater vehicles (AUVs), and so forth, that are used for commercial, scientific, and government applications.

The use of manned submersibles for commercial and scientific applications reached its zenith in the 1960s and early 1970s. In the mid-1960s, owing to there being few commercial standards for manned submersibles, ABS was approached by industry representatives and by the United States Navy to prepare standards for the design and construction of manned submersibles. ABS subsequently began the laborious effort of collecting and evaluating operational data, reviewing published literature, and developing the minimum requirements for the classification of manned submersibles. To assist with this effort, a Special Committee on Submersible Vehicles was established, made up of industry stalwarts such as Jacques Piccard and John Pritzlaff, as well as representatives from the navy; the United States Coast Guard; the Massachusetts Institute of Technology; Woods Hole Oceanographic Institution; General Dynamics; General Electric; and Lockheed Missiles and Space Company. This effort resulted in the publication in 1968 of the *ABS Guide for the Classification of Manned Submersibles*, a pioneering document and the first guide on manned submersibles to be offered by any classification society.

From the late 1960s through the 1970s, ABS gained extensive experience in the classification of underwater systems and vehicles. This experience was leveraged to update the 1968 guide and publish the *ABS Rules for Underwater Systems and Vehicles* in 1979. In addition to addressing manned submersibles, these rules included new requirements for diving bells, deck decompression chambers, and handling systems.

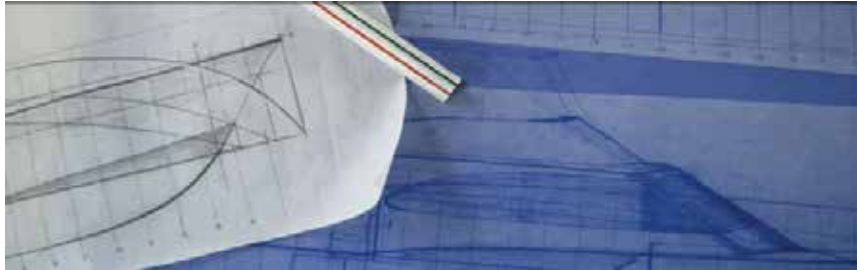
Continuing its pursuit of improving and developing standards to meet the needs of the industry as well as addressing technological advancements, ABS



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published *Rules for Building and Classing Underwater Vehicles, Systems and Hyperbaric Facilities* in 1990, which included specific requirements for passenger carrying submersibles. Over the next decade, these rules were periodically updated, and in 2002, ABS released an updated version of *Rules for Building and Classing Underwater Vehicles, Systems and Hyperbaric Facilities*.

In late 2005, in the aftermath of hurricanes Rita and Katrina, the subsea industry witnessed a surge in demand for commercial diving systems to carry out repair and salvage work in the Gulf of Mexico. Over the next few years, ABS classed numerous commercial diving systems, including saturation, mixed gas, and air diving systems. The experience and lessons learned from this effort were used to update the rules and subsequently introduce a detailed new chapter on diving systems in the 2010 update of *Rules for Building and Classing Underwater Vehicles, Systems and Hyperbaric Facilities*. A major change in



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The ABS Underwater Rules *continued*

these rules was that the general requirements applicable to any underwater unit were separated from the specific requirements applicable to a particular type of unit.

Over the next few years, ABS updated the rules to include new chapters on lock-out submersibles (2012), atmospheric diving suits and systems (2014), ROVs (2014), AUVs (2014), and ambient-pressure submersibles (2016). Updated editions of the rules were released in 2012, 2014, 2015, and 2016. The current, as well as archived editions, of the rules are available for free downloading from the ABS Web site at www.eagle.org.

Rules update process

As with the other ABS rules, the Underwater Rules are considered to be living documents and are regularly updated following a process that involves review by ABS subject matter experts and industry-based technical committees. Members of these committees include owners, operators, builders, and underwriters, as well as representatives from flag administrations and government agencies. Through this process, the Underwater Rules can be tailored to accommodate new technologies, novel applications, and unique approaches in the design, construction, operation, and maintenance of underwater units.

Proposed rule changes can be initiated by any member of the industry or ABS engineers/surveyors. As the first step, rule change proposals undergo a technical evaluation by ABS subject matter experts and are updated as necessary. Thereafter, rule change proposals are reviewed by members of the ABS Special Committee on Underwater Systems and Vehicles. Members of this committee include experts from the subsea industry with approximately 20 to 40 years of experience in design, fabrication, and operation of underwater units. Committee members review rule change proposals and provide feedback, which determines how the rules are updated. Thereafter, rule change proposals are submitted to the ABS Marine and Offshore Technical Committees for their review and feedback. Once again, rule change proposals are updated as necessary to address the feedback from the technical committees.

As the final step in the approval process, rule change proposals are reviewed by the ABS Rules Committee (an internal ABS approval committee). Upon approval from this committee, changes are incorporated into the rules and become effective on the date specified by ABS. Typically, this date is not less than six months from the date on which the rule changes were approved by the ABS Rules Committee. When necessary, however, individual rule changes can be brought into force before the six month anniversary.

Areas addressed

The Underwater Rules specify the minimum requirements for classification of underwater units. The components and

systems covered by the rules typically include items that are necessary to operate and maintain the underwater unit throughout its life cycle. The rule requirements for these components and systems principally address design, fabrication, testing, and survey.

In the 2016 Underwater Rules, the first ten chapters address the general requirements applicable to any type of underwater unit. These general requirements cover the following components and systems:

- metallic pressure boundary components
- acrylic windows and viewports
- life support systems
- piping systems
- electrical systems
- mechanical equipment.

The subsequent nine chapters of the 2016 Underwater Rules address the specific requirements for different applications, including the areas that follow.

Manned submersibles. This chapter is intended for recreational, research, and passenger carrying submersibles. Based on industry feedback, these requirements have been updated and fine-tuned periodically since the 1960s and at present offer one of the most advanced set of requirements for the classification of manned submersibles.

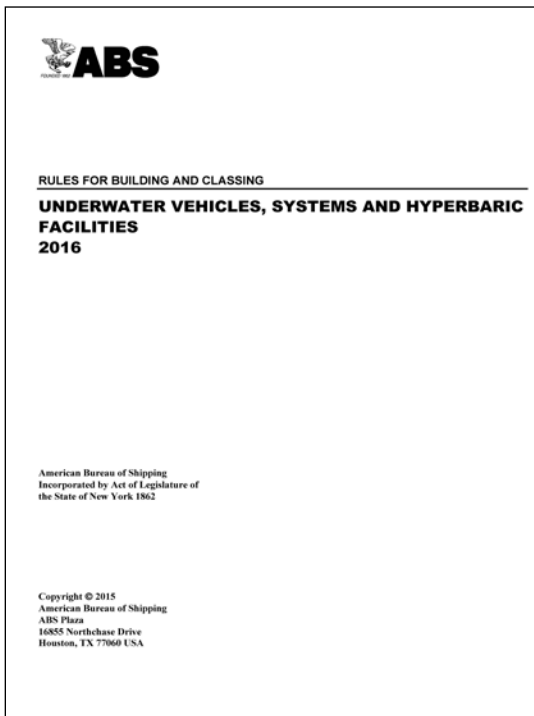
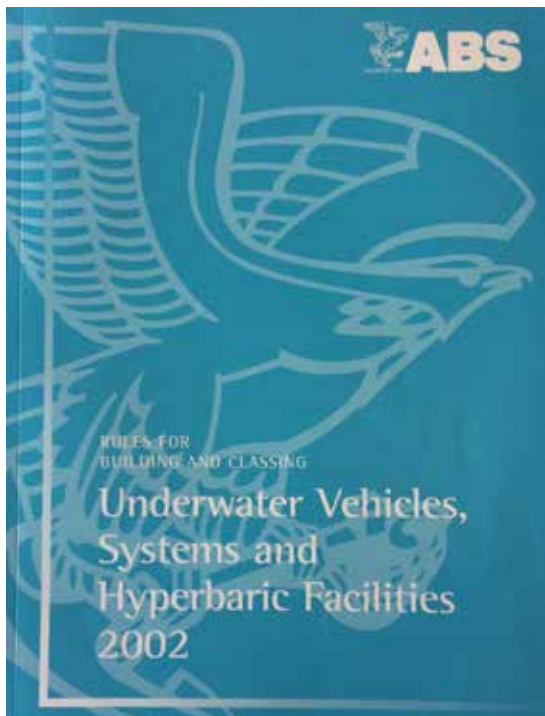
Lock-out submersibles. This chapter addresses submersibles used for diver lock-out applications. Before the advent of ROVs, submersibles were widely used in the oilfield for inspection, maintenance, and repair purposes. Recently, there has been a renewed interest in the military application of these submersibles.

Ambient-pressure submersibles. This chapter addresses wet, semi-dry and dry ambient-pressure submersibles. Submersibles of this type typically are used for recreational and military applications.

Diving systems. This chapter addresses saturation systems, which typically are used for deep-diving applications for extended durations. The subject chapter also addresses mixed gas and air diving systems, which typically are used for intermediate and shallow water diving applications, respectively.

Atmospheric diving suits and systems. This chapter addresses anthropomorphic single-person suits that have articulated limbs and are designed to withstand external pressure. The suits generally are used for subsea inspection, maintenance and repair, and salvage applications. This chapter also addresses the support systems for these suits, including their support stands, control stations, and handling systems.

ROVs. This chapter addresses observation vehicles, work class vehicles, seabed-working vehicles, and prototype/development vehicles as well as hybrid ROVs. Based on their category, ROVs are used for a variety of purposes, including



LEFT: An updated edition of the rules was introduced in 2002.
RIGHT: The current version of the Underwater Rules, published in 2016.

observation, subsea work, salvage, subsea mining, and testing/experimentation. This chapter also addresses support systems for these ROVs, including their control boxes/stations and handling systems.

AUVs. This chapter addresses vehicles that are completely autonomous as well as hybrid vehicles that can operate in the AUV or ROV mode. These vehicles typically are used for subsea survey and reconnaissance activities by the commercial and scientific community, as well as by the military.

Handling systems. This chapter addresses lifting appliances that are used for launch and recovery applications. These systems typically are used for handling manned submersibles, diving bells, ROVs, AUVs, and so forth.

Dive Control Stations. This chapter addresses control stations that could be used for a variety of applications, including diving systems, ROVs, and so forth.

Outside the rules

Classification society rules normally cover only the minimum requirements for classification and are not intended to be build/design specifications. When fabricating a newbuild underwater unit, the detailed build/design specification has to be developed separately by the designers/builders. Items in these specifications that are over and above the

class requirements need to be agreed upon with unit owners/operators.

Classification society rules do not address flag or coastal administration requirements. The Underwater Rules also do not address qualification requirements for personnel operating underwater units. Such requirements typically are covered by the flag administration requirements, with compliance being the responsibility of the owner/operator.

The Underwater Rules typically do not address military specific features and attributes, which would be addressed by supplementary requirements that would be developed jointly by the naval/military technical authorities and ABS. Such supplementary requirements have been developed and used successfully to class applications, such as the handling system for the navy's Submarine Rescue Diving and Recompression System.

As the industry strives for innovation, efficiency, and competitive advantage, ABS remains prepared to consider alternative arrangements or novel designs that can be shown—either through satisfactory service experience or systematic analysis based on sound engineering principles and risk assessment—to meet the overall safety standards of the Underwater Rules. **MT**

Roy Thomas is engineering manager at ABS.