SLS Mk IV Deep Diving Bail Out System

Introduction

The Divex Secondary Life Support (SLS) System is an emergency breathing apparatus intended for use in the event of a fundamental failure of a diver's primary life support umbilical. Designed in response to the acknowledged need to enhance diver safety, as man works to extreme depths in the world's most hostile environments. It operates on a semi-closed circuit rebreather principle independent from the primary system.

The SLS System provides the diver with a minimum supply of 13.5 minutes of breathing gas (heliox) at a rate of 62.51 RMV (litres per minute) which satisfies Norwegian Petroleum Directorate (NPD) Regulations 1995, Section 38.

Comprising a self-contained backpack and helmet that have been the subject of considerable development. The picture above shows the SLS Mk IV fitted to a Divex Ultrajewel 17C Gas Reclaim Helmet fitted with SLS Interface.

Design Improvements

Feedback from the users of the SLS System since it was introduced, has resulted in several design changes that have enhanced performance, diver comfort and safety. This brought about the introduction of the Mk II in 1988, the SLS Mk III in 1992 with the superflexible over-the-shoulder inhale and exhale hoses, and the current and most advanced version in 1996, the SLS Mk IV.

The main areas of change are:

a Improved serviceability of the redesigned backpack housing and scrubber housing.
b Improved scrubber canister door sealing arrangement and strengthened door.
c Refillable scrubber canister with screw on cap that is easier to fill.
d Positive pressure indicator (Rotowink) that allows the diver to visually check the integrity of the system.
e Improvements to harness and actuation system.
f Anti-silt protection.

Training & Safety

It is essential that personnel both operating and maintaining the SLS System are completely familiar with all operational and maintenance procedures. Divers should have attended a suitable training course and be totally comfortable and competent in the operation of the equipment, whilst technicians should have completed the three day SLS System Training Course.

The duration of the bailout which the SLS provides depends upon the time taken to fully deplete its stored gas. The oxygen partial pressure within the set will vary within acceptable limits depending on the workload. The endurance of the SLS System shown in the table is at 62.5 RMV, (assuming a cylinder charging pressure of 300 Bar and at depths between 50 msw and 400 msw).

With the diver at rest, the oxygen partial pressure rises from its initial value corresponding to the umbilical gas towards 2 Bar. At increasing workloads, the oxygen partial pressure decreases, but at no time falls below 0.2 Bar. The set injects gas until such time as the bottles become depleted. Following this, the diver will progressively breathe down the oxygen content of the set. However, it should be noted that gas remains breathable for some considerable time beyond exhaustion of the stored gas. This has not been used in the calculations and so the table shows a minimum duration.

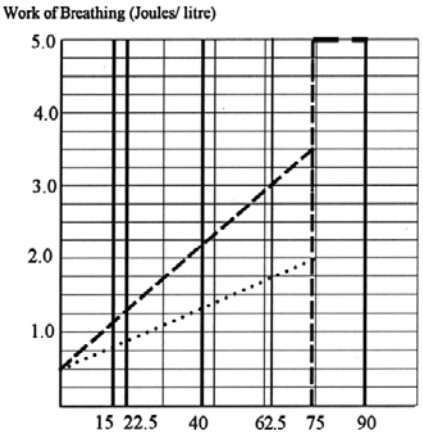
Duration of SLS MK IV System

Depth (msw)	Cylinder Charging Pressure Bar (max) (at the surface)	Duration (minutes)
50	300	56
100	300	37
150	300	28
200	300	22
250	300	19.5
300	300	17.5
350	300	16
400	300	13.5

Work of Breathing

The graph shows the work of breathing in Joules per litre (j/lt) against various breathing rates in RMV (Respiratory Minute Volume) at 400msw, and indicates the maximum permitted in the HSE/NPD Guidelines. The dashed lines indicates the maximum WoB permitted within the HSE/NPD Guidelines at 180 msw, the dotted line shows WoB at depths greater than 180 msw.

Very low Work of Breathing is achieved in all diver attitudes/ positions. In-house and independent testing has been carried out on all models of SLS throughout its development and this has contributed to its outstanding performance.



Performance

The SLS System has been proven in extensive manned and unmanned testing.

Description & Operating Principle

The operational principle of the SLS System is that of conventional semi-closed circuit breathing apparatus. In this type of equipment, exhaled gas is captured and is rebreathed by the wearer, after removal of the carbon dioxide and replacement of the oxygen previously used by the wearer.

The SLS System comprises a backpack and helmet. The Backpack consists of a main housing containing a gas injection system, scrubber canister and a thermal regenerator, plus harness and counterlungs. The gas injection system has three heliox cylinders manifolded together with charging point, two stage regulator, injection orifice, umbilical regulator, and a demand regulator, plus a Rotowink over-pressure indicator. The scrubber canister provides a chemical absorbent bed for the removal of the carbon dioxide and is integrated with the thermal regenerator to heat the breathing gas.

The harness is fitted with the flexible bags (counterlungs), in which the exhaled gas is captured. The preset breathing gas mix required depends on the depth, and guidance is given in the manual. During normal diving operations, the set is worn in standby mode with the bite mouth-piece stored within the oral nasal. The counterlungs are mounted on the front shoulder and chest and are stored packed in strong fabric enclosures which protect them from damage. Two actions are required to activate the SLS System:

a A rip cord on the harness has to be pulled to deploy the counterlungs and pull a spool valve which switches on the gas bleed for gas/oxygen makeup.
b The interface valve on the right hand side of the helmet has to be rotated through 180 degrees, to push the mouthpiece into the oral/nasal where the diver can bite onto it.

Full Redundancy

No other system offers such diver safety. The principle behind the SLS is that it does not rely on the primary breathing system to function in case of failure.

Recourse to a bail out system could be helmet flooding, due to diaphragm rupture, faceport or neckdam failure, but either would cause little problem as the diver would switch to the bite mouthpiece on the SLS. The system gives security in a flooded helmet and offers a good seal if the main gas supply is contaminated.

Umbilical failure, and main gas supply restriction are also both solved by switching to the SLS.

Frequently Asked

Since we introduced the SLS System we have often been asked: What gas do we need to run a shallow training dive, say around 5m/15ft deep?

Do NOT use air! All users must appreciate and understand that this system is a rebreather and the principle of operation must be fully understood. Refer to the guidance within the manual for gas mixes for all depths. The correct mix for the 15ft dive mentioned is a minimum of 46% oxygen. If air was used it would quickly be depleted of the oxygen required to support life. A suitable oxygen-rich mix as indicated above and in the manual must be used.

Training

JFD offers, and strongly recommends, all users of the SLS System to undergo full familiarisation training. Indoor training tank and lecture facilities are available at JFD headquarters in Aberdeen. Courses can also be held in other suitable locations.

Specification

Dimensions	
Backpack	
Width	12.45” (316mm)
Depth	5.67” (144mm)
Height	20.29” (515mm)
Weight in Air	50.6lbs (23kgs)
Weight in Water	7.7lbs (3.5kgs)

Helmet	
Weight in Air	15 kgs
Weight in Water	Neutral

Order Codes

SLS System with Ultrajewel 17C Reclaim Helmet	SLS Backpack and Helmet Interface to Retrofit to customers 17C Reclaim Helmet	Spares Kit	Tool & Instrument Kit	Hygiene Flushing Kit
A44740	A44770	C10202	C10203	C10205