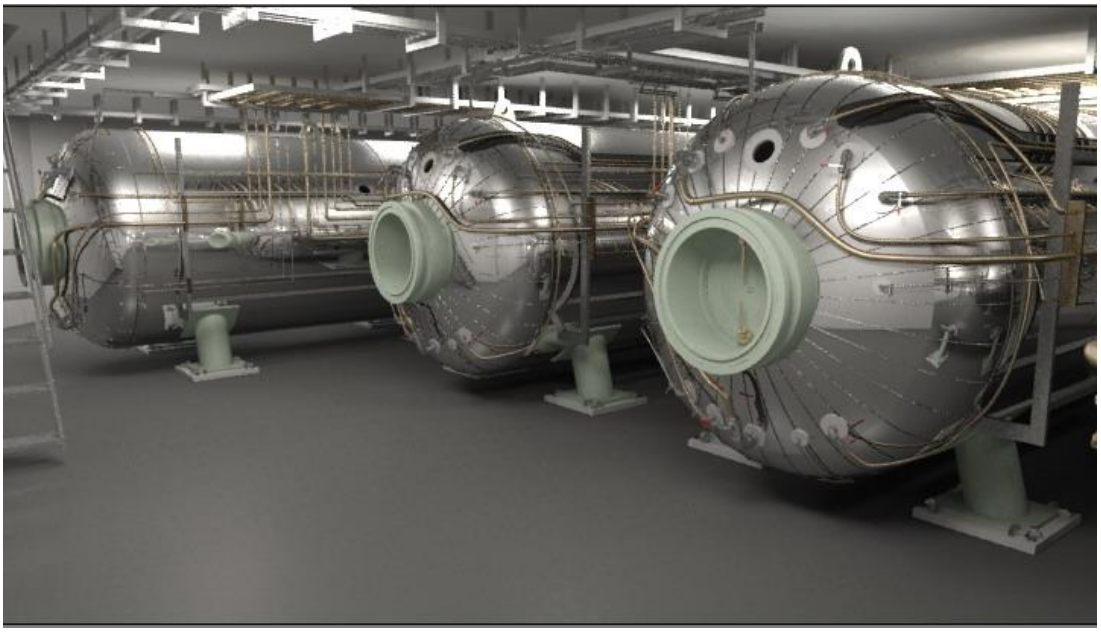
100 Series Saturation Diving System



Technical Specification for Single Bell System

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INTRODUCTION

Overview

This specification together with the related attachment defines the various options available for a 100 Series Saturation Diving System equipped with Single Bell.

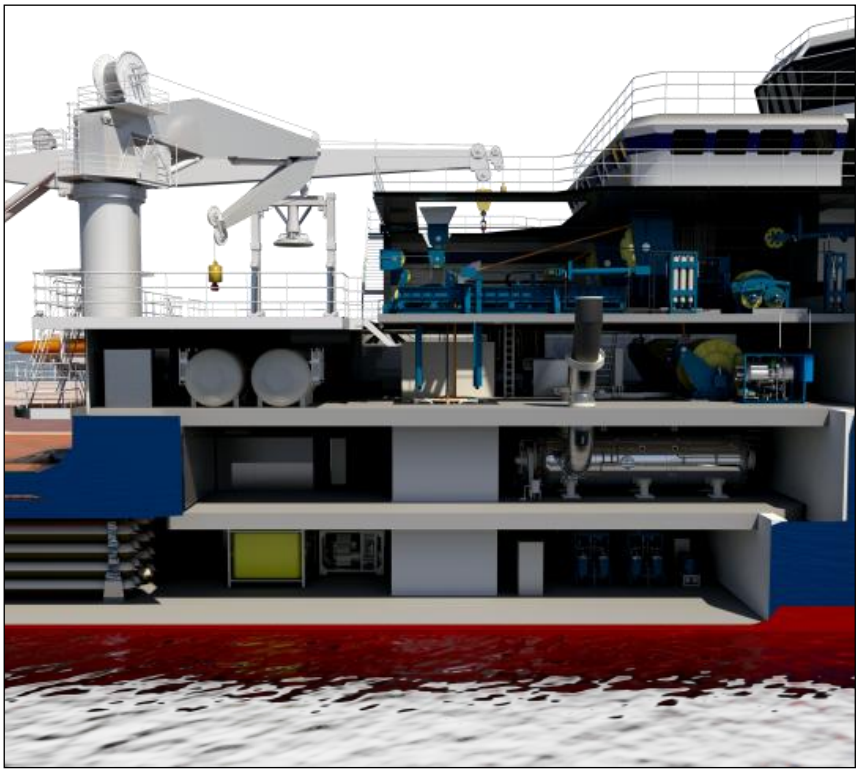
Whenever different options / configuration are highlighted, the proposed choice is marked in **bold red**, while the secondary proposed choices are marked in **bold blue**.

The Base Line dive system arrangement is a single bell 12-man system, 3 Diving Decompression Chambers, with port and starboard 12 man Hyperbaric Lifeboat. The bell is moon pool launched with cursors guidance.

The system is rated 300msw and is designed to provide 30 days of continuous activity at the deepest rated depth, considering the reclaim system and the recovery system in operation.

Surface diving stations are provided on port and starboard. Twin Lock decompression chambers are installed in a mid ship positioned surface dive facility. The surface diving system is installed in hangar.

In terms of vessel integration, minor variations to the Base Line main configurations are highlighted in the specific vessel general arrangement and are described in specific Annexes.



Picture 1 - Single Bell System Deck Configurations

Key Features

This specification includes standard key features, which represents Drass consolidated and proved standard.

In addition to the above Drass describes additional or alternative requirements, which are highlighted in tables of options, or described by a foot note. For such items a separate technical description and quotation is available on demand.

Proven Design and Build

The Dive System is a serial production, consisting of a pre approved design and of pre approved diving equipment.

This feature has been developed with the intent of:

minimizing the prototyping and redesign thus lowering the nonrecurring costs

granting a consolidated integration with the vessel design

allowing the development of a complete and exhaustive set of technical documentation

allowing the development of a complete life cycle service for the equipment, including

updates and improvements to the delivered configuration

Drass 100 Series, being installed already on several DSVs, has obtained all the DNV Certificates requested by the Class for the installation on a standard DSV, and the following installations are agreed as sister systems.

This achievement is a significant simplification in the Class approval process.

The typology of the requested certificates for the main equipment is provided in Annex B – of the Standard Diving Contract.

The copies of the existing certificates obtained for each diving equipment is provided in Annex B –of the Standard Diving Contract.

The available documentation includes a complete Installation, Commissioning and Sea Trials Procedure, fully executed under Class Verification.

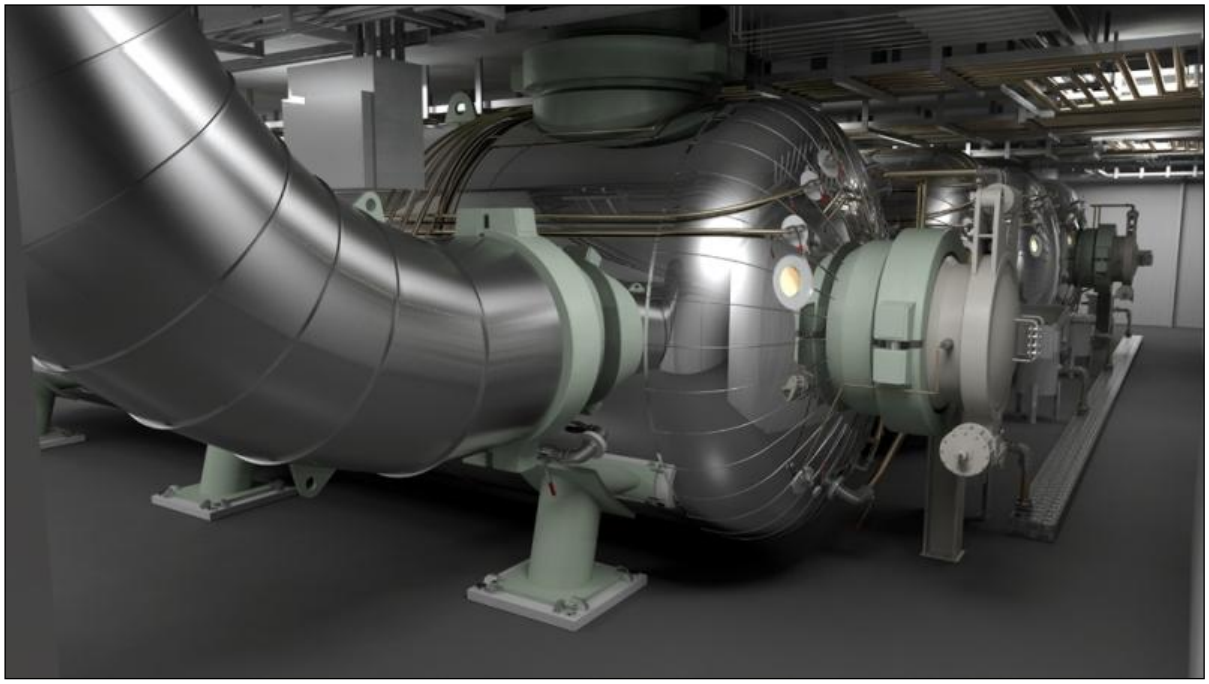
Drass 100 Series have been successfully audited in terms of IMCA compliance on the proven existing design.

Drass 100 Series are provided with the system FMEA (Failure Mode Effect Analysis) successfully issued with Class approval on the proven existing design.

Diving Decompression Chambers (DDC) Layout

The system standard arrangements can offer from 12 to 18 divers occupancy in the various below listed configurations. Such configurations represent the standard client requirement for a single bell saturation diving system.

Reductions and increase of occupancy are both available on demand and can be easily achieved thanks to the modular design of the system.



Picture 2 – 3D Arrangement of Diving Decompression Chambers with Escape Trunk

The DDC Layout is always designed in accordance to the following criteria:

All diving teams are able to access the diving bell without disturbance to other diving teams.

All diving teams are able to access all the available hyperbaric evacuation systems

The divers are arranged in twin lock diving decompression chambers with 3man and/or 6man occupancy, each provided with its own wet pot with toilet facility.

The overall internal volume of the chamber complex is optimized, in compliance with the above mentioned parameters, to minimize the gas consumption and reserves and therefore to maximize the continuous diving operation offshore

Escape routes and access to the Diving Bell are Ø800mm and all other man ways are minimum Ø620mm in accordance to DNV Rules.

The chamber arrangement is disposed in such way to strictly avoid closed loops of mating connections and transversal fatigue of the connection spools. This with the intent to avoid extreme requirement in terms of admissible deck torsion /

deflection and to create an acceptable foundation plan with compatible tolerances and sliding values.

A single lock compartment (transfer lock) can be installed to connect all the DDCs independently to the diving bell and to make continuously free the toilet facilities from passage to the bell.

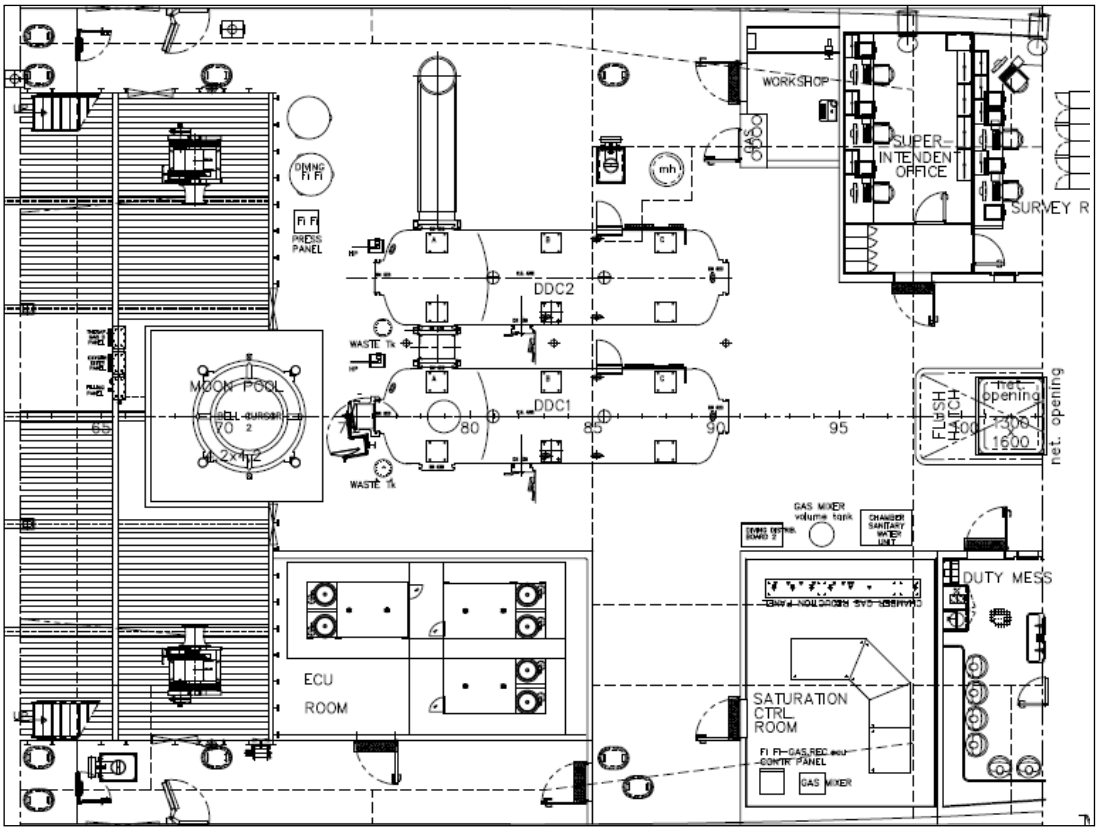
Each of the DDCs can be replaced by a combination of a wet transfer chamber (Transfer Lock) plus a living compartment DDC, with the aim of dedicating to each diver a sleeping and a living compartment.

The chamber compartment can be connected with one or two Hyperbaric Evacuation Systems.

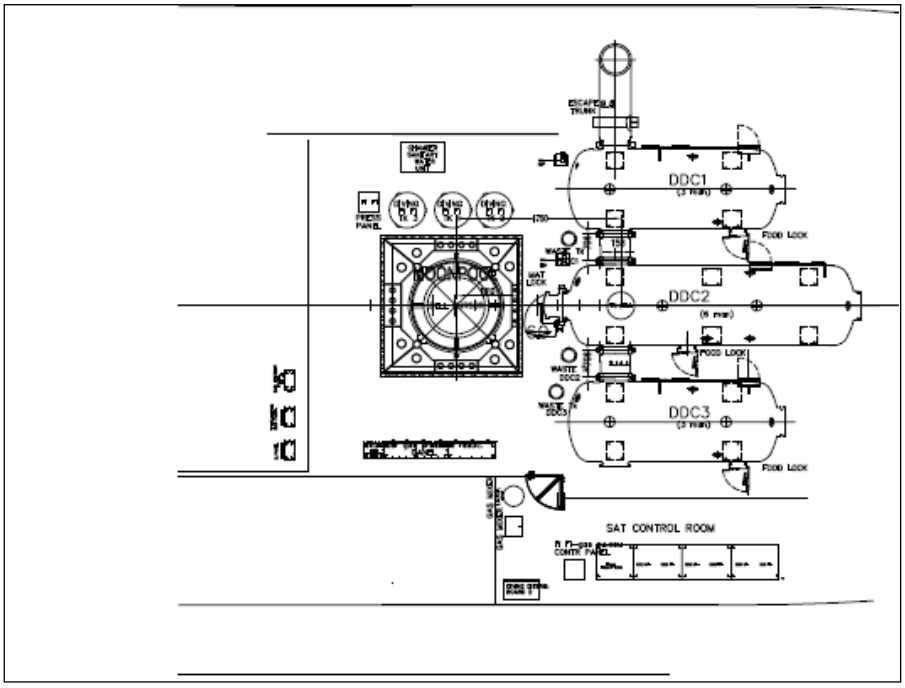
The standard arrangements of the Drass 100 Series are the following:

Code	Description	Transfer Lock	Living Compartment
SB 12x2	12 man – 2 x 6 man chambers	available	available
SB 12x3	12 man 2 x 3 and 1 x 6 man chambers	available	available
SB 15x3	15 man 1 x 3 and 2 x 6 man chambers	available	available
SB 18x3	18 man 3 x 6 man chambers	available	available

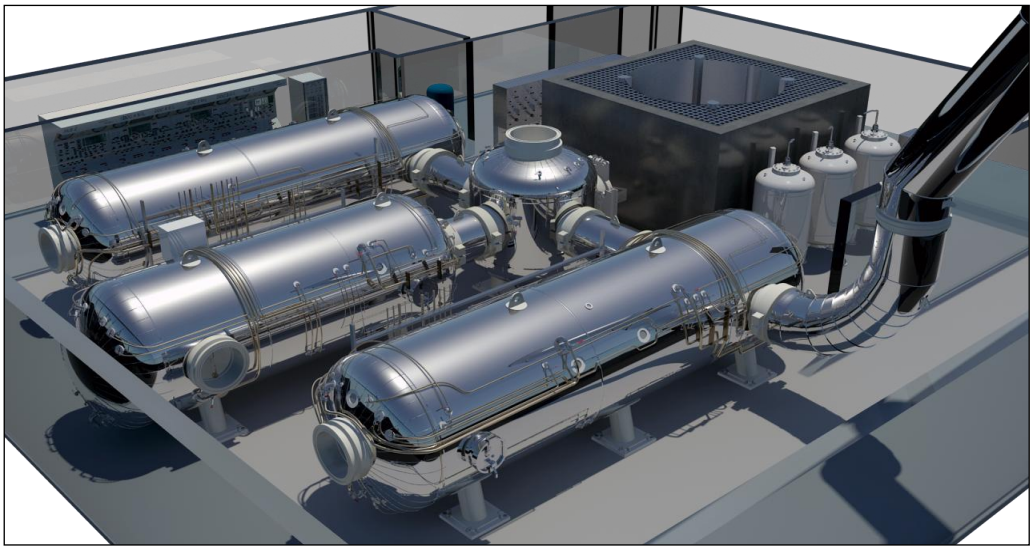
The 2D layouts and some artistic views of the chamber arrangement are shown in the following pages.



Picture 3 - SB 12x2– N° 2 6Man Decompression Chambers 12 Divers occupancy, single Hyperbaric Evacuation System (HES) (for reference only)

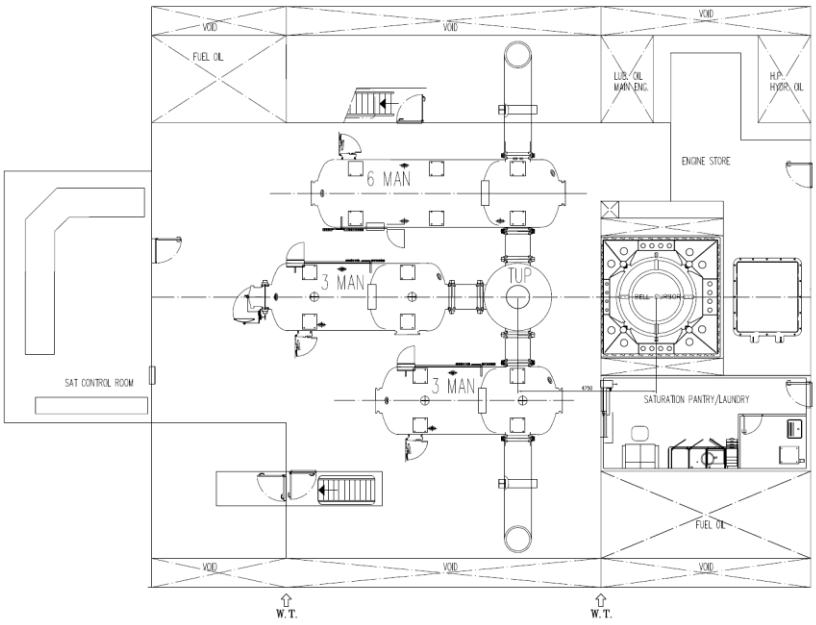


Picture 4 - SB 12x3 - n°2 3Man Chambers plus N°1 6Man Chamber, 12 Divers occupancy , single Hyperbaric Evacuation System (HES) (for reference only)

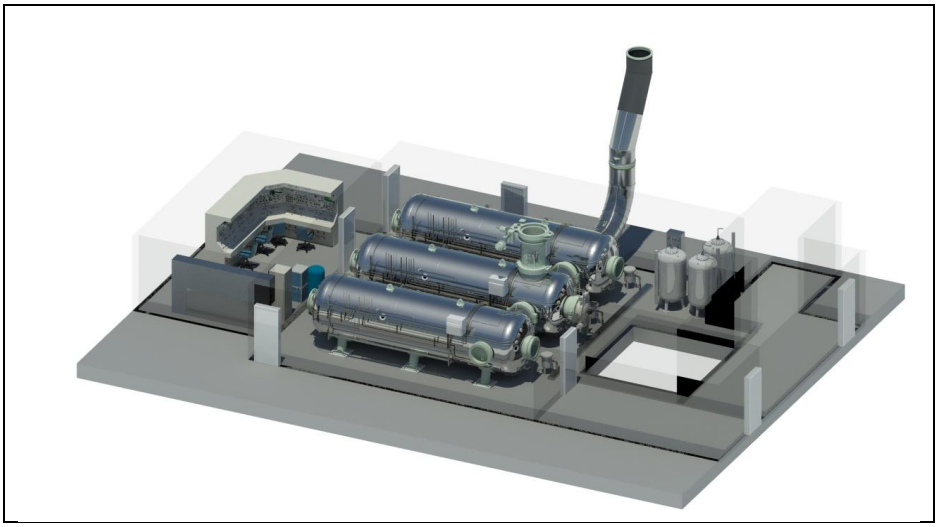


Picture 5 - SB 15x3: two 6Man DDCs , one 3Man DDC plus transfer lock arrangement, available with single or double HES. (for reference only)

The technical baseline arrangement of the chamber complex is shown below.

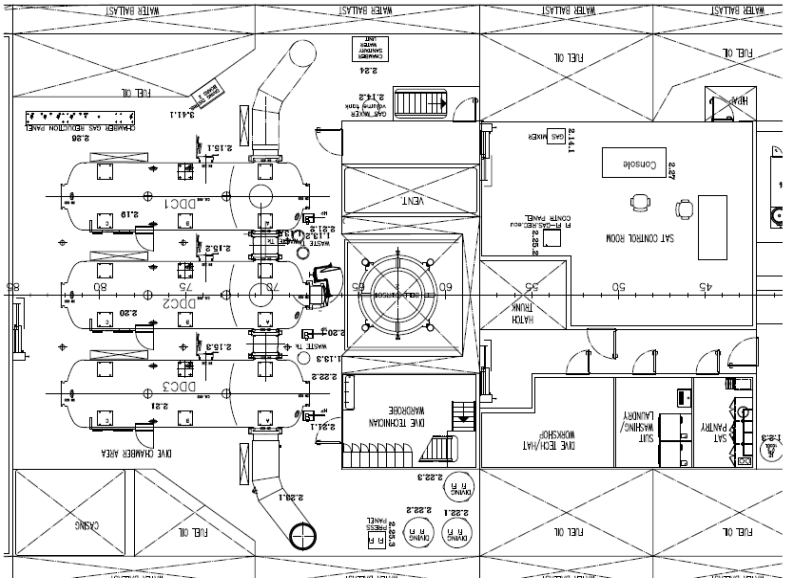


Picture 6- SB 15x3: 2D Arrangement of two 6Man DDCs , one 3Man DDC plus transfer lock arrangement, available with single or double HES. (for reference only)



Picture 7 - SB 18x3: three 6Man DDCs , 18 Divers occupancy available with single or double HES. (for reference only)

The technical baseline arrangement of the chamber complex is shown below



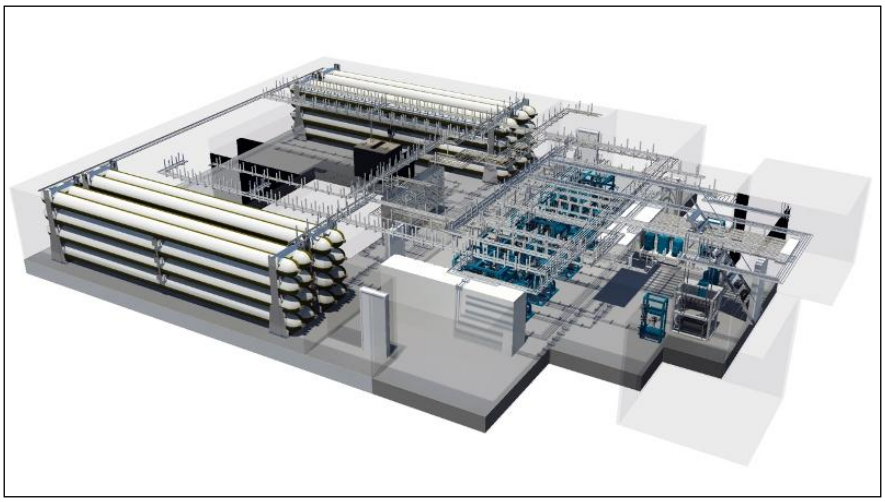
Picture 8 – 2D Arrangement of SB 18x3: three 6Man DDCs , 18 Divers occupancy available with single or double HES.

Diving Area Arrangement

The arrangement of the equipment in the remaining diving area are such to minimize the length of pipe work and wiring and shall at the same time allow installation in a compact environment.

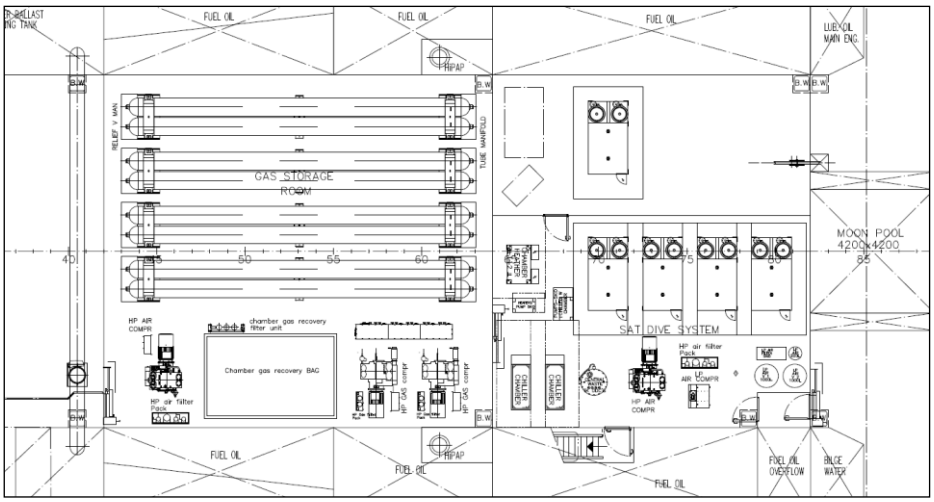
The gas storage is generally located below the chamber area, in the tween deck, together with the environmental control system and the high pressure gas system.

These includes the HP gas and Air Compressors and minor equipment.



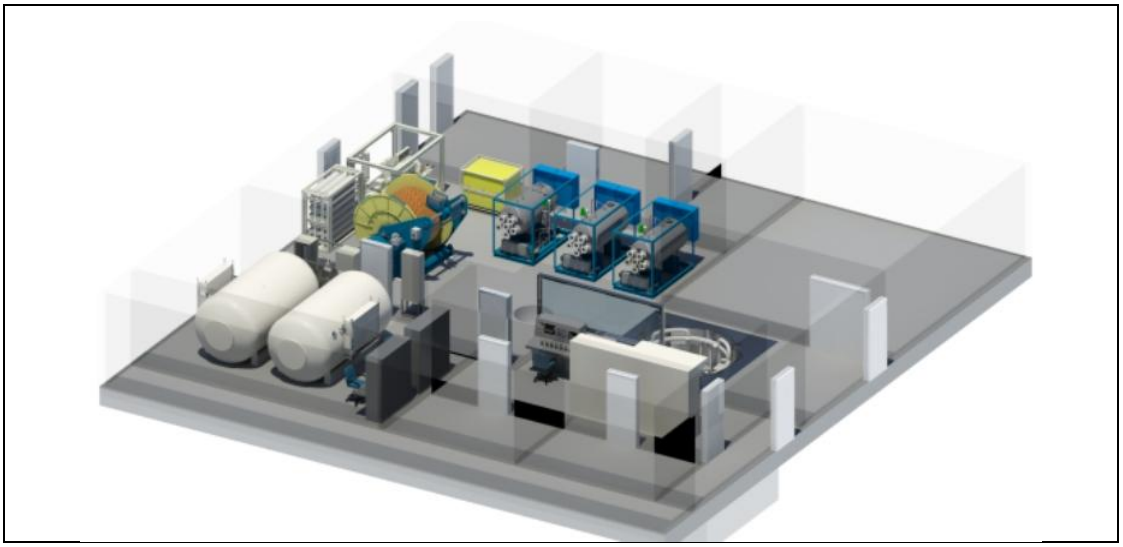
Picture 9 – 3D Arrangement of Tween Deck (for reference only)

The technical baseline arrangement is shown below



Picture 10 – 2D Arrangement of Tween Deck (for reference only)

The diving hangar is generally located on top of the chamber arrangement, on the shelter deck, including the dive control room, the umbilical winch, the diver heating units and the gas reclaim.

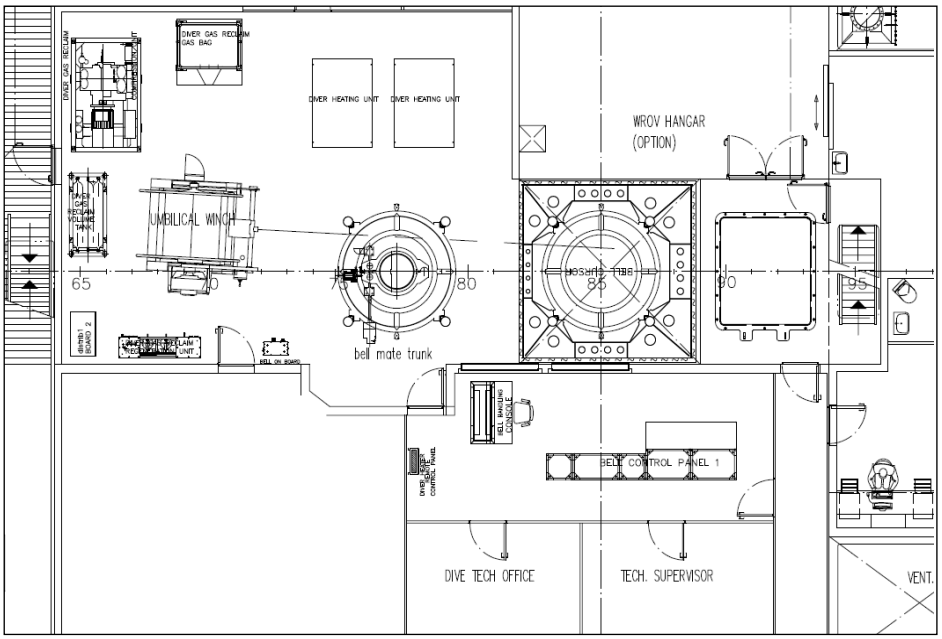


Picture 11 – 3D Arrangement of Shelter Deck (for reference only)

The diving bell travels in the hangar from the moon pool to the bell mating spool positioned on top of the connecting DDC.

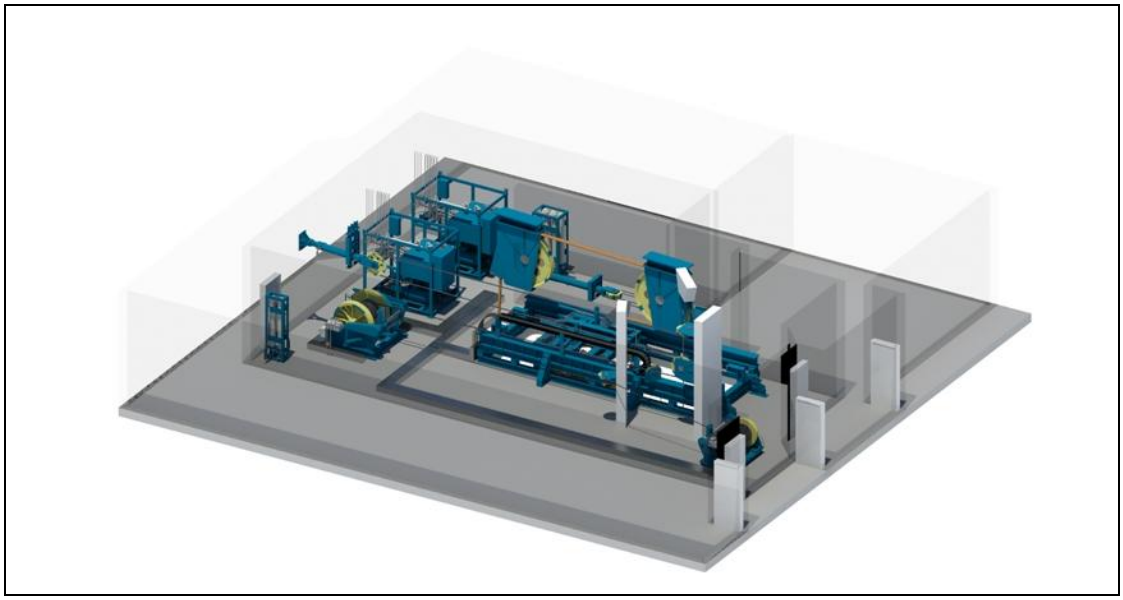
Picture 12 – Diving Bell on the Diving Hangar of the Well Enhancer

The technical baseline arrangement is shown below



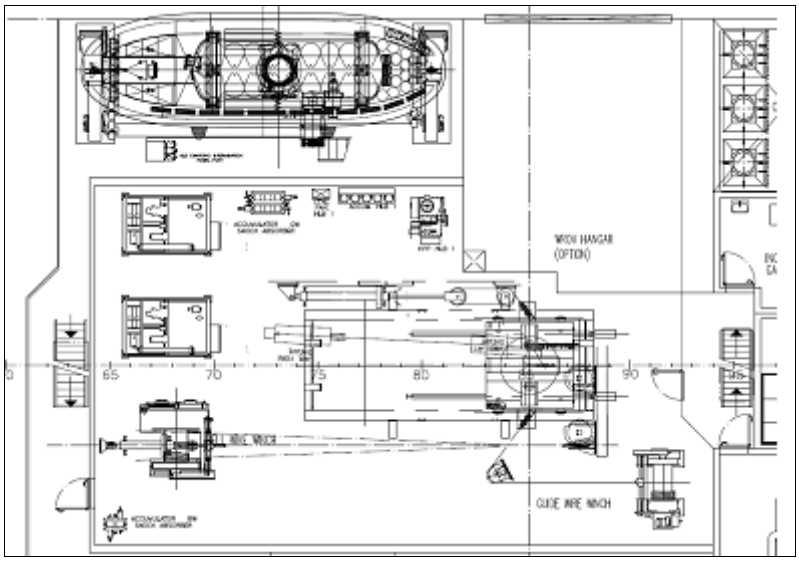
Picture 13 – 2D Arrangement of the Diving Angar (for reference only)

The trolley Launch and Recovery System (LARS) for the bell handling is generally located on the forecastle deck. This deck accommodates also the main and guide wire winches, inclusive of the hydraulic shock absorber system. The hydraulic power packs are positioned on this deck.



Picture 14 – 3D Arrangement of Forecastle Deck (for reference only)

In most of the vessel arrangements, the vessels side hosts the Hyperbaric Lifeboats, which are the main components of the Hyperbaric Evacuation System.



Picture 15 – 2D Arrangement of the Shelter Deck with Hyperbaric Lifeboats (for reference only)

Picture 16 – Hyperbaric Lifeboat

Fire Fighting and Detection

The Diving Inner Area is provided with fire detection and fighting system.

The Fire Detection System consists of a set of DNV Certified Hyperbaric Flame Sensors installed in adequate number in each DDC lock. Such detectors are connected with the Inner Area Fire Fighting System. The Logic of connection allows for automatic activation, delayed activation or activation trigged by the operator.

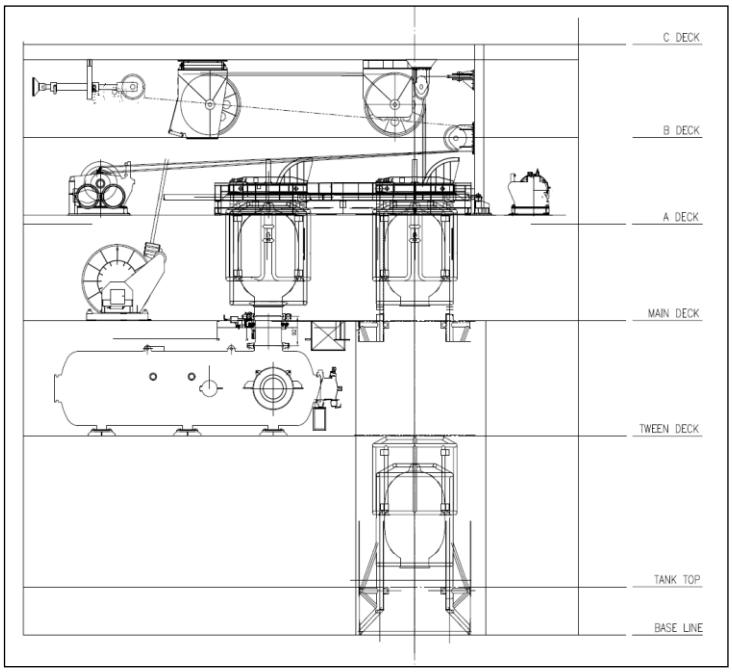
The Fire Fighting System consists of a DNV Certified water fog system installed in the inner area. The design of the system ensures that the differential pressure of the water jet in the nozzles in the inner area will equals the ideal design pressure requested to optimize the water fog. This is achieved by means of a differential pressure balance system set in accordance with the effective pressure of the inner area. The design and validity of the solution are certified by DNV and proven in operation.

Fire Fighting and Detection system for the outer area and Deluge system is provided as necessary outside of the diving scope of work.

Picture 17 - Fire Fighting and Detection system inside the Chamber

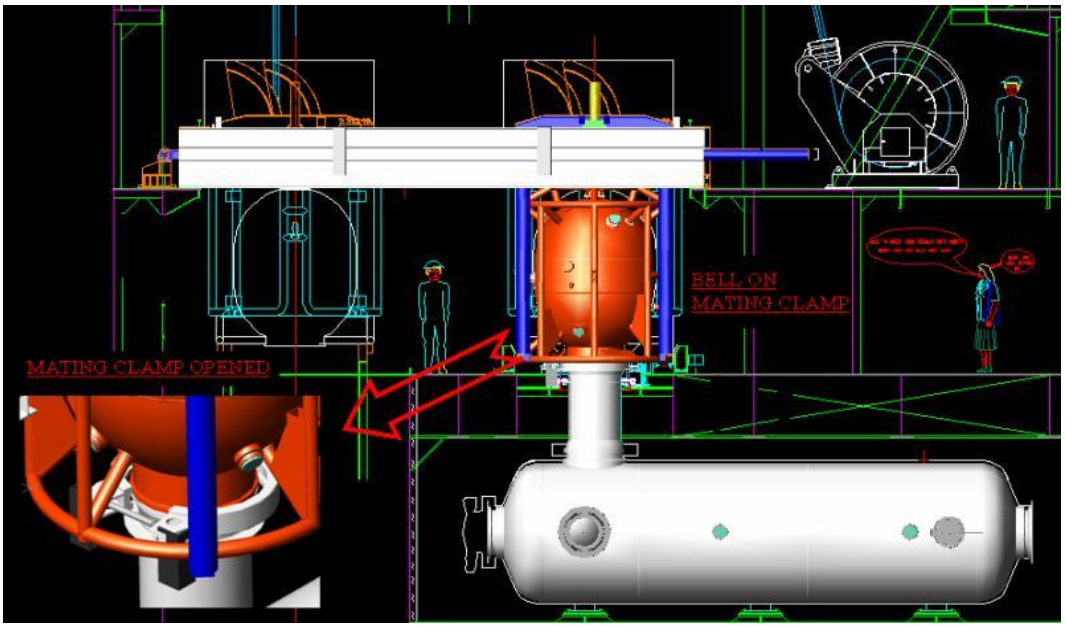
Launch and Recovery System

The Launch and Recovery System (LARS) is designed for moon pool launching of the diving bell. The LARS is a reliable and proved fully hydraulic design, provided of a double redundant hydraulic power pack. Diving operation is approved for limit of operation exceeding of 4m significant wave, conditioned by the vessel motion parameters.



Picture 18 – 2D Arrangement of the LARS (for reference only)

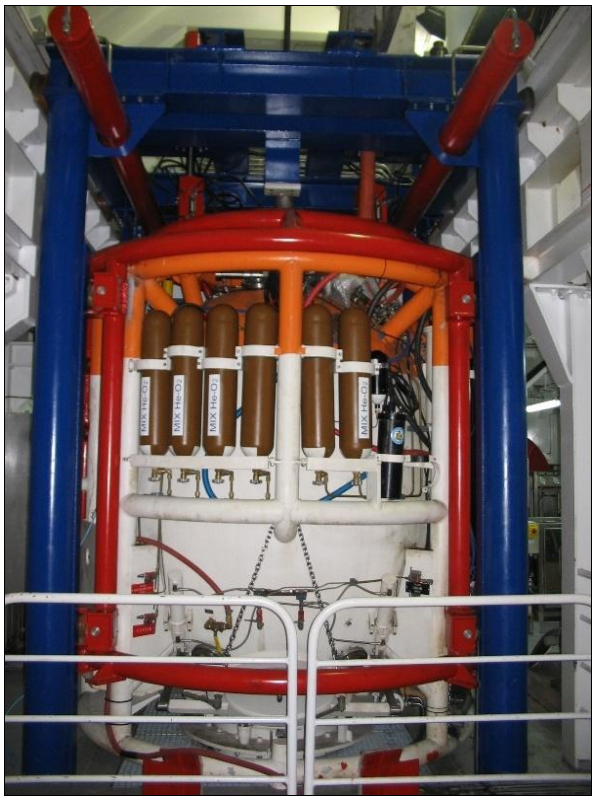
The LARS is controlled by PLC and provided with automatic, semiautomatic and manual launch and recovery procedures. The Launch and Recovery is operated from the LARS PLC Console, from the local control of the winches and from a remote portable emergency console.



Picture 19 – Typical PLC Schematic of the LARS PLC

The design of the LARS is of compact dimensions, based on passive cursor and capable to recover the complete diving bell and anchor weight in emergency condition with the guide wire winch.

The LARS design is based on an horizontal trolley guided by a couple of hydraulic rams. The trolley is designed in such way that the hydraulic circuit operates as hydraulic absorber to compensate the acceleration due to the motion parameters of the vessel.



Picture 20 – Trolley Lars for the Diving Bell

The LARS hydraulic system includes a passive shock absorber system for both the main wire and the guide wire, with hydraulic accumulators and rams. The passive shock absorber partially compensate the heave of the diving bell.

Diving Bell

The diving bell is moon pool launched and guided with passive cursor. Due to the single bell configuration the diving bell is positively buoyant in emergency by means of releasable ballast, to ensure a safe and proper tertiary mean of recovery.

The positively buoyant bell is necessary to avoid the permanent constraint of an operational working ROV capable to recover the bell from the sea bottom and to reconnect if to the vessel crane wire.

The main features are the following :

Pressure rating : the Bell is designed to operate to a depth of up to 300 m.s.w. It can be used in saturation mode with an internal pressure equivalent to the working depth, or in observation mode with an internal pressure of 1 bar and a maximum working depth of 300 m.s.w.

Main structural parts : The pressure vessel is made up of two hemispherical ends connected by a cylindrical shell as central body. All components are manufactured with high grade fine grain carbon steel.

The external protection frame is made of structural steel pipe to protect the PV against impact and allow insertion into the Bell Cursor during the movement through the moon pool guides. The ring in the top part can be used as a secondary main lifting point.

Manhole : It is equipped with double acting single door with hydraulically operated locking device complete with safety interlocking mechanism. The door is capable of withstanding inner and outer pressure of 300 m.s.w.

Diver umbilicals: on the seats for diver one and diver two 40m of standard diver umbilical can be stowed. Outside the bell on the external frame it is possible to stow up to 45m of tender diver umbilical cable. An increase of up to 70m diver umbilical is available as an option.

Heat insulation : The bell is provided with an insulating cover on the outer surface to reduce the heat loss when bell is deployed.

Medical lock : The bell is equipped with a stainless steel food lock that may be used during emergency operation of the bell on deck.

Picture 21 – Diving Bell in the Diving Hangar

Hot Water Diver Unit

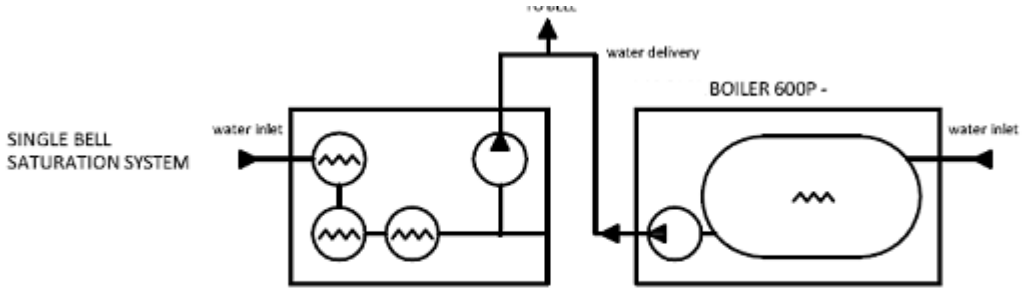
The Hot Water Diver Units grant all the necessary redundancy to the Divers and all the water flow and temperature necessary in accordance to the DNV Rules.

The Units is designed with multiple resistors connected in series in separate pressure vessels. This allows the operation even in failure mode of any of the resistors without compromising the continuity of service.

In addition the gradual increase of the sea water temperature in the cascade of recipients, exposes to the highest temperature, and therefore to the corrosive action of the heated sea water, only the last resistor, granting a much better maintenance and life cycle of the system.

The unit provides hot water supply to two saturation divers in accordance to the North Sea standards (60 lpm). The Hot Water Diver Unit is equipped with four independent in line heating element to allow the maximum level of control in case of failure of one heating element.

The Unit is connected in the following configuration:



The main components have the following features:

Main Data - Heater Unit	
Power Supply	220 kW, 440 V, 3ph, 60 Hz
Operational depth	300 m
Available Output Pump Pressure	60/70 Bar
Standard Flow Rate	60 lpm 30 lpm in emergency
Hot Water Temperature	Min. inlet 4°C –outlet 44°C/74°C
Temperature Control	+/-1 °C from set point
Emergency	Heating redundancy. Can be combined with another Boiler or with another Heater Unit.

Gas Reclaim System

The Drass Divers Gas Reclaim System allows the reclaim of gas mix breathed by 2 divers up to 300 msw at a flow rate of 35 l/min per diver. The Reclaim System controls the correct level of pressure in the various lines with a redundant check of O2 and CO2 level, before the last downstream check on the Bell Control Console.

It is possible to adjust the different pipelines to the correct level of pressure in order to set up the system at various depths.

The Gas Reclaim System is provided with its dedicate HP Gas Compressor unit, which shall be compatible and interchangeable with the other Gas Compressors installed in the system.

Picture 22 – Diver Gas Reclaim Panel into the Bell Control Console

Life Support System

The Life Support System consists of a set of Environmental Control Units (ECU) designed to provide the requested redundancy to the Diving Decompression Chambers.

Picture 23 - ECUs assembly

Each ECU is designed to maintain the requested environmental parameters in a DDC, assuming that 6 divers are present in each chamber and 4 complete recirculation cycles of the chamber atmosphere is executed in one hour time.

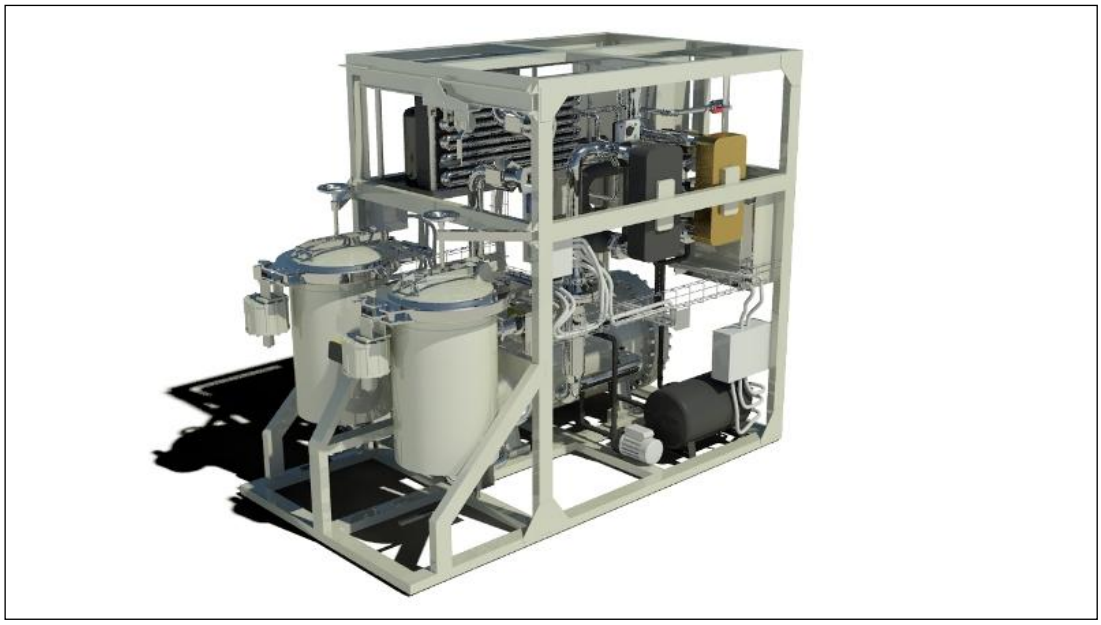
The temperature control is demonstrated to be within +/- 0,3°C from the set point.

The humidity control is demonstrated to be within +/- 7%RH from the set point.

The duration of the soda lime canister is demonstrated to be at least 24 hours in the worst conditions and maximum occupancy.

The ECU system shall be remotely controlled by PLC from the saturation control room. Humidity and temperature shall be independent set values.

ECU Main features	M.U.	Value
Power (440V / 60Hz / 3 phases)	kW	22
Required sea water flowrate	lpm	45
Sodalime Canister Capacity	kg	45x2
Gas Circulating Flow Rate	m3/h	Up to 200
Cooling and Heating capacity can be chosen according to Customer requirement		
- 45 kg total soda lime, 15 kg per filter (divided into 3 canisters)		
- Open design to guarantee an easy access and maintenance		
- High flow internal blower unit. Non-stop even in soda lime recharge operations		
- Automatic first class condensation dischargers provided for draining of condensation without loss of pressure		
- High flexibility and easy use		
- Locking mechanism physically ensures CO2 filters close in compliance with DNV OS-E402.		



Picture 24 - 3D Picture of ECU (for reference only)

Local Saturation Control System

The Local Saturation Control System is of proven and consolidated design. The Chamber Saturation Control Panel provides monitoring, redundant pressurization, redundant communication, fire-fighting system control and redundant gas analysis of each lock of the Deck Decompression Chambers and Self Propelled Hyperbaric Lifeboats / Hyperbaric Rescue Chamber and relevant Escape Trunks.

The Chamber Saturation Control Panel is supplied with all the various gas mixes from the Gas Pressure Reduction Panel; each section is provided with an UPS in order to assure supply in emergency situations and filtration of electrical distortion from the ship supply.

The Chamber Saturation Control Panel is also supplied from Therapeutic Gas Panel and O2 Deck Distribution Panel to assure metabolic O2 injection into the locks and various gas supply to the Built In Breathing apparatus (BIBs) in emergencies.

Vent and recovery gas lines are fitted to recover gas mix to the gas bag and avoid cross mixing of different gas mix.

The entire system is modular: there is a module for each double lock chamber or for Self Propelled Hyperbaric Lifeboat and relevant Escape Trunk. Due to modularity the Chamber Saturation Control Panel is available for expansion.

Picture 25 - Saturation Control Panel

Control and Monitoring

The automated control and monitoring system is an advanced solution, aimed to minimize the space occupancy of the control room, to shorten the overall piping installation and to give a computerized and graphic reporting of the saturation and diving operations.

At the same time Drass solution is designed to maximize the reliability and operability, avoiding the complexity and fragility of the previously delivered automated systems.

Control System

The automated control system is based on electro actuated valves controlled by PLC. The PLC is installed on the same chamber, and its touch screen control is installed in the saturation control room. This simple and reliable solution allows direct control of each valve through a direct link between the valve and the control console. At the same time the local automatic control and the manual emergency control are both available as a backup.

The automated control is installed on the same console of the monitoring system, and both system appear as fully integrated.

The simple logic of the system provides a technical solution which is modern, reliable, user friendly and easy to maintain.

Picture 26 – Automatic Control Console (for reference only)

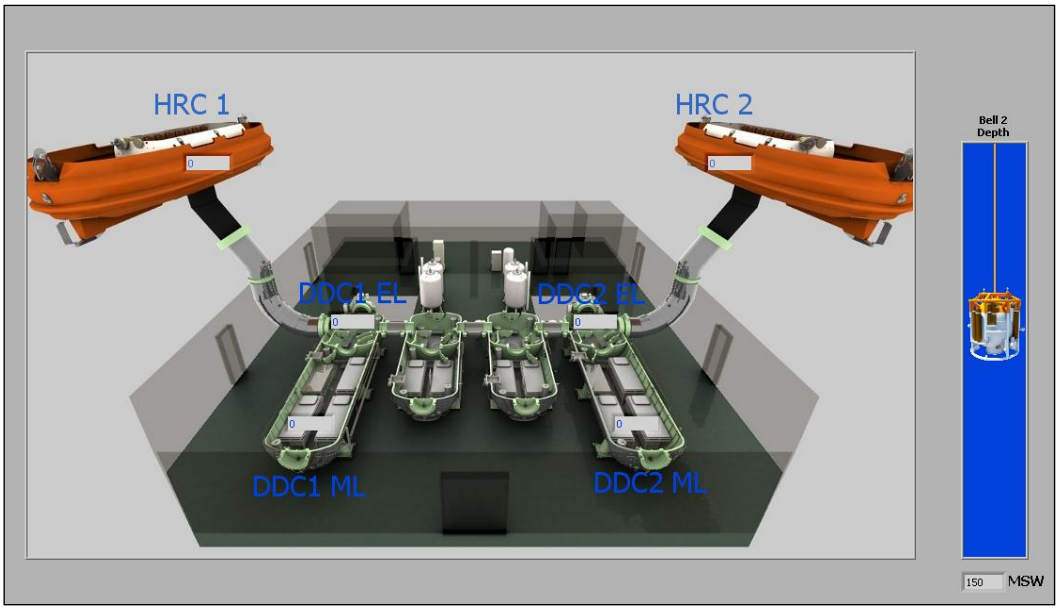
Monitoring System

The Diving System is equipped with a dedicated Monitoring System, installed to detect, store and display all the main parameters, warning and alarms of the chamber environment, handling system operation, gas storage reserves, video and audio communication.

The monitoring system is passively connected to the diving system equipment and has absolutely no interference with the operation and the control of the diving system, with the intent of not affecting the overall reliability of the diving system operation.

The monitoring system can also be connected to a transmission channel of the vessel and offer real time or delayed data to a similar station located on shore. This will provide the vessel managers in the headquarters with a real time picture of the diving operations on board.

The Monitoring System allows data transmission, mining and organization, to facilitate broadcast to clients and operation offices, and to support the issue of project reporting.



Picture 27 – Typical Graphic of the Monitoring System

The Monitoring System gives free access in copy to an open source database, to allow data manipulation and personalization for customized and tailored tasks.

Picture 28 – Typical Alarm Display of the Monitoring System

The system can be customized to associate the recorded data to each diver during all the saturation period. All the environmental parameters are linked to the divers and an Electronic Diver Logbook is made available to each diver. The parameters are treated in accordance with the legal prescription in terms of privacy and their collection and recording will be agreed in accordance with the OWNER Policy. The Diver Electronic Logbook is an optional equipment.

Video Module and Communication System

The Diving System is provided with the following communications tools, which are managed from the Saturation and Diving Control Rooms:

Voice Communication for the inner area: complete inner area communication system, including unscrambling devices

Voice Communication for the diving outer area: Complete communication system serving all the remote units connecting the working sites and positions of the diving outer area (diving hangar, decks, rooms, stores)

Video Module for the Saturation Control: Complete set of monitors (one very large screen display with quad screen plus 2 large screen plus 3 DVD recorders). The system is connected and integrated with the below mentioned Interface Matrix.

Video Module for the Bell Control: Complete set of monitors (3 large screen displays plus 2 DVD recorders and emergency communication system for the inner area).

Broadcast Emergency Communication for the Inner Area: Complete broadcast system for the chambers complex, consisting in piezoelectric transducers connected to the chamber pressure hulls, transmitting the sound information thanks to the vibration of the same metallic structure, without any electrical penetration in the inner area of the pressure vessel for human occupancy.

Black Box: double recording device for data, audio and video recording

Interface matrix: system to interconnect voice, video and data among diving inner area, diving outer area and vessel communication system. The interface matrix is an optional equipment.

High Pressure Gas Ring

The high pressure gas ring consists of the Gas Storage, transfer and pressure reduction tubes and panels, including the HP Air and Gas Compressors.

The complete ring is dimensioned for 200bar and about 18,000Nm3 of available gas storage volume.

The design allows gas transfer from the main deck from port and starboard.

The Gas Storage Skid is a specific modular installation designed for use in saturation diving.

Each module is self contained in a metal skid certified by DNV and specifically designed for installation on board.

The skid, properly installed on its foundations, can withstand all the ship motion-induced loads and additional loads as stated by DNV Rules for Diving System.

In terms of operation, the same skid is used for transportation, loading and installation on board, without any direct handling of the gas tubes.

The scope of work of the shipyard is therefore limited to the welding - on the properly designed and manufactured ship counter foundation - the base of the skid.

The skid contains 8 jumbo gas tubes, each one is 200 bar filling/working pressure rated, with 2,880 litres of floodable volume.

The tube cluster is provided with a dedicated manifold interconnection, including needle shut off valve on each tube and certified safety relief valves for each tube on the opposite side.

Sanitary Water System

The Sanitary Water System is dimensioned to supply simultaneously for different sanitary users with a flow higher than 80 liters per minute.

Hoses and Pumps are DNV Certified as per applicable rules.

Surface Diving

The surface diving system is built in hangar for the best maintenance and operation in severe weather conditions. This is allowed thanks to 2 (two) trolley launch and recovery systems (LARS) having maximum height of 3010mm including basement during operation. The trolley slides in extension allowing 1500mm clearance of the diver basket from the vessel side. Once retracted in the hangar, suitable roller doors close the side opening of the surface diving hangar.

Picture 29 –Surface Trolley LARS configuration (for reference only)

In alternative the compact A-Frame is available in single or twin version. Drass A-Frame is installed on a standard 10” basement, to ease the installation and the transportation. The A-Frame LARS for the surface diving is available in option.

Two (2) Ø2000mm or Ø1500mm (in option) inner diameter mixed gas chambers will be installed in the mid section and allow the maximum comfort to the surface

divers. At the same time Two (2) 2 Divers Surface Mix Gas Panels with Video Module shall be installed, one on each vessel side.

The Surface Diving System will be permanently connected and integrated with the Saturation System. The high pressure gas and air ring will be optimized for both surface and saturation operation and the air and gas supply redundancy to the surface system shall be improved with adequate buffer tanks.

Logistic Support Software

The Diving System shall be provided with a dedicated Integrated Logistic Support (ILS) Software for the management of the Configuration, Documentation, Maintenance, Stores and Procurement of Spares. The ILS Software shall be of proven and specialized design for diving.

The ILS Software shall be preloaded with the system configuration and will operate with graphical and data base navigation.

The ILS Software shall allow remote connection and interface with the vessel requested users and with ashore operating stations.

The ILS Software will be provided with an operating console integrated in the Monitoring System and will allow the connection of the users through a web server for the Intranet / VPN.

The ILS Software will have no direct interface with the operation of the Diving System itself to avoid reliability problems and assure the safest diving operation.

Logistic Support Spares

The Diving System will be provided with 2 years recommended spares parts plus critical spares. The recommended quantities will be demonstrated by means of a proper logistic analysis executed by the DSM.

RULES AND RECOMMENDATIONS

The applicable rules and recommendations are available in Annex B1

DIVING SYSTEM CONFIGURATION

The Drass 100 Series Saturation Diving System is logically split in the following main groups:

- Diving Saturation System (basic choice among 4 configurations)
- Surface System (basic choice among 2 configurations)
- Hyperbaric Evacuation System (basic choice among 2 configurations)
- Transfer Lock Addendum (option)
- Living Compartment (option)
- Options (main choices for the equipment features)

Diving Saturation System

The Baseline Configuration of the Diving Equipment composing the scope of work is herewith described as reference, to allow a clear alignment and identification of the diving equipment.

100 Series	Drass Code	U.M.	Configuration
HYPERBARIC CHAMBERS			
twin lock 6 man Hyperbaric Chambers	DSHC001	ea	3
twin lock 3 man Hyperbaric Chambers	DSHC002	ea	0
Bell mate spools	Drass standard design	ea	1
Connection Trunks	Drass standard design	ea	2
Food locks 330	DSDC008	ea	3
Material lock	DSDC010	ea	1
Waste Tanks	DSDC019	ea	3
Waste Central Tank	Drass standard design	ea	1
Fire Fighting Control	DSHC009	ea	1
Fi-Fi Tanks	DSHC009	ea	3
BELL			
3 Man Diving Bells- 6 m3	DSDB002	ea	1
BELL HANDLING SYSTEM			
Bell Cursor	DSHS001	ea	1
Bell Trolley Systems and Assembly	DSHS002	ea	1
Main Winch	DSHS003	ea	1
Guide Wire Winch	DSHS004	ea	1
Anchor Weight	DSHS005	ea	1
Umbilical Winch	DSHS006	ea	1
Main Umbilical	OEM	ea	1
Umbilical Sheaves & Roller System	DSHS008	ea	2
Bell Sheaves System	DSHS008	Set	1
Guide Sheaves System	DSHS008	Set	1
Hydraulic Power Packs	DSHS009	ea	2
Wires Set	Drass standard design	ea	2
Bell Handling Control Station	DSHS010	ea	1
Bell wire double shock absorber systems	DSHS012	ea	1
Anchor weight wire double shock absorber systems	DSHS011	ea	1
CONTROL PANELS			
Chambers Saturation Control	DSCP001	ea	6

100 Series	Drass Code	U.M.	Configuration
Chambers Sat Automatic Control Panel	Drass standard design	ea	2
Diving and Chamber Electrical Supply Panel	Drass standard design	ea	2
Chambers Gas Pressure Reduction Panel	DSCP003	ea	1
Bell Control Console	DSCP002	ea	1
Video Module for Bell Control Console	Drass standard design	ea	1
Gas Management & Distribution Panel	DSCP004	ea	1
Gas Transfer & Filling Panel	DSCP006	ea	1
Oxygen Supply Panel – Deck Panel	DSCP007	ea	1
Bell On Board Gas Charge Panel	DSCP009	ea	1
Therapeutic Gas Panel	DSCP010	ea	1
GAS SYSTEM			
Gas Storage	DSGS001	ea	4
Chamber Gas Recovery System	Drass standard design	ea	1
Divers Gas Reclaim Units	DSGR003	ea	1
Volume Tank	DSGR003	ea	1
ECU System	DSEC001	ea	4
Chiller plus Heater	DSEC002/003	Set	2
Additional Panels	Drass standard design	Set	1
Sanitary Water System	DSLS001	ea	1
Magma Sat 60(plus Boiler)	DSLS012	ea	1+1
ANCILLARY EQUIPMENTS			
O2 Booster Pump	OEM	ea	1
HP Gas Compressors	OEM	ea	2
HP Air Compressors	OEM	ea	1
Gas Mixer	OEM	ea	1
Installation Material	Drass standard design	ea	set

Surface Diving System

Drass 700 Series Surface Diving is an independent Surface Diving System, which is also provided as an integral part of Drass 100 Series Saturation Diving System.

The basic choice consists of :

Description	Drass Code	Qty
Air Dive Chamber	SSHC700	2
Air Dive Control Panel	SSHC700	2
2 Divers Air Dive Control Console	SSCP701	2
Air Dive Launching & Recovery System (A-Frame)	SSHS702	4
Magma Lite 30	DSLS012	1
HP Air Compressor (inclusive of filter pack& LP tanks)	OEM	1
Installation Material	Drass standard design	Set

Hyperbaric Evacuation System

The basic configuration of the Hyperbaric Evacuation System consists of the following equipment:

Description	Drass Code	Qty
Escape Trunk	Drass standard design	2
HLB Saturation Control Panel	DSCP001	4
HLB Termination Panel	DSCP013	2
HLB Gas Charging Panel / Bail Out Charging Panel	DSCP013	2
Hyperbaric Lifeboat 12 man / 18 Man	OWSS	2
Davit	OWSS	2
Clamp and Spool	Drass standard design	2
Hydraulic System for the Davit	OWSS	2
Installation Material	Drass standard design	Set

Each diving system is equipment with 2 Hyperbaric Evacuation Systems.

Transfer Lock Addendum

The Transfer Lock Addendum is a single lock transfer chamber interconnecting all the diving decompressing chambers.

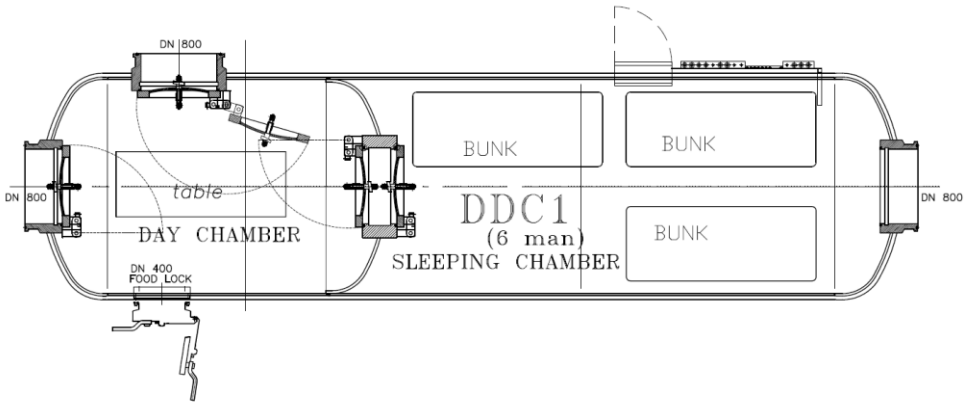
The inclusion in the arrangement of the Transfer Lock includes the supply of various and significant equipment as follows:

Description	Drass Code	Qty
Single lock transfer Hyperbaric Chambers	DSHC004	1
Trunking	As per Drass design	1
Food locks 330	DSDC008	1
Fire Fighting Water Systems	DSHC009	1
Chambers Saturation Control	DSCP001	1
ECU System	DSEC001	1
Installation Material	As per Drass design	Set

Living Compartment

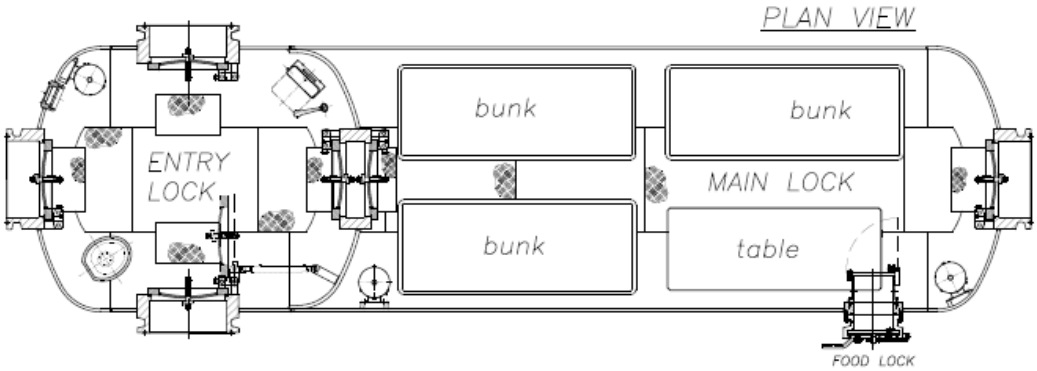
The Living Compartment option consists in the introduction of three locks in place of one or more of the standard twin lock chambers of the basic configuration.

The modification has the scope to provide to each divers' team a separate living and sleeping compartments, in addition to the already existing toilet facilities.



Picture 30 – Chamber Arrangement with Living Compartment (for reference only)

The living compartment configuration has a deep impact on the chamber arrangement, on the life support and saturation control configuration and finally on the overall costing of the system. The Living Compartment can be introduced only for the 6 man chamber or on the 3 man chambers as well.



Picture 31 - DDC standard configuration (for reference only)

Drass can anyhow easily introduce the living compartment modification making use of the standard items of production. Anyhow, due to the complexity and the number of possible variations, such option is analyzed on demand.

Options

The present paragraph highlights the most common variations which are available for Drass 100 Series Saturation Diving Systems.

Applicable to	Configuration
Transfer Lock	No
Living Compartment	No
Saturation Control	Automation
Saturation Control	Amron
Saturation Control	Simens
Surface System	2000mm DDC
Surface System	Air Dive System
Surface System	2 x 2 Divers Air Dive Panel
Surface System	Video Module for Control Panel
Surface System	A-Frame
Life Cycle Management	ILIS
Critical Spares	Yes
HES	Twin Lifeboat

The characteristics of the main diving equipment is listed in Annex B3 .

Basic Vessel Interface

Single Bell System -18 man – No. 3 chambers in line – No.2 Hyperbaric Lifeboat included	
Overall Weight of the diving equipment (including air dive)	410 tons
Air Consumption	Buffer tank 0.5m³ at 200 bar to be recharged in max 1h for aeration of Moon Pool
Electrical supply	1000 kw (full operation)
	500 kw (emergency)
Water	50 l/min cold water
	50l/min hot water
	Diving equipment cooling system 700 l/min at 5 bar
	Hot water for diver 140 l/min at 4 bar (salt water)
Recommended Moon Pool dimensions	3900 mm x 3900 mm
Recommended volume for the Bell Hangar and Handling System	2050 m³ (14.2x16.8x8.6)
Chamber area with Sat Control Room & related store workshop	745 m³ (17.2x12x3.6)
Gas Storage & Ancillary Area	880 m³ (15.4x12.2x4.7)
Life Support System Equipment Area and Reclaim	630 m³ (14.6x12x3.6)