



# **SAT DHURUV 12 MEN SATURATION DIVING SYSTEM SPECIFICATION**



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## General Description

The saturation diving system is of modular construction, meaning that the major components of the diving system are built into individual crash frames which will also allow the system to be configured in different configurations to make maximum use of the space available on the barge or proposed dive ship. The saturation diving complex and associated equipment is capable of supporting a 12 man diving team in 1 x 4 plus, 1 x 3 man bunk & 12 sitting HRC & 1 x 6 men chambers to a maximum working depth of 200 meters. The design and certification for the diving system will be for a maximum design pressure of 200 meters.

The diving bell will be equipped for three divers. It will be used for saturation mode only. The bell has one side mating position. The bell will be handled by a simple 'A' Frame assembly, with two hydraulic rams and the trolley will bring the bell in to the side mating position. For deployment, the bell will be trolley out and will be hoisted in to the catcher deployment system, the 'A' Frame will be boomed out to the launch position.

The handling system for the bell will also incorporate a hydraulic bell winch and a Hydraulic driven clump weight winch. The hydraulic main bell winch will be the primary means of recovery and deployment. This will use the hydraulic motor as the primary means of operating the winch and the air motor will be the secondary means of operating the winch and the clump weight winch will act as another means of recovery. The operation of the hydraulic handling system and winches will be from the hydraulic control consul, which is situated on top of the living chamber (DDC 013) Skid package.

## Summary of the Module Inventory

1. Single Lock Decompression Chamber (4-man) DDC 013
2. 6 Man Living Come Out Chamber (DDC023)
3. Diving Bell (3 man)
4. 12 x Man Hyperbaric Rescue Chamber with (1 x 3 bunk) living chamber (HRC)
5. TUP (Transfers under pressure) with spool four doors for chambers connection.
6. Four Environmental Control System (in Life Support Equipment Container)
7. Two Hot Water System-electric (in Life Support Equipment Container)
8. Saturation Control container with Potable Water System hot & cold water supply to all chambers.
9. Bell Dive Control Container with client office.
10. Bell Umbilical Basket C/W 250m new Main bell umbilical
11. Electrical Distribution Panel (in Sat / Bell dive Container)
12. HRC Trunk on TUP
13. Bell mating trunk on TUP.
14. DDC-013 mating trunk on TUP.
15. DDC-021 mating trunk on DDC-013.
16. Sanitary System
17. 'A' Frame Assembly with bell trolley assembly.
18. Clump Weight System
19. Hydraulic Bell Winch

20. Hydraulic Power Pack Module
21. Main Bell Umbilical hyd. Power Sheave
22. Hydraulic clump weight winch.
23. Workshop/Store Spares container
24. Secondary Divers Hot water unit diesel powered
25. HRC control unit with chillier unite
26. Life Support Equipment Container Transit frame

## **Diving System Components**

### **1. Three Men Diving Bell**

The diving bell will be equipped for three divers. It will be used for saturation mode only. The bell has one side mating position. The bell will be handled by a simple 'A' Frame assembly with two hydraulic rams and the trolley will bring the bell in to the side mating position.



## 2. Single Lock Decompression Chamber (4-man) DDC-013

Four-man single lock living decompression chamber with TUP Trunk, having 4 bunks, Medical lock and Man way to living decompression chamber DDC-021. This chamber was built in 1977 by Aqua Logistic and has an internal diameter of 2.2-mtr diameters, inside length 4.2 metres, internal volume 16,9 M3 and safe working depth-200 metres. The Design code BS1515 Part1-1965. Certifying authority Lloyds.

However the chamber has been fully refurbished and recertified by ABS in March 2009 along with the complete spread. The chamber is mounted in a heavy-duty transit frame, which forms part of the base for the A-frame bell deployment system, winch package and hydraulic power pack.

1. Pipe work and valves (JIC & NPT)
2. Electrical system 24V. DC
3. One internal conditioning system
4. Four CO2 scrubbers
5. One sound power phone
6. One speaker bull horn
7. Four call button
8. Four diver personal communication
9. Four hyperbaric bunk lights
10. Two hyperbaric chamber lights
11. One caisson gauge
12. One temperature and humidity gauge
13. Four bunks
14. Chamber aluminium flooring
15. Four overboard dump mask connection points, two manifold blocks and one tescom back pressure regulator
16. One temperature sensor
17. Medical lock with interlock
18. One toilet system
19. One shower system
20. One sinks



### 3. Single Lock Decompression Chamber (6-man) DDC-021

Six-man single lock living chamber with having 6 bunks, Medical lock and Man way to living decompression chamber DDC-013. This chamber was built 1977 by Seafath and has an internal diameter of 2.2-mtr diameters, inside length 7.6 metres, internal volume 36,8 M3 and safe working depth-200 metres. The Design code BS1515 Part1-1965. Certifying authority Lloyds. However the chamber has been fully refurbished and recertified by ABS in March 2009 along with the complete spread. The chamber is mounted in a heavy duty transit frame.

1. Pipe work and valves (NPT)
2. Electrical system 24V. DC
3. Two internal conditioning system
4. Six CO<sub>2</sub> scrubbers
5. One sound power phone
6. One speaker bull horn
7. Six call button
8. Six diver personal communication
9. Six hyperbaric bunk lights
10. Four hyperbaric chamber lights
11. One caisson gauge
12. One temperature and humidity gauge
13. Six bunks
14. Chamber aluminium flooring
15. Six overboard dump mask connection points, two manifold block and one Tescom back pressure regulator
16. One temperature sensor
17. Medical lock with interlock
18. One toilet system
19. One shower system
20. One sinks

### 4. Single Lock Hyperbaric rescue Chamber (12-man) HRC

1 x 3 man bunk & 12 sitting HRC chambers to a maximum working depth of 300 meters. Three-man single lock living chamber with having three door for mating clamp and 3 bunks, Medical lock and Man way to TUP. This chamber was built in 1982 by Aqua Logistic international ltd. and has an internal diameter of 2.2-mtr diameters, inside length 4.6 metres, internal volume 16,8 M3 and safe working depth-300mtrs. The Design code BS1515 Part1-1965. Certifying authority Lloyds. However the chamber has been fully refurbished and re-certified by ABS in March 2009 along with the complete spread. The chamber is mounted in a heavy-duty transit frame and launching skid with HRC Bottom four wheels which allow HRC to slid itself into water.

1. Pipe work and valves (JIC & NPT)
2. Electrical system 24V. DC
3. One internal conditioning system
4. Four CO<sub>2</sub> scrubbers
5. One sound power phone

6. One speaker bull horn
7. Three call button
8. Three diver personal communication
9. Three hyperbaric bunk lights
10. Two hyperbaric chamber lights
11. One caisson gauge
12. One temperature and humidity gauge
13. Three bunks
14. Chamber aluminium flooring
15. Three overboard dump mask connection points, two manifold blocks and one Tescom back pressure regulator
16. One temperature sensor
17. Medical lock with interlock
18. One toilet system
19. One shower system
20. One sink



### **5. Single Lock TUP Chamber with four spool connection doors.**

Single lock TUP chamber with having four spool connection doors, Man way to living decompression chamber DDC-013, Man way to HRC chamber, Man way trunk to Diving bell and top door closed & blanked from out side.

This chamber was built by Seafoth and has an internal diameter 1.7mtr, inside height 1.9 metre, internal volume 5.6 M3 and safe working depth-200 metres. The Design code BS1515 Part1-1965. Certifying authority Lloyds. However the chamber has been fully refurbished and certified by ABS in March 2009 along with the complete spread. The chamber is mounted in a heavy-duty transit frame. Which forms part of the base for the A-frame bell deployment system, winch package and hydraulic power pack.

1. Pipe work and valves (JIC & NPT)
2. Electrical system 24V. DC
3. One internal conditioning system
4. One CO2 scrubbers
5. One sound power phone
6. One speaker bull horn
7. One call button
8. Two hyperbaric chamber lights
9. One caisson gauge
10. Chamber aluminium flooring
11. One toilet system
12. One shower system
13. One sink

#### **6. Environmental Control System (in Life Support Equipment Container)**

This consists of four individual Kinergetic CMU units. The four units will be stacked in the life support equipment container complete with reservoir receivers mounted on the wall. These units will be configured as unit 1 and 2 as the primary operational units and unit 3 to be used as a stand-by unit. The system will maintain complete automatic control of the temperature and humidity in the chambers and will also remove CO<sub>2</sub> produced by the divers in the chamber. The system provides control of heating, cooling and dehumidification of the diver's Breathing gases. The pipe work from the reservoirs to the penetrate plates in the container will be hard plumbed with a series of pipe work and valves to interconnect all the CMU units. All the internal habitat control units (HCU) in the chamber are connected to the penetrator plate by suitable deck hoses.

#### **7. Hot Water System-electric (in Life Support Equipment Container)**

A single boiler/heater tank is supplied using a single pressure vessel with over pressurization devices. This heater unit will be electrically powered and capable of heating seawater and freshwater with a flow of 10 gpm @ 4 bar inlet water pressure, the unit should have a temperature range of 30°C to 70°C with +/- 2°C control.

A grundfoss pump is incorporated within the skid to boost this hot water supply to the divers at 27 bar. The hot water incorporate the following:

1. Inline water filtration.
2. Electrical isolation control.
3. Earth leakage trip system.
4. Low flow alarm.
5. High temperature alarm.
6. Pump motor start/stop delay.
7. Digital temperature control and display.

## 8. Saturation Control Container

The saturation control room has the following services included in the system:

1. Depth monitoring system DDC's , HRC and Trunks.
2. Pressurization and vent DDC's, HRC and Trunks.
3. Bib control panel DDC's and HRC.
4. CO2 and O2 analyzer panel DDC's and HRC.
5. Calibration gas panel DDC's and HRC.
6. O2 injection panel DDC's and HRC.
7. Environment control panel DDC's.
8. Temperature monitoring panel DDC's & HRC
9. Communication control panel to all compartments
10. Diver personnel communication system to all bunks in the chambers
11. On line gas storage panel (distribution).
  - Pressurization.
  - Bibs.
  - Treatment mix.
12. One B/A hose line connection.
13. Electric distribution Panel.

## 9. Bell Dive Control Container

The bell control room shall have the following services included in the system:

1. Depth monitoring system internal, external.
2. Depth monitoring system internal, diver 1 and 2.
3. Depth monitoring system internal, trunk to TUP.
4. Pressurization and vent of bell and trunk.
5. On line (gas supply) monitoring for divers.
6. CO2 and O2 analyzer panel for divers and bell.
7. Gas calibration panel.
8. Communication panel for bell and divers.
9. On line mix gas distribution panel.
10. One B/A hose line connection.
11. Electric distribution panel and isolation panel for total bell system.

## 10. Electrical Distribution Panel (in Sat/Bell Container)

Isolation control boxes will be situated in bell control container; all electrical services from the diving system are terminated at a breaker panel along side the main isolation panel and linked together. An earth leakage trip system is incorporated in the panel.

## 11. HRC Trunk

A HRC Trunk is supplied. This is connected to the TUP. The clamp will be an Hinge-type hand-operated clamp. All penetrations for the pressurization, vent and depth monitoring are fitted to the trunk.

## **12. Potable Water System (in Life Support Equipment Container)**

The potable water system supplies hot and cold water at 7 bars over the working pressure in continuous operation and consist of two systems including:

- Hot & Cold water tanks
- Gas Panel
- Temperature and Pressure Indicators

## **13. Umbilical Module**

A main bell umbilical is provided comprising of the following specification:

- 5 x ¼ Inch Pneumos
- 1 x ¾ Inch Hot Water Hose
- 1 x ¾ Inches Reclaim Hose
- 1 x ½ Inch Divers Gas Hose
- 1 x ½ Bell Blow Down
- 2 x Comms/TV & Power cables.

Close mesh polythene monofilament over braid. An umbilical storage basket is provided. The storage basket will be of steel construction with four lifting lugs and a four point lifting sling.

## **14. Spool Piece between Chambers (DDC013 & DDC 021)**

A spool piece between the DDC-1 and DDC2 incorporates pressurization, vent and depth monitoring in the trunk. The other spool piece will connect the TUP & DDC-013 living chamber.

## **15. Spool Piece between TUP & Chamber (DDC 013)**

A spool piece between the DDC-1 and TUP incorporate pressurization, vent and depth monitoring in the trunk. The other spool piece connects the TUP & HRC living chamber.

## **16. Spool Piece between HRC & TUP.**

A spool piece between the DDC-1 and HRC mating clamp incorporates pressurization, vent and depth monitoring in the trunk. The other spool piece will connect the TUP & BELL mating clamp.

## **17. Spool Piece TUP to Diving Bell mating clamp**

The spool piece between the diving bell mating clamp and TUP is positioned on the side man way on the TUP. This incorporate a hydraulically operated type clamp with safety interlock. This spool piece also equipped with:

1. Pressure and vent penetrator
2. Depth sensor line penetrator

## 18. Sanitary System

The DDC's sanitary system has a connection to connect to the ships sanitary system via a holding tank with all necessary valves and safety devices situated on the main skids.

## 19. 'A' Frame Assembly

a) The 'A' boom frame is constructed of 290 x 260 mm heavy-duty I beam steel and fabricated with ladder runs up the 'A' Frame to assist with the maintenance and inspection of the unit. A main bell lift wire sheave is located under the top/centre section of the "A" frame and in association with this there are pulley and stop-end for use with the clump weight and clump weight wire.

b) The 'A' boom davit is powered by two hydraulic rams which move the bell over the ship's side.

## 20. Clump Weight System

A guide wire system is fitted to provide stability to the bell. This system also acts as a secondary means of recovery of the bell to the interface and a means of supporting the bell clear of the bottom. The system consists of: -

- a) One hydraulic winch rated at 7 ton load / 13.6 ton pull
- b) 450 meters of 28mm spin resistant wire
- c) One clamp weight.

## 21. Hydraulic Bell Winch

The winch itself is a hydraulic man riding winch and is situated over the TUP & Single lock living chamber upper skid.

The winch has a spooling device for the wire rope to prevent any over-laying of wire. The pneumatic air motor with gearbox and chain drive will give twice the full load capacity to safely retrieve the bell in the event of electric power failure. Air auxiliary drives 10 tons at 6m/min. Air consumption 350 cfm at 80 psi. installation of the hydraulic system is geared to be of the shortest duration with all fittings of quick (Aero quip) disconnect type.

## 22. Newly build Hydraulic Power Pack Module

The hydraulic power pack utilizes 2 x 50 KW (100 HP) 3 Phase electric motor. This power pack provides sufficient power to run the system. The power pack delivers hydraulic pressure to the bell winch, the main 'A'-Frame rams, trolley ram, umb. Sheave and to clamp weight winch.



### **23. Main Bell Umbilical Power Sheave**

This consist of a 1.5 meter dia steel fabricated sheave to accommodate the main bell umbilical. The sheave is driven through Lucas type reduction gear box and driven by an independent hydraulic motor. This unit is mounted on a pedestal so it can be positioned along side the main bell umbilical and 'A' Frame to deploy and recover the main bell umbilical with the bell movements. The controls for this power sheave are located with the bell handling system controls above the main DDC Package.

### **24. Workshop/Spares Container**

This will contain spares and tools for the saturation system.

### **25. HRC Control Van**

This unit is fitted with a decompression panel including depth gauges, O2 and CO2 Analyzers, communication system and a Habitat control unit.

### **26. Certification**

All documentation and certification is in accordance with the H.S.E. & IMCA. (Code of Practice on the Initial & Periodic Examination, Testing and Certification of Diving Plant & Equipment DO18).