DNV SERVICE SPECIFICATION

DNV-DSS-105

Rules for Classification of Diving Systems

JULY 2014

The electronic pdf version of this document found through http://www.dnv.com is the officially binding version

DET NORSKE VERITAS AS

FOREWORD

DNV is a global provider of knowledge for managing risk. Today, safe and responsible business conduct is both a license to operate and a competitive advantage. Our core competence is to identify, assess, and advise on risk management. From our leading position in certification, classification, verification, and training, we develop and apply standards and best practices. This helps our customers safely and responsibly improve their business performance. DNV is an independent organisation with dedicated risk professionals in more than 100 countries, with the purpose of safeguarding life, property and the environment.

DNV service documents consist of among others the following types of documents:

— *Service Specifications.* Procedural requirements.
— *Standards.* Technical requirements.
— *Recommended Practices.* Guidance.

The Standards and Recommended Practices are offered within the following areas:

A) Qualification, Quality and Safety Methodology
B) Materials Technology
C) Structures
D) Systems
E) Special Facilities
F) Pipelines and Risers
G) Asset Operation
H) Marine Operations
J) Cleaner Energy
O) Subsea Systems
U) Unconventional Oil & Gas

Any comments may be sent by e-mail to *rules@dnv.com*

CHANGES – CURRENT

General

This document supersedes , July 2012.

Text affected by the main changes in this edition is highlighted in red colour. However, if the changes involve a whole chapter, section or sub-section, normally only the title will be in red colour.

Det Norske Veritas AS, company registration number 945 748 931, has on 27th November 2013 changed its name to DNV GL AS. For further information, see www.dnvgl.com. Any reference in this document to "Det Norske Veritas AS" or "DNV" shall therefore also be a reference to "DNV GL AS".

Main changes

- **General**

— EC has been changed to "appropriate approval body" and the definition of EC has been removed.

- **Sec.1 General**

— A102: "DSV class notation" has been changed to "Classification certificate".
— A201: "certification" has been changed to "classification".

Editorial corrections

In addition to the above stated main changes, editorial corrections may have been made.

CONTENTS

SECTION 1 GENERAL

A. Introduction

A 100 Objectives

101 The objectives of this DNV Service Specification (DSS) are to:

a) describe DNV's certification and Classification services for diving systems

b) provide guidance for owners and other parties for the selection of the level of involvement of those carrying out the certification and Classification activities

c) provide a common communication platform for describing the extent of Classification activities.

102 This DSS describes the necessary activities to be carried out to obtain initial DNV diving system component certificates and classification certificate. In addition the general requirements outlined in DNV Rules for Classification of Ships Pt.5 Ch.16 apply.

103 This DSS replaces DNV-OSS-305 "Rules for Certification and Verification of Diving Systems".

A 200 Scope

201 This DSS gives criteria for and guidance on classification of complete diving systems, and verification of the integrity of parts of diving systems.

202 The primary scope of the certification work is:

— The verification for the certification of components in the system,
— the integrity of the diving system,
— capacity to support diving operations under specified conditions.

203 This DSS may be adopted for the verification of parts of a diving system in accordance with either this standard or with recognised industry standards and practices.

204 Statutory certification of diving systems to the requirements of national authorities is not included specifically in the scope of application of this DSS. Such certification shall be governed by the regulations of the appointing authority. However, if these authorities do not give detailed procedures, this DSS will be used by DNV as a guideline for its work when appointed.

A 300 Application

301 This DSS applies to certification and classification during the design, construction and operation of diving systems. Classification is described in more detail in DNV Rules for Classification of Ships, in particular Pt.5 Ch.16 and Pt.7 Ch.1 Sec.6 for systems in operation.

A 400 Relation to other rules, standards, codes and guidelines

401 Controlling documents relating to DNV systems consist of a three-level hierarchy with these main features:

a) Principles and procedures related to DNV's certification and Classification services are separate from technical requirements and are presented in DNV Service Specifications. DNV Service Specifications present the scope and extent of DNV's services.

b) Technical requirements are issued as self-contained DNV Standards. DNV Standards are issued as neutral technical standards to enable their use by national authorities, as international codes and as company or project specifications without reference to DNV's services.

c) Associated product documents are issued as DNV Recommended Practices. The Recommended Practices give DNV's interpretation of safe engineering practice for general use by industry.

Guidance note:

Product documents issued under previous document structures may be called "Classification Notes" or "Guidelines". The latest revision of all DNV documents may be found in the publications list in the DNV web site www.dnv.com.

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A 500 Organisation of DNV-DSS-105

501 This document consists of two sections and four appendices:

— Sec.1 gives the general scope of the document, informative background information, definitions and references.
— Sec.2 describes the certification process and the activities for each of the project phases. Furthermore, it

describes the documents issued during and as a result of the certification process. The use of quality management systems is addressed here too.
— Appendix A lists the instances where DNV-DS-E402 SAT and DNV-DSS-105 requires certification and attendance by DNV.
— Appendix B lists the instances where DNV-DS-E403 SURFACE and DNV-DSS-105 requires certification and attendance by DNV.
— Appendix C is a list of sources to assist in obtaining reference documents.
— Appendix D outlines generic project sub phases.

A 600 Introduction to diving systems classification

601 General introduction to Classification is given in DNV Rules for Classification of Ships Pt.0 Ch.2.

602 A Diving system Class notation, **Diving system-SAT** or **Diving system-SURFACE**, will be issued in the diving system's Classification Certificate as a formal statement confirming that the diving system has been assembled tested and commissioned in accordance with specified requirements with required certification.

603 The Class notation will only be issued when all relevant activities have been satisfactorily completed. Outstanding issues will prevent the issue of the Class notation unless deemed of lesser importance, in which case Conditions of Class will be issued.

604 An appendix to the Class certificate will support the Class Notation by providing details of the operational limitations and conditions of use for which the diving system is intended codes and standards with which the diving system has been found to comply.
A data sheet for diving systems will be issued to support the Class Notation by giving a description of the diving system, its item number (when relevant) and referencing certificates and reports of components in the diving system.

605 An officer at DNV Høvik will sign the full-term classification certificate, whereas the local DNV office will sign the underlying certificates and the interim class certificate.

606 The DNV Høvik office will file the as-built documentation including the main certificates and drawings. Underlying certificates are filed at the local station.

B. References

B 100 Normative references

101 The latest revisions of the following documents apply as normative references:

Table B1 Rules and standards for certification
Title
DNV *Rules for Classification of Ships*
DNV *Standard for Certification No. 2.22 Lifting Appliances*

Table B2 Offshore service specifications	
Reference	*Title*
DNV-OSS-101	*Rules for Classification of Offshore Drilling and Support Units*

Table B3 Offshore standards	
Reference	*Title*
DNV-DS-E403	*Standard for Surface Diving Systems*
DNV-OS-A101	*Safety Principles and Arrangements*
DNV-OS-D201	*Electrical Installations*
DNV-OS-D202	*Instrumentation, Safety and Telecommunication systems*
DNV-OS-D301	*Fire Protection*
DNV-OS-E402	*Offshore Standard for Diving Systems*

Table B4 Recommended practices	
Reference	*Title*
DNV-RP-A201	*Plan Approval Documentation Types – Definitions*
DNV-RP-A204	*Quality Survey Plan (QSP) for Offshore Class Newbuilding Surveys*
DNV-RP-E401	*Survey of Diving Systems*
DNV-RP-E403	*Hyperbaric Evacuation Systems*

Table B5 Other normative references	
Reference	*Title*
ASME VIII Div.1	*ASME Boiler and Pressure Vessel Code - Rules for Construction of Pressure Vessels*
ASME PVHO-1-2012 edition (or latest)	*Safety Standard for Pressure Vessels for Human Occupancy*
ASME PVHO-2-2012 edition (or latest)	*Safety Standard for Pressure Vessels for Human Occupancy: In Service Guidelines*
ASTM G93-03 (2011)	*Standard Practice for Cleaning Methods and Cleanliness Levels for Materials and Equipment Used in Oxygen-Enriched Environments*
API	*Codes for hoses*
API 17E	*Specification for Subsea Production Control Umbilicals*
BS 4778	*Quality Vocabulary, Part 2 Quality Concepts and Related Definitions, 1991, British Standards Institute, London*
BS 5355	*Specification for filling ratios and developed pressures for liquefiable and permanent gases*
EN 738-1, -2 and -3: 1997/1998/2002	*Pressure regulators for use with medical gases*
EN 1964-1:2000	*Transportable gas cylinders (part 1:1999, part 2:2001 or part 3:2000)*
EN 1968:2002	*Periodic Inspection and testing of Seamless gas cylinders*
EN 10204	*Metallic Products - Types of inspection documents*
EN ISO 11120:1999	*Gas cylinders - Refillable seamless steel tubes for compressed gas transport, of water capacity between 150 l and 3000 l - Design construction and testing*
EN 13445	*Unfired pressure vessels*
EN 45011	*General Criteria for Certification Bodies Operating Product Certification, 1998, European Committee for Standardization, Brussels*
EN 1708-1:1999	*Welding - Basic weld joint details in steel*
IMO Resolution A.831(19)	*Code of Safety for Diving Systems, 1995*
IMO Resolution A.692(17)	*Guidelines and Specifications for Hyperbaric Evacuation Systems, 1991*
IMO MSC/Circ.645 of 6 June 1994	*Guidelines for Vessels with dynamic positioning systems*
IMO Resolution A.809(19)	*In reference to SOLAS Regulation III/6.2.1*
IMO res. MSC.61(67)	*(FTP Code)*
IMO resolution A.468 (XII)	*Code on noise levels on-board ships*
IEC No.79-10	*International Electro technical Commission's Publication No.79-10, and IMO (MODU) Code chapter 6*
ISO 6385-2004	*Ergonomic Principles in the Design of Work Systems*
ISO 9000	*Quality management*
ISO 10013	*Guidelines for quality management system documentation*
ISO 10380, BS 6501	*Pipework - Corrugated metal hoses and hose assemblies*
ISO 10474	*Steel and Steel Products - Inspection Documents*
ISO 13628-5	*Petroleum and natural gas industries – Design and operation of subsea production systems – Part 5: Subsea control umbilicals*
PD 5500:2009 + latest amendments	*Specification for Unfired Fusion Welded Pressure Vessels*
SAE J 517, DIN EN 853, 856, 857	*Rubber Hoses and Hose Assemblies*
Note: See also Appendix C List of sources to assist in obtaining reference documents	

B 200 Informative references

Table B6 Informative references	
Reference	*Title*
	A Guide to Hazard and Operability Studies, 1979, Chemical Industries Association Limited, London
NORSOK Standard U-100	*Manned Underwater Operations*
EN 849:1996	*Transportable Gas Cylinders - Cylinder Valves - Specification and Type Testing*
ISO 11114-3:2010	*Transportable Gas Cylinders - Compatibility of Cylinder and Valve Materials with Gas Contents - Part 3: Autogenous Ignition Test in Oxygen Atmosphere*
ISO 2503:2009	*Gas Welding Equipment - Pressure Regulators for Gas Cylinders used in Welding, Cutting and Allied Processes up to 300 bar*
ILO Convention 133, 1970	*Accommodation of crews*
(NFPA) Codes	*National Fire Protection Agency*
SOLAS 1974	*International Convention for the Safety of Life at Sea*

Guidance note:
The latest revision of the DNV documents may be found in the publication list at the DNV website www.dnv.com. For other sources see Appendix C.

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B 300 Terminology and definitions

301 The *Society* signifies Det Norske Veritas AS.

302 The definitions in DNV Rules for Classification of Ships Pt.1 Ch.1 Sec.1A, DNV-OS-E402 and DNV-DS-E403 Sec.1 also apply to this DSS.

303 *Verbal forms*

Term	*Definition*
Shall:	Verbal form used to indicate requirements strictly to be followed in order to conform to the document.
Should:	Verbal form used to indicate that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others, or that a certain course of action is preferred but not necessarily required.
May:	Verbal form used to indicate a course of action permissible within the limits of the document.
Note: In the cases where text from the (IMO Code of Safety for Diving Systems Chapter 2 Design, Construction and Survey) is used, the IMO use of "should" shall be interpreted as "shall".	

306 *"Agreement", "by agreement"*: Unless otherwise indicated, this means agreed in writing between the society, manufacturers, builder and owner.

307 Definitions are listed as Follows:

308 *Administration means the Government of the State whose flag a ship or floating structure which carries a diving system is entitled to fly or in which the ship or floating structure is registered.*
*(*IMO Code of Safety for Diving Systems Chapter 2 Design, Construction And Survey 1.3.1*)*

309 *As-built survey*: Survey of the installed and completed diving system, which is performed to verify that the completed installation work meets the specified requirements, and to document deviations from the original design, if any.

310 *Basket:* A divers basket (sometimes known as a stage) is a frame and mesh construction designed to accommodate divers whilst they are lifted in and out of the water.

311 *Bell:* A diving bell is a frame incorporating a dome, and including appendages, for transfer of divers between the underwater work site and the deck or the surface chamber (TUP or DDC). In the context of DNV-DS-E403 "DNV Standard for Surface Diving Systems", "bell" is defined as an open bell/wet-bell. (See *Open Bell, Closed Bell and Wet bell*)

312 *Bottle means a pressure container for the storage and transport of gases under pressure.*
(IMO Code of Safety for Diving Systems Chapter 2 Design, Construction And Survey 1.3.2)

313 *Breathing gas/breathing mixture means all gases/mixtures of gases which are used for breathing during diving operations.*
*(*IMO Code of Safety for Diving Systems Chapter 2 Design, Construction And Survey 1.3.3*)*

314 *Builder*: In the context of these rules, signifies the party contracted to build a diving system in compliance with the Society's rules.

315 *Built In Breathing System* (BIBS): A system of gas delivery to masks, located in the decompression

chambers, baskets and wet-bells. This system facilitates breathing in the event of a contaminated atmosphere, and allows for the use of therapeutic gases during decompression. BIBS may in rare cases be closed circuit breathing systems (see CCBS definition) but are normally open circuit systems where the exhaled gas is dumped to atmosphere.

316 *Case by case:* When the case by case approval procedure is used, documentation of the design shall be submitted for approval for each application as required in the applicable chapters of the rules. When the case by case survey procedure is used, the survey shall be performed on the basis of approved design documentation for the actual application and as required in the applicable sections of the rules. Compliance with the approved design documentation and applicable requirements will be documented by certificates as required in the applicable sections of the rules.

317 *"Category A machinery spaces" are those spaces and trunks to such spaces as defined in the International Convention for the Safety of Life at Sea, 1974, as amended.*
*(*IMO Code of Safety for Diving Systems Chapter 2 Design, Construction And Survey 1.3.20*)*

318 *Certificate:* A document confirming compliance with the Society's rules or with other rules and regulations for which the Society has been authorized to act.

319 *Certification:* A service confirming compliance with applicable requirements on the date that the survey was completed. Materials and components in DNV Classified diving systems shall be certified according to the level of certification given in DNV-DSS-105.

320 *Chamber:* Surface decompression, pressure or compression chambers (see also *DDC*), hereafter called the chambers, and are pressure vessels for human occupancy.

321 *Class:* In the context of these rules, Class is assigned to and will be retained by the diving system complying with applicable requirements of the Society's rules.

322 *Classification:* In the context of these rules, a service which comprises the development of independent technical standards for diving systems - and verifies compliance with the rules throughout the vessels' life.

323 *Closed bell:* A sealed submersible diving chamber *(SDC)* that locks on and off the chamber where the divers decompress (*DDC*). Pressure differentials are retained by way of a closed door sealing the divers in at pressures, elevated or lowered compared to the surrounding pressure.

324 *Closed Circuit Breathing System (CCBS)*: A system for supply of breathing gas to the diver and saving of his exhaled gases for re-circulation after scrubbing and replenishing.

325 *Commissioning*: In relation to diving systems, refers to activities which take place after installation and prior to operation, comprising the tests and trials outlined in DNV-OS-E402 Sec.2 J and DNV-DS-E403 Sec.1 A700 and A800.

326 *Compact umbilical: Umbilical* consisting of composite bundles of hoses, cables and strength members in a braiding or sheathing.

327 *Compartment:* Part(s) of a chamber sufficiently large to contain at least one person and which may have an internal pressure different from adjacent compartments.

328 *Construction phase*: All phases during construction, including fabrication, installation, testing and commissioning, up until the installation or system is safe and operable for intended use. In relation to diving systems, this includes procurements, manufacture assembly, rectification, installation, testing, commissioning and repair.

329 *Contractor*: A party contractually appointed by the Purchaser to fulfil all, or any of, the activities associated with design, construction and operation.

330 *Control stations*: normally as defined in regulation 3 and referred to in regulation 20, chapter II-2 of the International Convention for the Safety of Life at Sea. Control stand or Control station is a control station in which one or more of the following control and indicator functions are centralized:

a) Indication and operation of all vital life support conditions, including pressure control.
b) Visual observation, communication systems including telephones, audio-recording and microphones to public address systems.
c) Disconnection of all electrical installations and Insulation monitoring.
d) Provisions for calibration of and comparison between gas analysing.
e) Indication of temperature and humidity in the inner area.
f) Alarms for abnormal conditions of environmental control systems.
g) Fixed fire detection and fire alarm systems.
h) Ventilation fans.
i) Automatic sprinkler, fire detection and fire alarm systems.
j) Launch and recovery systems, including interlock safety functions.
k) Operation and control of the hyperbaric evacuation system.

331 *Corrosion allowance*: Extra wall thickness added during design to compensate for any reduction in wall thickness by corrosion (internally and externally) during operation.

332 *Customer*: Signifies the party who has requested the Society's service.

333 *Demobilised:* Diving system is stored on shore and requires a full maintenance regime for mobilisation.

334 *Deck Decompression Chamber (DDC)*: Deck mounted Pressure Vessel for Human Occupancy used for decompression.

335 *Depth means the water depth or equivalent pressure to which the diver is exposed at any time during a dive or inside a surface compression chamber or a diving bell.*
*(*IMO Code of Safety for Diving Systems Chapter 2 Design, Construction And Survey 1.3.6*)*

336 *Design*: All related engineering to design of the diving system.

337 *Design life*: The initially planned time period from initial installation or use until permanent decommissioning of the equipment or system. The original design life may be extended after a re-qualification.

338 *Design load*: For PVHOs see DNV-OS-E402/DNV-DS-E403 Sec.3 and for LARS see Sec.7.

339 *Design phase*: An initial phase that takes a systematic approach to the production of specifications, drawings and other documents to ensure that the diving system meets specified requirements (including design reviews to ensure that design output is verified against design input requirements). See ISO 9001.

340 *Design temperature, maximum*: The highest possible temperature to which the equipment or system may be exposed to during installation and operation. Environmental as well as operational temperatures shall be considered.
Design temperature, minimum: The lowest possible temperature to which the equipment or system may be exposed to during installation and operation, irrespective of the pressure. Environmental as well as operational temperatures shall be considered.

Guidance note:
For LARS, the design temperature is defined in DNV Standard for Lifting Appliances.

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341 *Designer*: Signifies a party who creates documentation submitted to the Society for approval or information.

342 *Diver heating:* A system for actively heating the divers in the water or in the inner area.

343 *Divers:* Personnel subjected to higher ambient pressure than one atmosphere.

344 *Diving bell means a submersible compression chamber, including its fitted equipment, for transfer of diving personnel under pressure between the work location and the surface compression chamber.*
*(*IMO Code of Safety for Diving Systems Chapter 2 Design, Construction And Survey 1.3.7*)*

345 *Diving system means the whole plant and equipment necessary for the conduct of diving operations.*
*(*IMO Code of Safety for Diving Systems Chapter 2 Design, Construction And Survey 1.3.8*)*
Diving system (in DNV terms): The whole plant and equipment necessary for safe conduct of diving operations where compression and decompression of divers are taking place.

346 *dmax:* Maximum operating depth of the SURFACE diving system. This is the depth corresponding to the maximum pressure for pressurizing divers. (For Classified systems this may be specified in the certificate and Data Sheet).

347 *DSV*: Class Notation in DNV representing 'Diving Support Vessel'.

348 *ECU*: Environmental Control Unit. Maintains Temperature, reduces humidity and may include removal of carbon dioxide.

349 *Enriched Air*: Nitrogen oxygen mixtures with elevated oxygen content. (See NITROX)

350 *Equipment lock:* A pressure tight independent lock mounted on the shell of the chamber providing the means for locking in equipment necessary for the divers and the operation of the system. (See also *Medical lock*)

351 *Evacuation system means a system whereby divers under pressure can be safely evacuated from a ship or floating structure to a position where decompression can be carried out.*
*(*IMO Code of Safety for Diving Systems Chapter 2 Design, Construction And Survey 1.3.9*)*

352 *Fabrication*: Activities related to the assembly of objects with a defined purpose. In relation to diving systems, fabrication refers to e.g. Deck Decompression Chambers, Wet-bells, and Pressure vessels for gas storage, Environmental Control Systems, Launch and recovery Systems etc.

353 *Fabricator*: The party performing the fabrication (in this context, normally of windows for PVHOs).

354 *Failure*: An event affecting a component or system and causing one or both of the following effects:

— loss of component or system function
— deterioration of functional capability to such an extent that the safety of the installation, personnel or environment is significantly reduced.

355 *Fatigue*: Cyclic loading causing degradation of the material.

356 *Flag administration:* The maritime administration of a vessel's country of registry.

357 *Gas:* In the context of this standard, gas includes air, oxygen and *Enriched Air/NITROX.*

358 *Gas containers:* Cylinders, bottles and pressure vessels for storage of pressurized gas.

359 *Guidance notes*: Contain advice which is not mandatory for the assignment or retention of class, but with which the Society, in light of general experience, advises compliance.

360 *Handling system means the plant and equipment necessary for raising, lowering and transporting the diving bell between the work location and the surface compression chamber.*
*(*IMO Code of Safety for Diving Systems Chapter 2 Design, Construction And Survey 1.3.10*)* (See *Launch and recovery System* (LARS)

361 *Hazard*: A deviation (departure from the design and operating intention) which could cause damage, injury or other form of loss (Chemical Industries Association HAZOP Guide).

362 *Hazardous areas are those locations in which an explosive gas-air mixture is continuously present, or present for long periods (zone O); in which an explosive gas-air mixture is likely to occur in normal operation (zone 1); in which an explosive gas-air mixture it not likely to occur, and if it does it will only exist for a short time (zone 2).*
*(*IMO Code of Safety for Diving Systems Chapter 2 Design, Construction And Survey 1.3.11*)*

363 *HAZOP (HAZard and OPerability study)*: The application of a formal systematic critical examination to the process and engineering intentions of new or existing facilities to assess the hazard potential of inadvertent operation or malfunction of individual items of equipment and their consequential effects on the facility as a whole (Chemical Industries Association HAZOP Guide).

364 *Hydro-test* or *Hydrostatic test*: See Pressure test

365 *Hyperbaric Evacuation System (HES):* System for evacuating divers under pressure. This includes the Hyperbaric Evacuation Unit (HEU), the launch and recovery and control systems.

366 *Hyperbaric Rescue Vessel (HRV):* IMO uses the term Hyperbaric Evacuation Unit (HEU). See above.

367 *IACS:* The International Association of Classification Societies.

368 *IMO*: Signifies the International Maritime Organization.

369 *Inner area:* The areas which are inside the chambers. Interconnecting trunks are considered part of the inner area when the door is opened into the chamber.

370 *Inspection*: Activities such as measuring, examination, testing, gauging one or more characteristics of a product or service and comparing the results with specified requirements for determine conformity.

371 *Installation* (activity): The operations related to installing the equipment, diving system or support structure, e.g. mounting chambers and handling systems etc., including final testing and preparation for operation.

372 *Installation Manual (IM)*: A document prepared by the Contractor to describe and demonstrate that the installation method and equipment used by the Contractor will meet the specified requirements and that the results can be verified.

373 *ISO:* Signifies the International Organisation for Standardization.

374 *Launch and recovery system (LARS):* The system and equipment necessary to launch and recover the divers, the diver's basket or wet-bell to the chambers as well as transport the divers between the surface support unit and the underwater working site, including any guide rope systems and cursor systems.

375 *Lay-up*: A terminology used for diving systems that are out of commission. In this state the diving system may be installed on board or permanently stored on shore.

376 *Life support system means the gas supply, breathing gas system, decompression equipment, environmental control system and equipment required to provide a safe environment for the diving crew in the diving bell and the surface compression chamber under all ranges of pressure and conditions they may be exposed to during diving operations.*
*(*IMO Code of Safety for Diving Systems Chapter 2 Design, Construction And Survey 1.3.12*)*

Life support systems (in DNV terms): The systems comprising gas supply systems, breathing gas systems, pressure regulating systems, environmental control systems, and systems required to provide a safe habitat for the divers, in the basket, the wet-bell and the chamber compartments under normal conditions during diving operation.

377 *Living compartment means the part of the surface compression chamber which is intended to be used as the main habitation for the divers during diving operations and which is equipped for such purpose.*
*(*IMO Code of Safety for Diving Systems Chapter 2 Design, Construction And Survey 1.3.13*)*

Living compartment (in DNV terms): A compartment which is intended to be used as the main habitation for the divers and which is equipped as such.

378 *Load*: Any action causing stress, strain, deformation, displacement, motion, etc. to the equipment or system.

379 *Load effect*: Effect of a single load or combination of loads on the equipment or system, such as stress, strain, deformation, displacement, motion, etc.

380 *Load effect factor*: The partial safety factor by which the characteristic load effect is multiplied to obtain the design load effect.

381 *Lot*: A number of components from the same batch. E.g. same heat, the same heat treatment batch and with the same dimensions.

382 *Main components of a diving system include the surface compression chamber, diving bell, handling system and fixed gas storage facilities.*
*(*IMO Code of Safety for Diving Systems Chapter 2 Design, Construction And Survey 1.3.14*)*

383 *Manufacture*: Making of articles or materials, sometimes in larger volumes. In relation to diving systems, refers to activities for the production of pressure vessels, distribution panels and other components, performed under contracts from one or more contractors.

384 *Manufacturer*: Signifies the entity that manufactures the material or product, or carries out part production that determines the quality of the material or product, or does the final assembly of the product.

385 *Mating device means the equipment necessary for the connection and a disconnection of a diving bell to a surface compression chamber.*
*(*IMO Code of Safety for Diving Systems Chapter 2 Design, Construction And Survey 1.3.15*)*

386 *Maximum operating depth of the diving system is the depth in metres or feet of seawater equivalent to the maximum pressure for which the diving system is designed to operate.*
*(*IMO Code of Safety for Diving Systems Chapter 2 Design, Construction And Survey 1.3.16*)*

387 *Medical lock*: A pressure tight independent lock mounted on the shell of the chamber providing the means for locking in provisions, medicine and equipment necessary for the divers and the operation of the system. (See also *Equipment lock*)

388 *NDE level: The* extent and acceptance criteria for the NDE of the components.

389 *NITROX:* Nitrogen oxygen mixtures with elevated oxygen content. (See *Enriched air*)

390 *Nominal outside diameter: The* specified outside diameter. This shall mean the actual outside diameter.

391 *Nominal wall thickness*: The specified non-corroded wall thickness, which is equal to the minimum steel wall thickness plus the manufacturing tolerance.

392 *Normal cubic meters:* (Nm^3) is taken as cubic meters of gas at standard conditions of 0°C and 1.013 bar.

393 *Open bell* (also known as Wet bell): A suspended canopy chamber, open at the bottom like a moon pool structure that is lowered underwater to operate as a stage for the divers with the advantage of providing an air pocket for refuge and a space for communication outside the mask/helmet.

394 *Operation, Incidental*: Conditions that are not part of normal operation of the equipment or system. In relation to diving systems, incidental conditions may lead to incidental pressures.

395 *Operation, Normal*: Conditions that arise from the intended use and application of equipment or system, including associated condition and integrity monitoring, maintenance, repairs etc. In relation to diving systems, this should include, start and finish of dives (pre- and post-dive checks), treatment of decompression-related incidents, gas transfer and changing out of consumables.

396 *Operations (phase):* The phase when the diving system is being used for the purpose for which it was designed.

397 *Organization means the International Maritime Organization (IMO).*
*(*IMO Code Of Safety For Diving Systems Chapter 2 Design, Construction And Survey 1.3.17*)*

398 Out of roundness: The deviation of the perimeter from a circle. This can be stated as ovalisation (%), or as local out of roundness, e.g. flattening, (mm).

B 400 Terminology and definitions (continued)

401 *Outer area:* Those areas of the diving system that are exposed to atmospheric conditions during operation, i.e. outside the inner system and the room or area that surrounds or contains the diving system.

402 *Ovalisation*: The deviation of the perimeter from a circle. This has the form of an elliptic cross section.

403 *Owner*: Signifies the registered owner or manager of the diving system or any other organization or person who has assumed the responsibility for operation of the diving system and who on assuming such responsibility has agreed to take over all the duties and responsibilities. Ref. DNV Rules for Classification of Ships Pt.1 Ch.1 Sec.1 A.

404 *Oxygen systems*: Systems intended for a gas with a higher oxygen percentage than 25.

405 *Personal diving equipment:* Equipment carried by the diver on his person including his tools, diving suit, diving helmet and self-contained breathing apparatus with gas bottles. This is normally not included in the diving system specified in the standard.

406 *Plan approval:* Signifies a systematic and independent examination of drawings, design documents or records in order to verify compliance with the rules or statutory requirements. Plan approval will be carried out at the discretion of the Society, which also decides the extent and method of examination.

407 *Planned Maintenance System (PMS):* A system for planning and recording of maintenance activities.

408 *Pressure control system*: In relation to diving systems, this is the system for control of the pressure in the various systems, comprising the pressure regulating system, pressure safety system and associated instrument and alarm systems.

409 *Pressure regulating system*: In relation to diving systems, this is the system which ensures that, irrespective of the upstream pressure, a set pressure is maintained downstream (at a given reference point) for the component.

410 *Pressure safety system*: The system which, independent of the pressure regulating system, ensures that the allowable set pressure is not exceeded.

411 *Pressure test*: The hydrostatic pressure test initially performed at the manufacturer of the pressure vessel in accordance with requirements in the design code.

412 *Pressure, Collapse*: Characteristic resistance against external over-pressure.

413 *Pressure, Design*: In relation to diving system assemblies, this is the maximum internal pressure during normal operation, referred to a specified reference point, to which the component or system section shall be designed. The design pressure must take account of the various pressurised components in the adjoining systems, and their relative design pressures.

414 *Pressure, System test*: In relation to diving systems, this is the internal pressure applied to the component or system during testing on completion of installation work to test the diving system for tightness (normally performed as hydrostatic testing).

415 *Pressure vessel means a container capable of withstanding an internal maximum working pressure greater than or equal to 1 bar.*
*(*IMO Code of Safety for Diving Systems Chapter 2 Design, Construction and Survey 1 3.18)

416 *Purchaser*: The owner or another party acting on his behalf, who is responsible for procuring materials, components or services intended for the design, construction, installation or modification of a diving system.

417 *Quality Assurance (QA):* Planned and systematic actions necessary to provide adequate confidence that a product or service will satisfy given requirements for quality.

418 *Quality Plan (QP):* The document setting out the specific quality practices, resources and sequence of activities relevant to a particular product, project or contract. A quality plan usually makes reference to the part of the quality manual applicable to the specific case.

419 *Quality system*: Signifies both the quality management system and established production and control procedures.

420 *Reliability*: The probability that a component or system will perform its required function without failure, under stated conditions of operation and maintenance and during a specified time interval.

421 *Re-qualification*: The re-assessment of a design due to modified design premises and or sustained damage.

422 *Resistance*: The capability of a structure, or part of a structure, to resist load effects.

423 *Risk*: The qualitative or quantitative likelihood of an accident or unplanned event occurring, considered in conjunction with the potential consequences of such a failure. In quantitative terms, risk is the quantified probability of a defined failure mode times its quantified consequence.

424 *Risk reduction measures*: Those measures taken to reduce the risks to the operation of the diving system and to the health and safety of personnel associated with it or in its vicinity by:

a) Reduction in the probability of failure.

b) Mitigation of the consequences of failure.

Guidance note:

The usual order of preference of risk reduction measures is:

a) inherent safety
b) prevention
c) detection
d) control
e) mitigation
f) emergency response.

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425 *Rules*: All requirements adopted by the appropriate approval body as the basis for classification.

426 *Safety objectives*: The safety goals for the construction, operation and decommissioning of the diving system including acceptance criteria for the level of risk acceptable to the owner.

427 *Saturation diving:* Once a diver becomes saturated with the gases that make decompression necessary, the diver does not need additional decompression. When the blood and tissues have absorbed all the gas they can hold at that depth, the time required for decompression becomes constant. As long as the depth is not increased, additional time on the bottom is free of any additional decompression.

428 *Self-Propelled Hyperbaric Lifeboat (SPHL):* (see HEU and DNV-DS-E402)

429 *Shipyard*: Signifies the party contracted to build a vessel in compliance with the Society's rules.

430 *Significant wave height*: When selecting the third of the number of waves with the highest wave height, the significant wave height is calculated as the mean of the selection.

431 *Specified Minimum Tensile Strength*: The minimum tensile strength prescribed by the specification or standard under which the material is purchased.

432 *Specified Minimum Yield Stress*: The minimum yield stress prescribed by the specification or standard under which the material is purchased.

433 *Statement of compliance*: A statement or report signed by a qualified party affirming that, at the time of assessment, the defined phase, or collection of activities, met the requirements stated by the customer.

434 *Submersible Decompression Chamber (SDC)*: Closed bell.

435 *Suitable breathing gas:* A gas or gas mixture that is breathable to divers for the pressure and duration they are exposed to it.

436 *Supplementary requirements*: Requirements for material properties of component that are additional to the basic requirements, and that are intended to apply to components used for specific applications.

437 *Surface compression chamber means a pressure vessel for human occupancy with means of controlling the pressure inside the chamber.*
*(*IMO Code of Safety for Diving Systems Chapter 2 Design, Construction And Survey 1.3.5)

438 *Survey:* Signifies a systematic and independent examination of a diving system, materials, components or systems in order to verify compliance with the rules and/or statutory requirements. Surveys will be carried out on the vessel, at the construction or repair site as well as at sub-suppliers and other locations at the discretion of the Society, which also decides the extent and method of control.

439 *Survey Planning Document:* As described in DNV Rules for Classification of Ships Pt.7 Ch.1 Sec.6 I100 *General*

440 *Tentative rules:* Provisional requirements and/or guidelines to which the Society reserves the right to make adjustments in order to obtain the intention reflected in the rules.

441 T_{op}: Maximum operation time, i.e. the time from start of pressurization of the diver, until the diver is back to atmospheric conditions.

442 *Transfer compartment:* Compartment that is intended to be used for a lock-in or -out operation of divers between other compartments or outer area. Also known as TUP (Transfer Under Pressure)
The diving system should be capable of allowing the safe transfer of a person under pressure from the diving bell to the surface compression chamber (and vice versa).
*(*IMO Code of Safety for Diving Systems Chapter 2 Design, Construction And Survey 2.2.7)

443 *Transferable diving system:* A diving system designed to be easily transferable in one or more units and which may be installed on-board a ship, barge or offshore platform for a short period of time not exceeding one year. A transferable diving system may be assembled from different units into a particular configuration suitable for a specific working operation.

444 *Type approval*: is a procedure for plan approval. Type approval can be applied to products, groups of products, systems or retention survey. This procedure should normally be used for approval of standard designs. The type approval procedure may consist of the following elements: plan approval, initial survey, type testing and issue of a type approval certificate. The type approval procedure used by DNV is described in DNV Standard for Certification No. 1.2.

445 *Ultimate Tensile Strength:* The measured ultimate tensile strength.

446 *Umbilical means the link between the diving support unit and the diving bell and may contain surveillance, communication and power supply cables, breathing gas and hot water hoses. The hoisting and lowering strength member may be part of the umbilical.*
*(*IMO Code of Safety for Diving Systems Chapter 2 Design, Construction And Survey 1.3.19)

Umbilical (in DNV terms): A link between support vessel and the divers, or the diving wet-bell, which may contain gas hoses, hot water hose, power supply cables and communication cables.

447 *Verification* A service that signifies a confirmation through the provision of objective evidence (analysis, observation, measurement, test, records or other evidence) that specified requirements have been met.

448 *Wet bell*: (see *Open bell*)

449 *Witnessing*: Signifies attending tests or measurements where the surveyor verifies compliance with agreed test or measurement procedures.

450 *Work*: All activities to be performed within relevant contract(s) issued by Owner, Builder or Manufacturer.

451 *Working weight:* of the basket or wet-bell shall be taken as the maximum weight of the fully equipped basket or wet-bell, including each fully equipped diver of 200 kg. The load from this weight applies to:

a) launch and recovery in air

b) launch and recovery submerged, combining the maximum negative buoyancy of the wire rope, umbilical and basket or wet-bell at maximum operating depth.

452 *Yield Stress*: The measured yield tensile stress.

B 500 Abbreviations and symbols (guidance)

API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AUT	Automatic Ultrasonic Testing
BS*	British Standard (*Note: Now PD – Public document)
C-Mn	Carbon Manganese
CE	Conformité Européene (European Conformity)
CRA	Corrosion Resistant Alloy
DNV	Det Norske Veritas
DP	Dynamic Positioning
EBW	Electronic Beam Welded
FMEA	Failure Mode Effect Analysis
HAZ	Heat Affected Zone
HAZOP	Hazard and Operability Study
HFW	High Frequency Welding
HPIC	Hydrogen Pressure Induced Cracking
IM	Installation Manual
ISO	International Organisation for Standardisation
KV	Charpy value
LBW	Laser Beam Welded
MPQT	Manufacturing Procedure Qualification Test
MPS	Manufacturing Procedure Specification
MSA	Manufacturing Survey Arrangement
NACE	National Association of Corrosion Engineers
NDE	Non-Destructive Examination
NDT	(Non-Destructive Testing) see NDE
NPD	Norwegian Petroleum Directorate
P	Production
Q	Qualification
QA	Quality Assurance
QC	Quality Control
QP	Quality Plan
QRA	Quantitative Risk Analysis
ROV	Remotely Operated Vehicle
UTS	Ultimate Tensile Strength
WPS	Welding Procedure Specification
YS	Yield Stress

501 Symbols

A = Cross section area
D = Nominal outside diameter.
D_{max} = Greatest measured inside or outside diameter
D_{min} = Smallest measured inside or outside diameter
D_i = $D-2t_{nom}$ = Nominal internal diameter
E = Young's Modulus
f_0 = Ovality, $\frac{D_{max} - D_{min}}{D}$
H = Wave height
H_s = Significant wave height
ID = Nominal inside diameter
O = Out of roundness, D_{max} - D_{min}
OD = Nominal outside diameter
T = Operating temperature
T_{max} = Maximum design temperature
T_{min} = Minimum design temperature
T_{nom} = Nominal thickness

B 600 Legal provisions

601 Legal provisions are given in DNV Rules for Classification of Ships Pt.1 Ch.1 Sec.5.

SECTION 2 PROCEDURAL REQUIREMENTS

A. Classification principles for diving systems

A 100 Objectives

101 The objectives of this section are to provide:

a) an overview of certification and Classification activities relating to diving systems
b) details of DNV's certification and Classification services for diving systems
c) information and requirements on the classification process in general.

A 200 Scope

201 Generic scopes of work for certification and Classification are given in the tables in this section.

202 Design and construction aspects, relevant to diving system safety and integrity, will be covered by certification.

203 Certification describes the totality of verification activities leading up to the issue of a DNV certificate.

204 The following parts and systems are covered by DNV's certification and Classification of a complete diving system (for specific certification levels, see Appendix A):

a) Chambers (NV certificate)
b) Bell (NV certificate)
c) permanent gas storage containers (NV certificate)
d) other pressure vessels (NV certificate)
e) life support systems (Various certificates)
f) Divers heating systems
g) electrical systems and installations (Various certificates)
h) fire protection, detection and extinction (Various certificates)
i) launch and recovery systems (NV certificate)
j) main umbilical (NV certificate)
k) pipes, valves and fittings (Works certificates – mostly)
l) booster pumps and compressors (NV certificate – mostly)
m) helium reclaim plant (if installed) (NV certificate)
n) gas analysers (Works certificate)
o) gas mixing units (NV certificate)
p) gas absorbers (Various certificates)
q) breathing systems (Various certificates)
r) depth gauges (Works certificate)
s) sanitary system (NV certificate)
t) communication system (Works certificate).

205 The classification of the diving system will cover assembly of the components into a system and include the following matters:

a) launching and recovery system for bell
b) the arrangement of the diving system assembly
c) the complete diving system assembly with respect to safety.

206 The classification of the diving support vessel will be in accordance with DNV Rules for Classification of Ships Pt.5 Ch.16 and cover the following matters:

a) the vessel's ability to keep its position during diving operations
b) the hull structural arrangements related to the diving system, e.g. moon pool (launching and recovery well for bell)
c) the installation of the diving system
d) stability and floatability
e) arrangement for hyperbaric rescue of divers in saturation.

A 300 Application

301 This section applies to all diving systems, components and assemblies, for diving systems **SURFACE** and **SAT**.

302 This section also applies to installation of the diving system assembly on a support vessel, for **DSV - SURFACE** and **-SAT**.

A 400 References

401 Classification principles in general are given in DNV Rules for Classification of Ships Pt.0 and Pt.1.

A 500 Statutory certification

501 The Society undertakes statutory certification on behalf of flag administrations when and to the extent the Society has been authorised to do so by the individual flag administration, in accordance with requirements given in DNV Rules for Classification of Ships Pt.1 Ch.1 Sec.1 D.

502 In the context of diving systems, statutory certification is carried out in compliance with IMO Code of Safety for Diving Systems, 1995 Resolution A.831(19). A corresponding "Diving System Safety Certificate" may be issued upon proof of compliance.

B. Documentation

B 100 Purpose of certification documents

101 Certification documents are normally issued by DNV. The purpose of these documents is to:

a) provide documentation that design approval, monitoring of fabrication and testing of final product has been presented
b) confirm the diving system's components conformity with the requirements
c) document the work performed by DNV.

102 Final certification documents, consisting of statements and certificates, are formal documents in which DNV states that a particular aspect of the work (a product or service) has been completed in conformance with the requirements for certification specified or requested for the diving system by the owner.

103 The certification documents are as follows and the hierarchy is shown in Figure 1 below:

a) class notation with appendix
b) installation report with data sheet
c) product certificates
d) material certificates
e) survey report
f) comments.

104 Applicable certificates include:

a) Request for Certification/Classification of Diving Systems and parts of Diving Systems (Form no. 14.30a)
b) Classification Certificate for diving system (Form no. cdsv)
c) Classification Certificate for ship (Form no. cship)
d) Certificate of Interim Class (Form CINT)
e) Installation Report Diving System (Form no. 51.71a)
f) Certificate for Diving System (Form no. 14.39a)
g) Data Sheet for Diving System (Form 20.201a).
h) Certificate for Chambers for Diving Systems (Form no. 14.31a).
i) Certificate for Diving Bells (Form no. 14.32a).
j) Examination of Lifting Appliances of Lifting Gear (Form no. CG11)
k) Survey Report (Form no. 40.9a)
l) Plan Approval letter.
m) IMO Diving System Safety Certificate (Form no. DSV-SERT)
n) Certificate of Conformity Diving Systems (Form no. DSV.CON)

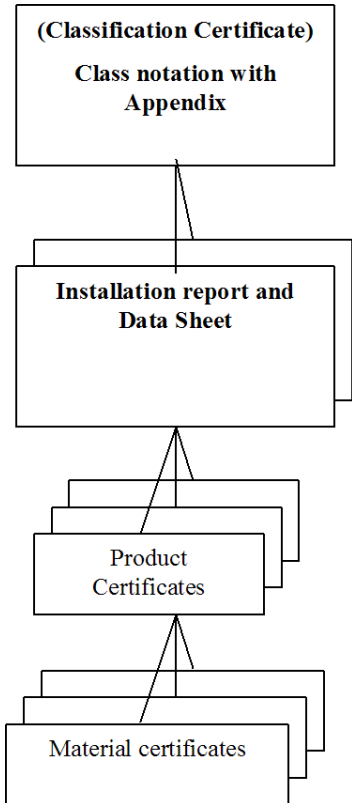

Figure 1
Document hierarchy for certification

B 200 Certification documents

201 The types of documents issued by DNV for the different stages of the certification process are illustrated in Table B1.

Table B1 Diving system certification – documents provided by DNV								
Reference standard for certification	DNV Standard DNV-OS-E402 *Offshore standard for diving systems* and DNV-DS-E403 *Standard for surface diving systems* and DNV-DSS-105 *Rules for classification of diving systems*							
Project phases	Design		Construction					Operation
	Conceptual design	Detail design	Manufacturing of materials	Manufacturing of components	Manufacturing of sub-systems and assemblies	Installation	Project completion	Operation, maintenance and repair
Certification phase	Pre - certification	Certification				Classification		Maintenance of classification
Types of certification documents provided	Letter	Approval letter	Documents for individual phase or natural part thereof: Certificates of materials and components, survey reports and Data Sheet			Certificate, data sheet and Class Notation		Retention of Class Notation

B 300 Validity of certification documents

301 Certification documents are, in principle, documents confirming that an examination has been carried out, and are valid only at the date of issue. However, for some certificates a specified period of validity, and maintenance conditions for ensuring this validity, may be given in the certificate. e.g. statutory and Class certificates.

C. Service process

C 100 General principles

101 The process of DNV's certification and Classification of diving systems is based on distinct project phases and the recognition of key milestones. Verification performed by DNV as part of the certification process, progresses through these project phases and includes all aspects of the project.

102 The certification process follows the project phases:

Pre-certification:

a) conceptual design.

Certification:

a) detail design
b) construction
c) manufacturing of diving system components.

Classification of diving system

a) manufacturing of diving systems assemblies
b) project completion of assembly with issue of classification certificate including *Diving System* class notation.
c) *Class Notation to support vessel*
d) installation on-board (See DNV Rules for Classification of Ships Pt.5 Ch.16)
e) project completion of installation with issue of classification certificate including issue of *DSV* class notation as appropriate to the vessel's main class certificate.

Maintenance of Class Notations:

a) operations, maintenance, repair and surveys. See DNV Rules for Ships Pt.7 Ch.1 Sec.6 I.

D. Plan approval

D 100 Pre-contract evaluation

101 Design verification during pre-certification shall be combined with DNV pre-contract review of the builder's concept in view of the operational aspects of the support vessel and the project schedule.

D 200 Information flow

201 Communication lines are illustrated in Figure 2 Communication Lines. What lines that are open for communication depends on the particular contractual agreements.

202 For instances where DNV (3rd party) does not have a contract with the owner (1st party), DNV recommends strongly that the owner, through his contract with the 2nd party, secures a direct communication line from DNV to owner and vice versa.

Guidance note:
The recommendation springs from DNV's experience with projects where communications difficulties between the parties have jeopardised the issue of certificates.

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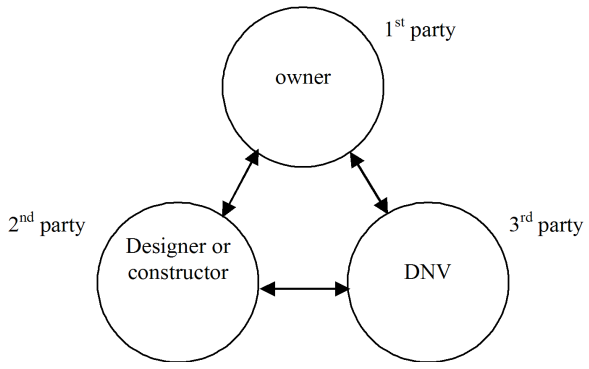

Figure 2
Communication lines

D 300 Obligations

301 The obligations of the parties are given in DNV Rules for Classification of Ships Pt.1 Ch.1 Sec.1 and Sec.3.

D 400 Overall project management

401 Overall project management shall be implemented as a means by which the entire project is controlled.

402 Necessary controls shall be in place to ensure that information flows between the various interfaces. This is especially important where separate contractors have been employed for different phases of the project such as design and installation.

403 Documents required in each section of DNV-OS-E402 and DNV-DS-E403 shall be submitted for review and or approval by DNV. The documents required shall be organised in accordance with a master document register.

D 500 Technical innovation and contractor experience

501 The degree of technical innovation in the diving system shall be considered. Risks to the diving operation are likely to be greater for a diving system with a high degree of technical innovation than with a diving system designed, manufactured and installed to well-known criteria in well-known vessels.

502 Similarly, the degree of risk to the diving system should be considered where contractors are inexperienced or the work schedule is tight.

503 Factors to be considered include:

a) degree of difficulty in achieving technical requirements
b) knowledge of similar diving systems
c) knowledge of contractors' general system experience
d) knowledge of contractors' experience in similar work.

D 600 Plan approval during design

601 **Plan approval** is the examination of the assumptions, methods and results of the design process and is performed at the specified level of certification to ensure that the specified requirements of the diving system will be achieved. A systematic review shall be is carried out as part of design. See DNV-DS-E403 and DNV-OS-E402 Appendix A.

602 **Plan approval** will entail:

a) reviewing specifications for design
b) reviewing design reports and drawings
c) performing independent parallel calculations for certain systems and components
d) reviewing specifications for manufacture and operation, resulting from design.

603 Definition of scope of work for plan approval of design will follow Table E1.

Table E1 Scope of work for plan approval of design
Plan approval activity
Review of the design process by
a) review of design quality management documentation
b) audit of design quality management system
Review of specifications for design by
c) review of the design basis with emphasis on the typical location on and interface with the support vessel. Evaluation of the design criteria – specifically or in general depending on the installation
Review of design reports and drawings by
d) review of the main documentation to ensure that the main conditions have been accounted for in design, that the governing conditions are identified, and that the chosen design philosophies are in accordance with specified codes and standards
e) evaluation of the main methods used and spot checks of the input data and the calculation results
f) detail review of main design reports
Performing independent parallel calculations by
g) simplified independent analysis and calculation(s) performed by spot checks
h) advanced independent analysis and calculation(s) performed by spot checks
Review of specifications for manufacture and operation by
i) spot check of critical aspects
j) review of main specifications
k) review of underlying specifications.

D 700 Type approval

701 Type approval may be offered for designs of components, systems or assemblies as appropriate, in compliance with rule requirements. Type approval is explained further in DNV Rules for Classification of Ships Pt.1 Ch.1 Sec.4 B300

D 800 Letter of approval

801 Documents subject to approval will be examined by the Society. The results of the examination will be stated in a letter of approval. Comments, conditions and limitations may be stated on the plans returned or in an accompanying letter.

E. Certification

E 100 Certification of materials, components and systems

101 Certification should be planned in close co-operation with the owner and each of its contractors, to provide a scope of work that is tailor-made to the schedule of each production process or activity, i.e. to make the verification activities, surveillance and hold points, an integrated activity.

Guidance note:

Some contractors have approved quality control systems and quality control departments, with competent personnel to perform, for example, inspection at manufacturing plants and specialist material engineers competent to review and verify the performance of manufacturers.
Reference is made to 'Manufacturing Survey Arrangements' described in DNV Rules for Classification of Ships Pt.1 Ch.1 Sec.4 B500.

In that situation DNV's certification activities can be confined to:

a) reviewing the competence of the Contractor's personnel
b) auditing their working methods and their performance of that work
c) reviewing the documents produced by them.

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102 At the request from the manufacturer, and when satisfied that all requirements corresponding to the rules have been met, DNV certificates may be issued for diving system components and systems, which has been designed, built, equipped, marked, inspected and tested in compliance with this service specification, DNV-OS-E402 and DNV-DS-E403 and or applicable codes, standards or regulations. These will be stated in the *Data Sheet for Diving System* (Form 20.201a).

103 The operational limitations and basic assumptions and conditions for use will also be stated in the *Data Sheet for Diving System*.

104 The Society's commission related to the certification of materials and components (CMC) is completed when the certificates are forwarded to the manufacturer.

105 For environmental control systems a copy of the approved test program completed with the final set points will be endorsed by the Surveyor, and shall eventually be kept available on-board.

106 Where DNV-OS-E402 and DNV-DS-E403 refers to certification, survey, acceptance, agreement or qualification this shall be by DNV. A list of these instances is provided in Appendix A and B.

107 DNV certification to internationally recognised standards shall follow the principles described in this DSS.

108 Where other standards and external criteria are used, the exact terms of reference and documents to be issued shall be agreed at the beginning of the project and formally defined in the contract. The use of other standards does not allow for a reduction of the quality management requirements as described in the safety philosophy of DNV-OS-E402 and DNV-DS-E403.

109 DNV reserves the right to call for additional requirements to cover issues essential to the certification and classification process if not covered by the standards in question.

110 It is normally not acceptable to mix standards due to the possible differences in safety philosophies.

Guidance note:

Most standards are a coherent collection of requirements for all the relevant aspects of a system. These aspects are normally adjusted to give an overall acceptable safety level. To pick requirements from different standards can then easily result in unpredictable (low) levels of safety. However, in some instances a mixture of standards need to be applied where certain aspects are not covered in one standard alone. (e.g. ASME PVHO-1 applies to acrylic windows regardless of the design code for the pressure vessel.

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E 200 Inspection and test plans (ITP)

201 The tabular description of the inspections and tests to be carried out during the work is frequently known as the Inspection and Test Plan.

202 The following items should be checked for inclusion within the inspection and test plan:

a) each inspection and test point and its relative location in the production cycle should be shown

b) the characteristics to be inspected and tested at each point should be identified

c) the use of sub-contractors should be indicated and details of how the verification of sub-contractor's quality shall be carried out should be shown

d) hold points established by the constructor, the operator or a third party, where witness or review of the selected inspection or test is required, should be shown.

E 300 Survey during manufacture, assembly and installation

301 **Survey** during manufacture is either carried out by means of full time attendance, audits, inspection or spot checks of the work, as appropriate, in sufficient detail to ensure that the specified requirements of the diving system will be achieved.

302 Verification of these activities relates not only to the contractor's work but also to the monitoring of this work carried out by others.

303 During manufacture surveys verification shall consist of one, or more, of:

a) reviewing the manufacture process

b) reviewing manufacture procedures

c) reviewing qualification process

d) surveillance during manufacture activities

e) reviewing final documentation.

304 Definition of scope of work for certification of manufacture shall follow Table F1 and for manufacturing and fabrication.

Table F1 Scope of work for attendance during manufacturing and fabrication of components
Survey activity
Review of the manufacturing and fabrication process
a) Review of manufacturing management systems
b) Audit of the quality management system
Review of manufacturing and fabrication procedures
c) Review manufacturing, fabrication, method and inspection procedures for confirmation of compliance with the manufacturing specification
Review of qualification process
d) Review the Manufacturing Procedure Specification, (MPS), Manufacturing Procedure Qualification Test (MPQT), if applicable
e) Full time attendance during MPQT, if applicable, or first day production
Surveillance during manufacturing and fabrication activities
f) Attendance during testing, to ensure, based on spot checks, that the delivered products have been produced in accordance with the manufacturing specification
Review of final documentation

305 Definition of scope of work for installation shall follow Table F2

Table F2 Scope of work for attendance during installation
Verification activity
Review of the installation process
a) Review of installation management systems
b) Audit of the quality management system
Review of installation procedures
c) Spot check of Installation Manual, (IM)
d) For critical operations (identified from the systematic review) review the IM
Review of qualification process
e) For critical operations, review the qualification of the IM
f) Full time attendance during tests, if applicable, or at start-up

Table F2 Scope of work for attendance during installation (Continued)
Verification activity
Surveillance during installation activities
g) Attendance during start-up of each sub-system installation.
h) Full time attendance during trials and associated visit- based attendance during testing.
Review of final documentation

306 After completed installation, the diving system is to be tested in compliance with an approved test program in presence of the surveyor according to Table F3. The required tests are stated in DNV-OS-E402 and DNV-DS-E403.

Table F3 Scope of work for attendance during final testing for operation, including as-built survey and project completion
Verification activity
Review of procedures
a) Review of the procedures for system tests to ensure that the test procedure will test the diving system in accordance with the design requirements
Surveillance during testing and completion activities
b) Attendance during pressure testing.
c) Full time attendance during pipe testing and audit based attendance during cleaning, and drying.
d) Full time attendance during as-built surveying and system testing
Review of final documentation
e) Check of as-built documentation
f) Review of as-built documentation

307 Diving components that are temporarily out of service may be subject to periodical inspections. The inspection requirements will be agreed upon between the owner and DNV on a case by case basis.

F. Classification

F 100 Assumptions

101 Classification is based on the assumption that:

a) the diving systems shall be properly maintained and operated by competent personnel

b) that a pre-check procedure is followed to ensure that all systems and components function properly before start of each operation

c) that current, wave and wind conditions shall be within the design limits for the various systems.

102 Diving systems in operation will retain their class notation provided that:

a) the diving system is operated within the specified limitations

b) periodical surveys are carried out in accordance with DNV Rules for Classification of Ships Pt.7 Ch.1 Sec.6 I and an approved Survey Planning Document (SPD)

c) the owner provides adequate documentation from inspection and maintenance activities

d) the owner maintains any installed systems for condition monitoring and carries out condition evaluations as applicable

e) information about damage, repairs and modifications, which may affect the certification, is promptly reported to DNV

f) Conditions of Class (CC) issued by DNV are acted upon within the specified time.

103 It is also assumed that whenever a significant component of the diving system is repaired or replaced it is re-tested or certified in accordance with this service specification. A report will be issued after any modification or repair of the diving system.

104 Diving systems that are temporarily out of service shall be subject to periodical inspections if the class notation is to be retained. The inspection requirements will be agreed upon between the owner and DNV, as described in DNV Rules for Classification of Ships Pt.7 Ch.1 Sec.1 A500.

105 The class notation can be withdrawn if the owner fails to:

a) comply with the operational procedures for the diving system accepted by DNV

b) carry out the regular in-service inspection and maintenance programme according to the procedures accepted by DNV

c) comply with any conditions of class issued by DNV.

106 Additionally, the class notation can be withdrawn if the diving system:

a) is damaged, or is suspected of having been damaged, in a manner likely to impair its safety or integrity

b) demonstrates signs of deterioration likely to impair its safety or integrity

c) is subjected to any modifications or repairs, which can impair its safety or integrity

d) is considered demobilised or taken out of use.

107 If the situation leading to withdrawal of the Class notation no longer exists, the Notation may be reinstated. However, the diving system will be subject to special assessment or monitoring prior to and or following the reinstating of the Class Notation.

F 200 Assignment of class - new systems

201 A request for classification of a new diving system shall be submitted in writing by the customer. The Society reserves the right to decline a request for classification. Assignment of class shall follow the requirements given in DNV Rules for Classification of Ships Pt.1 Ch.1 Sec.2 A. The scope of attendance will be agreed before manufacturing commences and in agreement between manufacturer, local office and approval centre.

202 Upon class request, the Society's surveyor may inspect the manufacture and assembly of the diving system and attend the final necessary tests.

203 When a diving system certified by the Society has been assembled, a class notation may be included in the certificate of class, provided the following requirements are met:

a) Launch and recovery systems for diving bell handling systems shall be certified in compliance with the Society's Standard for Certification No. 2.22 Lifting Appliances (separate publication), as applicable, and the additional requirements for handling systems given in DNV-OS-E402 and DNV-DS-E403 Sec.7.

b) The installation and testing requirements given in DNV-OS-E402 and DNV-DS-E403 shall have been complied with.

c) The diving system will be subjected to periodical surveys as specified in the respective rules for classification, in order to ensure that the system is properly maintained in good condition for retention of class. See also DNV Rules for Ships Pt.7.

204 Depending on the operational restrictions, a diving system may obtain one of the class notations given in Table G1.

Table F1 Class notations

Class	**Diving system – SURFACE**	**Diving system – SAT**
Restrictions	d_{max}< 60msw* T_{op}< 8 hours	As stated in the requirements and assumptions in the certificate, appendix to Classification certificate and Data Sheet (20.201a)
Provisions	Open bell or basket deployment allowed No HES required	Closed bell Dedicated HES required

*msw = metres sea water, d_{max} = maximum operating depth.

Guidance note:

As lifesaving appliances is covered by statutory regulations, there may be overriding requirements for Hyperbaric Evacuation Systems (HES). Consequently, it is important to inform DNV at an early stage what Flag State is intended for the vessel and what geographical areas of operation the diving system should be approved for.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

205 Requirements which do not specifically refer to **Diving system–SURFACE** or **Diving system–SAT**, or which are called minimum requirements in the Standard, apply to all systems.

206 In DNV-OS-E402 and DNV-DS-E403, the major differences between **Diving system–SURFACE** and **Diving system–SAT** diving systems appear as requirements for the:

a) physical size of the chambers

b) life support system

c) control stand

d) communication system

e) capacity of emergency power supply.

207 An arrangement may be agreed for periodical surveys in order to ensure proper maintenance of the diving system. Corresponding documents will be issued.

208 When a diving system has been assigned class, its main particulars and details of the class assigned will be entered in the Society's register according to requirements given in DNV Rules for Classification of Ships Pt.1 Ch.1 Sec.2 D.

F 300 Assignment of class - existing systems

301 A request for class entry of an existing diving system shall be submitted in writing by the customer. The Society reserves the right to accept or decline an application for class entry. The assignment of class shall follow the requirements given in DNV Rules for Classification of Ships Pt. 1 Ch.1 Sec.2 B.

302 When a diving system, or part of a diving system, has been certified by another recognised classification society, evidence of previous design approval will be required. Such evidence shall include drawings of the arrangement and details bearing the approval stamp, or specifically covered by an approval letter. In addition, for components requiring certification, the corresponding certificates shall be available along with maintenance records.

303 After review of the evidence and examination and testing in accordance with relevant parts of DNV-OS-E402 and DNV-DS-E403, the system or components may be registered under the Class Notation with DNV.

F 400 Diving support vessel class notation (DSV)

401 Class notation DSV is assigned to the support vessel in order to determine applicable rule requirements for assignment and retention of class. Vessels having diving system installations found to satisfy the rule requirements in DNV Rules for Classification of Ships Pt.5 Ch.16 may be assigned one or both corresponding optional class notations **DSV-SAT** and/or **DSV-SURFACE** as applicable. The requirements shall be regarded as supplementary to those given for the assignment of main class for the vessel and for assignment of Diving System class for the diving system.

F 500 Retention of class

501 During the operations phase, the scope of work in order to maintain the Class notation is outlined in DNV Rules for Classification of Ships Pt.7.

G. Verification

G 100

101 Verification need not only be performed as part of a complete certification of a diving system but can be stand-alone service for all or part of approval.

102 Applying these principles of verification for distinct smaller or larger parts of the diving system or selected phases may not result in a DNV certificate. Therefore, instead of using the term certification, the term verification is used to describe this service.

103 Verification constitutes a systematic and independent examination of the various phases in the life of a diving system to determine whether it has (or continues to have) sufficient integrity for its purpose.

104 Verification shall be complementary to routine design, manufacture and operations activities and not a substitute for them. Therefore, although verification will take into account the work, and the assurance of that work, carried out by the owner and its contractors, it is inevitable that it will duplicate some work that has been carried out previously by other parties involved in the diving system.

105 An offshore support vessel may be verified for compliance with required supports and services for preparation and conversion to a diving support vessel. If the vessel is found compliant, a Memo to Owners will be included in the ship’s registry.

APPENDIX A
DIVING SYSTEM SAT
- INSTANCES WHERE DNV-DSS-105 AND DNV-OS-E402 REQUIRE CERTIFICATION AND/OR ATTENDANCE BY DNV

A. Introduction

A 100 General

101 The Tables B to E give the instances where DNV-OS-E402 requires certification. In those cases where DNV is providing a certificate, this shall be a DNV Product Certificate (NV). (See DNV Rules for Ships Pt.1. Ch1. Sec.4 B100 regarding definitions of DNV Product Certificates (NV), Works Certificates (W) and Test Report (TR)). In those cases where DNV is providing a certificate, this attendance shall be by DNV.

102 The table is subdivided into:

a) Design and Manufacture
b) Assembly
c) Installation
d) Operations

B. Design and manufacture

Table B1 Instances of certification and of attendance required by DNV-OS-E402 - Design and manufacture

Section	*Letter*	*Hundred*	*Description*
1	A	305	Consideration of application of standard
2	B	500	Verify quality assurance by assessment of quality system
2	F	102	Consideration of requirements for mooring by anchors (if applicable)
2	F	103	Acceptance of DYNPOS redundancy
2	H	104	Verify documentation
2	J	-	Verify overall test requirements in general
2	J	-	Approval of Inspection and Test Plans (ITPs)
2	J	101	Verify as built status against approved drawings
2	J	103	Approve installation test programme
2	J	201	Pressure tests – Attend and/or verify tests
2	J	202	Compressors - Attend and/or verify tests
2	J	203	Closed Circuit Breathing Systems (CCBS) - Attend and/or verify tests
2	J	204	Flexible hoses - Attend and/or verify tests
2	J	205	Umbilical - Attend and/or verify tests
2	J	206	Electrical pressure vessel penetrators - Attend and/or verify tests
2	K	-	Verify Marking and signboards
3	A	602	Agreement on alternative design loads
3	B	102	Agreement on design code used
3	B	102	Testing according to applied standard
3	B	104	Acceptance of use of other pressure vessel code
3	B	105	Certification of Pressure Vessels for Human Occupancy (PVHO) - Product certificate (NV)
3	B	108	Windows in PVHO - Product certificate (NV)
3	C	102	Consideration for use of other material grades
3	C	102	Material grades - Test Reports (TR) and additional testing of materials
3	C	103	Materials for main pressure retaining parts - Product certificate (NV)
3	C	104	Stainless steel parts welded to non-stainless pressure vessel - Test Report (TR)
3	C	201	Manufacturers of pressure vessels - Approved manufacturer
3	C	202	Approval of design specifications, Approved welders and welding materials, Testing of weld qualifications

Table B1 Instances of certification and of attendance required by DNV-OS-E402 - Design and manufacture (Continued)

Section	*Letter*	*Hundred*	*Description*
3	C	203	Audit NDE and approval of NDE operators
3	C	203	NDE operators - Approved NDE operators and NDE - Approval of NDE design specifications
3	C	203	NDE of piping with Test Reports (TR)
3	C	204	Testing after heat treatment - Test Reports (TR)
3	C	205	Tolerance checks - Test Reports (TR)
3	D	102/103	Consideration of strain gauge measurements as an alternative to fatigue evaluation
3	D	102	Acceptance of finite element analysis
3	E	101	Smaller gas cylinders considered essential - Product certificate (NV)
3	E	101	Certification of Gas bags for Helium reclaim systems - Test Report (TR)
3	E	101	Manufacturers of, and certification of, gas cylinders - Approved manufacturer and (3.2) Certificate
3	E	102	Materials as defined by EN 10204for Gas cylinders - Works certificate (W) or (3.2) certificate
3	E	103	Acceptance of other standard and Design evaluation. Testing EN 10204 to applied standard – Test Report (TR)
3	E	400	Production tests of gas cylinders - Test Reports (TR)
3	F	200-500	Approval and Testing of acrylic material in accordance with ASME PVHO-1
4	B	201	Pressure relief devices and shut-off valves - Works certificates (W)
4	C	206/301	BIBS Masks - Works certificates (W)
4	C	101	Manifolds - Works certificate (W) and Test Report (TR)
4	C	107	Oxygen analyser – Works certificate (W)
4	E	201	Overpressure alarm - Works certificate (W) and Test Report (TR)
4	E	303	Safety valves and Overpressure alarm - Works certificate (W) and Test Report (TR)
4	E	304	Chamber mounted valves for water - Works certificate (W) and Test Report (TR)
4	F	100/200	Heaters for bells and chambers - Works certificate (W) and Test Report (TR)
4	F	100/200	Temperature controls - Works certificate (W)
4	F	101	Temperature indicator - Works certificate (W) and Test Report (TR)
4	F	401	Noise reduction - Test Report (TR)
4	F	600	Carbon dioxide removal – Works certificate (W) and Test Report (TR)
4	F	700	Helium regeneration - Works certificate (W) and Test Report (TR)
4	G	200	Control, alarm and safety systems in gas mixers - Product certificates (NV) and Test Reports (TR)
4	I	102/103	Lights - Works certificates (W)
4	I	203	Monitors in wet bell - Test Reports (TR)
5	B	102	Consideration for use of higher voltages than 30V
5	B	200	Electrical motors - Works certificate (W) under 100 kW - Product certificate (NV) over 100kW Ref. DNV Rules for Classification of Ships Pt.4 Ch.8 Sec.1 B Table B3
5	B	303	Acceptance of control gear in inner area
5	B	305	Fire Proof Cables - Type Approval and Works certificate (W) including fire resistant cables (IEC 60331) or flame retardant for not critical cabling
5	B	308	Electrical motors in inner area - Works certificate (W)
5	B	600	Testing in accordance with DNV-OS-D201
5	B	601	Electrical switchboards - Works certificate (W) and Test Report (TR)
5	C	201	Testing pressure resistant enclosures – Test Report (TR)
5	C	501	Cables - Type Approval (TA) or Works certificate (W) with Test Report (TR)
5	C	502	Electrical penetrators for pressure vessels - Product certificate (NV) and Test Report (TR)
5	E	-	Pressure indicators and gas analysers - Type Approval (TA) or Works certificate (W) with Test Report (TR)
5	E	601	Consideration for use of other analysis instrumentation to detect other gases
6	B	102	Non-hazardous materials - Test Report (TR) and Test of 'non-hazardous materials' – verify test report
6	B	102	Consideration of alternatives to material testing
6	C	101	Fire detection and alarm system - Type Approval (TA) or Works certificate (W) with Test Report (TR)

Table B1 Instances of certification and of attendance required by DNV-OS-E402 - Design and manufacture (Continued)

Section	*Letter*	*Hundred*	*Description*
6	D	200	Manually operated fire fighting device for inner area - Type Approval (TA) and/or Test Report (TR) and/or Works certificate (W) depending on device
6	E	100	Fire fighters outfit - Type Approval (TA) or Works certificate (W) with Test Report (TR)
6	E	201	Portable fire extinguishers - Type Approval (TA) or Works certificate (W) with Test Report (TR)
7	A	-	Winches and power packs - Product certificates (NV)
7	B	102/103	Stops and brakes - Test Report (TR)
7	B	100	Winches and power packs - Product certificate (NV)
7	B	101	LARS control and monitoring - Product certificate (NV)
7	B	302	Release mechanisms for hoists and guides - Type Approval (TA) or Works certificate (W) with Test Report (TR)
7	B	400	Power tests – Test Report (TR) including hydraulic, electric - load test, high voltage/ pressure, insulation/leak
7	C	201	Ropes - Product certificates (NV) with Test Reports (TR). Ref. DNV Standard for Certification of Lifting Appliances Table B2 Wire ropes to be delivered with DNV CG4 or ILO FORM 4 certificate
7	C	202	Blocks and shackles - Test Reports (TR) CG3 or ILO FORM 3
7	C	202	Sheaves - Product certificate (NV)
7	C	203	Materials for structural members in launch and recovery systems - Works certificate (W)
7	C	203	Acceptance of other codes/standards
8	A	401	Tested for noxious, toxic or flammable properties - Test Report (TR)
8	A	402	Materials and components in oxygen systems - Test Report (TR) and Works certificates (W)
8	B	-	Verify design specifications
8	B	101	Piping – Product certificate (NV) or Works certificate (W) (see Ship Rules Pt.4 Ch.6)
8	B	102	Welding – WPQ, WPS and welders (see DNV Rules for Classification of Ships Pt.2 Ch.3 Sec.5 B. Welding Procedure Specification)
8	B	104	Hydrostatic testing of piping with Test Reports (TR)
8	B	200	Flexible hose assemblies (with couplings) including umbilical hoses - Type Approval certificate (TA) and Works certificate (W)
8	B	300	Shock testing of hoses for use in oxygen systems with Test Reports (TR)
8	C	-	Valves and Pressure regulators - Works certificates (W)
8	D	-	Fittings and Pipe connections - Works certificates (W)
8	E	-	Compressors – Product certificate (NV)
8	F	-	Umbilical – Product certificate (NV)
8	F	600	Mechanical testing of umbilical with Test Reports (TR)
8	F	700	Completion testing of umbilical with Test Reports (TR)

Table B2 Instances of certification and of attendance required in DNV-DSS-105 - Design and manufacture

Section	*Letter*	*Hundred*	*Description*
2	A	204	Agree certification coverage to be reflected in Request for Certification
2	B	100	Agree purpose of certification to be reflected in Request for Certification
2	E	108/109	Agree on alternative standards to be reflected in Request for Certification
2	E	300	Agree on survey scope to be reflected in Request for Certification

C. Assembly

Table C1 Instances of certification and of attendance required in DNV-OS-E402 – Assembly			
Section	*Letter*	*Hundred*	*Description*
2	B	200	Review safety objective
2	B	300	Verify adequate systematic review
2	C	100	Kick-off meeting before concept development
2	C	100	Verify concept development
2	C	200	Review execution plan
2	E	200	Evaluate Lay-out plans
2	I	200	Acceptance of documentation of arrangement
2	J	-	Approval of Inspection and Test Plans (ITPs)
2	J	101	Verify as built status against approved drawings
2	J	103	Approve installation test programme
3	D	102	Oxygen alarm – Works certificate (W)
4	D	104	Components for oxygen systems - Test Report (TR)
4	E	101	Pressure relief valves - Works certificates (W) and Test Report (TR)
4	E	103	Filters - Works certificate (W)
4	E	105	Shut-off valves - Works certificates (W)
4	E	301	Non-return valves, flow-fuses and valves - Works certificates (W) and Test Reports (TR)
4	H	100	Closed Circuit Breathing System (CCBS) -Product certificate (NV) and Test Reports (TR)
5	A	500	Define essential services and emergency services
5	D	-	Communications systems - Type Approval (TA) or Works certificate (W) with Test Report (TR)
6	D	105	Consideration of fire extinguishing on open deck
7	A	101	Launch and recovery system certified as lifting appliance - Product Certificate (NV) (CG2)
7	B	-	Verify design specifications
7	B	200/300	Acceptance of alternative recoveries
8	A	401	Tested for Noxious, toxic or flammable properties - Test Report (TR)
8	A	402	Materials and components in oxygen systems - Test Report (TR) and Works certificates (W)
8	B	-	Verify design specifications
8	B	-	Piping – Product certificate (NV) or Works certificate (W) (see Ship Rules Pt.4 Ch.6)
8	B	101	Piping – Product (NV) or Works certificate (W) (see Ship Rules Pt.4 Ch.6)
8	B	101	Welding – WPQ, WPS and welders (see DNV Rules for Classification of Ships Pt.2 Ch.3 Sec.5 B. Welding Procedure Specification)
8	B	102	Welding – WPQ, WPS and welders (see DNV Rules for Classification of Ships Pt.2 Ch.3 Sec.5 B. Welding Procedure Specification)
8	B	102	Hydrostatic testing of piping with Test Reports (TR)
8	B	104	Hydrostatic testing of piping with Test Reports (TR)
8	B	200	Flexible hose assemblies (with couplings) including umbilical hoses - Type Approval Certificate (TA) and Works certificate (W)
8	B	300	Shock testing of hoses for use in oxygen systems with Test Reports (TR)
8	C	-	Valves and Pressure regulators - Works certificates (W)
8	D	-	Fittings and Pipe connections - Works certificates (W)
8	F	600	Mechanical testing of umbilical with Test Reports (TR)
8	F	700	Completion testing of umbilical with Test Reports (TR)

Table C2 Instances of certification and of attendance required in DNV-DSS-105 - Assembly			
Section	*Letter*	*Hundred*	*Description*
1	A	204	Agree on applicable statutory scope and certification
1	A	602	Agree on scope to be reflected in Request for Certification
1	A	604	Agree on conditions and limitations to be reflected in Request for Certification/Data Sheet (Form 20.201a)
2	A	204	Agree certification coverage to be reflected in Request for Certification
2	A	205	Agree on Classification scope for the diving system (Diving System- Class Notation)
2	A	500	Agree on applicable statutory scope and certification
2	B	100	Agree purpose of certification to be reflected in Request for Certification
2	E	102 to 107	Certification – Various according to request and Data Sheet (Form 20.201a)
2	E	108/109	Agree on alternative standards to be reflected in Request for Certification
2	E	300	Agree on survey scope to be reflected in Request for Certification
2	F	200	Assignment of Class – Class Certificate

D. Installation

Table D1 Instances of certification and of attendance required in DNV-OS-E402 - Installation			
Section	*Letter*	*Hundred*	*Description*
2	C	300	Meet at suitable milestone after plan for manufacture, installation and operation.
2	C	700	Classification of diving system
2	E	400 to 600	Define acceptance level of deflection in ship's hull. Approve supporting structures
2	E	300	Evaluate Hazardous zones. Consideration for the location of diving system in Hazardous Zone 2
2	E	301	Certified components for systems used in Hazardous Zone 2. - Special consideration
2	E	403	Acceptance of alternative standard for supporting structures and foundations
2	F	105	Acceptance of stability and floatability of support vessel
2	G	501	Define maximum sea state (see also Sec.7 A103)
2	I	102/103	Acceptance of documentation procedures and registry
2	J	-	Overall test requirements with reports
2	J	-	Approval of Inspection and Test Plans (ITPs)
2	J	101	Verify as built status against approved drawings
2	J	103	Approve installation test programme
2	J	300	Installation report
2	J	303	Acceptance of actual leakage rate during testing
2	K	-	Survey report
3	A	400	Testing and marking after completion with reports
3	D	102	Oxygen alarm – Works certificate (W)
4	D	104	Components for oxygen systems - Test Report (TR)
4	E	101	Pressure relief valves - Works certificates (W) and Test Report (TR)
4	E	103	Filters - Works certificate (W)
4	E	105	Shut-off valves - Works certificates (W)
4	E	301	Non-return valves, flow-fuses and valves - Works certificates (W) and Test Reports (TR)
5	A	500	Define essential services and emergency services
6	B	202	A-60 Fire division including bulkhead penetrators - DNV Type Approval Certificates (TA)
6	C	100/200	Fire detection and alarm systems - Type Approval (TA) and Product certificate (NV)
6	D	101 to 104	Approved extinguishing system
6	D	100	Fixed fire extinguishing system - Various certificates and Type Approval (TA) depending on system, ref. DNV Rules for Ships Pt.4 Ch.10. - Sprinklers require Type Approval (TA) and Works certificates (W)
6	D	105	Consideration of fire extinguishing on open deck
6	E	101	Fireman's outfit - Various certification requirements depending on Statutory regulations. Works certificates (W) as a minimum with Test Reports (TR)

Table D1 Instances of certification and of attendance required in DNV-OS-E402 - Installation (Continued)			
Section	*Letter*	*Hundred*	*Description*
6	E	202	Portable fire extinguishers - Type Approval (TA) ref. DNV Rules for Ships Pt.4 Ch.10
7	A	103	Defined load conditions
8	B	-	Piping – Product (NV) or Works certificate (W) (see Ship Rules Pt.4 Ch.6)
8	B	101	Welding – WPQ, WPS and welders (see DNV Rules for Classification of Ships Pt.2 Ch.3 Sec.5 B. Welding Procedure Specification)
8	B	102	Hydrostatic testing of piping with Test Reports (TR)
9	-	-	Various considerations in regard to Hyperbaric evacuation
9	-	-	Hyperbaric Evacuation System and Hyperbaric Evacuation Unit - Statement/Certificate of conformance depending on statutory engagement. - Test Report (TR)
9	A	204	Test of Hyperbaric Evacuation System with Test Reports (TR)
9	A	402	(Chamber for Hyperbaric Evacuation Unit) as for Sec.3 B105
9	A	901	Consideration for entry into CEC
9	A	1801	Launch and Recovery system (HES) - Type Approval (TA) and Test Report (TR)
9	A	2500	SPHL - Type Approval (TA) and Test Report (TR)
9	A	2508	Radio – Works certificate (W)
9	A	2800	Survey – Survey and Test Report (TR)

Table D2 Instances of certification and of attendance required in DNV-DSS-105 – Installation			
Section	*Letter*	*Hundred*	*Description*
2	A	206	Agree on scope of Class Notation **DSV-**
2	A	500	Agree on Statutory scope of certification
2	B	100	Agree on purpose of certification documentation to be reflected in Request
2	F	305	Agree on scope of attendance
2	F	400	Class Notation DSV- assignment to support vessel

E. In Operation

Table E1 Instances of certification and of attendance required in DNV-OS-E402 – In operations			
Section	*Letter*	*Hundred*	*Description*
2	C	304	Evaluate plans for operations
2	C	305	Evaluate plans for demobilisation
2	D	102	Agree on changes to design conditions
2	D	201	Evaluate planned remedial actions
2	I	301	Acceptance of documentation for systems in operation
2	I	301	Acceptance of documentation for systems in operation
2	J	-	Overall test requirements
2	J	-	Approval of Inspection and Test Plans (ITPs)
2	J	101	Verify as built status against approved drawings
2	J	103	Approve installation test programme
3	A	400	Testing and marking after completion
9	A	2600	Hyperbaric Evacuation System tests and drills with Test Reports (TR)
9	A	2600	Hyperbaric Evacuation System tests and drills with Test Reports (TR)

Table E2 Instances of certification and of attendance required in DNV-DSS-105 – In operation			
Section	*Letter*	*Hundred*	*Description*
1	A	603	Issue Conditions of Class
2	F	100	Agree on scope of survey attendance to be reflected in Survey Planning Document
2	F	500	Agree on retention of Class and scope of work

APPENDIX B
DIVING SYSTEM SURFACE - INSTANCES WHERE DNV-DSS-105 AND DNV-DS-E403 REQUIRE CERTIFICATION AND/OR ATTENDANCE BY DNV

A. Introduction

A 100 General

101 The Tables B to E give the instances where DNV-DSS-105 and DNV-DS-E403 requires certification and or attendance for certification and Classification of **SURFACE** diving systems.
In those cases where DNV is providing a certificate, this shall be a DNV Product Certificate (NV) and attendance shall be by DNV. (See DNV Rules for Ships Pt.1 Ch.1 Sec.4 B100 regarding definitions of DNV Product Certificates (NV), Works Certificates (W) and Test Report (TR)).

102 The table is subdivided into:

a) Design and Manufacture.
b) Assembly.
c) Installation.
d) In Operation.

B. Design and manufacture

Table B1 Instances of certification and of attendance required by DNV-DS-E403 - Design and manufacture

Section	*Letter*	*Hundred*	*Description*
1	A	200/300	Consideration of application of standard
2	A	700/800	1) Verify overall test requirements in general Approval of Inspection and Test Plans (ITPs) 2) Verify as built status against approved drawings 3) Approve individual test programmes 4) Pressure tests – Attend and/or verify tests
2	A	900	Verify marking and signboards
2	B	103/104	Verify Master Document Register (MDR) of information required
2	C	400	Verify quality assurance by assessment of quality system
3	A	402/407	Agreement on design code used
3	A	404/408	Acceptance of use of other pressure vessel code
3	A	405/500	Certification of Pressure Vessels for Human Occupancy (PVHO) - Product certificate (NV)
3	A	406	Windows in PVHO - Product certificate (NV)
3	A	407	Acceptance of other standard and Design evaluation. Testing to applied standard – Test Report (TR)
3	A	407/500	Manufacturers of, and certification of, gas cylinders - Approved manufacturer and (3.2) Certificate according to EN 10204
3	A	503	Smaller gas cylinders considered essential - Product certificate (NV)
3	A	600	Agree on required information to be documented
3	A	602	Agreement on alternative design loads
3	A	700/708	Production tests of gas cylinders - Test Reports (TR)
3	A	700/800	1) Verify overall test requirements in general Approval of Inspection and Test Plans (ITPs) 2) Verify as built status against approved drawings 3) Approve installation test programme 4) Pressure tests – Attend and/or verify tests
3	A	701	Tolerance checks - Test Reports (TR)
3	A	702	NDE operators - Approved NDE operators and NDE - Approval of NDE design specifications

Table B1 Instances of certification and of attendance required by DNV-DS-E403 - Design and manufacture (Continued)

Section	*Letter*	*Hundred*	*Description*
3	A	703	Testing after heat treatment - Test Reports (TR)
3	A	900	Verify Marking and signboards
3	A	1001	1) Material grades - Test Reports (TR) and additional testing of materials 2) Materials for main pressure retaining parts - Product Certificate (NV)
3	C	102	Consideration for use of other material grades in welded pressure vessels
3	C	104	Stainless steel parts welded to non-stainless pressure vessel - Test Report (TR)
3	C	201	Manufacturers of pressure vessels - Approved manufacturer
3	C	202	Approval of design specifications, Approved welders and welding materials, Testing of weld qualifications
3	C	403	Acceptance of finite element analysis
3	C	403/404	Consideration of strain gauge measurements as an alternative to fatigue evaluation
3	D	101	Materials for gas cylinders - Works certificate (W) or (3.2) Certificate according to EN 10204
3	E	200 to 400	Approval and testing of acrylic material in accordance with ASME PVHO-1
4	A	600	Agree on required information to be documented
4	A	700/800	1) Verify overall test requirements in general Approval of Inspection and Test Plans (ITPs) 2) Verify as built status against approved drawings 3) Approve installation test programme 4) Pressure tests – Attend and/or verify tests 5) Compressors - Attend and/or verify tests 6) Closed Circuit Breathing Systems (CCBS) - Attend and/or verify tests 7) Flexible hoses - Attend and/or verify tests 8) Umbilical - Attend and/or verify tests
4	A	703	Shock testing of hoses for use in oxygen systems with Test Reports (TR)
4	A	900	Verify Marking and signboards
4	A	1001	Tested for noxious, toxic or flammable properties - Test Report (TR)
4	A	1006	Materials and components in oxygen systems - Test Report (TR) and Works certificates (W)
4	B	201/202	Overpressure alarm - Works certificate (W) and Test Report (TR)
4	C	306/402	BIBS Masks - Works certificate (W)
4	C	602	Control, alarm and safety systems in gas mixers - Product certificates (NV) and Test Reports (TR)
4	D	301	Heaters for chambers - Works certificate (W) and Test Report (TR)
4	D	302	Temperature controls - Works certificate (W)
4	D	401/402	Noise reduction - Test Report (TR)
4	D	600	Carbon dioxide removal – Works certificate (W) and (TR) Report
4	E	-	Hydrostatic testing of piping with Test Reports (TR)
4	E	102	Piping – Product certificate (NV) or Works certificate (W) (see Ship Rules Pt.4 Ch.6)
4	E	102/103	Welding – WPQ, WPS and welders (see DNV Rules for Classification of Ships Pt.2 Ch.3 Sec.5 B. Welding Procedure Specification)
4	F	104	Flexible hose assemblies (with couplings) including umbilical hoses - Type Approval Certificate (TA) and Works certificate (W)
4	F	600	Mechanical testing of umbilical with Test Reports (TR)
4	F	700	Completion testing of umbilical with Test Reports (TR)
4	G	206	Safety valves and Overpressure alarm - Works certificate (W) and Test Report (TR)
4	G	206/207	Pressure relief devices and shut-off valves - Works certificates (W)
4	G	208	Chamber mounted valves for water - Works certificate (W) and Test Report (TR)
4	G/I	-	Valves and pressure regulators - Works certificates (W)
4	H	-	Fittings and pipe connections - Works certificates (W)
4	H	101	Manifolds - Works certificate (W) and Test Report (TR)
4	I	-	Pressure regulators - Works certificates (W)
4	J	101	Compressors - Product certificate (NV)
4	K	101	Umbilical - Product certificate (NV)

Table B1 Instances of certification and of attendance required by DNV-DS-E403 - Design and manufacture (Continued)			
Section	*Letter*	*Hundred*	*Description*
5	A	600	Agree on required information to be documented
5	A	700/800	1) Verify overall test requirements in general Approval of Inspection and Test Plans (ITPs) 2) Verify as built status against approved drawings 3) Approve installation test programme 4) Pressure tests – Attend and/or verify tests 5) Umbilical - Attend and/or verify tests 6) Electrical pressure vessel penetrators - Attend and/or verify tests
5	A	1000	— Verify Marking and signboards
5	B	201b)	Consideration for use of higher voltages than 30V
5	B	801	Switchboards - Testing in accordance with DNV-OS-D201
5	B	803	Acceptance of control gear in inner area
5	B	900	Lights - Works certificates (W)
5	C	301	Electrical penetrators for pressure vessels - Product certificate (NV) and Test Report (TR)
5	D	101	Electrical motors - Works certificate (W) under 100 kW - Product certificate (NV) over 100 kW Ref. DNV Rules for Classification of Ships Pt.4 Ch.8 Sec.1 B Table B3
5	D	102	Testing pressure resistant enclosures – Test Report (TR)
5	E	-	Cables - Type Approval (TA) or Works certificate (W) with Test Report (TR)
5	E	101	Fire proof cables - Type Approval and Works certificate (W) including fire resistant cables (IEC 60331) or flame retardant for not critical cabling
6	A	600	Agree on required information to be documented
6	A	700/800	1) Verify overall test requirements in general Approval of Inspection and Test Plans (ITPs) 2) Verify as built status against approved drawings 3) Approve installation test programme
6	A	900	Verify Marking and signboards
6	A	1103	Non-hazardous materials - Test Report (TR) and Test of 'non-hazardous materials' – verify test report Consideration of alternatives to material testing
6	C	-	Fire detection and alarm system - Type Approval (TA) or Works certificate (W) with Test Report (TR)
6	D	200	Manually operated fire fighting device for inner area - Type Approval (TA) and/or Test Report (TR) and/or Works certificate (W) depending on device
6	E	100	Fire fighters outfit - Type Approval (TA) or Works certificate (W) with Test Report (TR)
6	E	201	Portable fire extinguishers - Type Approval (TA) or Works certificate (W) with Test Report (TR)
7	A	400	Acceptance of other codes/standards
7	A	600	Agree on required information to be documented
7	A	700/800	1) Verify overall test requirements in general approval of Inspection and Test Plans (ITPs) 2) Verify as built status against approved drawings 3) Approve installation test programme
7	A	1000	Verify marking and signboards
7	B	300	Winches and power packs - Product certificates (NV)
7	B	300	LARS control and monitoring -Product certificate (NV)
7	B	300	Stops and brakes - Test Report (TR)
7	B	500	Power tests – Test Report (TR) including hydraulic, electric - load test, high voltage/ pressure, insulation/leak
7	C	201	Ropes - Product certificates (NV) with Test Reports (TR). Ref. DNV Standard for Certification of Lifting Appliances, DNV-STC-2.22 Table 2-2 Wire ropes to be delivered with DNV CG4 or ILO FORM 4 certificate
7	C	202	Blocks and shackles - Test Reports (TR) CG3 or ILO FORM 3
7	C	202	Sheaves - Product certificate (NV)
7	C	203	Materials for structural members in launch and recovery systems - Works certificate (W)
8	A	600	Agree on required information to be documented

Table B1 Instances of certification and of attendance required by DNV-DS-E403 - Design and manufacture (Continued)			
Section	*Letter*	*Hundred*	*Description*
8	A	700/800	1) Verify overall test requirements in general Approval of Inspection and Test Plans (ITPs) 2) Verify as built status against approved drawings 3) Approve installation test programme
8	A	900	Verify Marking and signboards
8	B	102	Verify design specifications
8	B	514	Temperature indicator - Works certificate (W) and Test Report (TR)
8	B	600/700	Monitors in wet bell - Test Reports (TR)
8	B	600/700	Pressure indicators and Gas analysers - Type Approval or Works certificate (W) with Test Report (TR)
8	B	700	Oxygen analyser – Works certificate (W)
8	B	800	Consideration for use of other analysis instrumentation to detect other gases
9	A	600	Agree on required information to be documented *(If applicable through statutory requirement)*
9	A	700/800	1) Verify overall test requirements in general Approval of Inspection and Test Plans (ITPs) 2) Verify as built status against approved drawings 3) Approve installation test programme 4) Pressure tests – Attend and/or verify tests *(If applicable through statutory requirement)*
9	A	900	Verify marking and signboards *(If applicable through statutory requirement)*

Table B2 Instances of certification and of attendance required in DNV-DSS-105 - Design and manufacturers			
Section	*Letter*	*Hundred*	*Description*
2	A	204	Agree certification coverage to be reflected in Request for Certification
2	B	100	Agree purpose of certification to be reflected in Request for Certification
2	E	108/109	Agree on alternative standards to be reflected in Request for Certification
2	E	300	Agree on survey scope to be reflected in Request for Certification

C. Assembly

Table C1 Instances of certification and of attendance required in DNV-DS-E403 during assembly			
Section	*Letter*	*Hundred*	*Description*
1	A	200/300	Consideration of application of standard
2	A	700/800	1) Verify overall test requirements in general Approval of Inspection and Test Plans (ITPs) 2) Verify as built status against approved drawings 3) Approve Assembly test programme 4) Tests – Attend and/or verify tests
2	A	900	Verify Marking and signboards
2	B	100/200	Verify Master Document Register of information required
2	C	100	1) Kick-off meeting before concept development 2) Verify concept development
2	C	200	1) Review Safety objective 2) Review execution plan
2	C	302	Agree scope of systematic review
2	C	400	Verify quality assurance by assessment of quality system
2	C	500	Approval of Inspection and Test Plans (ITPs)
2	E	-	Evaluate environmental conditions designed for, against request

Table C1 Instances of certification and of attendance required in DNV-DS-E403 during assembly (Continued)

Section	*Letter*	*Hundred*	*Description*
3	A	600	Agree on required information to be documented
3	A	602	Agreement on alternative design loads
3	A	700/800	1) Verify overall test requirements in general Approval of Inspection and Test Plans (ITPs) 2) Verify as built status against approved drawings 3) Approve assembly test programme 4) Pressure tests – Attend and/or verify tests
3	A	701	Tolerance checks - Test Reports (TR)
3	A	800	Survey after assembly
3	A	900	Verify Marking and signboards
4	A	800	1) Verify overall test requirements in general Approval of Inspection and Test Plans (ITPs) 2) Assembly - Attend and/or verify tests 3) Verify as built status against approved drawings 4) Pressure tests – Attend and/or verify tests 5) Flexible hoses - Attend and/or verify tests 6) Umbilical - Attend and/or verify tests
4	A	900	Verify Marking and signboards
4	C	600	Mixing System - Product certificate (NV) and Test Reports (TR)
4	E	-	Hydrostatic testing of piping with Test Reports (TR)
4	E	102	Piping – Product certificate (NV) or Works certificate (W) (see Ship Rules Pt.4 Ch.6)
4	E	102/103	Welding – WPQ, WPS and welders (see DNV Rules for Classification of Ships Pt.2 Ch.3 Sec.5 B. Welding Procedure Specification)
5	A	600	Agree on required information to be documented
5	A	700/800	1) Verify overall test requirements in general Approval of Inspection and Test Plans (ITPs) 2) Verify as built status against approved drawings 3) Approve assembly test programme
5	A	1000	Verify Marking and signboards
5	B	900	Lights - Works certificates (W)
5	E	-	Cables - Type Approval (TA) or Works certificate (W) with Test Report (TR)
5	E	101	Fire Proof Cables - Type Approval (TA) and Works certificate (W) including fire resistant cables (IEC60331) or flame retardant for not critical cabling
6	A	600	Agree on required information to be documented
6	A	700/800	1) Verify overall test requirements in general Approval of Inspection and Test Plans (ITPs) 2) Verify as built status against approved drawings 3) Approve assembly test programme
6	A	900	Verify Marking and signboards
6	C	-	Fire detection and alarm system - Type Approval (TA) or Works certificate (W) with Test Report (TR)
7	A	502	Launch and recovery system certified as lifting appliance - Product Certificate (CG2)
7	A	600	Agree on required information to be documented
7	A	602	Acceptance of other codes/standards
7	A	700/800	1) Verify overall test requirements in general Approval of Inspection and Test Plans (ITPs) 2) Verify as built status against approved drawings 3) Approve assembly test programme
7	A	1000	Verify Marking and signboards
7	B	-	Verify design specifications
7	B	300	Winches and power packs - Product certificates (NV)
7	B	300	LARS control and monitoring - Product certificate (NV)
7	B	300	Stops and brakes - Test Report (TR)

Table C1 Instances of certification and of attendance required in DNV-DS-E403 during assembly (Continued)			
Section	*Letter*	*Hundred*	*Description*
7	B	400	Acceptance of alternative recoveries
7	B	500	Power tests – Test Report (TR) including hydraulic, electric - load test, high voltage/ pressure, insulation/leak
7	C	201	Ropes - Product certificates (NV) with Test Reports (TR). Ref. DNV Standard for Certification of Lifting Appliances 2.22 Ch.2 Sec.1 item 9 Table 1-6 Wire ropes to be delivered with DNV CG4 or ILO FORM 4 certificate
7	C	202	Blocks and shackles - Test Reports (TR) CG3 or ILO FORM 3
7	C	202	Sheaves - Product certificate (NV)
7	C	203	Materials for structural members in launch and recovery systems - Works Certificate
8	-	-	Oxygen alarm – Certificate (W)
8	A	600	Agree on required information to be documented
8	A	700/800	1) Verify overall test requirements in general Approval of Inspection and Test Plans (ITPs) 2) Verify as built status against approved drawings 3) Approve assembly test programme
8	A	900	Verify Marking and signboards
8	B	102	Verify design specifications
8	B	800	Consideration for use of other analysis instrumentation to detect other gases
9	-	-	Hyperbaric Evacuation System and Hyperbaric Evacuation Unit - Statement/Certificate of conformance depending on statutory engagement. - Test Report (TR) *(If applicable through statutory requirement)*
9	-	-	Test of Hyperbaric Evacuation System with Test Reports (TR) *(If applicable through statutory requirement)*
9	-	-	(Chamber for Hyperbaric Evacuation Unit) as for Sec.3 B105 *(If applicable through statutory requirement)*
9	-	-	Launch and Recovery system (HES) - Type Approval (TA) and Test Report (TR) *(If applicable through statutory requirement)*
9	-	-	Hyperbaric Evacuation System tests and drills with Test Reports (TR) *(If applicable through statutory requirement)*

Table C2 Instances of certification and of attendance required in DNV-DSS-105 - Assembly			
Section	*Letter*	*Hundred*	*Description*
1	A	204	Agree on applicable statutory scope and certification
1	A	602	Agree on scope to be reflected in Request for Certification
1	A	604	Agree on conditions and limitations to be reflected in Request for Certification/Data Sheet (Form 20.201a)
2	A	204	Agree certification coverage to be reflected in Request for Certification
2	A	205	Agree on Classification scope for the diving system (**Diving System** - Class Notation)
2	A	500	Agree on applicable statutory scope and certification
2	B	100	Agree purpose of certification to be reflected in Request for Certification
2	E	102 to 107	Certification – Various according to request and Data Sheet (Form 20.201a)
2	E	108/109	Agree on alternative standards to be reflected in Request for Certification
2	E	300	Agree on survey scope to be reflected in Request for Certification
2	F	200	Assignment of Class – Class Certificate
2	G	600	Verification during manufacture
2	H	600	Audits with reports
2	H	700	Surveys with reports
2	I	400	Review of quality management programme

D. Installation

Table D1 Instances of certification and of attendance required in DNV-DS-E403 - Installation

Section	*Letter*	*Hundred*	*Description*
1	A	200/300	Consideration of application of standard
2	A	700/800	1) Verify overall test requirements in general Approval of Inspection and Test Plans (ITPs) 2) Verify as built status against approved drawings 3) Approve Installation test programme 4) Tests – Attend and/or verify tests
2	A	900	Verify Marking and signboards
2	B	100/200	Verify Master Document Register of information required
2	C	100	1) Kick-off meeting before concept development 2) Verify concept development
2	C	200	1) Review Safety objective 2) Review execution plan
2	C	302	Agree scope of systematic review
2	C	400	Verify quality assurance by assessment of quality system
2	C	500	Approval of Inspection and Test Plans (ITPs)
2	E	-	Evaluate environmental conditions designed for, against request
2	F	-	Installation report (Form 51.71a)
3	A	600	Agree on required information to be documented
3	A	602	Agreement on alternative design loads
3	A	700/800	1) Verify overall test requirements in general Approval of Inspection and Test Plans (ITPs) 2) Approve installation test programme
3	A	800	Survey after installation
3	A	900	Verify Marking and signboards
4	A	800	1) Verify overall test requirements in general Approval of Inspection and Test Plans (ITPs) 2) Installation - Attend and/or verify tests 3) Verify as built status against approved drawings
4	A	900	Verify Marking and signboards
4	E	-	Hydrostatic testing of piping with Test Reports (TR)
4	E	102	Piping – Product certificate (NV) or Works certificate (W) (see Ship Rules Pt.4 Ch.6)
4	E	102/103	Welding – WPQ, WPS and welders (see DNV Rules for Classification of Ships Pt.2 Ch.3 Sec.5 B. Welding Procedure Specification)
5	A	600	Agree on required information to be documented
5	A	700/800	1) Verify overall test requirements in general Approval of Inspection and Test Plans (ITPs) 2) Verify as built status against approved drawings 3) Approve installation test programme
5	A	1000	Verify Marking and signboards
5	E	-	Cables - Type Approval (TA) or Works certificate (W) with Test Report (TR)
5	E	101	Fire Proof Cables - Type Approval and Works certificate (W) including fire resistant cables (IEC60331) or flame retardant for not critical cabling
6	A	600	Agree on required information to be documented
6	A	700/800	1) Verify overall test requirements in general Approval of Inspection and Test Plans (ITPs) 2) Verify as built status against approved drawings 3) Approve inspection test programme
6	A	900	Verify Marking and signboards
6	B	102	A-60 Fire division including bulkhead penetrators - DNV Type Approval Certificates (TA)
6	C	100	Fire detection and alarm system - Type Approval (TA) or Works certificate (W) with Test Report (TR)

Table D1 Instances of certification and of attendance required in DNV-DS-E403 - Installation (Continued)			
Section	*Letter*	*Hundred*	*Description*
6	D	100	Fixed fire extinguishing system - Various certificates and Type Approval depending on system. ref. DNV Rules for Ships Pt.4 Ch.10. - Sprinklers require Type Approval (TA) and Works Certificates (W)
6	D	101 to 104	Approved extinguishing system
6	D	106	Consideration of fire extinguishing on open deck
6	E	100	Fireman's outfit - Various certification requirements depending on Statutory regulations. Works Certificates (W) as a minimum with Test Reports (TR)
6	E	202	Portable fire extinguishers - Type Approval ref. DNV Rules for Ships Pt.4 Ch.10
7	A	600	Agree on required information to be documented
7	A	700/800	1) Verify overall test requirements in general Approval of Inspection and Test Plans (ITPs) 2) Verify as built status against approved drawings 3) Approve installation test programme
7	A	1000	Verify Marking and signboards
7	B	-	Verify design specifications
7	B	400	Acceptance of alternative recoveries
7	C	100	Defined load conditions
7	C	300	Materials for structural members - Works Certificate (W)
8	A	600	Agree on required information to be documented
8	A	700/800	1) Verify overall test requirements in general Approval of Inspection and Test Plans (ITPs) 2) Verify as built status against approved drawings 3) Approve installation test programme
8	A	900	Verify Marking and signboards
8	C	-	Acceptance of chosen communications on-board.
9	-	-	Various considerations in regard to Hyperbaric evacuation. *(If applicable through statutory requirement)*
9	A	901	Consideration for entry into CEC *(If applicable through statutory requirement)*

Table D2 Instances of certification and of attendance required in DNV-DSS-105 – Installation			
Section	*Letter*	*Hundred*	*Description*
2	A	206	Agree on scope of Class Notation
2	A	500	Agree on Statutory scope of certification
2	B	100	Agree on purpose of certification documentation to be reflected in Request
2	F	305	Agree on scope of attendance
2	F	400	Class Notation **DSV** - assignment to support vessel

E. In Operations

Table E1 Instances of certification and of attendance required in DNV-DS-E403 – In operation			
Section	*Letter*	*Hundred*	*Description*
2	B	400	Evaluate plans for operations
2	I	301	Acceptance of documentation for systems in operation
2	J	103	Approve Survey Planning Document
3	E	800	Inspection of windows in PVHO
9	A	-	Hyperbaric Evacuation System tests and drills with Test Reports (TR) *(If applicable through statutory requirement)*

Table E2 Instances of certification and of attendance required in DNV-DSS-105 – In operation			
Section	*Letter*	*Hundred*	*Description*
1	A	603	Issue Conditions of Class
2	F	100	Agree on scope of survey attendance to be reflected in Survey Planning Document
2	F	500	Agree on retention of Class and scope of work

APPENDIX C
LIST OF SOURCES TO ASSIST IN OBTAINING REFERENCE DOCUMENTS (INFORMATIVE)

A. General

A 100 Introduction

101 The usual procedure for buying standards is to order through the national standards organisations. IMO documents are frequently available through local publishing firms, but may also be ordered through the IMO home page.

Reference document	*Source*
— DNV Standards and Offshore Standards	DNV, Veritasvn. 1, N-1322, Høvik, Norway http://www.dnv.com.
— A Guide to Hazard and Operability Studies, 1979, Chemical Industries Association Limited, London.	http://www.cia.org.uk/
— ISO 8402 Quality – Vocabulary, 1994 — ISO 6385-2004 Ergonomic principles of the design of work systems — ISO 9000 *Quality management*. — ISO 10013 Guidelines for quality management system documentation. — ISO 10 380, BS6501 Pipework -- Corrugated metal hoses and hose assemblies — ISO 10474 Steel and steel products; inspection documents — ISO 13628-5 Subsea umbilicals	International Organization for Standardization, Geneva. http://www.iso.ch/
— BS 4778 Quality Vocabulary, Part 2 Quality Concepts and Related Definitions, 1991, British Standards Institute, London.	British Standards Institute http://www.bsi-global.com/
— EN 45011 General Criteria for Certification Bodies Operating Product Certification, 1998 — EN585, Section 11.5.3. Gas welding equipment - Pressure regulators for gas cylinders used in welding, cutting and allied processes up to 200 bar — EN 10204 Metallic products; types of inspection documents	European Committee for Standardization, Brussels. http://www.cenorm.be/
— ASME VIII Div.1 — ASME PVHO-1-2007 edition (or later) “Safety Standard for Pressure Vessels for Human Occupancy”.	American Society of Mechanical Engineers http://www.asme.org/
— API codes for hoses — API 17E “Specification for Subsea Production Control Umbilicals”.	American Petroleum Institute http://api-ec.api.org/
— IMO Code of Safety for Diving Systems, 1995 Resolution A.831(19), — IMO Guidelines and Specifications for Hyperbaric Evacuation Systems, 1991 Resolution A.692(17) — IMO MSC/Circ.645 of 6 June 1994 “Guidelines for Vessels with dynamic positioning systems” — IMO Resolution A.809(19) in reference to SOLAS Regulation III/ 6.2.1. — IMO res. MSC.61(67) (FTP Code) FTP code: international code for application of fire test procedures: resolution MSC.61(67): including fire test procedures referred to in and relevant to the FTP code — IMO resolution A.468 (XII) code on noise levels on-board ships. — IMO (MODU) Code chapter 6 — SOLAS 1974 (International Convention for the Safety of Life at Sea).	International Maritime Organization http://www.imo.org/
— AODC and IMCA documents	http://www.imca-int.com/
— International Electro technical Commission's Publication No.79-10	http://www.iec.ch/
— NORSOK Standard U-100 'Manned Underwater Operations'	http://www.nts.no/norsok/
— PD 5500:2009 Specification for unfired fusion welded pressure vessels	British Standards Institute http://www.bsi-global.com/

Reference document	*Source*
SAE J 517 HYDRAULIC HOSE — EN 853 Rubber hoses and hose assemblies - Wire braid reinforced hydraulic type - Specification, 856 Rubber hoses and hose assemblies - Rubber-covered spiral wire reinforced hydraulic type - Specification, 857 Rubber hoses and hose assemblies - Wire braid reinforced compact type for hydraulic applications - Specification	Society of Automotive Engineers http://www.sae.org/
— National Fire Protection Agency Codes	NFPA (National Fire Protection Association) 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101 USA Teleph: +1 617 770-3000 Fax: +1 617 770-0700 www.nfpa.org

APPENDIX D
GENERIC DESCRIPTION OF PROJECT SUB-PHASES

A. Introduction

A 100 General

101 Some examples of descriptions of project sub-phases or milestones are given below. These descriptions are not intended to be precise definitions but are given as suggestions as to how particular project-specific definitions can look.

B. Initial studies

B 100 Feasibility study

101 A feasibility study is a study directed at evaluation of the feasibility of one or more concepts.

102 The feasibility study is an evaluation of one or more proposed technical concepts against project cost and schedule. It should identify special technical problems and indicate the solution or solve these to the degree necessary to confirm the feasibility of the project cost and schedule.

103 The feasibility study shall address all essential cost and schedule aspects, and should conclude on what the most uncertain factors are and how they should be approached. It should preferably address aspects such as support vessel design, special legislation etc. that are peripheral to diving system integrity.

B 200 Concept study

201 A concept study is a design made to establish the main dimensions and data of the diving system.

202 These include, for example, diameter, wall thickness, material type etc. Other aspects include placement on the support vessel and identification of possible needs for major conversion works (existing vessels and designs) and or (additional) surveys. In short, the study has to establish the basic parameters for the work to be performed in the next stages of design and a means for more detailed cost estimation and possibly comparison of a number of concepts detailed to the same level.

203 It is expected only to indicate the preferred or possible methods or solutions of how to solve design issues, configurations, installation practices, etc. On this basis it is expected that the concept study documentation identifies how far the design has reached, what needs to be further detailed or investigated and how the designer foresees the use of the given information as part of the subsequent design.

C. Design

C 100 Basic design

101 Basic design is a design made to establish the main dimensions and data of the diving system to a level where it is possible to make a detailed cost estimate and to place fabrication orders without taking any significant economic risk.

102 The following should be defined:

a) The maximum significant wave height in which the bell is to be launched, the diving system group (**SURFACE - SAT**), the range of ambient temperatures, maximum operating depth(s), maximum operating time(s)

b) number of chambers and their dimensions, number of bells and their dimensions, other pressure vessels and their particulars, gas storage with particulars

c) number of compressors with their particulars, umbilical with particulars

d) basic information on electrical supply and distribution with estimated consumers and capacity

e) proposed fire protection

f) particulars of the handling system(s)

g) proposed hyperbaric evacuation system

h) A draft to the Data Sheet for Diving System (DNV form 20.201a) should be made to give an overview of the system. This Data Sheet may be updated as the project progresses.

In short, to establish a design for which only local details remain to be defined.

103 On this basis, it is expected that a large part of the basic design documentation will be the final design

documentation and that it identifies what needs to be further detailed or investigated and how this shall be done by the designer.

C 200 Detail design

201 Detail design means the finalisation of design. It can entail all stages of design, as it does not necessarily have to be preceded by another distinct phase. It shall address all design issues for all items of the diving system and finalise all the specifications for the subsequent production phases.

D. Other phases

D 100 General

101 Descriptions of other project phases, such as construction (manufacturing, installation, and commissioning) or operations are not given, as there is rarely any confusion of their meaning or extent. (See also DNV-OS-E402 and DNV-DS-E403 Sec.1).

CHANGES – HISTORIC

Note that historic changes older than the editions shown below have not been included. Older historic changes (if any) may be retrieved through http://www.dnv.com.

July 2012 edition

This is a new document replacing DNV-OSS-305 “Rules for Certification and Verification of Diving Systems”.

The rules come into force 1 January 2013.