James Fisher
Subtech

Portable HRF
(Hyperbaric Reception Facility)

Expertise for
the **extremes**

18-Man Hyperbaric Reception Facility

General

JF Subtech hereby offers to supply a Lloyds-classed, 18-man emergency Hyperbaric Reception Facility (HRF) to accommodate divers evacuated from the diving system by means of the Self Propelled Hyperbaric Lifeboat (SPHL).

Note: As DSV/SPHL has not been specified to James Fisher Subtech at this time. Mating flange, cradle and test fit are not included in this offer but will be a requirement before operations commence.

Specifications

There is 1 main pressure vessel in the system – a twinlock reception/ accommodation chamber. There is 1 control van to accommodate both saturation control and the life support machinery.

Depth Capacity

DDC#1 has a depth capability of 300 mtrs, as currently tested.

Testing

The HRF system was designed, built, maintained and tested in accordance with IMCA guidelines and is built under full class design and manufacture survey by Lloyds Register of Shipping (LRS) to the following :-

- International Maritime Contractors Association IMCA DO18 rev 1- Initial and Periodic Examination and Testing of Diving Plant and Equipment June 2014 – (sections 1, 2.1., 2.2, 2.4, 3.5.7 and 8).
- International Maritime Contractors Association IMCA D053 DESIGN for the hyperbaric reception facility (HRF) forming part of a hyperbaric evacuation system (HES) April 2014
- Lloyds Register Rules and Regulations for the Construction and Classification of Submersibles and Underwater Systems Dec 1989

The pressure vessel was hydrostatically tested to 1.3 times the design depth of 330 metres, as per the PD5500 design code

All electrical components were subjected to continuity checks and di-electric checks as applicable.

General Arrangement

The HRF is designed to mate to a SPHL or to a HRC to allow the divers to transfer under pressure to the HRF chamber.

Power Requirements

Power supply required to operate the HRF and its electrical components is 440V AC 60 Hz, triple phase, 150 amps. A generator can be supplied separately if required, but is not included in the standard HRF system proposed.

Medical Locks

A medical lock 305 mm I.D. x 500 mm long is located in the side of the main lock. It is manually actuated by a tube turn clamp. An interlock is provided to precent accidental opening of the outer door with pressure still inside the medical lock.

The interlock is a Divex part and is approved by Lloyds / DNV.

Penetrations

316 Stainless steel NPT penetrations are located in each lock of the DDC#1 to provide access for all the gas and electrical connections necessary for piping the systems within the DDC#1.

Main electrical penetrators are Hydrobond Series HPS penetrators, Lloyds Approved, and 50% redundancy will be provided in these penetrators.

An electrical penetrator for monitoring ECG is installed in DDC'1. This will be a 24-way Hydrobond type as above.

Outfitting

Outfitting has been undertaken in such a way to make the DDC#1 comfortable utilitarian. All items are corrosion proof, fire resistant, non toxic and suitable for diving to the rated depth of the system.

External Outfittings

- External electrical penetrators (see 1.7.9)
- Double valving on all gas penetrations – valves will be 316 SS ball valve on all lines except oxygen and therapeutics mixes, which will be Brass screw-lift type
- All fittings will be Parker triple-lock type brass fittings

DDC Enclosure

The structure is sheeted in with profiled cladding. This cladding is external to an insulating layer of the Armaflex insulation foam material (25mm). This classing encapsulates the twinlock DDC and its piping associated trunking and locks remain accessible.

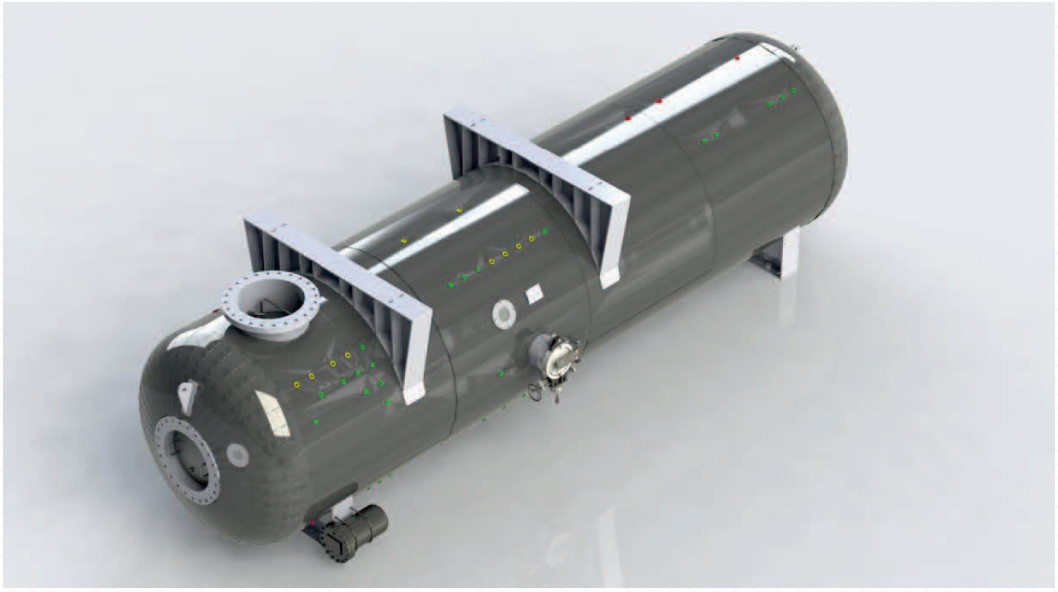

Figure 1 - Chamber External

Figure 2 - Chamber Main Lock Internal

Deck Compression Chamber 1

Description

DDC#1 is a twinlock skid mounted and enclosed saturation living chamber consisting of the main lock (ML) and entry lock (EL).

DDC#1 allows habitation for 18 rescued divers and a medical attendant if required.

Depth Capacity

DDC#1 has a depth capability of 300 mtrs, as currently tested.

Testing

The DDC#1 is designed and built in accordance with PD 5500 (2009), and tested in accordance with the IMCA guidelines, fully design appraised and surveyed by Lloyds Register of Shipping. DDC#1 is hydrostatically tested to 1:3 times the design depth of 330 metres.

Configuration

The DDC#1 is 2300 mm I.D. x 9300 mm overall length, cylindrical in shape with elliptical heads each end. Intermediate heads are included to separate the main lock and entrance lock.

Man Ways

One 700 mm I.D. man way is located in each end of the DDC#1 and each has a bolted flange.

Two internal man ways 700 mm I.D. are located in each of the intermediate heads, and each man way has double doors to allow either lock to be pressurised independently.

The chamber also has a top mate manway to connect to the SPHL and a side manway to connect to a Hyperbaric Rescue Chamber (HRC).

A SPHL trunking and damp assembly can be installed on the top of the entry lock to suit the bottom – mate SPHL, - this is offered separately.

A guide frame and landing saddles to allow the SPHL to mate, can also be provided.

Viewports

One (1) 144 mm diameter acrylic view ports, 0-ring sealed is located beside the medical lock in the main chamber, and two (2) 95mm viewports are located in the dished ends of the main lock and entry lock.

DDC Control Container

Saturation Control

The saturation control console is located in a 20 ft container (partitioned approximately in half to the further accommodate the life support machinery). The console is fitted with ¼% accurate to 0-360m digital depth gauges for each system lock, and incoming HP gas regulator panel, gas analysis panel and electrical control panel.

The panels are identical to the main saturation control panels in a Divex saturation system and allow full control of the chamber.

Internal Outfittings

- Twelve bunks approx. 1800 mm long, are located in the main lock of DDC#1
- Seating for up to 6 personnel is installed
- Flooring is made of aluminium diamond grid checker-plate
- Shelving is supplied for equipment storage
- Pressurisation and exhaust system is supplied with appropriate valving and silencers
- A built-in breathing system is provided. 18 BIBS masks are supplied with overborad dumping capability for oxygen use, in the main lock, and 4 sets in the outer lock. The BIBS manifolds are fitted with quick-connect fittings and conveniently located for each bunk
- BIBS exhaust control is maintained by divex back pressure regulators type RP700
- Pneumo penetrations are provided for pressures measurement. This pressure is monitored in the saturation control room
- Secondary sound powered phones are supplied in each lock. These sound-powered phones are fitted with call generators
- Main communication with head sets are supplied. The communications boxes are located one in the main lock and one in the entry lock
- Three backup Kinergetics DH-21 scrubbers are provided in the main lock and one in the outer lock
- A wash basin, shower and pressure proof toiler is supplied in the entrance lock. The toiler is protected by an interlock system and flushes to an external holding tank, which in turn can be connected to the vessels sewage system
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- The chamber is fitted with Divex “Hyfex” hyperbaric fire extinguishers – one in each lock
- Each compartment of the chamber is fitted with a caisson gauge (0-360msw)
- Each compartment is fitted with a temperature and humidity gauge
- A hyperbaric PPo2 analyser type G14 is supplied in each compartment
- Two overhead lights are fitted in the main compartment, and an overhead light in the entry lock. The lights are Divex LP 20 type and are fitted with 20W bulbs
- Environmental control is achieved by three Divex Kinergetics HCU units. The main lock is fitted with two HCU 3/6 units which control temperature, humidity and remove CO2 in the main lock

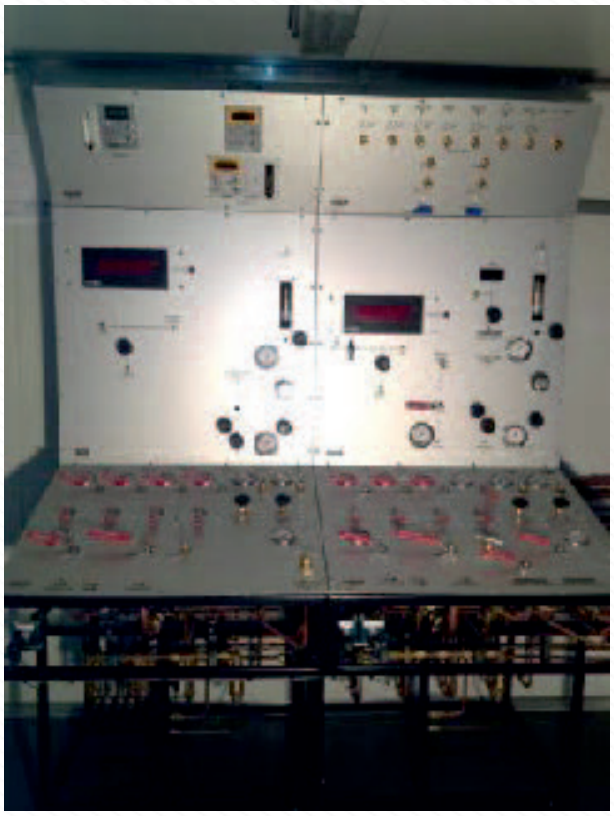

Figure 3 - Control Panel

Figure 4 - Electrical Rack

Materials

All HP pipework is stainless steel and tungum on high oxygen lines. Fittings are Triple-lock brass throughout, and all valves and regulators are 316 stainless steel or brass.

Communications

Communications are provided by means of Divex 3-diver helium unscramblers. Back-up communiations are provided by Silec sound powered phones in each lock.

Gas Analysis

All gases supplied to the chambers are monitored by Divex G22 oxygen analysers and Divex G30 Co2 analysers. A patch panel is provided to allow each compartment and each gas to be monitored independently.

Depth Measurement

Digital depth gauges are provided to monitor each lock depth. These gauges are ¼% accurate, and are scaled 0-360msw.

0-360m digital gauges are provided to monitor the bell trunking and HRC trunking depths.

Video Monitoring

Each compartment of the system is monitored by CCTV, with LCD displays mounted on the saturation control panels.

Environmental Monitoring

The container has a Divex G21-2 oxygen monitor with hi/lo alarms fitted to monitor the internal environment in case of heliox leak from the panel pipework.

Smoke Mask

Two smoke masks for the life support supervisors are fitted in the event the atmosphere inside the container is rendered unbreathable by fire or major gas leak.

Machinery Container
(partitioned with DDC Control)

Environmental Control System

Two Divex Kingergetics heating and Chilling Skids HCD-01 systems are installed to provide adequate cooling and heating to the DDC to maintain a comfortable living atmosphere for the occupants. The units can be cross-connected to each or both locks of the DDC and thus provide full redundancy.

Heating Capacity	9 kQ
Cooling Capacity	9 kW
Temperature Control	Adjustable set point, ±1 °C hot/cold fluid
Circulation Pumps	35 litre /min at 4 bar Cooling Water Input
Cooling Water Input (Sea Water Condenser)	47 ltr/min @ 32°C, 8 bar max

Figure 5 - Heating and Chilling Skid (HCS-01)

Fresh Water Shower Tanks

An insulated Kinergetics potable water unit (PWS-01) provides potable hot and cold water to be fed to the DDC#1 shower and toilet.

Delivery Pressure	10 bar to 68 bar
Hot Delivery	7.5 litres/minute
Cold Delivery	7.5 litres/minute
Thermostat Setting	65°C (factory)
Hot Water Range	30°C to 70°C adjustable
Heating Capacity	9 kW
Hot Water Tank	60 litres
Power Requirement	440V 2Ph 50 Hz 20 A
Drive Air	2.8 m3/minute @ 8 bar

Figure 6 - Potable Water System (PWS-1)

Main Electrical Distribution Board

The system's main electrical distribution board is located in the machinery section of the container. The electrical distribution board provides power to all the main system components and is designed to offer redundancy in the event of circuit failure. All electrical system comply to the Australian Standards.

Figure 7 - Machinery Compartment

Interconnecting Spoolpieces and Clamps with DDC Control

The system will require interconnecting spoolpieces and clamps, and HRC/SPHL reception cradles which are not included in the basic system scope of supply, as these will require to be fabricated to suit a client's particular hyperbaric rescue craft.

SPHL/HRC Spoolpiece and Clamp

A fully certified spoolpiece and clamp to make the SPHL can be provided, which will be bolted to the manway in the top of the entry lock in the HRF DDC.

Base Skid

A base skid, formed from an ISO standard 40ft flat rack, will form the DDC base skid on which the chamber is mounted, equipment installed and lifting points attached.

SPHL Reception Saddles

Reception saddles for the SPHL can be fabricated and provided to allow accurate mating of the recovered SPHL to the HRF chamber. The reception saddles are fitted with an adjustment system to accurately level the SPHL to ensure it can be mated quickly to the HRF. The reception saddles located at the top of the HRF to accept a bottom-mated SPHL.

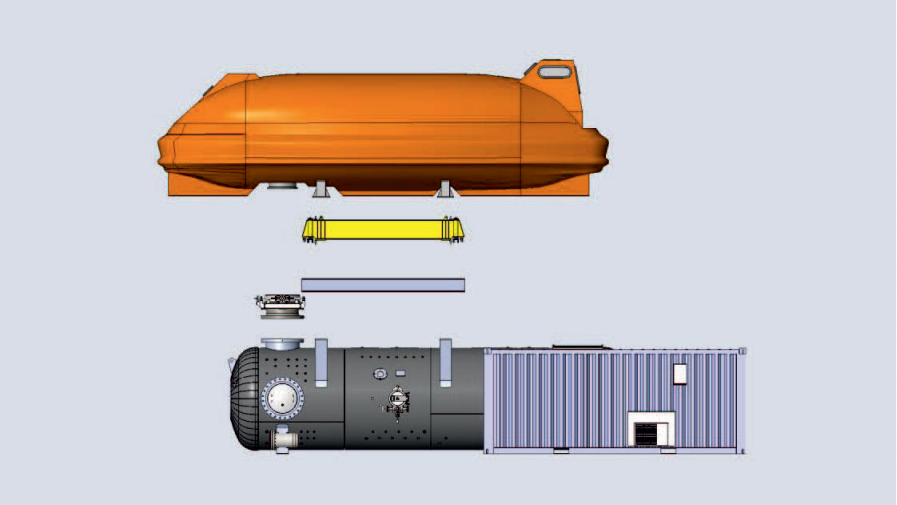

Figure 8 - SPHL reception saddles and spoolpiece

Interconnecting Whips and Cables

The system comes complete with interconnecting whips and cables required for operation, with the exception of the main power cable which is client supply.

Certification

The HRF system is designed, built, maintained and tested in accordance with IMCA guidelines and is designed constructed and fully tested under full survey to Lloyds Register Rules to allow the system to be entered into class.

Classification Societies for full Class Survey and Design Appraisal

Lloyd's Registeer document "Rules and Regulations for the construction and Classification of Submersibles and Underwater Systems – 1989".

Compliance

International Maritime Contractors Association (IMCA), with particular reference to the following document:

- International Maritime Contractors Association IMCA Do24 – Diving Equipment Systems Inspection and Guidance Note for Saturation Dicing Systems (Bell) March 2001 – all sections.
- International Maritime Contractors Association IMCA DO18 – Initial and Periodic Examination and Testing of Diving Plant and Equipment – Feb 1999 (sections 1, 2.1, 2.2, 2.4, 3.5.7 and 8).
- International Maritime Contractors Association IMCA D053 DESIGN for the hyperbaric reception facility (HRF) forming part of a hyperbaric evacuation system (HES) April 2014
- Lloyds Register Rules and Regulations for the Construction and Classification of Submersibles and Underwater Systems Dec 1989

Pressure Vessel Design Code

Pressure Vessel Build:

- PD5500:2000 Cat 1

Pressure Vessel Materials:

- Plate to BSEN10204
- Forgings to BS1503/BS1501 as specified

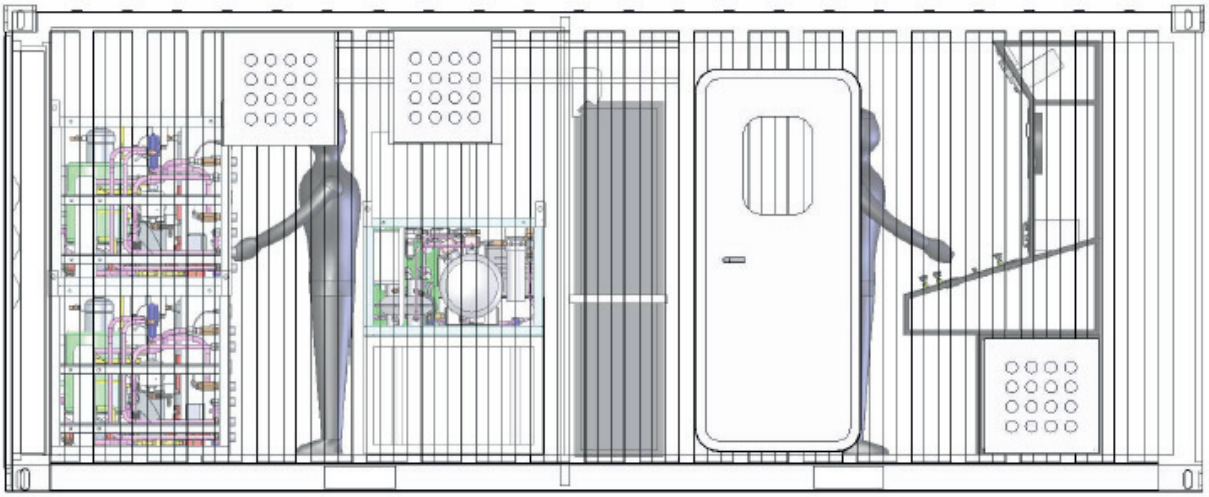

Figure 9 - Control Container (Right)

Figure 10 - HRF Chamber

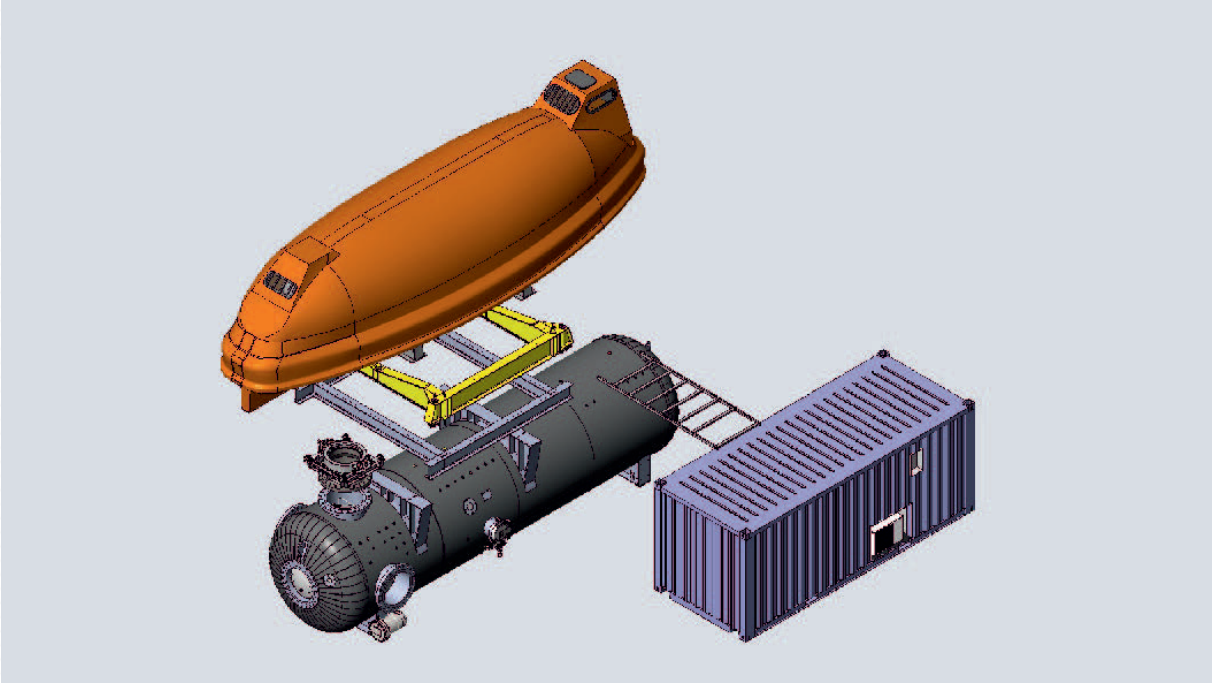

Figure 11 - SPHL Mated Iso (typical SPHL)

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