



**SATURATION DIVING SYSTEM (300 MSW)
SETIA SELAM II**

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The specification given in this document is best to our knowledge and IS NOT GAURANTEE, clients need to inspect the system and satisfy themselves. MEDS shall not be liable for any discrepancies in between technical data sheets against actual.

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CHAPTER 1: ENGINEERING DEPT

Author's:	HSC
Subject:	Description of equipments
Date of issue:	11-05-2010
Design Code:	DNV – Det Norsk Veritas

CHAPTER 2: GENERAL DESCRIPTION

2.1 System Description

The equipment is intended for:

- Performing saturation diving down to 300 msw,
- Accommodating a maximum of 12 divers working by shift of 3 divers (2 divers + 1 bellman).

The proposed modular system is built around a main structure housing the 6-person chamber, the TUP, the diving bell and its handling system. A 3-person chamber with twin lock and a Hyperbaric Evacuation Chamber complement the system. The ancillary equipments are mostly incorporated into containers.

The use of the Additional Chamber as a decompression lock enables 24hr diving schedule indefinitely.

The HRC is designed for 12 persons. It is used as a 3-person living chamber in normal conditions.

The bell can be used to perform observation dive at atmospheric pressure down to 300 msw.

2.2 Data Sheet

Transferable system, to be installed in a safe area with respect to explosive gas-air mix (not in zone 0, 1 or 2, as defined in IMO (MODU) code)

Maximum number of divers:	12
Maximum operating depth:	300 msw
Maximum operating time:	unlimited
Maximum observation depth bell:	300 msw
Range of ambient temperature:	air: -10°C to +50°C water: 0°C to +30°C

Maximum significant wave height: 2 m

CHAPTER 3: DETAILED DESCRIPTION

3.1 Chambers

Designation	TL or SL	Design Pressure (bar)	Internal diameter (mm)	Shell t (mm)	Corr. allow. (mm)	Total Volume (m ³)	No of Divers	Trunk size (mm)	Design code	Shell material	Relief Valve setting (bar)
Main Chamber	SL	30.3	2400	25	1	25	6	700	DNV	P295GH	31
TUP	SL	30.3	2400	25	1	10	2	700	DNV	P295GH	31
Additional Chamber	TL	30.3	2200	23	1	14+5	3+2	700	DNV	P295GH	31
HRC	SL	30.3	2200	23	1	15	3 (12)	700	DNV	P295GH	31

3.2 Diving Bell



Internal Design Pressure (bar)	External Design Pressure (bar)	Internal diameter (mm)	Shell t (mm)	Corr. allow. (mm)	Total Volume (m ³)	No of Divers	Lateral Trunk size (mm)	Water Access Trunk size (mm)	Design code	Shell material	Relief Valve setting (bar)
30.3	30.3	1900	15	1	6	3	700	800	DNV	P295GH	31

3.3 Umbilical (Hoses)

Designation	Length (m)
<i>Bell</i>	330
<i>Diver #1</i>	50
<i>Diver #2</i>	50
<i>Bellman</i>	55



Minimum size of the Umbilical basket (8-shape winding): Housed in = 20” Standard Container Frame Work

3.4 Gas Absorbers / Scrubbers



No.	Type designation	Gas being absorbed	Absorbing agent	Location	Capacity
1	<i>Scrubber</i>	CO ₂	<i>Soda lime</i>	<i>Main Chamber</i>	<i>24h / 6p</i>
1	<i>Scrubber</i>	CO ₂	<i>Soda lime</i>	<i>Add. Chamber Main Lock</i>	<i>48h / 3p</i>
1	<i>Scrubber</i>	CO ₂	<i>Soda lime</i>	<i>HRC</i>	<i>48h / 3p</i>
2	<i>Scrubber</i>	CO ₂	<i>Soda lime</i>	<i>Main Chamber</i>	<i>8h / 6p</i>
1	<i>Scrubber</i>	CO ₂	<i>Soda lime</i>	<i>TUP</i>	<i>48h / 1p</i>

No.	Type designation	Gas being absorbed	Absorbing agent	Location	Capacity
1	Scrubber	CO ₂	Soda lime	Add. Chamber Main Lock	16h / 3p
1	Scrubber	CO ₂	Soda lime	Add. Chamber Entrance Lock	48h / 1p
3	Scrubber	CO ₂	Soda lime	HRC	8h / 12p
2	Scrubber	CO ₂	Soda lime	Diving Bell	32h / 3p

3.5 Type Of Heating



Chambers	Bell
<i>Exchanger in each chamber with individual electric fans</i>	<i>SWH Comanex 180 kW / 800 L / 45 L/min With backup pumps and heat resistance</i>

The exchangers are connected to 2 heating units and 2 cooling units.

A connection panel for the sea water is located on the Diver Heating Unit container.

Water flow needed for the SWH: 45 L/min

3.6 Electrical Installation

The main electrical panel is located on the Machinery container.

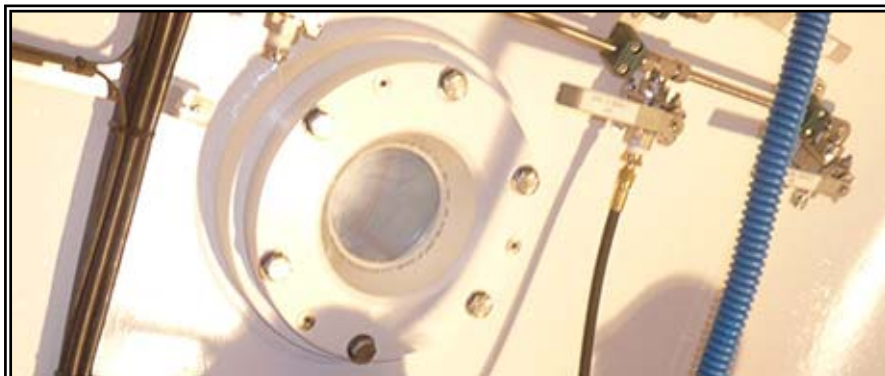
Main power supply from	<i>440 V / 60 Hz</i>
Maximum Nominal Load (kW)	<i>300</i>
Emergency power supply from	<i>250</i>
Type of cables permanently installed in inner system	<i>Hyperbaric power cable</i>

Voltages / Frequencies :			
Bell lighting	<i>24V DC</i>	Chambers lighting	<i>24V DC</i>
Bell internal power	<i>24V DC max</i>	Chambers internal power	<i>24V DC max</i>
Bell heating	<i>Fan only (24V)</i>	Chambers heating	<i>Fan only (24V)</i>
Bell external power	<i>250V AC max</i>	Handling	<i>440V AC</i>

Electrical Penetrators
Type <i>Jupiter connectors</i>

Self-contained emergency power for bell :
Type : <i>Lithium battery</i>

3.7 Viewports In Pressure Vessels For Human Occupancy



Diameter	Certificate No.	Chamber / Bell No.	Compartment	Number of windows
220mm	Altuglass	Main Chamber		4
220mm	Altuglass	TUP		3
220mm	Altuglass	Add. Chamber	Main Lock	3
220mm	Altuglass	Add. Chamber	Entrance Lock	1
220mm	Altuglass	HRC		3
220mm	Altuglass	Diving Bell		7

3.8 Masks In Pressure Vessels For Human Occupancy

Chamber / Bell No.	Compartment	Number of masks	Type of masks
Main Chamber		7	Oral Nasal with Dump valves
TUP		4	Oral Nasal with Dump valves
Add. Chamber	Main Lock	4	Oral Nasal with Dump valves
Add. Chamber	Entrance Lock	2	Oral Nasal with Dump valves
HRC		13	Oral Nasal with Dump valves
Diving Bell		3	Oral Nasal with Dump valves

3.9 Fire Protection

Transferable system, to be installed in a safe area with respect to explosive gas-air mix (not in zone 0, 1 or 2, as defined in IMO (MODU) code).

A connection panel for the outer system and the inner system is located on the External of Main Skid.

Since a fire is not likely to occur deeper than 60 meters, the 2 systems are to be supplied with 10 bar pressure water.

Water flow needed for the outer system : 40 L/min

Water flow needed for the inner system : 40 L/min



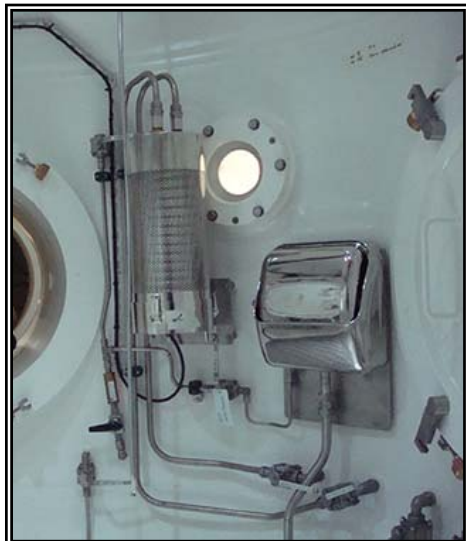
3.10 Sanitary System

A connection panel for hot and cold fresh water is located on the External/Machinery (Diver Hot Water).

Water flow needed for the cold water system : 20 L/min
 Water flow needed for the hot water system : 20 L/min



Toilet	
Installed in : <i>TUP, Additional Chamber Entrance Lock and HRC</i>	
Type of arrangement preventing flushing the toilet unintentionally : <i>Interlock</i>	
Volume sanitary tank : 3 L³	Pressure sanitary tank (bar) : 30



Sanitary Water	
Wash basin : <i>TUP, Additional Chamber Entrance Lock</i>	Principle of operation : <i>Electric</i>
Shower : <i>TUP</i>	Principle of operation : <i>Electric</i>
Type of arrangement preventing flushing the water unintentionally :	
Volume sanitary tank : 3 L ³	Pressure sanitary tank (bar) : 30

3.11 Communication System



TV Camera installed at :	<i>In each Lock + 1 (Bell Mating) + 1 (Winch + Umb. basket)</i>
Type of system between control stand and bridge :	<i>VHF / Hand wired Telephone</i>
DP alarm details :	<i>Tandem with ship</i>
Type of through water communication :	<i>Subcom</i>
Other surveillance systems :	<i>SPT chamber and medical lock main chamber and annexe</i>

3.12 Bell Handling System



Working Load (kN) : <i>100</i>	Dimension of hoisting wire (mm) : <i>32</i>	Type of locking mechanism : <i>Hook</i>	Heave compensator : <i>No</i>
Design load (kN) : <i>200</i>	Min. breaking load (kN) :	Emergency means of recovery : <i>Guide lines and free ascent</i>	Designed for seastate: <i>sign. Wave height < 2m</i>
Static test load (kN) : <i>200</i>	Type of secondary lifting : <i>Guide lines</i>	Certification : <i>DNV</i>	

3.13 HYPERBARIC EVACUATION SYSTEM



Launching system : *Vessel crane / HRC Skid*
HES Chamber : *HRC described above*
Dimension of mating flange : *700 mm*

Shape of mating flange : Hinge Type, Round

Dimension of medical lock: *diameter 250 mm. No possibility bigger diameter*

Weight of Hyperbaric Evacuation Unit (HEU) (kN) : 130 kN

Specifications on navigational aids : 37.5 khz

Specifications on emergency connectors : Quick Connectors

No. of divers the system is rated for : 12

Remarks :

Prior to launching the HRC, the following shall be done :

- disconnect the external regeneration
- disconnect the gas connections (mixture and O₂)
- disconnect the electrical connections with the system
- disconnect the communication connections with the Control Stand
- disconnect the sanitary water
- disconnect the heating water
- disconnect water deluge

CHAPTER 4 : SATURATION SYSTEM EQUIPMENTS

4.1 Main Chamber

Items	Designation	QTY
1	Horizontal pressure vessel : inside diameter 2400 mm ; length approx.6000 mm One compartment Working pressure : 300 msw internal	1
2	Man way 700 mm	2
3	View ports	4
3 bis	Retro projection View port	1
4	Medical lock Diameter 400 mm – long 400 mm and SPT	1
5	Removable flooring	1
6	Foldable table + 3 seats	1
7	Bunks 198x80 cm with led light	6
8	Pressurization and decompression circuit	1
9	Relief valve and sound alarm	1
10	O ₂ make up circuit	1
11	External regeneration (Humidity regulation and CO ₂ absorption)	1
12	CO ₂ scrubbers	2
13	Oral Nasal Breathing Masks (BIBS)	7
14	Dump valves	7
15	Second stage dump valve (for up to 4 dump valves)	2
16	Emergency respiratory unit	6
17	Under the floor exchanger with individual electric fan (temperature regulation)	1
18	10 bar water deluge	1
19	Drain off system for evacuation of condensation and fluids	1
20	Hyperbaric fire extinguisher	1
21	LED light at the top of chamber	2
22	Individual light + headset per bunk	6
23	Survey micro camera	1
24	Communication - SPT	1



Instrumentation		
25	Pressure, hygrometry and temperature gauges	1
	Hygrometry and temperature sensor	1
	O ₂ analyser	1
	CO ₂ analyser	1
	O ₂ sensor	1
	O ₂ hyperbaric monitor	1

4.2 TUP

Items	Designation	QTY
1	Vertical pressure vessel : inside diameter 2400 mm ; height approx. 3000 mm One compartment Working pressure : 300 msw internal	1
2	Man way 700 mm	4
3	View ports	3
4	Removable flooring	1
5	Folding seat	2
6	Pressurization and decompression circuit	1
7	Relief valve and sound alarm	1
8	O ₂ make up circuit	1
9	CO ₂ scrubbers	1
10	Oral Nasal Breathing Masks (BIBS)	2
11	Dump valves	2
12	Second stage dump valve (for up to 4 dump valves)	1
13	Emergency respiratory unit	3
14	Exchanger with individual electric fan (temperature regulation)	1
15	Shower hose and head	1
16	Wash basin	1
17	Toilet bowl	1
18	10 bar water deluge	1
19	Drain off system for evacuation of condensation and fluids	1
20	Hyperbaric fire extinguisher	1
21	LED light at the top of chamber	2
22	Survey micro camera	1
23	Communication - SPT	1

24	Instrumentation	
	Pressure, hygrometry and temperature gauges	1
	Temperature sensor	1
	O ₂ analyser	1
	CO ₂ analyser	1

4.3 Additional Chamber

4.3.1 Main Lock



Items	Designation	QTY
1	Horizontal pressure vessel : inside diameter 2200 mm ; length approx. 6000 mm Twin lock chamber Working pressure : 300 msw internal	1
2	Man way 700 mm	3
3	View ports	3
3 bis	Retro projection View port	1
4	Medical lock Diameter 400 mm – long 400 mm and SPT	1
5	Removable flooring	1
6	Foldable table + 1 seat	1
7	Bunks 198x80 cm with led light	3
8	Pressurization and decompression circuit	1
9	Relief valve and sound alarm	1
10	O ₂ make up circuit	1

11	External regeneration (Humidity regulation and CO ₂ absorption)	1
12	CO ₂ scrubbers	1
13	Oral Nasal Breathing Masks (BIBS)	4
14	Dump valves	4
15	Second stage dump valve (for up to 4 dump valves)	1
16	Emergency respiratory unit	4
17	Under the floor exchanger with individual electric fan (temperature regulation)	1
18	10 bar water deluge	1
19	Drain off system for evacuation of condensation and fluids	1
20	Hyperbaric fire extinguisher	1
21	LED light at the top of chamber	2
22	Individual light + headset per bunk	3
23	Survey micro camera	1
24	Communication - SPT	1
25	Instrumentation	
	Pressure, hygrometry and temperature gauges	1
	Hygrometry and temperature sensor	1
	O ₂ analyser	1
	CO ₂ analyser	1
	O ₂ sensor	1
	O ₂ hyperbaric monitor	1

4.3.2 Entrance Lock

Items	Designation	QTY
1	View ports	1
2	Removable flooring	1
3	Pressurization and decompression circuit	1
4	Relief valve and sound alarm	1
5	O ₂ make up circuit	1
6	CO ₂ scrubbers	1
7	Oral Nasal Breathing Masks (BIBS)	2
8	Dump valves	2
9	Second stage dump valve (for up to 4 dump valves)	1
10	Emergency respiratory unit	2
11	Under the floor exchanger with individual electric fan (temperature regulation)	1
12	Toilet bowl	1
13	Wash basin	1

14	10 bar water deluge	1
15	Drain off system for evacuation of condensation and fluids	1
16	Hyperbaric fire extinguisher	1
17	LED light at the top of chamber	1
18	Survey micro camera	1
19	Communication - SPT	1
20	Instrumentation	
	Pressure, hygrometry and temperature gauges	1
	Temperature sensor	1
	O ₂ analyser	1
	CO ₂ analyser	1
	O ₂ hyperbaric monitor	1

4.4 Hyperbaric Rescue Chamber (HRC)



Items	Designation	QTY
1	Horizontal pressure vessel : inside diameter 2200 mm ; length approx. 4400 mm One compartment Working pressure : 300 msw internal The chamber and outside equipment protected by a tubular cage	1
2	Man way 700 mm – TUP and exit	2
3	View ports	3
3 bis	Retro projection View port	1
4	Medical lock Diameter 250 mm – long 250 mm – No possibility bigger	1
5	Removable flooring	1
6	Seating with safety belt and protection helmet	12
7	Pressurization and decompression circuit	1
8	Relief valve and sound alarm	1
9	O ₂ make up circuit	1
10	O ₂ Manifold (manual addition)	1
11	CO ₂ scrubbers	3
12	Oral Nasal Breathing Masks (BIBS)	4
13	Dump valves	4
14	Second stage dump valve (for up to 4 dump valves)	3
15	Emergency respiratory unit	13
16	Medical kit	1
17	Survival suit	1
18	Heat exchanger with individual electric fan (temperature regulation)	1
19	Drain off system for evacuation of condensation and fluids	1
20	Toilet bowl (Emergency use only)	1
21	10 bar water deluge	1
22	Hyperbaric fire extinguisher	1
23	LED light at the top of the chamber	2
24	Survey micro camera	1
25	Communication - SPT, VHF radio for emergency	1
36	Lithium battery container	1
27	Bunks with led light	3
28	Instrumentation	
	Pressure, hygrometry and temperature gauges	1
	Hygrometry and temperature sensor	1
	O ₂ analyser	1
	CO ₂ analyser	1

	O ₂ sensor	1
	O ₂ hyperbaric monitor	1
29	Auxiliary handling point	1
30	Strobe light and radar reflector	1

4.5 Diving Bell



Items	Designation	QTY
1	Spherical pressure resistant hull : inside diameter 1900 mm ; height approx. 3000 mm Volume approx. 6m ³ Working pressure : 300 msw internal and external The hull and outside equipment protected by a tubular cage : diameter 2500 mm ; height approx. 3500 mm	1
2	Man way 700 mm – TUP	1
	Man way 800 mm – Sea water – 2 compensated doors	1
3	View ports	7
4	Medical lock Diameter 150 mm – long 150 mm	1
5	Folding seats	3

6	Pressurization and decompression circuit	1
7	Breathing mixture storage 200 bar – 77L	7
8	Breathing mixture storage 200 bar – 14L	2
9	O ₂ storage 200 bar – 77L	1
10	O ₂ storage 200 bar – 5L	1
11	Relief valve	1
12	O ₂ make up circuit	1
13	O ₂ Manifold (manual addition)	1
14	CO ₂ scrubbers	2
15	Oral Nasal Breathing Masks (BIBS)	4
16	Emergency respiratory unit	3
17	Medical kit	1
18	Survival suit	3
19	Heat exchanger with individual electric fan (temperature regulation)	1
20	Drain off system for evacuation of condensation and fluids	1
21	Hyperbaric fire extinguisher	0
22	LED light at the top of bell	2
23	External projector 250 W – 230 V – 30 bar	3
24	Lithium battery container	1
25	Survey micro camera	1
26	Communication - SPT	1
27	Umbilical junction box	1
28	Electrical inside junction box	1
29	Instrumentation	
	Pressure, temperature gauges	1
	O ₂ analyser	1
	CO ₂ analyser	1
	O ₂ sensor	1
	O ₂ hyperbaric monitor	1

4.6 Bell Handling System



Items	Designation	QTY
1	A Frame with two hydraulics rams	1
2	Bell winch	1
3	Guide line winches	2
4	Structure supporting winches	1
5	Control of winches, A frame, and power packs in dive control hydraulic container	1
6	Main hydraulic module	1
7	Back up hydraulic module	1
8	Guiding device for bell mating in front of TUP	1
9	Lighting devices for illumination of areas essential to all operations	6



4.7 Heating And Cooling Container





Items	Designation	QTY
1	Heating unit to supply hot water in Environmental Control Unit and Sanitary use	1
2	Back up Heating unit	1
3	Cooling unit to supply cool water in Environmental Control Unit and	1
4	Back up Cooling unit	1
5	Diver Heating unit	1

4.8 Diving Sat Control





Items	Designation	QTY
1	One container at the SAT control with one door and windows using security lock - windows open outside – insulated and air conditioned	1
2	Gas circuits and depth measurements	1
3	Gas analysis	1
4	Communication and video – Connected phone with the bridge	1
5	Electrical circuits and Extinguisher	1
6	Temperature regulation	1
7	DP Alarm in container control and hydraulic control	1
	Chambers and HRC : Each pressurized compartment with a panel	
8	Internal pressure measurement	1
9	Pressurisation	1
10	Gas distribution to BIBS	1
11	Decompression	1
12	O2 make up	1
13	Gas analysis panel for each chambers	4
14	Communications and Video for each chambers with screen using 4 windows	4
15	Electrical circuits and Extinguisher	4
16	Temperature regulations	4
	Diving bell :	
17	2 consoles : handling control and SDC control / monitoring equipment	
18	Gas circuits and depth measurement	1
19	Gas analysis	1
20	Communication and video	1
21	Electrical circuits	1
22	Temperature regulations	1

	Gas Handling System	
23	Gas panels – A set of panels and manifolds	1
24	WORKSHOP and STORAGE CONTAINER	1

4.9 Bell Umbilical System



Items	Designation	QTY
1	Umbilical Friction sheave	1
2	Umbilical basket	1