General Plan

OXYGEN SERVICE CONTAINER 2005

Version 1.02

Laser Gas		
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i) Version history

Version	Date	Authors	Commentary (changes, corrections...)
1.0	04.12.03	RH	

ii) Markings and abbreviations

PSA; produces oxygen of pure pressured air

iii) Contents

1. Introduction

This document contains a plan of oxygen production process under special circumstances on the field. As a general starting point of oxygen production under special circumstances can be held a model in which oxygen's production process is placed close enough of the user. Oxygen transportation under special circumstances is primarily a logistical problem and on the other hand the service certainty of oxygen is improved by allocating an adequate amount of modular production units which can be directed to the direction of the centre of gravity when it is needed. With current technique it is possible to accomplish oxygen production process which suits as container assembled for the use in terrain conditions.

Definition of the requirements:

- the device has to be removable
- the device has to suit for road transportation
- the device's production capacity has to be 500 m3/24 h at minimum
- the device has to have the ability to work autonomously
- the device has to have the ability to support the operation of field hospital
    - field electricity certainty
- the device has to suit for long-time period storing
- the device has to able to be hidden in the terrain.

The process consists of a steel container which is used as an installation base, where the needed process energy's production devices are placed; process devices, responsible of production; a room for the pre-handling of packages; a room for pressuring the packages and the connections for energy input and outlet.

Process energy is produced in a diesel generator. The space for the fuel's so called day-container is reserved in the container. The external fuel container is used as the actual fuel storage of the process, for example 2000 litre fuel trailer or input from the immovable container.

There are two compressors in the device with which the compressed air is produced for the device. Compressed air is filtered through the filters for two oxygen-PSA devices, from which the pure oxygen is compressed for filling the empty bottles. There is a differentiated heat and voice isolated room where the empty oxygen bottles can be placed for fulfilling.

2. Design of field oxygen generator

In terrain conditions accomplished medical oxygen's production diagram is represented in process diagram (appendix 2). The description of the planned production is represented in appendix 1. The PI-diagram in appendix 3 represents the components of the device which are most obvious owing of the operation. In addition, appendix 4 represents a draft of the construction of the device which is based on the selection of components.

Low pressure components

Low pressure components are described in the PI-diagram.

- 2 pieces of compress air compressors 2 x 11 kW = 2 x 1,5 m³/min
- 2 pcs of air dryer units
- Compressed air active-carbon filter
- Filter unit, coarse and fine
- Gas container for compress air 500l / 10bar
- 2 pcs of PSA-devices 2 x 200 l/min O_2 93 %
- Gas container for oxygen 300l / 6 bar acid-proof steel

Filtration and values of produced oxygen

Filtration is based on the need to remove the impurities out of the air which is used in the process. With manifold filtration it is ensured that PSA-units operate without disturbances and also the end product is in pursuance of requirements. Analyzing the end results, ISO 10083:1992(E) standards are used.

- Compress air is filtered to breathing air level
    - condensation point + 4˚C
- Produced oxygen's values (400 l / min)
    - oxygen content 93 % ± 3 % maximum

- carbon monoxide 5 mg / kg maximum
- carbon dioxide 300 mg / kg maximum
- hydrocarbons < 0.5 mg / m³
- condensation point - 40 ºC in normal atmosphere, maximum

Driving

- Driving is accomplished with two parallel connected PSA-device so, that production periods are synchronized with turn phase principle. This way the production flow will be as steady as possible. For exceptional situations at least one of the PSA-devices can be driven manually.

Analyzing the end results

ISO 10083:1992(E) standards are to be followed when analyzing the end results:

- There is separate oxygen analyzer for both PSA-devices [PI-diagram (A)].
- Separate analyzers of oxygen container [PI-diagram (A)].
- Analyzer connected to ”on line” product flow.
- Analyzers are temperature compensated. Maximum error display is ± 1 % of the measurement area.
- Sensors are error secured
- Both oxygen generators are equipped with maximum influx rota meter alarms.
- Adjustable dual-level alarm limit is required in the analyzer.

Pressure raising and bottle filling

- Pressure rising is carried out with two membrane compressor.
- User safety is secured by membrane injury sensors.
- Lubricant, which does not react with oxygen, is used for membrane compressor's lubricant.
- High pressure compressor's - production 300 l/min
  - production pressure about 220 bar

Low pressure output

- Low pressure outputs 2 pcs are taken from oxygen's storage container via pressure degrader.
- Pressure degrader 0-7 bar / 100 l/min

Filling device

Oxygen bottles that need to be fulfilled are taken in from outside in the assistance room (etuteltta vast), where the bottles are pre-purificated and checked approximately. After that, the bottle platform is transferred (for example with forklift truck) out of the double-door (900+400) in the side of the container, to bottle fulfilment station. The double-door is also used by the fulfilment personnel's door. There will be a bottle connector, which can be attached separately, in every bottle. Fulfilling process takes about an hour. After filling, the full bottle platform is transferred for usage and an empty pre-checked bottle platform is taken in.

Heating

- Container include “stand by” – heating with which the temperature of the device will stay at +5˚c at minimum.
- Heating is accomplished by Webasto-like fuel oil heater, with which the container is kept in operation temperature- level also during the transfers. Heater’s operation energy operates from differentiated accumulator and from the power source powering them.
- There is thermal insulation in the container.
- For storage, there is differentiated heating, which has its own differentiated electricity connection (400 / 3~ VAC 16 A). The mean of the heating is to keep the device dry during a long-time period storage.

Indoor air cooling in the container

- The device’s required air cooling apertures are protected with water traps so, that it will not rain into them and the solid particles will not get in during transfers.

Condensation water

- Condensation water is directed out.

Electric generator

- In dimensioning, it is needed to take into consideration that every device can be used at the same time and that the device can be driven hundreds of hours without any risks concerning overloading, only on service breaks. Generator is dimensioned for short-circuit power and start-up power. Additionally, in dimensioning, all the process devices's simultaneous use is taken into consideration.
- Determining the right power level it is needed to take into consideration also the required voltage, frequency, start-up power and when the device is in use, the power needed and their alternation sensitivity.
- Earthling and the earthling methods of the device are taken into consideration and for earthling the generator, transferred devices in the container are reserved.

Electric net connection

- Electric net connection is possible with contact plug, driving choice in electric power machine's driving device for net or generator use.
- There is also possibility to feed the field electric net with the generator, when the oxygen production device is out of use.

Channelling

Differentiated 24 VDC accumulators are used for the container device's channelling electric. Then the channelling power is still being preserved though the generator for some reason would go out. Accumulators are powered with differentiated 24 V DC power source.

Channelling energy needed in process is made by differentiated power source, which is accumulator-proofed. The power source gets its energy from diesel generator in normal usage situation.

During long-time period storage accumulators need to be filled with maintenance power, which does not harm the confirmation accumulators. If the control circuit is used for example for lighting, these circuits need to be cabled separately and protect with its own safety device.

Alarms

Alarms are dual-levelled; alarm information for user and alarms stopping the device. Alarm information are added and changed to be pursuance of construction when needed.

- Alarms stopping the device
  - humidity detector in the compress air container, which prevents drop-shaped water getting in to it
  - too low oxygen level
  - low level of low pressure oxygen
  - compress air below the limit value

- Device faults which inform the user overloading
  - overloading
  - temperature protectors of the compressors
  - low oxygen level

Container

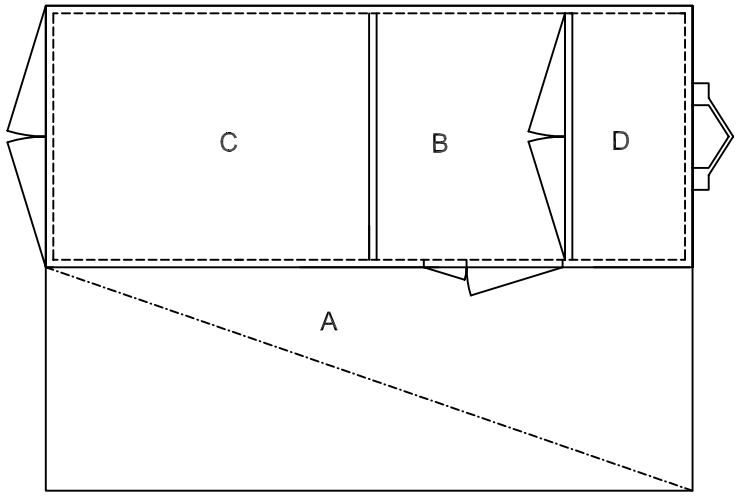
Sea container's longer sides have to be left free from outside so, that it is possible to pile the containers next to each other. Differentiated device room and sound-proof room for fulfilling the bottles are to be built. There is a double-door (900+400) to this room in the side of the container. The container is coated with protection paint that the user wants.

Authority orders

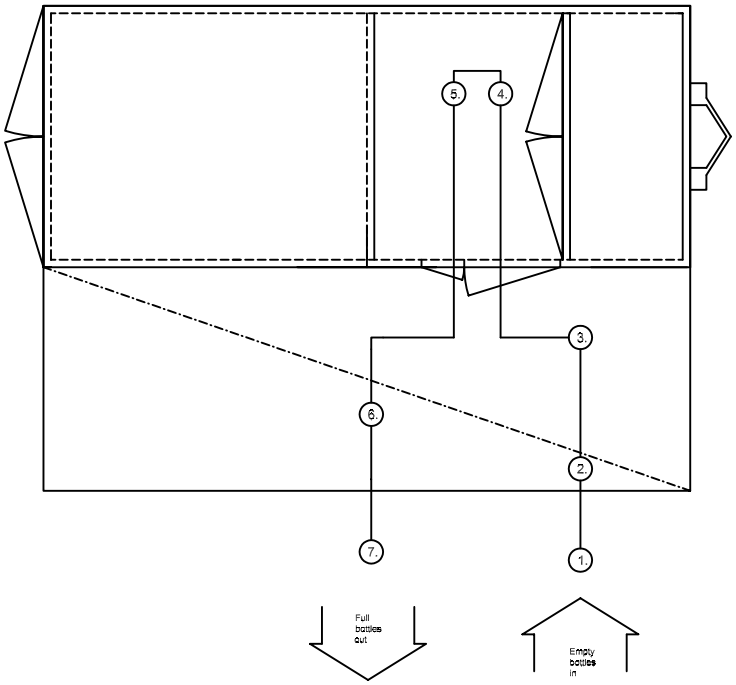
- The entity needs to fulfil all the EU directive orders which concern the entity (98/37/EY ; 73/23/ETY ; 93/42/ETY; 97/23/EY etc). To show this the pursuance of required certificate needs to be written out and the CE-markings are attached to the device.
- The deliverer draws the operation diagram of the electric device, user safety instruction's replacement part -manual and operating instructions and maintenance instructions.
- The electric checking –certificate, pressure vessel –checking certificate and authority accepted certificates of the components, and a nominated pressure device controller's statement of fulfilling the device's pressure-device authority orders.

STATUS MARKINGS

A, A_0	TERMINAL	SHELTER
B	FULFILLMENT STATION	CONTAINER
C	PROCESS ROOM	CONTAINER
D	ENERGY PACKAGE	CONTAINER

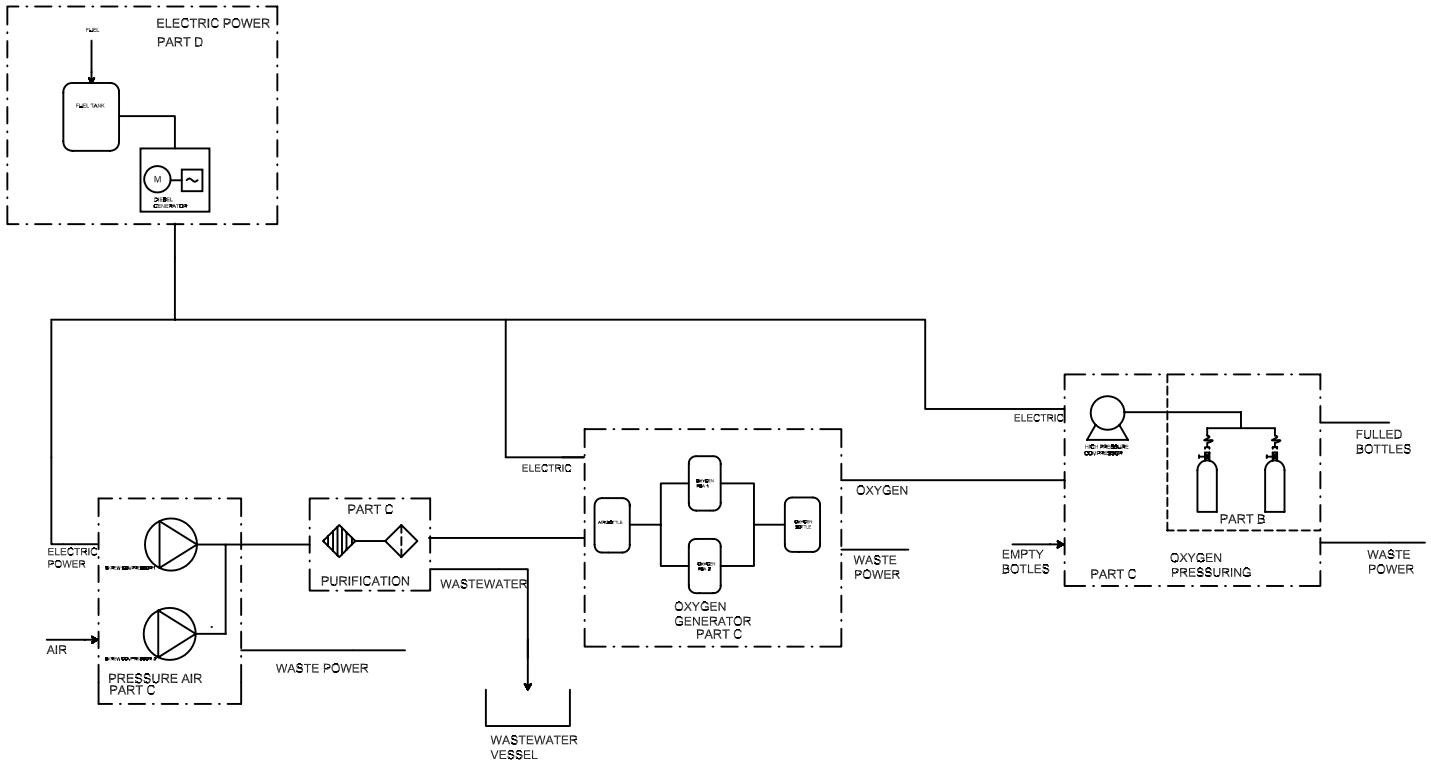


A_0

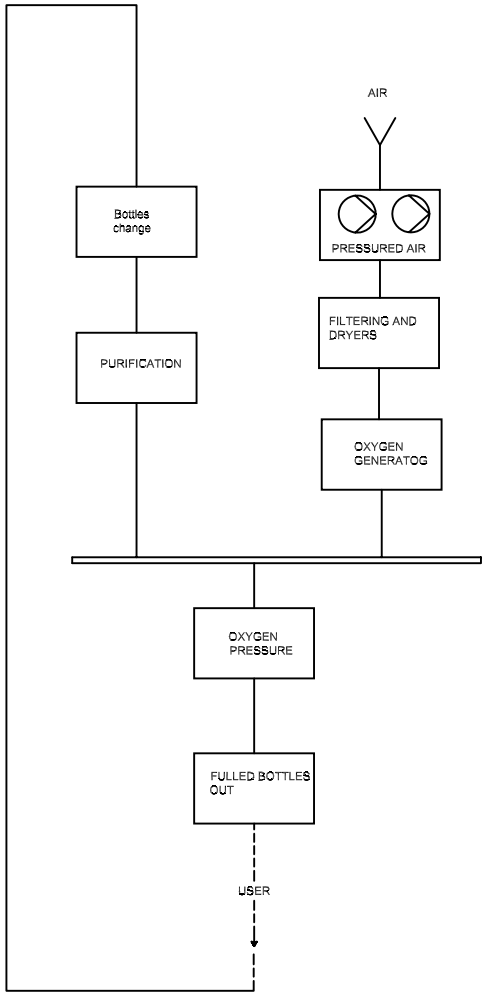


STATUS	STAGE NO.	WORK STATUS
A_0	1.	RECEPTION
A	2.	INSPECTION
A	3.	PRE-HANDING
B	4.	LINKAGE AND FULLFILLMENT
B	5.	DETACHMENT AND PLUGGING
A	6.	SHIPMENT
A	7.	SHIPMENT
.	8.	

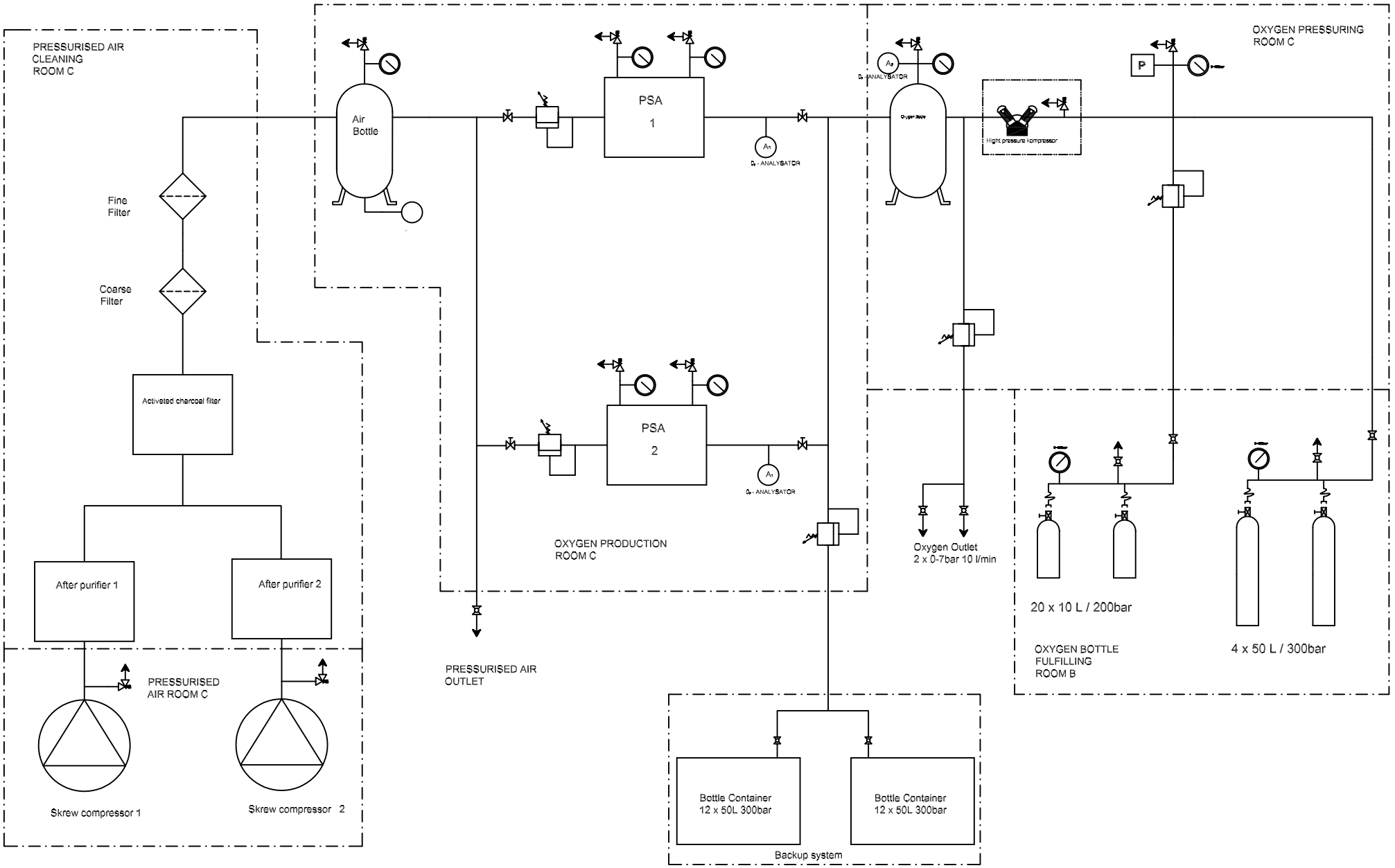
.	11. 01 .2004	Laser Gas Oy	supplement 1	.
.	RH	STATES AND RUNNING PROCESS OXYGEN GENERATOR	.	.
.			DRAVING NUMBER	.
.		.	.	



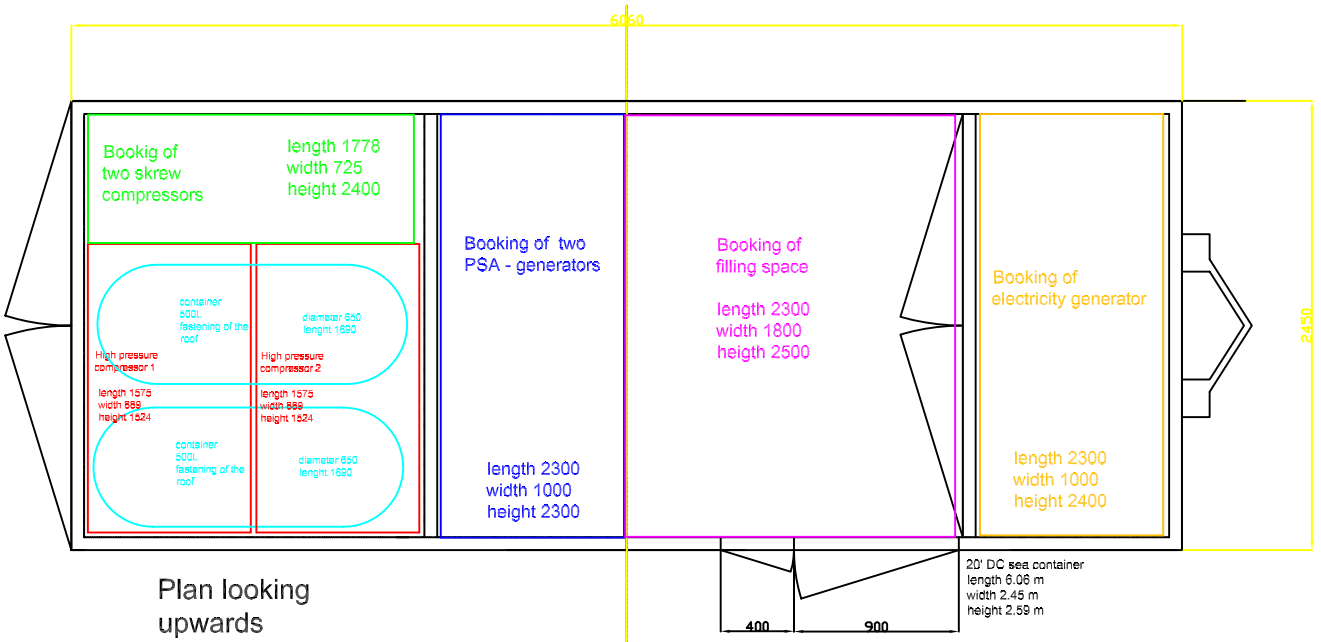
PRODUCTION DIAGRAM



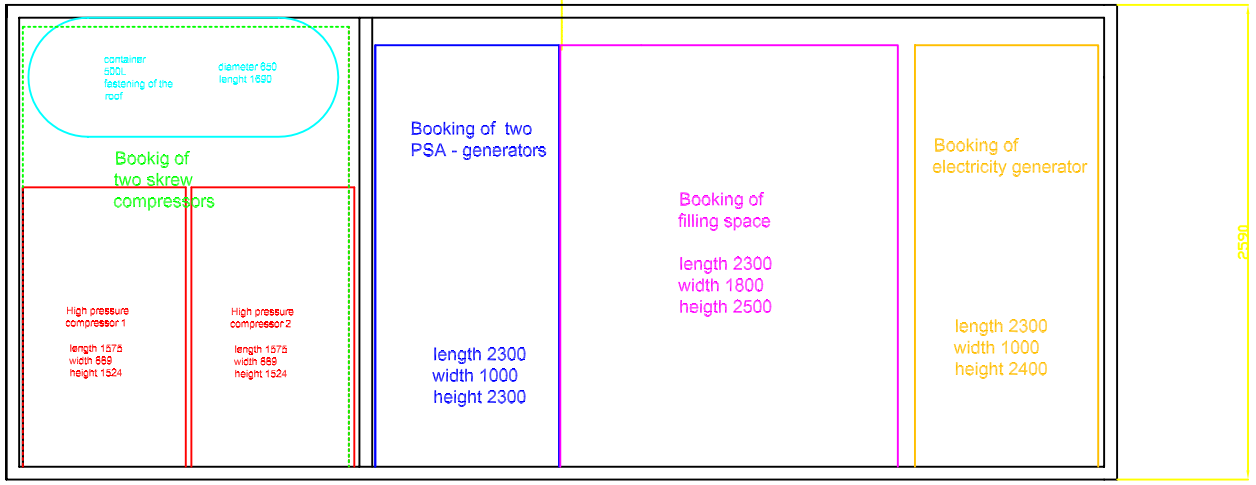
.	2. 12 .2003	Laser Gas Oy	supplement 2
.	RH	PROSES DIAGRAM	
.		OXYGEN COMTAINER	. 2
.		. .	



.	2. 12 .2003	Laser Gas Oy	supplement 3
.	RH	PI-CHART	
.		Oxygen Generator	
.		.	.



Plan looking
upwards



Side wiew

	.	2. 12 .2003	Laser Gas Oy	supplement 4
	.	RH	LAY - OUT (DELINEATION)	
	.		OXYGEN GENERATOR	
	.		.	

Oxygen container technical specification

Compressor	**Amount**	**Electrical power**	**Dimensions**
Skrew compressor	2	22kW	length 725 width 586 height 497 weight 200 kg
High pressure compressor	2	12 kW	length 1575 width 889 height 1524 weight 536 kg
Electricity generator	1	150 kVA	
Heatig		6kW	
PSA	2		length 1500 width 1000 height 2300
O_2 - analysator	2		
Containers			
Pressure air container 500L	1		diameter 650 length 1690
Oxygen container 500L	1		diameter 650 length 1690

Production	
max. O_2 - production	500 m3 / day
max. production pressure	220 bar

Details	
Device as placed into sea container	
length	6.06m
width	2.45m
height	2.59m