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Ships and marine technology — Submersibles — Vocabulary

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Foreword

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Introduction

Many countries have the technology and ability to design, construct and operate submersibles, together with the industrial capability and resources to support safe and effective submersible operations. To enable greater international understanding and collaboration between participating regions, operators and manufacturers, it is advantageous to use a common set of terms and concept definitions. This will result in several benefits including facilitating comparison of products, contributing to innovation, reducing misunderstanding, improving efficiency and enabling international trade. In essence, standardized terminology is fundamental to a series of standardization activities of submersibles.

Ships and marine technology — Submersibles — Vocabulary

1 Scope

This document provides basic terminology and concepts related to submersibles. It covers 11 aspects of terminology related to submersibles: types, performance, structural system, mechanical system, electrical system, acoustic system, control system, surface system, work pattern, test and maintenance and personnel.

It is not applicable to particular conditions, such as the classification and construction of submersibles.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1 Types

3.1.1
submersible
type of powered vessel that can travel and manoeuvre underwater

3.1.2
manned submersible
submersible (3.1.1) that encloses one or more persons within its *pressure hull* (3.3.2), fitted with one or more available surface accesses, or underwater pressurized or non-pressurized accesses

3.1.3
tethered submersible
submersible (3.1.1) with an *umbilical* (3.8.1) or *tether* (3.8.2) attached to the surface, *support ship* (3.8.4) or underwater structure

3.1.4
untethered submersible
submersible (3.1.1) without an *umbilical* (3.8.1) or *tether* (3.8.2)

3.1.5
transport submersible
manned submersible (3.1.2), designed for the movement of cargo, equipment or *passengers* (3.11.3) in addition to *crew* (3.11.2) underwater, for recreation, scientific expedition, rescue or other purposes

3.1.6
passenger submersible
passenger-carrying mobile vessel, which primarily operates under water and relies on surface support

[SOURCE: IMO MSC/Circ. 981, 1.2.12]

3.1.7
deep submergence rescue vehicle
DSRV
submarine rescue vehicle
SRV
manned submersible (3.1.2) and *untethered submersible* (3.1.4), specifically designed to evacuate persons from a disabled or distressed submarine using an underwater mating interface to create one or more dry personnel transfer structures under normobaric or hyperbaric conditions

3.1.8
lock-out submersible
manned submersible (3.1.2) and *untethered submersible* (3.1.4), equipped with a lock-in or lock-out chamber and access hatch for entry, egress and accommodation of a diver or *divers* (3.11.4) with an adjustable *operating pressure* (3.2.8) capability

3.1.9
towed submersible
tethered submersible (3.1.3) towed by a power-driven vessel with depth and attitude adjustment ability

3.1.10
atmospheric diving suit
ADS
anthropomorphic and single-person *tethered submersible* (3.1.3) with manually operated articulated arms and/or legs, which can perform related underwater tasks, withstanding external pressure and maintaining internal pressure at or near one atmosphere

3.1.11
dry diving bell
manned submersible (3.1.2) and *tethered submersible* (3.1.3), equipped with a hemispherical frame and specialized apparatus for transferring persons between the underwater site and deck or the *deck compression chamber* (3.8.6) of a *support ship* (3.8.4) for operation, rescue or other purposes

3.1.12
saturation diving system
complex of functionally integrated technical means, devices and facilities in which a *diver* (3.11.4) is exposed to hyperbaric pressure for a period until the diver's blood and tissues have absorbed all the gas

Note 1 to entry: The time required for decompression becomes constant at this hyperbaric pressure after the diver's blood and tissues have absorbed all of the gas.

3.1.13
seabed laboratory
submersible (3.1.1) designed to conduct a field inspection and support a long-term underwater habitat for persons or other creatures for an in-situ test

3.2 Performance

3.2.1
life expectancy
designed number of dives that a *submersible* (3.1.1) can complete safely before requiring an appropriate technical engineering review of its structural integrity to ensure it can again be safely operated underwater

3.2.2
design mission time
time period for a *submersible* (3.1.1) from launch to recovery, when the designed mission is performed under operating conditions defined by the manufacturer

3.2.3
working time
time period which consists of *design mission time* (3.2.2), excluding the processing time of the *launch and recovery system* (3.8.5) and the related surfacing and submerging

3.2.4
bottom time
time during which a *submersible* (3.1.1) is permitted to sit on seabed

3.2.5
light weight
air mass of a complete *submersible* (3.1.1) including all its permanently installed components, liquids and gas in machinery and *piping* (3.4.16) to their working levels as defined by the manufacturer, but excluding consumables, *payload* (3.2.6), persons and effect

3.2.6
payload
passengers (3.11.3) from the *transport submersible* (3.1.5), rescued persons from the *deep submergence rescue vehicle* (3.1.7) or other items carried by a *submersible* (3.1.1) in addition to the *crew* (3.11.2), *pilot* (3.11.1) and permanently fitted equipment, performing the specific mission

3.2.7
operating depth
depth in metres of water (seawater or fresh water) for which a *submersible* (3.1.1) normally operates

3.2.8
operating pressure
pressure which a *submersible* (3.1.1) withstands to operate normally

Note 1 to entry: It is expressed in megapascals (MPa).

3.2.9
design depth
maximum *operating depth* (3.2.7) to which a *submersible* (3.1.1) is designed to dive safely, as measured from the surface to its keel

3.2.10
design pressure
maximum pressure which a *submersible* (3.1.1) can withstand to dive safely

Note 1 to entry: It is expressed in megapascals (MPa).

3.2.11
collapse depth
depth at which a submersible's *pressure-resistant structure* (3.3.1) is predicted to fail, causing the *pressure hull* (3.3.2) to collapse

3.2.12
collapse pressure
external pressure which is liable to causing the *pressure-resistant structure* (3.3.1) to collapse

3.2.13
test depth
pre-determined depth used to enable safe pressure testing of the *submersible* (3.1.1) during manufacture and through life certification of the vessel

3.2.14
test pressure
pressure withstood by the *pressure-resistant structure* (3.3.1) of a *submersible* (3.1.1) during tests such as the *tightness test* (3.10.13) or the *hydrostatic pressure test* (3.10.14)

3.2.15
life support system
equipment and systems required to maintain a *manned submersible* (3.1.2) in a habitable condition in all anticipated operating conditions

[SOURCE: IMO MSC/Circ. 981, 1.2.6, modified — "the passenger submersible craft" has been replaced by "a manned submersible" in the definition.]

3.2.16
breathing air supply system
equipment providing breathing air to the *manned compartment(s)* (3.3.3) while a *manned submersible* (3.1.2) is surfaced or submerged

[SOURCE: ISO 22252:2020, 3.7, modified — ”the submersible” has been replaced by ”a manned submersible” in the definition.]

3.2.17
carbon dioxide removal
apparatus removing carbon dioxide from the pressure hull for persons within a *manned submersible* (3.1.2) during its underwater operation and observation

3.2.18
diving and operation training simulation system
system that can simulate the physical appearance, internal structure, underwater view, operation procedure and fault response of a *submersible* (3.1.1), with a view to reducing training cost, improving training efficiency and ensuring training safety

3.3 Structural system

3.3.1
pressure-resistant structure
material structure capable of withstanding external pressure from the water column in which a *submersible* (3.1.1) is designed to operate, or internal pressure from the *pressure hull* (3.3.2)

Note 1 to entry: A pressure-resistant structure includes the lock-in or lock-out chamber, *viewport* (3.3.4), *buoyancy material* (3.3.7) and other relevant equipment.

3.3.2
pressure hull
shell capable of withstanding the internal and external *design pressure* (3.2.10), in which occupants and the required equipment are housed

[SOURCE: ISO 21173:2019, 3.7, modified — "external pressure" has been replaced by "external design pressure" in the definition.]

3.3.3
manned compartment
compartment within the *pressure hull* (3.3.2) designed to accommodate persons inside a *manned submersible* (3.1.2)

3.3.4
viewport
penetration (3.3.15) in a *manned submersible* (3.1.2) including *window* (3.3.5), flange, retaining ring, and *seal* (3.3.16)

[SOURCE: IMO MSC/Circ. 981, 1.2.18, modified — "the pressure boundary" has been replaced by "a manned submersible" in the definition.]

3.3.5
window
material which is a transparent, impermeable, and pressure-resistant insert in the *viewport* (3.3.4)

Note 1 to entry: There are several shapes of window, such as hemi-spherical window, full-scale window, model-scale window, flat window and conical window.

[SOURCE: ASME PVHO-1–2019, Appendix II]

3.3.6
medical lock
small pressure-tight chamber for transferring small items such as medicine, tools and food across the *pressure hull* (3.3.2) within a *manned submersible* (3.1.2)

3.3.7
buoyancy material
pressure-resistant material for a *submersible* (3.1.1), whose density is lower than that of the operating ambient medium

3.3.8
framework
space frame structure for installing instruments and devices for a *submersible* (3.1.1), such as *battery enclosure* (3.5.4), *releasable ballast device* (3.4.5) and *buoyancy material* (3.3.7), which is also the main load-carrying structure for the *launch and recovery system* (3.8.5) and *deck lashing* (3.3.20)

3.3.9
light external shell
external shell which forms a hydrodynamic shape for a *submersible* (3.1.1) and prevents its internal instruments and devices from surface wind and wave shock

3.3.10
guy eye
perforated metal piece located on a *submersible* (3.1.1) for the attachment of guy tackle

3.3.11
lashing point
point of strength, located on a *submersible* (3.1.1) for *deck lashing* (3.3.20)

3.3.12
lift point
point of strength, located on a *submersible* (3.1.1) for lifting during its launch and recovery process

3.3.13
bottom-sitting plate
part of a *submersible's* (3.1.1) structure designed to enable it to safely rest or sit on the seabed or platform

3.3.14
adhesively attached part
adhesively attached fitting
part or fitting which is bonded inside a buoyancy block by a specially formulated adhesive to facilitate assembly and disassembly of *buoyancy material* (3.3.7)

3.3.15
penetrator
pressure-tight penetrating structure, pipework or fitting which allows equipment, cabling and gas, air or hydraulic supplies to be inserted into the *pressure-resistant structure* (3.3.1) within a *submersible* (3.1.1)

3.3.16
seal
material or part that prevents fluid or gas leakage and ambient seawater from entering a *submersible* (3.1.1)

3.3.17
environmental load
expected load on a *submersible* (3.1.1) owing to ambient conditions such as wind speed, wind direction, wave height, current speed and water depth

3.3.18
design load
maximum expected load on a *submersible* (3.1.1) which consists of its own weight, associated dynamic effects and *environmental load* (3.3.17)

3.3.19
deformation compatibility
criteria that ensures structural elements of a *submersible* (3.1.1), of different shapes and material, remain within proportional fractions of their structural strength

3.3.20
deck lashing
phenomenon that fastens a *submersible* (3.1.1) to the deck of a *support ship* (3.8.4) for transportation security

3.4 Mechanical system

3.4.1
hydraulic powerpack
apparatus that takes the fluid as a working medium, utilises pressure energy of the fluid and drives hydraulic actuators through controlling valves and other components

3.4.2
valve pack
box with modularized integration of hydraulic control valve components for controlling pressure, flow rate and flow direction within pipes

3.4.3
buoyancy regulating device
device that controls the buoyancy of a *submersible* (3.1.1), which is required for operations at any *operating depth* (3.2.7)

Note 1 to entry: This device includes a *variable ballast device* (3.4.4), *releasable ballast device* (3.4.5), and associated pipes.

3.4.4
variable ballast device
device capable of ballasting or de-ballasting water (seawater or fresh water), compensating for all loading conditions of a *submersible* (3.1.1)

3.4.5
releasable ballast device
device capable of decreasing the total mass of a *submersible* (3.1.1), which is used for buoyancy ascent or termination of descent

3.4.6
emergency release device
releasable device capable of quickly decreasing the total mass of a *submersible* (3.1.1), which is used for fast buoyancy ascent in emergencies

3.4.7
emergency buoy
buoy released to the surface in an emergency to aid a *support ship* (3.8.4) in locating a *submersible* (3.1.1)

3.4.8
explosive bolt
bolt which disengages or breaks from a designated part on account of its internal explosive burning or explosion to be unlocked or disconnected

3.4.9
trim control system
system which enables the trim of a *submersible* (3.1.1) to be adjusted during diving operations to optimise the configuration of a vessel in the operating environment

3.4.10
hydraulic compensator
device fitted to a hydraulic system to prevent ingress of water by compensating the system's pressure to maintain it above ambient water pressure

3.4.11
manipulator
remotely operated work arm which is equipped on a *submersible* (3.1.1)

3.4.12
manipulator-held tooling
tool which is not capable of independently carrying out work and is fully dependent on a *manipulator* (3.4.11)

EXAMPLE Cleaning brush, torque tool, cable cutter, rotary cutter and core sampling tool.

3.4.13
portable tooling
tool which is independent of a *manipulator* (3.4.11) and is designed to be remotely control or pre-programmed without human intervention

EXAMPLE Water sampler and in situ culture tool.

3.4.14
modular tooling unit
unit integrating one or several tools, which is installed on a *submersible* (3.1.1) when required for use, and is fully dependent on manual control

EXAMPLE Tube gripper and cable gripper.

3.4.15
sampling basket
platform which stores a site sample or *modular tooling unit* (3.4.14) during *working time* (3.2.3)

3.4.16
piping
device which is an assembly of pipes, pipe straps and associated components providing technical support for realization functions of other apparatuses of a *submersible* (3.1.1)

3.5 Electrical system

3.5.1
battery cell
basic unit for the interconversion of chemical and electrical energy, usually consisting of electrodes, diaphragm, electrolyte, housing and terminals, and which is designed to be rechargeable

3.5.2
battery module
combination of more than one *secondary cell* (3.5.1), by series connection, parallel connection or series-parallel connection and used as a power supply

3.5.3
battery management system
BMS
system that monitors the status of the battery (e.g. temperature, voltage, state of charge) and can provide communication, safety, *secondary cell* (3.5.1) balancing and management control for the battery, as well as communication interface for applications

3.5.4
battery enclosure
assembly containing a *battery module* (3.5.2), *battery management system* (3.5.3) and corresponding components, with mechanical connection, electrical connection and protection

3.5.5
battery pack
rechargeable device, usually consisting of a *battery module* (3.5.2), *battery management system* (3.5.3), *battery enclosure* (3.5.4) and corresponding accessories (e.g. cooling components and connecting cables)

3.5.6
battery system
energy storage system consisting of one or more *battery packs* (3.5.5) and corresponding accessories (e.g. management system, high-voltage circuit, low-voltage circuit, temperature controller and mechanical assembly)

3.5.7
power battery system
battery system (3.5.6) designed to supply the power system and high-power equipment of a *submersible* (3.1.1)

3.5.8
auxiliary battery system
control battery system
battery system (3.5.6) designed to supply low-power equipment of a *submersible* (3.1.1), such as computers, sensors and controllers

3.5.9
oil-immersed battery
battery system (3.5.6), whose *battery enclosure* (3.5.4) is filled with hydraulic oil to provide a suitable working environment for its *battery module* (3.5.2), ensuring power supply of a *submersible* (3.1.1) as defined by the manufacturer

3.5.10
wireless charging technology
technology developed for transmitting energy and data through a magnetic field between a *battery module* (3.5.2) and its charger without wire connection

3.5.11
power distribution unit
equipment used to control and distribute electrical power during operation in non-fault condition, which is designed to automatically or manually isolate an electrical power circuit fault to enable continued operation for a *submersible* (3.1.1) as far as possible given that a fault occurred

3.5.12
junction box
box which aggregates and transfers signals of power supply, control and detection from every electrical device, providing access interface for watertight connectors

3.5.13
ground fault circuit interrupter
GFCI
device which is attached to the topside AC power source having receptacles, any of which can be attached to underwater cables supplying power to a *submersible* (3.1.1) and its equipment

[SOURCE: IMCA D 057 Rev. 1.1, Clause 1, modified — “tools or lighting” has been replaced by "a submersible and its equipment" in the definition.]

3.5.14
underwater camera
device which uses the standard industry capture camera enclosed in a pressure housing wired with watertight connectors

EXAMPLE HD camera and low light camera.

3.5.15
pan-tilt
support platform with a function such as a horizontal pitch or rotation to extend the field of view of an *underwater camera* (3.5.14) when mounted

3.5.16
lighting
lights which consist of external lights and internal lights on a *submersible* (3.1.1), providing lighting for *underwater camera* (3.5.14) and persons within the *manned compartment* (3.3.3) during an underwater operation

EXAMPLE HMI lamp, halogen lamp and LED lamp.

3.5.17
thruster
device which provides a *submersible* (3.1.1) with directional thrust power for manoeuvring

Note 1 to entry: A thruster usually consists of an electric motor, propeller, nozzle, fairing and control unit.

3.6 Acoustic system

3.6.1
beacon
colloquial term for a transponder or other seabed unit that transmits acoustic ranges or data

[SOURCE: IMCA D 057 Rev. 1.1, Clause 1]

3.6.2
pinger
beacon (3.6.1) which is set to transmit at a fixed and regular interval

[SOURCE: IMCA D 057 Rev.1.1, Clause 1, modified — "acoustic beacon" has been replaced by "beacon" in the definition.]

3.6.3
responder
beacon (3.6.1) which, upon receiving an electrical trigger supplied via a cable or another external connecting link, replies after a short fixed time delay after the interrogation signal

[SOURCE: IMCA D 057 Rev. 1.1, Clause 1, modified — ”umbilical” has been replaced by “another external connecting link” in the definition.]

3.6.4
underwater acoustic transducer
device for the exchange of acoustic and electrical energy in water

3.6.5
underwater sound projector
underwater acoustic transducer (3.6.4), which converts an electrical signal into an acoustic signal to be emitted into water

3.6.6
hydrophone
underwater acoustic transducer (3.6.4), which converts a received acoustic signal into an electrical signal

3.6.7
underwater acoustic communication device
device which is designed to establish a real-time communication link between a *manned submersible* (3.1.2) and a *support ship* (3.8.4) through instruction codes, audio, text messages and site photos

3.6.8
underwater telephone
device which is designed to establish a real-time communication link between a *manned submersible* (3.1.2) and a *support ship* (3.8.4) through audio

3.6.9
underwater sound positioning system
USPS
system based on the propagation of an acoustic wave in water, providing the function of positioning

3.6.10
ultra-short baseline acoustic positioning system
USBL acoustic positioning system
underwater sound positioning system (3.6.9) in which an array of *acoustic transducers* (3.6.4) is deployed on a *support ship* (3.8.4) and transducers are all built into a single transceiver assembly

3.6.11
long baseline acoustic positioning system
LBL acoustic positioning system
underwater sound positioning system (3.6.9) which consists of a number of acoustic transponder beacons moored in fixed locations on the seabed or mounted on fixed locations of objects such as a *support ship* (3.8.4)

3.6.12
ranger
mechanically scanning single-beam sonar which senses obstacles and locates major anomalies surrounding a *submersible* (3.1.1)

3.6.13
imaging sonar
fan-shaped sonar beam which scans surfaces at shallow angles, usually through an angle in the horizontal plane, and displays colour images or pictures

3.6.14
bathymetric side scan sonar
BSSS
surveying and mapping device, which is designed to investigate seabed micro topography during *near-bottom swimming* (3.9.1) and draw a three-dimensional map of the scene in real time

3.6.15
doppler velocity log
DVL
acoustic instrument which is based on the Doppler effect to acquire its submerged speed relative to the seabed and flow field data in the scene

3.7 Control system

3.7.1
manoeuvring control
function which controls the underwater three-dimensional motion of a *submersible* (3.1.1) by taking associated information data as input parameters, such as navigation, trajectory and attitude

3.7.2
rudder
device that controls the yaw of a *submersible* (3.1.1) underwater by using the hydrodynamic forces acting on its rudder blade

3.7.3
horizontal control plane
device that controls the pitch of a *submersible* (3.1.1) underwater by using the hydrodynamic forces acting on its surface

3.7.4
stabilizing fin
stationary device with an airfoil section, which improves motion stability of a *submersible* (3.1.1)

3.7.5
inertial navigation system
INS
system whose operating sensor is an inertial measurement unit made up of three accelerometers and three gyros for measuring acceleration and rotational velocity for dead reckoning in subsea environments

3.7.6
global positioning system
GPS
radio navigation system that allows land, sea and airborne users to determine their exact location, velocity and time, 24 hours a day in all weather conditions, anywhere in the world

[SOURCE: IMCA D 057 Rev. 1.1, Clause 1]

3.7.7
altimeter
device known as a single beam echo sounder for measuring the height of a *submersible* (3.1.1) relative to the seabed

3.7.8
depth gauge
device for measuring the depth of a *submersible* (3.1.1) relative to the surface

3.7.9
conductivity, temperature, depth sensor
CTD sensor
detecting instrument for measuring the temperature and salinity at different depths of water

3.7.10
level sensor
pressure sensor that measures the level of liquids

3.7.11
leak sensor
sensor based on the principle that liquid can be conductive by applying electrodes to detect water

3.8 Surface system

3.8.1
umbilical
external connecting link of a *tethered submersible* (3.1.3), which should consist of life support hoses, surveillance, communication, remote control, power supply cables and load-carrying elements (ropes) for the *launch and recovery system* (3.8.5)

3.8.2
tether
external connecting link of a *tethered submersible* (3.1.3), connecting a *tethered submersible* (3.1.3) to its *tether management system* (3.8.3), or connecting a *tethered submersible* (3.1.3) to its *support ship* (3.8.4), which should consist of communication, remote control and power supply cables excluding load-carrying elements (ropes) for the *launch and recovery system* (3.8.5)

3.8.3
tether management system
TMS
underwater system for storing, deploying and retracting *tether* (3.8.2), which is designed to reduce additional drag and interference for a *tethered submersible* (3.1.3) operation, caused by a *support ship* (3.8.4) swing and current influence acting on *tether* (3.8.2)

3.8.4
support ship
ship capable of housing, handling operation, rescue and maintenance of a *submersible* (3.1.1) and accommodation of persons on board, being engaged in related support work while a *submersible* (3.1.1) operates at a designated place underwater

3.8.5
launch and recovery system
LARS
system supporting launch, recovery and other handling operations of a *submersible* (3.1.1)

Note 1 to entry: This system consists of cranes, booms, masts, frames, davits, foundations, winches, as well as associated mechanical, *piping* (3.4.16) and electrical systems, as necessary for the intended operations.

3.8.6
deck compression chamber
DCC
transfer chamber of a *support ship* (3.8.4) used in association with a *submersible* (3.1.1), which allows for gas saturation, lodging, recovery and desaturation periods for *divers* (3.11.4) and disabled submarine survivors

3.8.7
mating device
device which is designed for a pressure-tight connection of a *deep submergence rescue vehicle* (3.1.7), *lock-out submersible* (3.1.8) or a *dry diving bell* (3.1.11) to a *deck compression chamber* (3.8.6), enabling the transfer of persons under conditions of continuous high-gas medium pressure

3.8.8
control module
control compartment
position in a *submersible* (3.1.1) or a *support ship* (3.8.4) where the control of the *submersible* (3.1.1) is conducted and where the essential indicators, controls, navigation devices, positioning devices, monitoring devices and communications are arranged

3.9 Work mode

3.9.1
near-bottom swimming
mode in which a *submersible* (3.1.1) can be manoeuvred to make a lateral and longitudinal movement while approaching the seabed

3.9.2
hovering
mode in which a *submersible* (3.1.1) can hold position at a fixed angle to the ocean current relative to the seabed in the specified environment

3.9.3
auto-pilot
mode in which the computing system of a *submersible* (3.1.1) takes charge of *motion control* (3.7.1) without anthropogenic intuition, normally including *auto-heading control* (3.9.4), *auto-speed control* (3.9.5), *auto-depth keeping* (3.9.6) and *auto-height keeping* (3.9.7)

3.9.4
auto-heading control
computer-controlled mode to maintain the designated heading relative to the seabed

3.9.5
auto-speed control
computer-controlled mode to maintain the designated speed relative to the seabed

3.9.6
auto-depth keeping
computer-controlled mode to maintain the designated depth relative to the surface

3.9.7
auto-height keeping
computer-controlled mode to maintain the designated height above the seabed

3.9.8
bottom sitting
mode in which a *submersible* (3.1.1) can be manoeuvred to lay on the seabed for a long-term or short-term period

3.9.9
swarmed operation
multiple *unmanned submersibles* (3.1.3) operating simultaneously in the same water space under managed control to enable coordinated, concurrent underwater operations to be conducted

3.10 Test and maintenance

3.10.1
initial survey
survey including a complete and thorough examination of a *submersible* (3.1.1), which ensures full compliance with the applicable provisions of associated rules and guidelines before *formal operation* (3.10.2)

3.10.2
formal operation
initial moment for a *submersible* (3.1.1) going into service when all design specifications and other operation conditions, such as sea state, are achieved

3.10.3
full operational capability
FOC
status when a *submersible* (3.1.1) is capable of filling its full range of designed operational capabilities

3.10.4
routine maintenance
routine upkeep, repair, refill and replacement of components required to keep a *submersible* (3.1.1) in full working order for operational diving activities, such as gas and *battery system* (3.5.6) charging, replacement of consumables and upload/download of system software

EXAMPLE Gas and battery system charging, replacement of consumables and upload/download of system software.

3.10.5
overhaul
full or partial deep maintenance procedure designed to return the equipment to its full designed operational functionality

3.10.6
annual survey
survey completed every year to examine the material state of a *submersible* (3.1.1) to assess its condition and confirm it is materially safe to operate for the next twelve-month period

3.10.7
dry-docking survey
survey including a complete and thorough examination of a *submersible* (3.1.1), which ensures full compliance with the applicable provisions of associated rules and guidelines after a specified time interval since the *formal operation* (3.10.2) of the *submersible* (3.1.1)

3.10.8
special survey
survey which undertakes to examine a *submersible* (3.1.1) when substantial change happens, such as a *support ship* (3.8.4) being changed, or main parts being damaged or altered

3.10.9
decommission
technical condition in which a *submersible* (3.1.1) is beyond its *life expectancy* (3.2.1) or cannot be repaired to achieve its operational requirement

3.10.10
extend life
technical means for extending *life expectancy* (3.2.1) in response to different degradation phenomena after long-term usage

3.10.11
human-closed test
testing of the *life support system* (3.2.15) which involves accommodating persons within the *pressure hull* (3.3.2) under a given condition for a given time interval in accordance with the designated procedure for its performance

Note 1 to entry: The elements measured in this test are breathing air supply, carbon dioxide absorption, temperature and humidity control.

3.10.12
loading test
testing of the *framework* (3.3.8) by applying multiple load cases in accordance with the designated procedure to simulate the load acted on a *submersible* (3.1.1) during the *design mission time* (3.2.2)

3.10.13
tightness test
testing of the *pressure-resistant structure* (3.3.1), welds, joints or *piping* (3.4.16) by applying internal working gas at medium pressure or hydrostatic pressure equal to *test pressure* (3.2.14) in accordance with the designated procedure for leakage

3.10.14
hydrostatic pressure test
testing of the *pressure-resistant structure* (3.3.1) by applying external *test pressure* (3.2.14) in accordance with a designated procedure in a test chamber to simulate resisting ambient pressure while a *submersible* (3.1.1) is working underwater

3.10.15
continuous pressurization and depressurization test
hydrostatic pressure test (3.10.14) in which the pressurization rate and depressurization rate keep the same values without any pause for strain measurement

[SOURCE: ISO 21173:2019, 3.12, modified — “test” has been replaced by “hydrostatic pressure test” in the definition.]

3.11 Personnel

3.11.1
pilot
person appointed and qualified to command a *submersible* (3.1.1)