Operation and Maintenance Manual
Secondary Life Support (SLS Mk IV) System Backpack

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Review

This document is subject to review and revision in accordance with ISO 9001.

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ABBREVIATIONS

cm	centimetre
CO_2	Carbon Dioxide
ft	foot or feet
H_2O	Water
in	inch
J	Joule
kg	kilogram
lb	pound (weight)
LH	Left Hand
lpm	litres per minute
Lt	Litre
m	metre
mbar	millibar
mm	millimetre
msw	metres seawater
Mk	Mark
N	Newton
NPD	Norwegian Petroleum Directorate
NUTEC	Norwegian Underwater Technology Centre
O_2	Oxygen
PBS	Primary Breathing System
psi	pounds per square inch
RH	Right Hand
RMV	Respiratory Minute Volume
SI	System International
SLS	Secondary Life Support
US	United States
WG	Water Gauge

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DANGER, WARNING & CAUTION

Danger, Warnings, Cautions and Notes where used within this manual are placed prior to the text to which they are pertinent. Their uses are as follows;

DANGER

INFORMS THE READER OF AN OPERATION OR CONDITION WITCH MAY INVOLVE RISK TO LIFE.

WARNING

INFORMS THE READER OF AN OPERATION OR STATE WITH POTENTIAL FOR PERSONNEL INJURY.

CAUTION

Informs the reader of an operation or state with potential for damage to equipment.

Note ***Informs the user of additional information for clarification or to assist with an operation.***

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PREFACE

The Secondary Life Support (SLS) System is an emergency breathing apparatus intended for use by professional saturation divers, operating from a diving bell. The system is intended for use in the event of a fundamental failure of a diver's primary life support system (e.g. loss of primary breathing gas, loss of hot water, etc). It has been designed in response to the acknowledged need to enhance diver safety, as divers begin to work to extreme depths in the world's most hostile diving environments. The System operates on a semi-closed circuit principle with complete independence from the diver's primary breathing system.

The SLS System meets the Norwegian Petroleum Directorate (NPD) Regulations 1995, Section 38, which requires that whilst breathing at a rate of 62.5 lpm (litres per minute) RMV (respiratory minute volume), the diver should be provided with a minimum of 10 minutes of breathing gas in order to return to the safety of the diving bell. It consists of a self-contained Backpack and Helmet that have been the subject of considerable development and testing.

Feedback from users of the SLS System, since it was introduced in 1986, has resulted in several design changes that have enhanced performance, diver comfort and safety. These changes brought about the introduction of the SLS Mk II in 1988, the SLS Mk III in 1992 and the current and most advanced version in 1996, the SLS Mk IV. The main areas of change in the Mk IV are:

- Improved serviceability with redesigned backpack housing and scrubber housing.
- Improved scrubber canister door sealing arrangement and strengthened door.
- A refillable scrubber canister with a screw on cap that is easier to fill.
- The incorporation of a positive pressure indicator (a Rotowink) that allows the diver to visually confirm the correct operation of the positive pressure system.
- Various improvements to the harness and actuation system.

This Manual contains information for the operation and maintenance of the SLS System Mk IV Backpack. This consists of a main housing containing a gas injection system, a CO2 scrubber canister and a thermal regenerator. The backpack harness also contains the system counterlungs.

The operation and maintenance of the SLS System Mk IV Helmet is documented in a separate Manual with the reference OM112.

It is essential that personnel both operating and maintaining the SLS System are completely familiar with all the operational and maintenance procedures. Divers should have attended a Familiarisation Course and be totally comfortable and competent in the operation of the equipment, while technicians should have completed the Divex three (3) day SLS System Training Course.

It is also important that the level of diver to technician competence is maintained and achieved to a high level through regular use or experience. If in doubt of the individuals competency the person should be re-trained.

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Chapter 1 - Introduction

Contents

1.1 Purpose of equipment

The Secondary Life Support (SLS) System is an emergency breathing apparatus designed for use by professional saturation divers, operating from a diving bell. It is intended for use in the event of a fundamental failure of a diver’s primary life support system (e.g. loss of primary breathing gas, loss of hot water, etc). The System operates using semi-closed circuit breathing apparatus principles and provides complete independence from the diver’s primary systems. The SLS System meets the Norwegian Petroleum Directorate (NPD) Regulations 1995, Section 38, which requires that whilst breathing at a rate of 62.5 lpm (litres per minute) RMV (respiratory minute volume), the diver should be provided with a minimum of 10 minutes of breathing gas in order to return to the safety of the diving bell.

1.2 General description

The SLS System comprises a Backpack (Figure 1.1, Item 1) and a Helmet (Figure 1.1, Item 2). The operational principle of the System is basically that of a conventional semi-closed circuit breathing apparatus, in which exhaled gas is captured in the counterlungs and is then re-breathed by the wearer, after removal of the carbon dioxide (CO_2) and replacement of the oxygen.

The SLS System layout is shown in Figure 1.2 with the Helmet (See separate Manual Ref: P1939-O-0112) in plan view. The Backpack consists of a main housing containing a gas injection system, a CO_2 scrubber canister and a thermal regenerator. The main harness also contains the system counterlungs.

The gas injection system has three (3) heliox cylinders manifolded together with a charging point, burst disc, two stage regulator, injection orifice, single stage regulator, demand regulator and a overpressure indicator.

The CO_2 scrubber canister provides a chemical absorbent bed for the removal of the carbon dioxide. A thermal regenerator temporarily stores the heat within the breathing gas in order to avoid losing it to the water as the breathing gas passes into flexible bags (the counterlungs). The SLS Backpack harness has the counterlungs fitted to its shoulder straps.

The mixture of breathing gas required depends on diving depth, and complete details are given in the operating information within the 'Preparation for Use' procedures (section 3.1).

During normal diving operations the SLS System is worn in stand-by mode with the mouthpiece retracted into the helmet interface assembly. The counterlungs are mounted on each of the diver’s shoulders and are stored packed in strong fabric enclosures to protect them from damage.

Two actions are required to activate the SLS System:

- The interface valve on the right hand side of the Helmet has to be rotated through 180°, to push the mouthpiece into the oral / nasal where the diver can bite onto it.
- An actuation handle on the harness has to be pulled to deploy the counterlungs and pull a spool valve which switches on the gas bleed for make-up gas.

Note ***If the actuation handle is not pulled the diver will run out of breathing gas as the system has now become open circuit.***

Figure 1.1 SLS System Mk IV

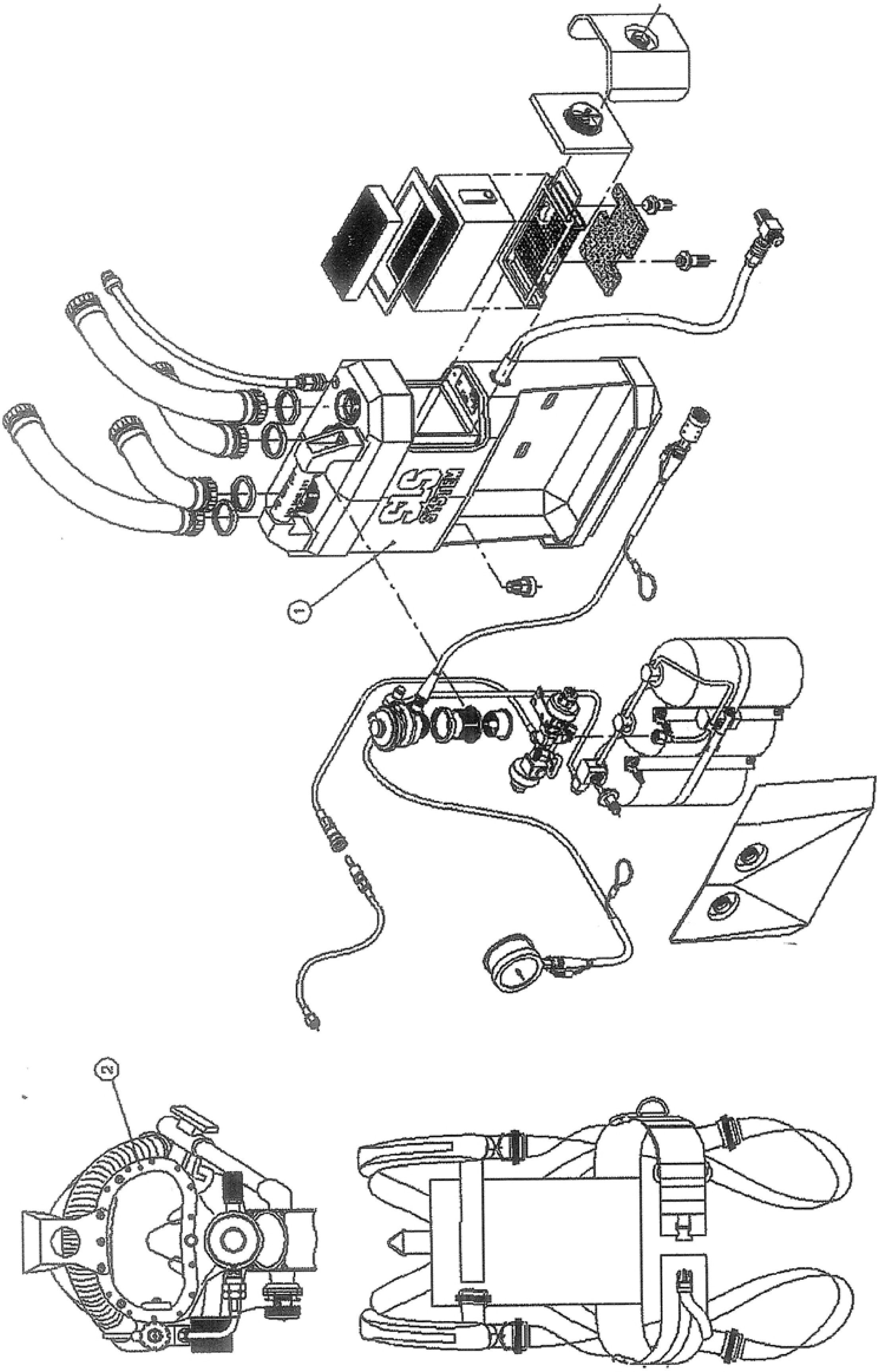
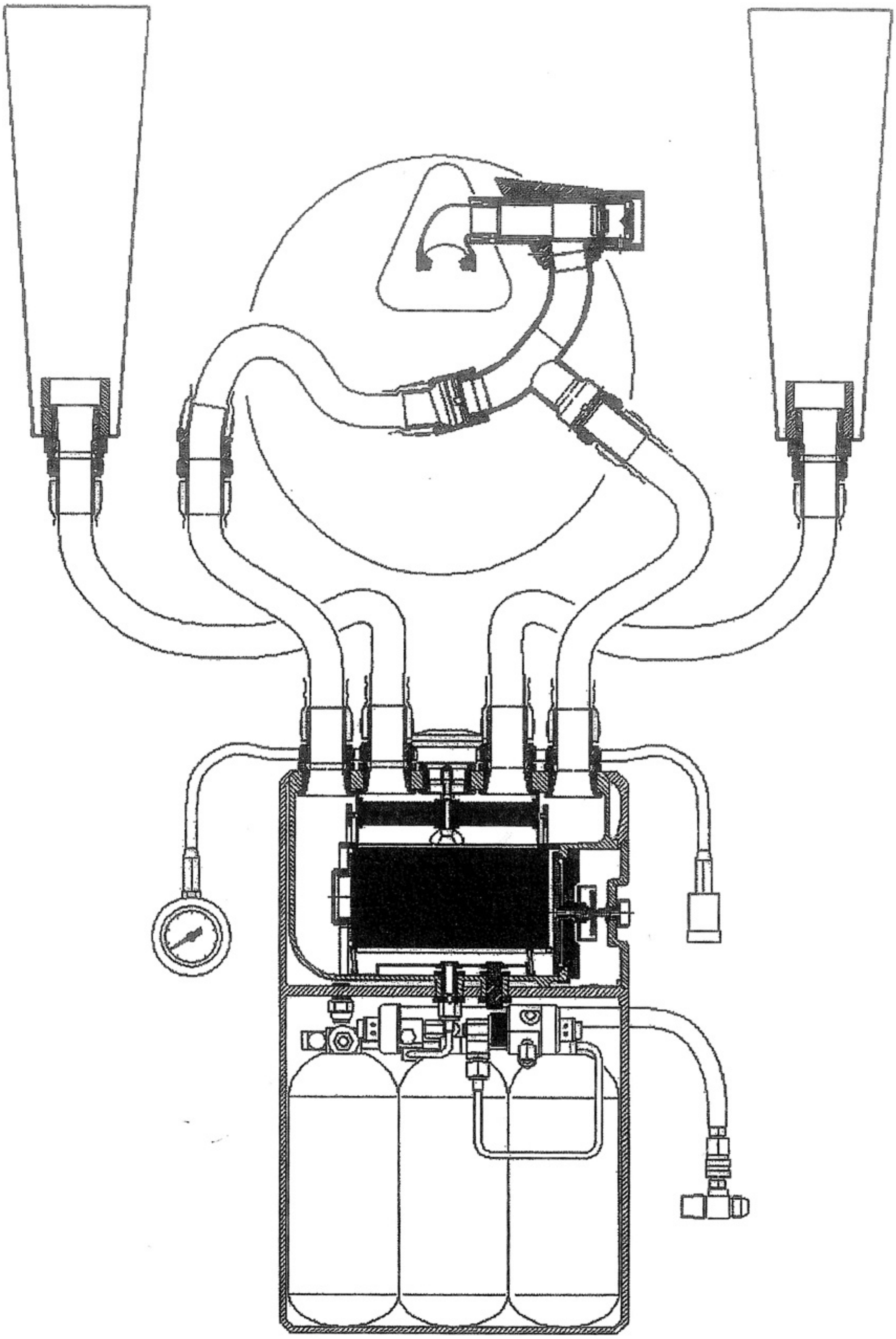


Figure 1.2 SLS system layout



1.3 Performance and Limitations

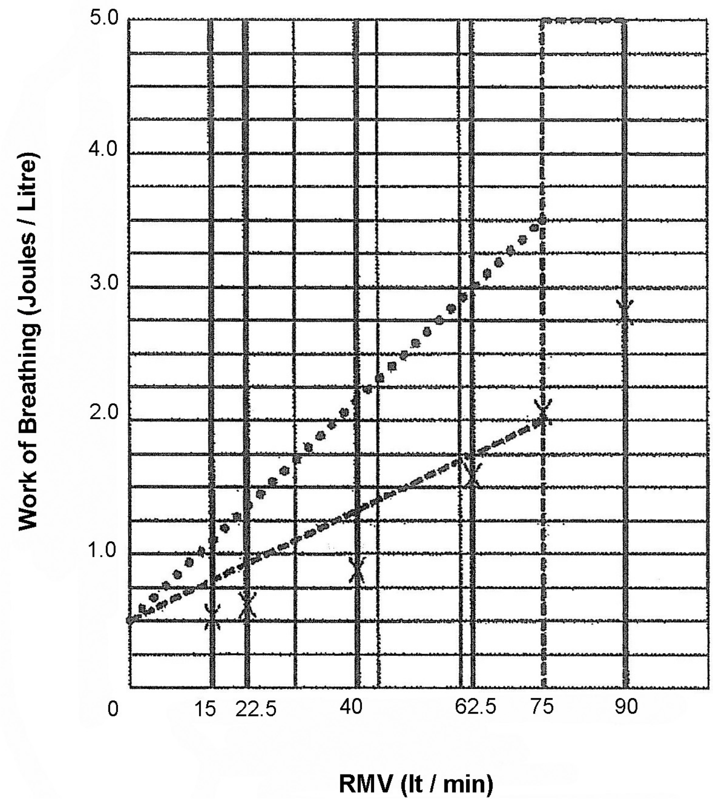
The SLS System has been proven in extensive unmanned and manned testing. A selection of unmanned test data is presented below.

1.3.1 Work of breathing

Figure 1.3 shows the work of breathing in Joules per Litre as a function of breathing rate in lpm RMV at a depth of 400 msw using heliox gas. The W.O.B. performance is even better at shallower depths.

The dashed line indicates the maximum W.O.B. permitted within the HSE/NPD Guidelines at >180 msw, the dotted line showing W.O.B. maximum <180 msw.

Figure 1.3 Work of breathing



1.3.2 Oxygen partial pressure / endurance

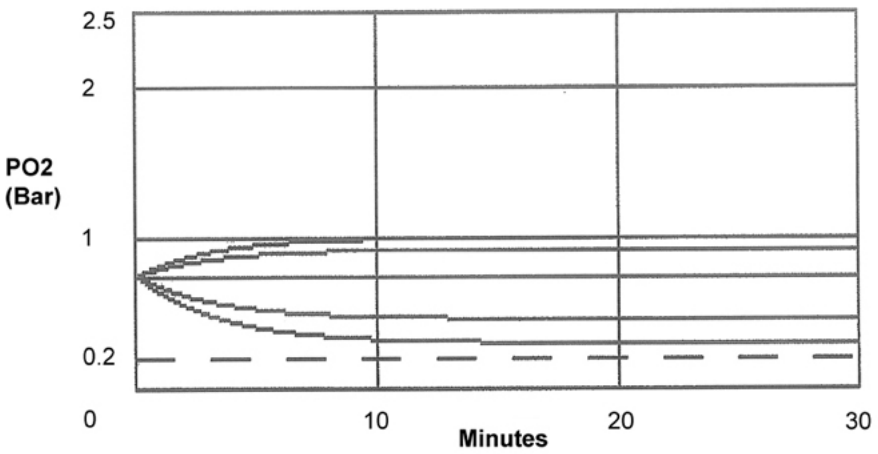
The duration of the bailout which the SLS System provides depends on one of two factors; the time taken to fully deplete its stored gas or the life of the CO_2 scrubber canister. The oxygen partial pressure within the System will vary depending on diver breathing rate. This is illustrated in Figure 1.4 to Figure 1.13 for depths from 50 msw to 500 msw. The System's cylinder duration can also be seen from these graphs but it should be noted that at shallow depths duration is limited by the life of the CO_2 scrubber canister.

With the diver at rest, the oxygen partial pressure rises from its initial value (corresponding to the umbilical gas) towards 2 bar (pp) At increasing workloads, the oxygen partial pressure is lower, but at no time falls below 0.2 bar. The System injects gas until such time as the cylinders become depleted. Following this, the diver will progressively breathe down the oxygen content in the System. However, it should be noted that the gas remains breathable for some considerable time beyond exhaustion of the stored gas.

Figure 1.4 Partial pressure of oxygen at 50 msw

SLS BAILOUT SYSTEM

Depth	50m	Charging pressure	300 Bar	Inject rate	3.39 alpm
Bottle O2	18.5%	Bottle Volume	4.00 litres	RMV's	15 22.5 40 62.5 75

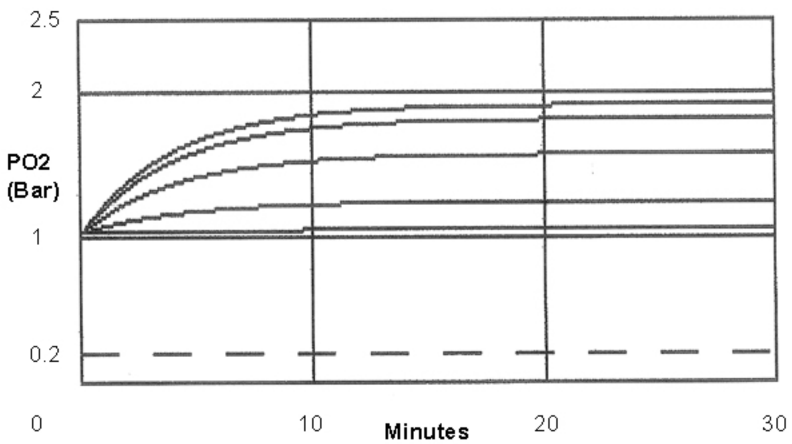


GRAPH OF PARTIAL PRESSURE IN SET VERSUS TIME

Figure 1.5 Partial pressure of oxygen at 100 msw

SLS BAILOUT SYSTEM

Depth	100m	Charging pressure	300 Bar	Inject rate	2.58 alpm
Bottle O2	18.8%	Bottle Volume	4.00 litres	RMV's	15 22.5 40 62.5 75

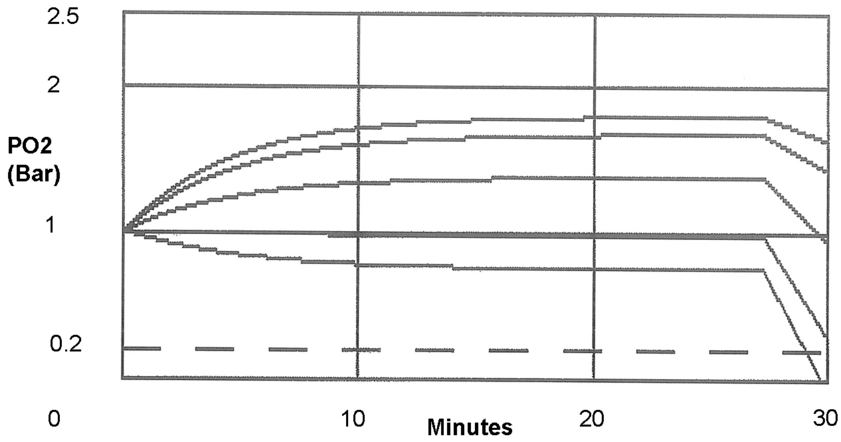


GRAPH OF PARTIAL PRESSURE IN SET VERSUS TIME

Figure 1.6 Partial pressure of oxygen at 150 msw

SLS BAILOUT SYSTEM

Depth	150m	Charging pressure	300 Bar	Inject rate	2.23 alpm
Bottle O2	12.5%	Bottle Volume	4.00 litres	RMV's	15 22.5 40 62.5 75

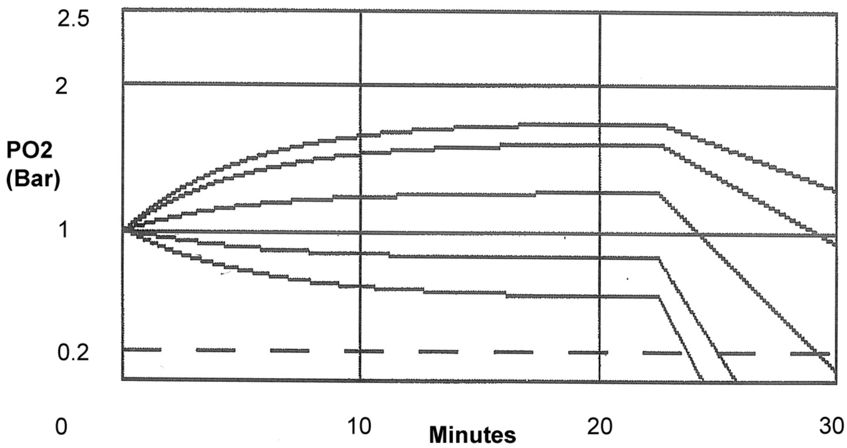


GRAPH OF PARTIAL PRESSURE IN SET VERSUS TIME

Figure 1.7 Partial pressure of oxygen at 200 msw

SLS BAILOUT SYSTEM

Depth	200m	Charging pressure	300 Bar	Inject rate	1.99 alpm
Bottle O2	9.5%	Bottle Volume	4.00 litres	RMV's	15 22.5 40 62.5 75

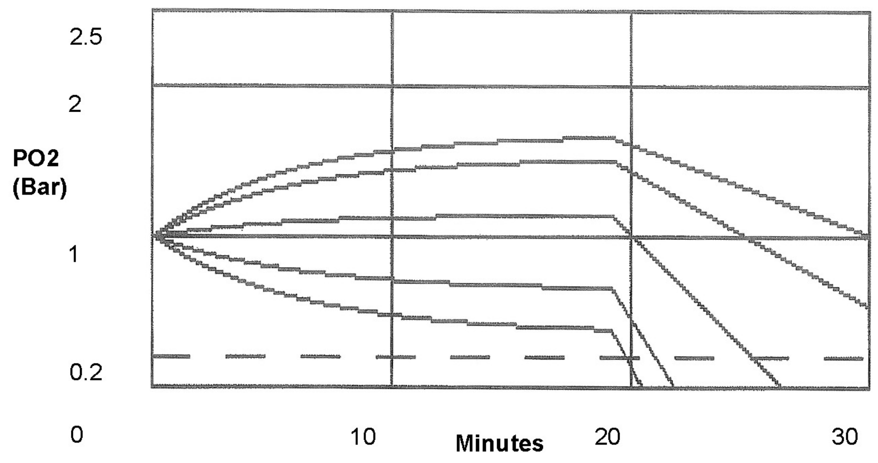


GRAPH OF PARTIAL PRESSURE IN SET VERSUS TIME

Figure 1.8 Partial pressure of oxygen 250 msw

SLS BAILOUT SYSTEM

Depth	250m	Charging pressure	300 Bar	Inject rate	1.82 alpm
Bottle O2	7.5%	Bottle Volume	4.00 litres	RMV's	15 22.5 40 62.5 75

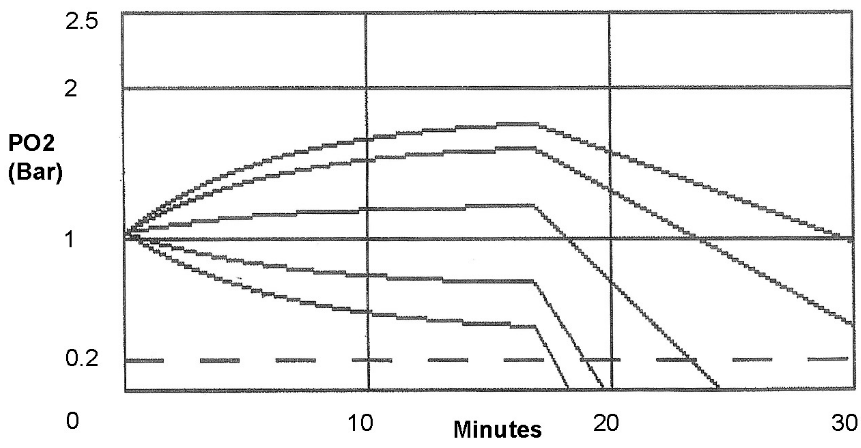


GRAPH OF PARTIAL PRESSURE IN SET VERSUS TIME

Figure 1.9 Partial pressure of oxygen at 300 msw

SLS BAILOUT SYSTEM

Depth	300m	Charging pressure	300 Bar	Inject rate	1.67 alpm
Bottle O2	6.8%	Bottle Volume	4.00 litres	RMV's	15 22.5 40 62.5 75

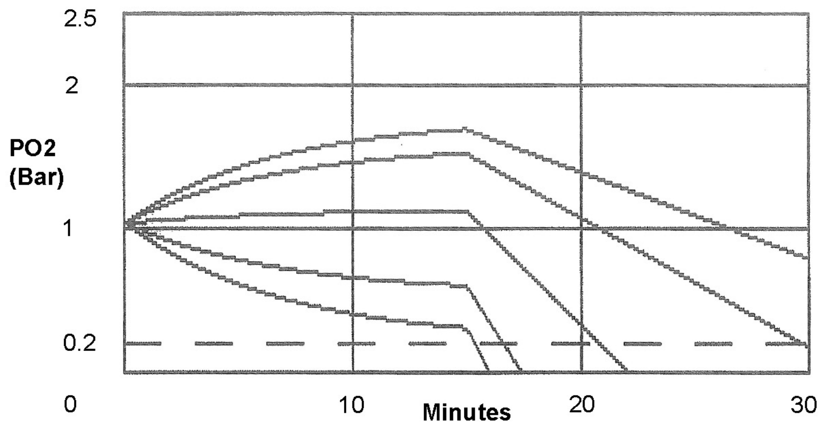


GRAPH OF PARTIAL PRESSURE IN SET VERSUS TIME

Figure 1.10 Partial pressure of oxygen at 350 msw

SLS BAILOUT SYSTEM

Depth	350m	Charging pressure	300 Bar	Inject rate	1.56 alpm
Bottle O2	5.8%	Bottle Volume	4.00 litres	RMV's	15 22.5 40 62.5 75

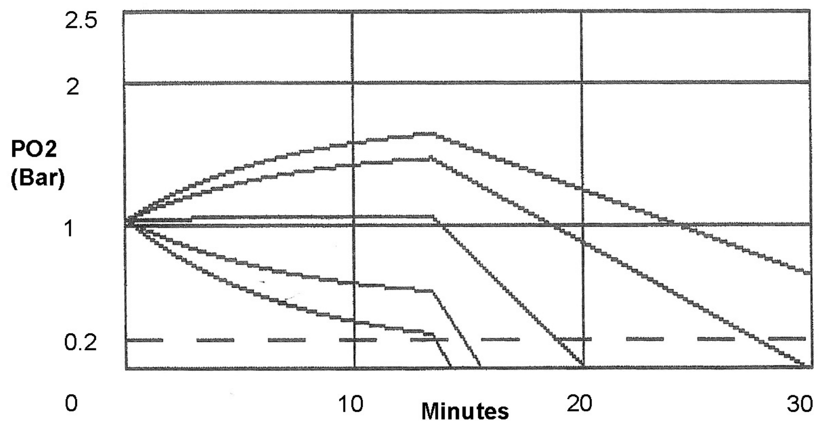


GRAPH OF PARTIAL PRESSURE IN SET VERSUS TIME

Figure 1.11 Partial pressure of oxygen at 400 msw

SLS BAILOUT SYSTEM

Depth	400m	Charging pressure	300 Bar	Inject rate	1.47 alpm
Bottle O2	5.1%	Bottle Volume	4.00 litres	RMV's	15 22.5 40 62.5 75

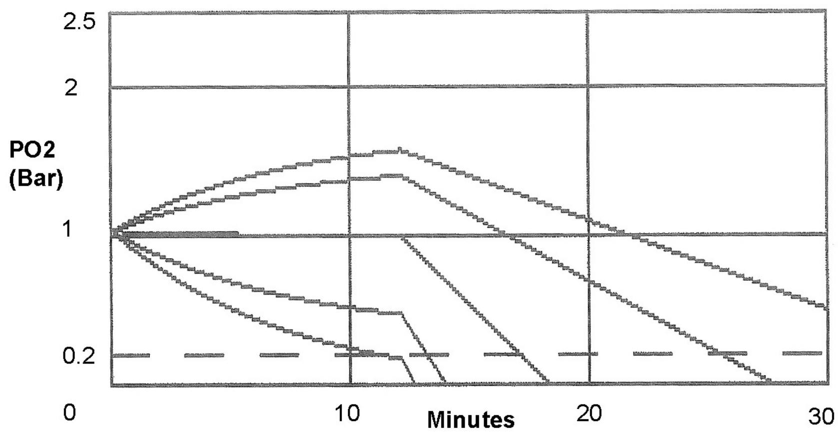


GRAPH OF PARTIAL PRESSURE IN SET VERSUS TIME

Figure 1.12 Partial pressure of oxygen at 450 msw

SLS BAILOUT SYSTEM

Depth	450m	Charging pressure	300 Bar	Inject rate	1.40 alpm
Bottle O2	4.5%	Bottle Volume	4.00 litres	RMV's	15 22.5 40 62.5 75

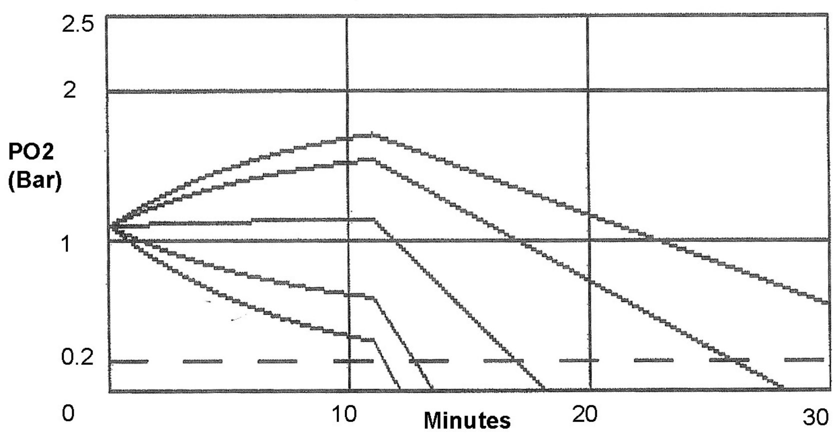


GRAPH OF PARTIAL PRESSURE IN SET VERSUS TIME

Figure 1.13 Partial pressure of oxygen at 500 msw

SLS BAILOUT SYSTEM

Depth	500m	Charging pressure	300 Bar	Inject rate	1.33 alpm
Bottle O2	4.5%	Bottle Volume	4.00 litres	RMV's	15 22.5 40 62.5 75



GRAPH OF PARTIAL PRESSURE IN SET VERSUS TIME

1.3.3 Carbon dioxide scrubbing / thermal performance

The thermal protection in the SLS System is provided by a combination of passive means and recovery of the heat generated by the exothermic absorption of CO_2 in sodalime.

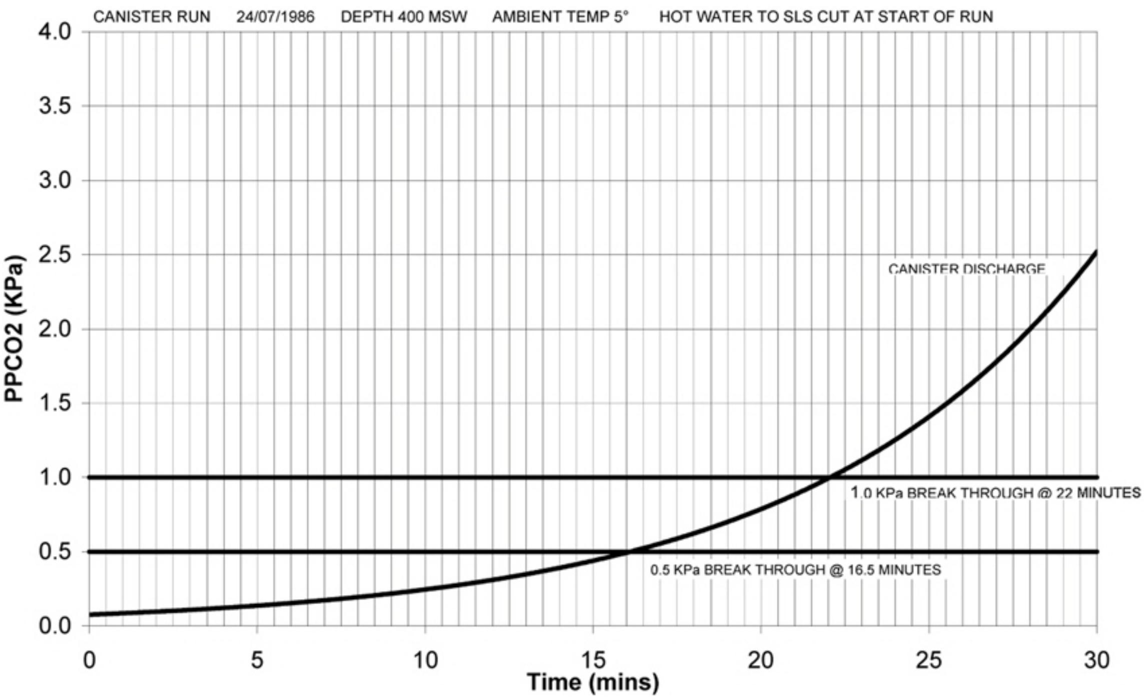
Thermal protection consists of:

- Stored heat from hot-water system.
- Thermal regeneration to prevent heat loss from gas in the counterlungs.

Figure 1.14 shows the inspired CO_2 level in the SLS System as a function of time when breathed at a continuous 40 RMV (moderate work) at 400 msw on a breathing simulator. It may be seen that the SLS System maintains gas within primary breathing system specification for a period well in excess of the bottle endurance.

Note ***A constant supply of hot water to the hot water jacket significantly increases the duration and efficiency of the scrubber and should always be used.***

Figure 1.14 SLS system carbon dioxide levels endurance of the SLS system



The endurance of the SLS System is shown in Table 1.1. This shows the minimum time taken for either the cylinders or the CO_2 scrubber canister to become depleted. It also shows the minimum recommended cylinder charging pressures (to achieve 10 min. bailout is defined by NPD) at depths between 50 msw and 400 msw.

Note ***At shallow depths there is no advantage in charging the cylinders to higher pressures.***

Table 1 SLS system endurance

Depth	Charging Pressure	Duration
50 msw	300 bar (max)	30 mins*
50 msw	175 bar	30 mins
50 msw	100 bar (min)	17 mins
100 msw	300 bar (max)	30 mins*
100 msw	250 bar	30 mins
100 msw	100 bar (min)	12 mins
150 msw	300 bar (max)	28 mins
150 msw	150 bar (min)	14 mins
200 msw	300 bar (max)	22 mins
200 msw	150 bar (min)	10 mins
250 msw	300 bar (max)	19.5 mins
250 msw	200 bar (min)	12.5 mins
300 msw	300 bar (max)	17.5 mins
300 msw	200 bar (min)	11 mins
350 msw	300 bar (max)	16 mins
350 msw	200 bar (min)	10 mins
400 msw	300 bar (max)	13.5 mins
400 msw	250 bar (min)	11 mins

* Duration limited by CO_2 scrubber canister duration.

Chapter 2 - Technical Description

Contents

2.1 System Description

A schematic diagram of the SLS System is shown in Figure 2.1. As the diver exhales, gas passes via the diver's mouthpiece through the Helmet Interface Assembly and is directed by the check valves through an insulated hose to the Backpack. It then passes through the CO_2 scrubber canister and up through the thermal regenerator into the counterlungs. The thermal regenerator removes and stores the heat from the warm gas.

As the diver inhales, the now cold gas passes back through the thermal regenerator and picks up the stored heat. The gas then passes up through a second insulated hose assembly and back into the diver’s mouthpiece via the Helmet interface assembly.

The oxygen make-up to the SLS System is provided by means of a constant bleed of oxygen rich gas from storage cylinders located at the base of the Backpack. This gas bleed mixes with the exhaled gas at the inlet to the CO_2 scrubber and will maintain a safe oxygen partial pressure within the SLS System at all times. The gas is supplied from the gas cylinders through a two-stage regulator to the injection orifice which regulates the flow rate.

During normal diving operations the SLS System is worn in stand-by mode with the mouthpiece retracted within the Helmet interface assembly. The counterlungs are mounted one on each of the diver’s shoulders’ and are stored packed in strong fabric enclosures to protect them from damage.

Water ingress into the SLS System, whilst in its stand-by mode, is prevented by positively pressurising the breathing circuit. A single stage regulator, set at 138 mbar (2 psi) supplies this positive pressure. The regulator obtains its gas from the diver’s main umbilical via a connection on the Helmet sideblock assembly.

The overpressure valve ensures that this pressure can never exceed 172 mbar (2.5 psi) above ambient pressure. Visual indication of this overpressure is provided by means of the overpressure indicator, which changes from green to red if a significant loss of pressure occurs.

The overpressure within the SLS System will vary slightly as a diver excurts up or down (138 mbar (between 2.0 psi) and 172 mbar (2.5 psi)) and this may cause a temporary change to the Rotowink until the umbilical gas (single stage) regulator injects enough gas.

The hot water supply to the diver’s primary demand regulator shroud heater is directed through the SLS System Backpack. This water jacket surrounds the CO_2 scrubber housing and keeps the chemical absorbent warm and ready to start work when needed. The outlet from this jacket is positioned at the top of the backpack and from here the hot water is normally connected to the helmet.

It should be noted that the diver's primary demand regulator will normally require a shroud heater when diving deeper than 180 msw. A hot water supply to the SLS System Backpack is required at all diving depths.

Should a situation occur during normal diving operations which requires activation of the SLS System, it may be brought into use by two actions, as follows:

1 The interface valve on the right hand side of the Helmet has to be rotated through 180o. This action pushes the mouthpiece into the Helmet oral / nasal, where the diver can bite onto it.

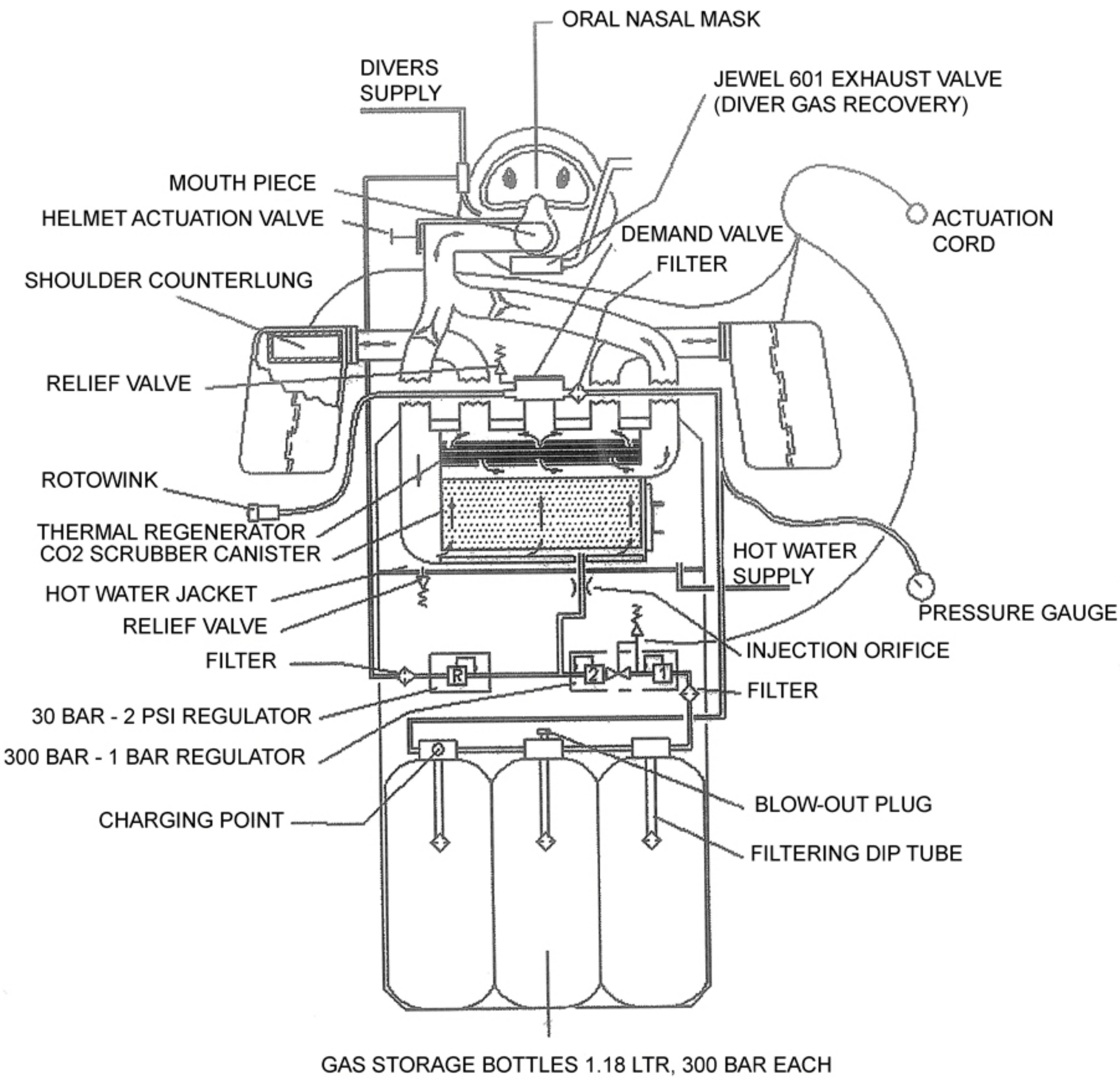
2 The actuation handle on the harness has to be pulled. This allows the counterlungs to deploy and also pulls a spool valve, which switches on the bleed for the enriched gas make-up.

Note ***If the actuation handle is not pulled the diver will run out of breathing gas as the system has now became open circuit.***

Because the counterlungs are tightly packed, there is very little gas available for the diver to inhale after activation, hence a demand valve situated on top of the SLS System Backpack supplies the gas for his first breath. Then, as the diver exhales, the counterlungs are filled and from then on the SLS System functions in its semi-closed circuit mode. There are three gas cylinders each of 1.18 litres water capacity which together provide 1060 litres of gas when charged to 300 bar (See Chapter 3) for complete details of required gas mixes, charging pressures etc.).

The SLS System Mk IV is deliberately weighted slightly negatively buoyant because most divers find that, with a hot water suit, a small mount of extra weight is required to control buoyancy. The Backpack harness has two weight pockets fitted in case additional weight is desired.

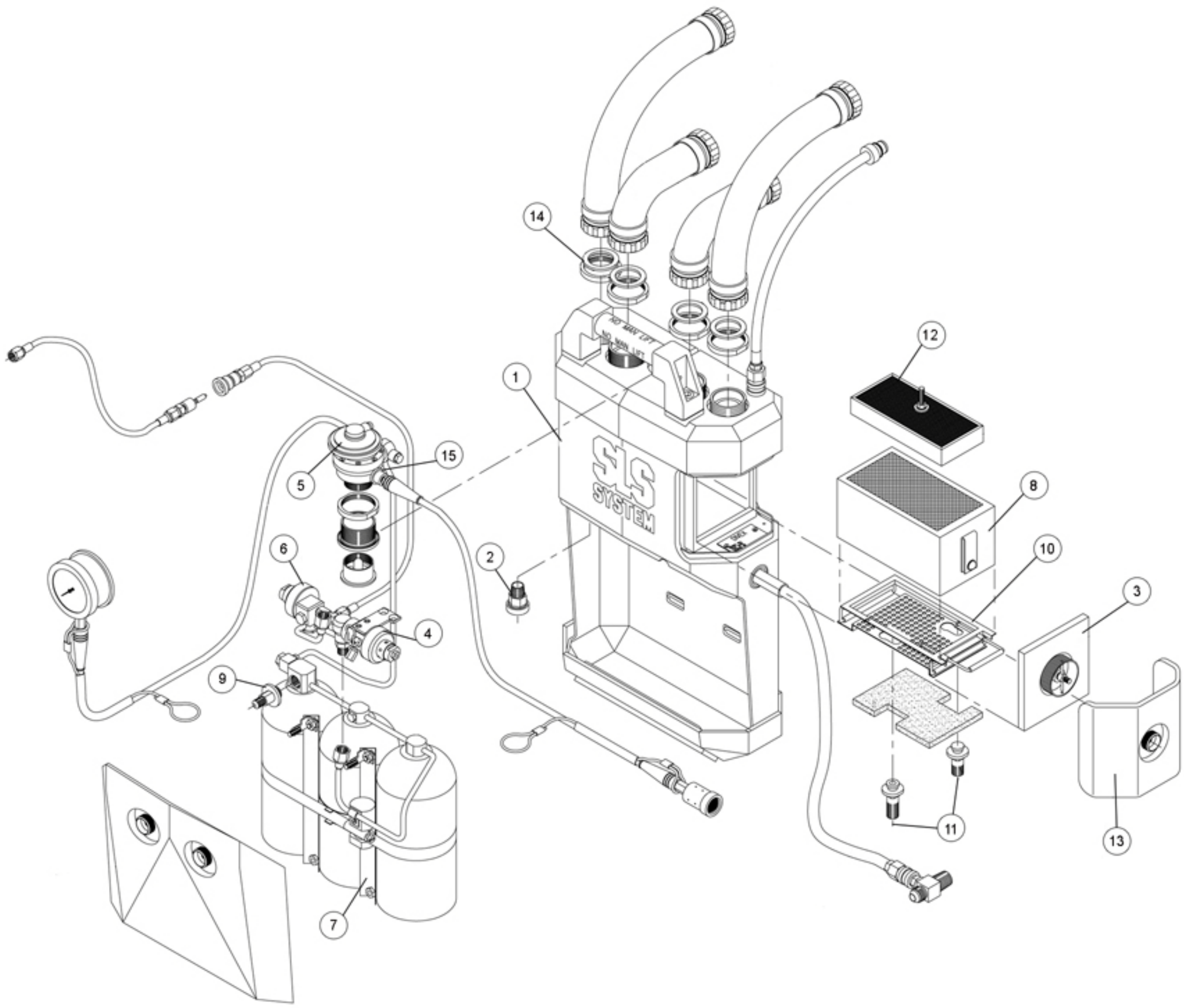
Figure 2.1 SLS System Mk IV (Schematic)



2.2 Backpack Housing Assembly

The major components of the backpack housing assembly are shown in Figure 2.2.

Figure 2.2 Backpack housing assembly



Item	Description
1	Backpack Housing Moulding
2	Relief Valve
3	Lid Screw Assembly
4	Two Stage Regulator
5	Protection Cap
6	Single Stage Regulator
7	Gas Cylinder Retainer
8	Refillable Sodalime Canister

Item	Description
9	Gas Cylinder Manifold
10	Canister Lift Mechanism
11	Penetrators
12	Thermal Regenerator Assembly
13	Housing Side Door
14	Sealing Washer
15	Demand Valve

2.2.1 Main backpack housing

The main Backpack (Figure 2.2, Item 1) contains the gas cylinders and manifold (Figure 2.2, Item 9), the charging point and the associated regulators (Figure 2.2, Items 4 & 6) in its lower part. The upper part of the Backpack contains the CO_2 scrubber housing (Figure 2.2, Item 8) the canister lift mechanism (Figure 2.2, Item 10), the thermal regenerator (Figure 2.2, Item 12) and the penetrators (Figure 2.2, Item 11).

2.2.2 Scrubber door assembly

The lid screw assembly (Figure 2.2, Item 3) seals the internal CO_2 scrubber housing closed. Access to the CO_2 scrubber canister is obtained by first removing the outer side door (Figure 2.2, Item 13). The lid screw assembly (Figure 2.2, Item 3) can then be opened by releasing the catch. Within the housing the refillable CO_2 scrubber canister (Figure 2.2, Item 8) is held in place by the scrubber lift mechanism (Figure 2.2, Item 10).

2.2.3 CO_2 scrubber canister

During normal diving, hot water is passed through an outer compartment that surrounds the CO_2 scrubber housing (Figure 2.2, Item 8). This water maintains the temperature of the CO_2 scrubber canister (Figure 2.2, Item 8) and ensures that should the SLS System be required, the CO_2 absorbent is warm enough to enable the required chemical reaction to take place and absorb the CO_2.

Note ***Failure to connect this water supply could result in a hazard to the user if the SLS System is required.***

2.2.4 CO_2 scrubber canister lift mechanism

The CO_2 scrubber canister lift mechanism (Figure 2.2, Item 10) is secured to the penetrators (Figure 2.2, Item 11). This lifts the CO_2 scrubber canister (Figure 2.2, Item 8) and presses it against a gasket, creating the loading necessary to effect a seal. Beneath this mechanism is a highly absorbent sponge pad which absorbs any moisture (e.g. condensation, saliva etc.) which may collect within the SLS System when in use. Removal of the CO_2 scrubber lift mechanism (Figure 2.2, Item 10) to give access to the sponge pad, is facilitated by pressing down on the centre and sliding it towards the door. This releases it from the locating feature incorporated in the penetrators.

2.2.5 Thermal regenerator

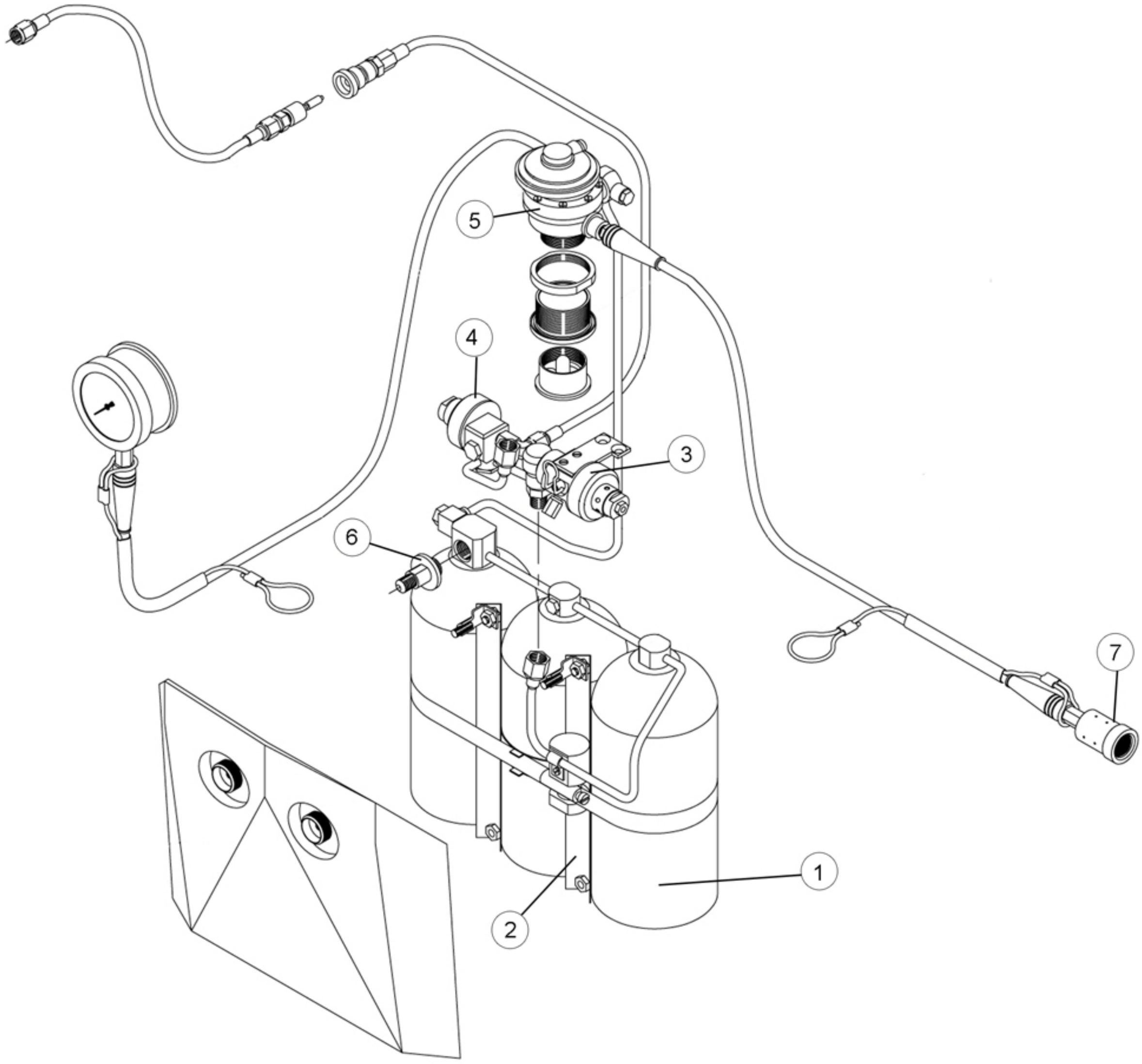
When the CO_2 scrubber canister (Figure 2.2, Item 8) is removed, the thermal regenerator (Figure 2.2, Item 12) may be seen in the upper part of the scrubber housing (Figure 2.2, Item 1). This is a passive device which recovers heat from the exhaled gas passing to the counterlungs, and uses this heat to then pre-heat the gas passing from the counterlungs back to the diver.

2.2.6 Penetrators

There are two penetrators (Figure 2.2, Item 11). One contains the restrictor orifice through which the gas injection enters the SLS System during use. The other penetrator is blank and is used as a locating pin for the scrubber lift mechanism.

2.3 Gas Injection System

Figure 2.3 Gas Injection System



Item	Description
1	Gas Cylinders and Manifold
2	Bottle Bracket Assembly
3	Two Stage Regulator
4	Single Stage Regulator
5	Demand Regulator c/w Protection Cap
6	Charging Point / Check Valve
7	Overpressure Indicator

Figure 2.3 shows the principle components of the gas injection system. In operational mode, gas flows from the cylinders (Figure 2.3, Item 1) to the two stage regulator (Figure 2.3, Item 3). The first stage of this regulator reduces stored gas pressure to an interstage pressure of around 15 barg (217 psig). The second stage reduces the pressure further to precisely 1 barg (14.5 psig). The gas is then supplied into the SLS System via the injection orifice located within the lower penetrator. It then passes into the breathing circuit at the bottom of the CO_2 scrubber housing.

The spool valve between the first and second stages of the two stage regulator (Figure 2.3, Item 3) acts as the gas injection shut-off valve, and is switched by the actuation cable release, which transfers the SLS System into the operational mode.

A second feed from the H.P. manifold supplies gas to the demand regulator (Figure 2.3, Item 5) located on top of the Backpack. This connection is tee'd at the regulator to provide a connection for the SLS Systems H.P. contents gauge. This gauge provides the diver with a visual indication of the contents of the HP cylinders.

In its stand-by mode the SLS System is kept at a positive pressure of 138 mbar (2 psi) by the single stage regulator (Figure 2.3, Item 4). This is supplied with umbilical gas via a hose from a connection from the Helmet side-block. This single stage regulator also supplies its gas to the SLS System through the injection orifice.

Another connection, this time into the demand regulator body, is also provided to which the overpressure indicator (Figure 2.3, Item 7) is connected. This indicator provides the diver with a visual indication that everything is functioning correctly when the SLS System is in its stand-by mode.

2.3.1 Gas cylinders and manifold

SLS System enriched gas (heliox) is stored in three 1.18 litre cylinders, at 300 bar maximum charging pressure. Each bottle is fitted internally with a sintered filter dip tube assembly. This is fitted to prevent any internal corrosion within the cylinders from entering the pipework and potentially blocking the gas flow. The three cylinders are connected together via a common manifold.

Incorporated within the manifold are connections for the cylinder charging point (Figure 2.3, Item 6) the 300 bar cylinder over-pressurisation protection burst disc and the supply line to the demand regulator (Figure 2.3, Item 5).

2.3.2 Charging point / check valve

The cylinder charging point, 4 JIC, (Figure 2.3, Item 6) is installed in the left-hand cylinder fitting. This has a built in check valve to allow easy filling and a sintered filter element to protect the check valve seat from damage during charging.

2.3.3 Burst disc assembly

The burst disc is located on the inside face of the centre bottle fitting. This provides a safety valve in the event of the gas cylinders being accidentally overcharged.

2.3.4 Two stage regulator

Figure 2.4 shows a cross-section through the two-stage regulator. Gas from the storage cylinders is supplied via the banjo fitting (Figure 2.4, Item 9). This is retained by a circlip (Figure 2.4, Item 21) and sealed by two O-rings (Figure 2.4, Item 27). The first stage piston (Figure 2.4, Item 4) provides regulation of the interstage gas pressure to approximately 15 bar (217 psi). This piston is initially raised from its seat by the spring (Figure 2.4, Item 20). Gas flows past the seat and then along the hole in centre of the piston into the chamber to the left of the piston. The pressure in this chamber rises until it is sufficient to overcome the force exerted by the spring. The piston then moves across to seal the regulator port.

Figure 2.4 Two-stage regulator

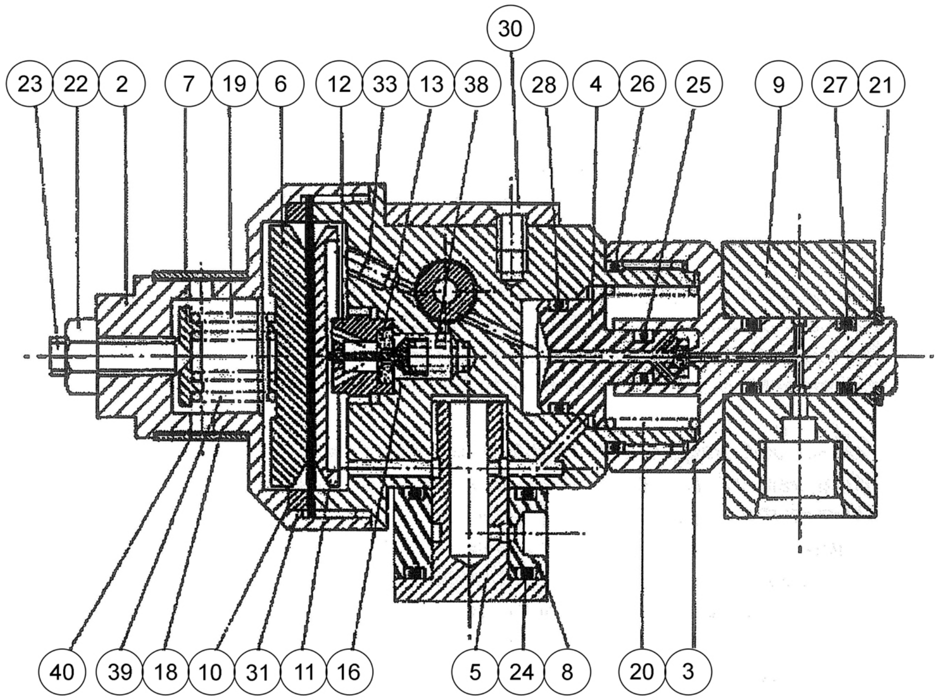


Figure 2.5 Spool valve

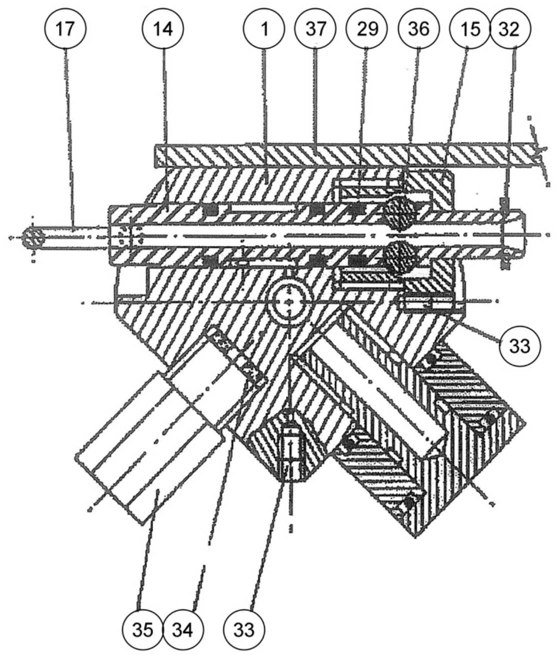


Figure 2.5 shows the spool valve in another cross-section through the two-stage regulator. This illustrates the position of the pull ring (Figure 2.5, Item 17) on the spool (Figure 2.5, Item 14). The spool valve is moved from the closed to the open position by pulling the actuation cable. A bullet on the end of the cable contacts the two ball bearings (Figure 2.5, Item 36) in the centre of the spool, drawing the valve to the open position. The ball bearings then drop out of the way allowing the bullet to pass through and away up the cable sheaths.

Gas flow's from the regulator first stage to the spool (Figure 2.5, Item 14). When the SLS System is in its stand-by mode, the spool isolates the first stage from the second stage of the regulator. When the actuation cable is pulled, the spool moves across allowing gas flow to the regulator second stage.

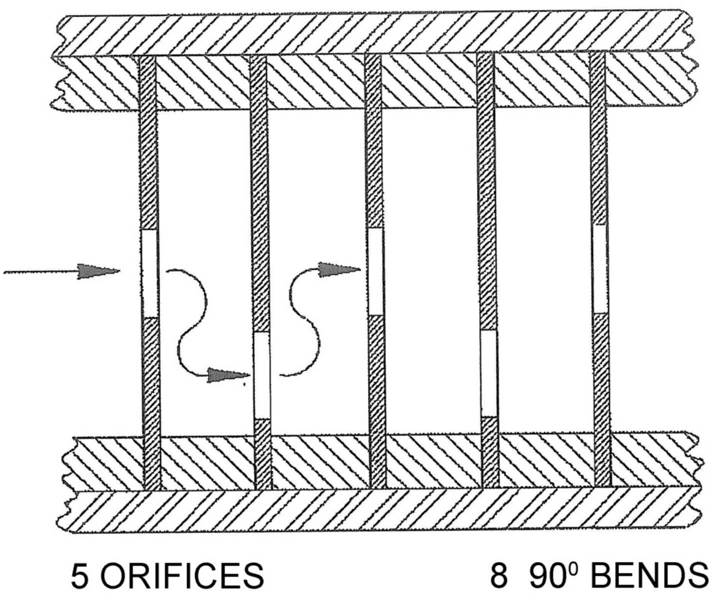
The second stage of the regulator is a diaphragm type. The pin (Figure 2.4, Item 16) is held off the seat (Figure 2.4, Item 13) by the diaphragm (Figure 2.4, Item 31) and the support plate (Figure 2.4, Item 11) under the action of the spring (Figure 2.4, Item 19). As the pressure in the space to the right of the diaphragm increases, the diaphragm and hence the pin moves to the left, sealing off the seat fully at the pre-set outlet pressure.

The outlet pressure is adjusted by varying the tension of the spring (Figure 2.4, Item 19) by slackening the locknut (Figure 2.4, Item 22) and adjusting the grub screw (Figure 2.4, Item 23) until the desired outlet pressure is achieved.

2.3.5 Injection orifice

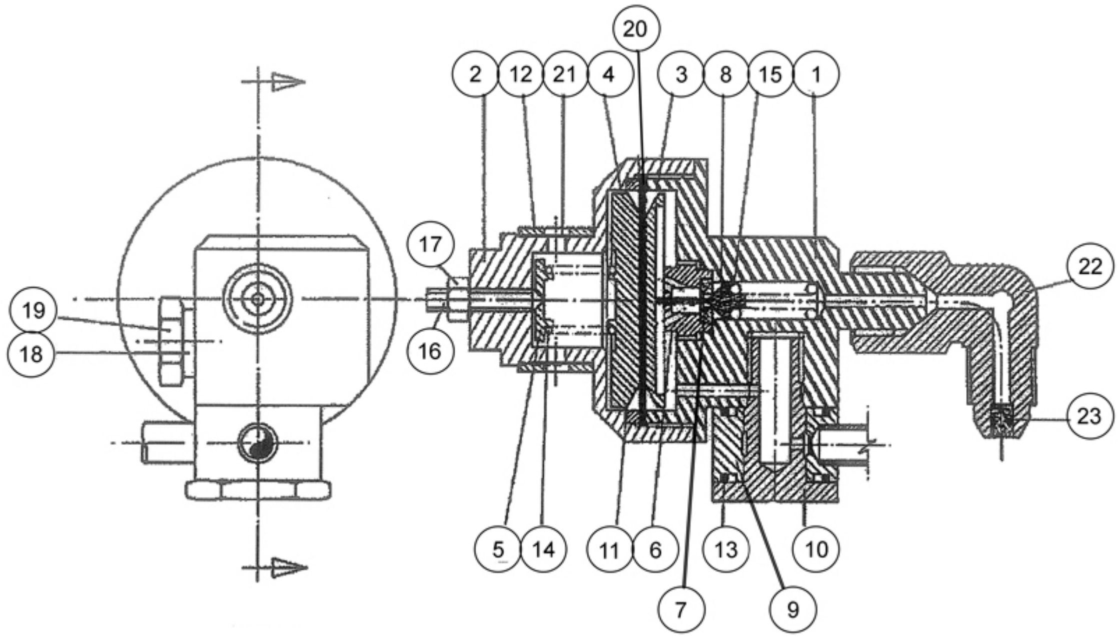
The injection orifice (Figure 4.13, Item 3) is shown in cross-section in Fig 2.6. It contains a group of orifices in series with the flow path making many 90° changes in flow direction. The combined effect is to allow the system to contain much larger holes than there would be for a single orifice with the same resistance. This therefore reduces greatly the chance of blockage.

Figure 2.6 Injection Orifice



2.3.6 Single stage regulator

Figure 2.7 Single Stage Regulator



The function of the single stage regulator is to maintain a positive pressure inside the SLS System while it is in its stand-by mode. Gas is supplied to the regulator from a connection on the Helmet side-block. The regulator is of a diaphragm type (similar to the second stage of the two-stage regulator).

The SLS System is designed to cope with diver upward and downward excursions at a controlled rate not exceeding 22 msw / minute (75 fsw/ minute). The single stage regulator is designed to flow sufficient gas at all operating depths to maintain 138 mbar (2 psi) over ambient pressure within the SLS System.

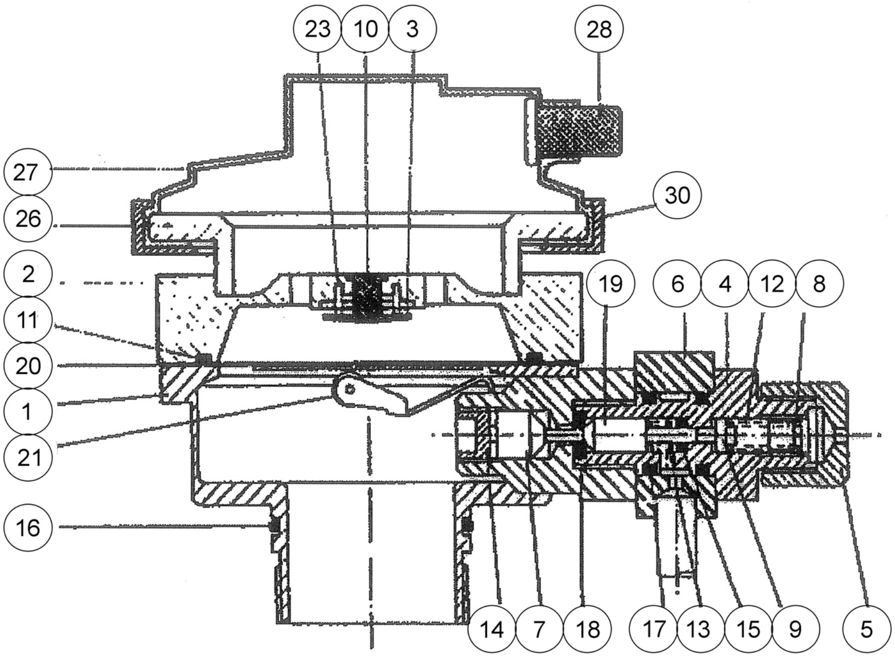
The valve pin (Fig 2.7, Item 8) is held off the valve seat (Fig 2.7, Item 7) by the diaphragm (Fig 2.7, Item 20) and the support plate (Fig 2.7, Item 4), under the action of the spring (Fig 2.7, Item 14). As the pressure in the space to the right of the diaphragm increases the diaphragm and hence the valve pin moves to the left sealing off the valve seat fully at the set outlet pressure.

The outlet pressure is adjusted by varying the spring (Fig 2.7, Item 14) tension by slackening the locknut (Fig 2.7, Item 17) and adjusting the grub screw (Fig 2.7, Item 16) until the desired pressure is reached.

2.3.7 Demand regulator

Fig 2.8 shows a cross-section through the demand regulator. The SLS System's overpressure valve is also incorporated in the demand regulator body but is excluded from this drawing for clarity.

Figure 2.8 Demand Regulator



The purpose of the demand regulator is to supply cylinder gas to the SLS System when inhaling from deflated counterlungs and to compensate in gas volume during any descent whilst the SLS System is activated.

Normally, this regulator will function only during the first inhalation when using the SLS System. To prevent it from passing gas when not required, it is biased such that it will flow gas only when subjected to a negative pressure of 26 to 27 cm WG. The regulator is similar in principle to a conventional demand regulator but differs in that it is designed to function with gas supply pressures ranging up to 300 bar so that it does not require first stage pressure regulation.

Additionally there is an indicator pin fitted to the lid which uses the diaphragm movement to indicate to the diver's attendant that the positive pressure system is functioning whilst in the stand-by mode (this is an additional confirmation to the overpressure indicator).

H.P. gas enters the demand regulator through the banjo fitting (Fig 2.8, Item 6). The valve pin (Fig 2.8, Item 19) is pressure balanced since gas supply pressure acts on the pin at the O-ring (Fig 2.8, Item 15) and (over the same area) at the valve seat (Fig 2.8, Item 18). This means that the regulator supplies gas at the same negative pressure setting over a wide range of gas supply pressures. The valve is normally held closed by means of the spring (Fig 2.8, Item 12). When the pressure difference sensed by the diaphragm (Fig 2.8, Item 20) is sufficiently great for the lever fork (Fig 2.8, Item 21) to overcome the spring (Fig 2.8, Item 12) the lever fork pushes the valve pin allowing gas to flow into the SLS System.

The overpressure valve (Fig 5.11, Item 19 - not shown above) ensures that in the stand-by mode, the internal pressure in the SLS System, never exceeds 172 mbar (2.5 psi). This valve is factory set and should not require adjustment.

The internal pressure within the SLS System will vary between the single stage regulator set pressure of 138 mbar (2 psi) and the overpressure valve set pressure of 172 mbar (2.5 psi) as the diver's ambient pressure changes during upward or downward excursions.

2.3.8 Overpressure Indicator

The overpressure indicator provides a visual indication that positive pressure is maintained in the SLS System whilst it is in stand-by mode. The indicator consists of a red to green colour change 'Rotowink' pressure indicator installed in a robust metal housing. This housing is allowed to flood in order to reference the ambient water pressure. A fine mesh screen, fitted to prevent the ingress of dirt protects the sensitive internal parts.

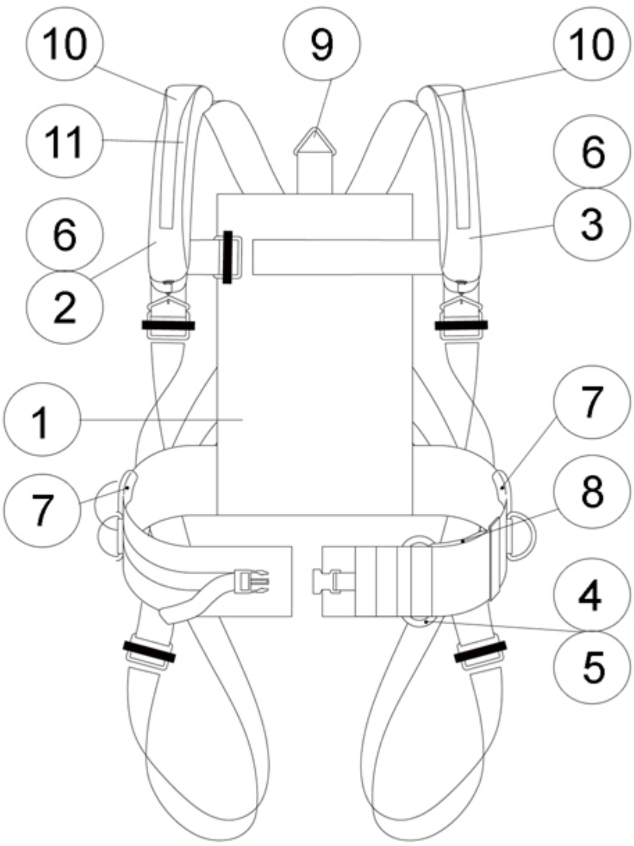
Note ***There are two versions of overpressure indicator in service, denoted Type 1 and Type 2.***

2.4 Harness and Counterlungs

2.4.1 Harness

The backpack housing assembly is attached to the diver's back by a fully adjustable harness, which is shown in Fig 2.9.

Figure 2.9 Harness and Counterlungs (Part No: C2604)



Item	Description	Part No.
1	Harness	C35650
2	Counterlung Enclosure Divers Right	DM46630B
3	Counterlung Enclosure Divers Left	DM36010B

Item	Description	Part No.
4	Actuation Sleeve Assembly	C45540B
5	Actuation Cable Assembly	C2937
6	Counterlung Assembly	CA2607
7	Weight Pocket	D308
8	Handle Retaining Band	D302
9	Rescue Lifting Point	-
10	Cable Wiper Sleeve	D328
11	Bush	D322

The harness is load tested in accordance with BS EN 361 and incorporates a rescue lifting point (Fig 2.9, Item 9).

Note ***The rescue lifting point 'D' ring is has a SWL (safe working load) of 200kg.***

Removable enclosures (Fig 2.9, Items 2 & 3) on each shoulder strap of the harness keep the counterlungs stored flat during normal diving operations. These are made in a strong cordura fabric to prevent damage. To release the counterlungs the diver pulls the actuation cable assembly (Fig 2.9, Item 5). This draws the two actuation cables through a series of Teflon lined loops on the counterlung enclosures allowing them to fall open and the counterlungs to deploy ready for use. The harness also has two optional weight pockets (Fig 2.9, Item 7) to enable the diver to adjust his buoyancy if required.

2.4.2 Counterlungs and Enclosures

The counterlungs are fitted inside fabric enclosures (Fig 2.9, Items 2 & 3) which are laced up, whilst the SLS System is in its stand-by mode, to form a compact protection sleeve over the diver's shoulders. When the actuation handle (Fig 2.10, Item 7) is pulled, the counterlung enclosures open up and permit the counterlungs to deploy.

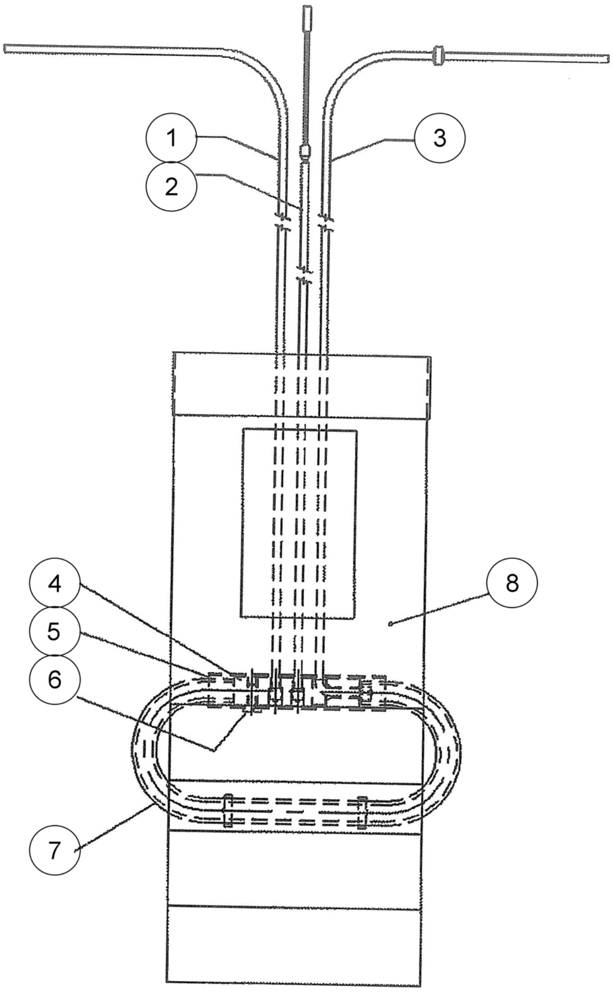
2.4.3 Actuation Cable Assembly

The actuation cable assembly is shown in Fig 2.10. Pulling this cable is one of the actions required to transfer the SLS System from its stand-by to operational mode. The actuation cable is pulled out completely when the system is required. This action switches on the two stage regulator to start the gas bleed and deploys the counterlungs.

The actuation sleeves, which run inside the harness, form an armoured protection sheath for the actuation cables. These are routed from the harness waistband to the counterlungs and the two stage regulator. Cable wiper sleeves (Fig 2.9, Item 10) are fitted at the counterlung ends of these sleeves.

Note ***These are an important feature and are fitted to protect the cables and sleeves from damage or grit ingress, as this could compromise the actuation of the SLS System.***

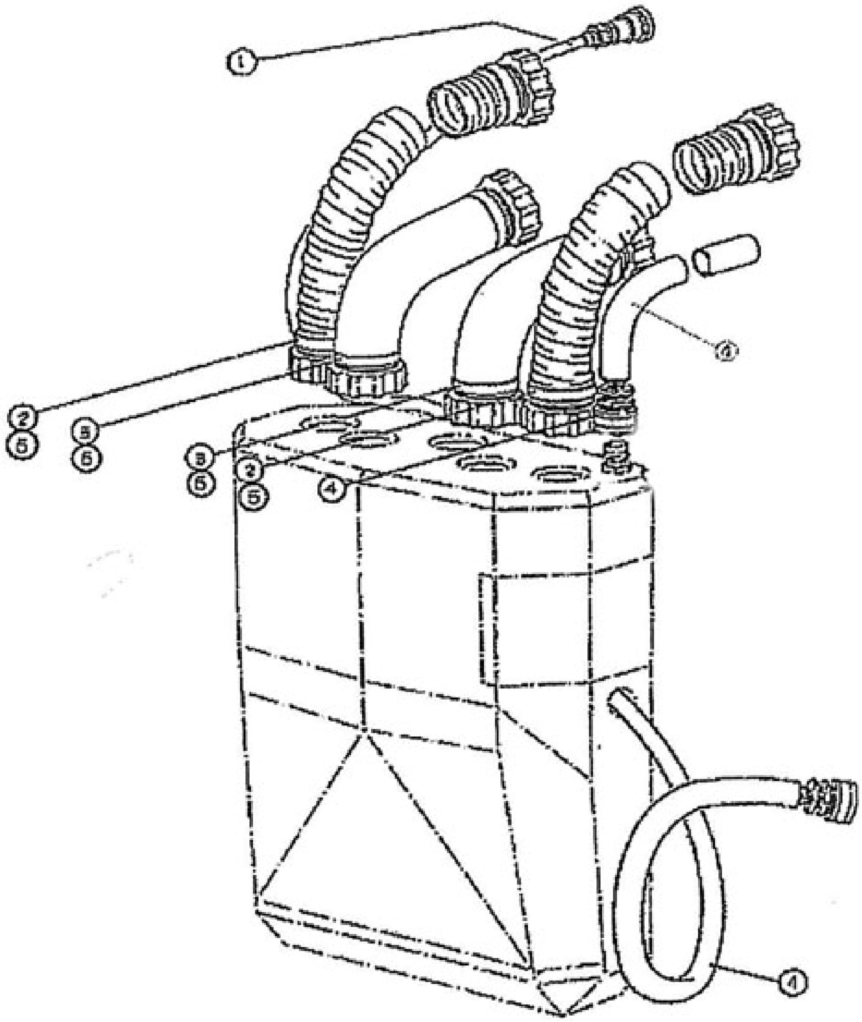
Figure 2.10 Actuation Cable Assembly (Part No: C2937)



Item	Description	Part No
1	Counterlung Cable Assy, Short	DM3572
2	Regulator Actuation Cable Assy	DM3571
3	Counterlung Cable Assy, Long	DM3573
4	Actuation Handle Cable Holder	D3273
5	Actuation Handle Sleeve	D3274
6	Screw	FB312
7	Actuation Handle	DM3574
8	Handle Retention Strap	D34901

2.5 Hose Connections and Interfaces

Figure 2.11 Hose Connections and Interfaces



1	**Single Stage Regulator Hose**	**D2751**
2	Inhale / Exhale Hoses	C28700
3	Counterlung Hose (each)	C3253A
4	Hot Water Shroud Hose Kit	CB156
5	O-Ring	RN028-7

2.5.1 Inhale / Exhale Hoses

The outer hose ducts on top of the SLS System Backpack are connected to the Helmet by two large bore, fabric reinforced hoses (Fig 2.11, Item 2). These are fitted with threaded (O-ring type) connectors at each end. A second pair of shorter hoses (Fig 2.11, Item 3) connect the inner hose ducts to the counterlungs, mounted one on each of the diver’s shoulders.

A small stainless steel braided hose (Fig 2.11, Item 1) provides the supply of umbilical gas for the SLS System single stage regulator. It runs between the Helmet side-block supply fitting and the single stage regulator inside the Backpack. It is equipped with a quick-connect fitting in the middle of the hose to facilitate diver dressing and undressing.

2.5.2 Hot Water System

Addition of a simple splitter block to the diver’s umbilical hot water hose allows a small flow of water to be diverted into the SLS System Backpack, via the quick-connect hose assembly (Fig 2.11, Item 4). This water keeps the CO_2 scrubber canister warm, ready to start work if required. After passing through the Backpack, the water can then be connected to a DSI shroud heater for primary gas heating. The connection for this is via a quick connect located on the top of the Backpack (Fig 2.11, Item 4).

The diver’s Helmet demand regulator will normally require a shroud heater when diving deeper than around 200 msw. A hot water supply to the SLS System Backpack is required at all diving depths.

Two splitter blocks are available for use with the SLS System:

1. Divex Part No. D2665 is the standard splitter used for operations between 50 and 450 msw, with or without the helmet demand regulator heating shroud.

2. Divex Part No. D2664 is used for extreme deep diving operations (>450 msw).

Note ***Prior to June 2004 Splitter block assy, D2665 covered the depth range 50-200msw while D2664 was specified for operational depths of 200 to 450 msw.***

The requirements for the supply of hot water will vary, dependant on diving depth. Higher flows and temperatures will be required at deeper depths. As a general rule a hot water flow should be provided per diver, of a flow between 10 and 30 lpm. Users should check with their Safety Department to obtain the specific requirements.

Extensive testing of the SLS System has been carried out at various diving research centres, including NUTEC in Bergen, the National Hyperbaric Centre in Aberdeen and the US Navy Experimental Diving Unit in Panama City. The recommendations for the use of hot water have been based on these results.

When diving in Norwegian waters, SINTEF UNIMED conducted a study (Report No. STF23 A92012) on the design requirements for Diving Bells. This report requires that a flow of hot water of 30 l/min per diver should be available from a diving bell. The SLS System formed a part of this study and these flows took into account SLS System hot water requirements.

Some Divers have complained of feeling cold when using the SLS system and therefore disconnect the SLS Backpack.

However the SLS does not 'use' any water - it is merely diverted through the backpack and back to the helmet. Once the thermal regenerator has warmed up, there is virtually no heat requirement and the unit therefore does not detract from the heat supplied to the diver.

The two hot water systems utilised for diver heating are:

2.5.2.1 Primary Gas Heating (Ultrajewel 601)

The diver’s primary gas heating system utilises the DSI Heating Shroud Kit. This flows hot water over the Helmet side-block assembly, the bent tube assembly and the Ultraflow 601 regulator body. The supply of hot water is taken via a splitter block and requires a flow of 2 to 6 lpm of hot water (taken from the suit supply of 10 to 30 lpm). The Divex splitter block automatically provides sufficient flow to the diver’s suit and the hot water shroud (assuming sufficient hot water is supplied from the vessel supply - NPD requirements state '30 lpm shall be provided at the diver’s hot water connection').

2.5.2.2 CO_2 Scrubber Heating (SLS Mk IV)

The flow from the splitter block to the primary gas heater shroud is first passed through an outer annulus surrounding SLS System’s CO_2 scrubber canister. No additional hot water is required for the SLS System. With the CO_2 scrubber pre-heated, the carbon dioxide absorption will start immediately upon system actuation. The exothermic reaction of sodalime will then generate sufficient heat to maintain the gas temperature with the diver’s hot water supply cut off. This is one of the main benefits of using the SLS System. Even with the diver’s hot water supply cut off, warm gas is still provided, helping to maintain his core body temperature.

Chapter 3 - Operating Information

Contents

Title **page**

3.1 Preparation For Use

3.1.1 Gas bottle charging

Note ***It is essential that the gas cylinders be completely empty before filling and that the correct gas mix is used for the diving depth. Failure to do this could result in an extreme hazard to the diver.***

The following table provides the limits of the gas mixtures, which should be used within the cylinders of the SLS System at various diving depths. See the example overleaf for an explanation of its use.

Table 3.1 SLS System Gas Mixtures Versus Diving Depth

Diver Excursion Depth (MSW)	Minimum Heliox O_2 %	Maximum Heliox O_2 %
0	67	100
5	46	100
10	39	99
20	28.5	69
30	23.5	52
40	20	42
50	17.8	35.5
60	15.7	31
70	14.4	27
80	13.4	24
90	12.4	21.9
100	11.6	20
110	11.0	18.4
120	10.5	17.0
130	10.2	15.9
140	9.8	15.0
150	9.5	14.0
160	9.1	13.2
170	8.8	12.5
180	8.4	11.9
190	8.2	11.4
200	8.0	11.0
210	7.8	10.4
220	7.6	10.0
230	7.3	9.7
240	7.1	9.3
250	6.9	8.9
260	6.8	8.7
270	6.65	8.4
280	6.5	8.15
290	6.4	8.0
300	6.2	7.7
310	6.1	7.5
320	6.0	7.3
330	5.8	7.1
340	5.75	6.9
350	5.6	6.8
360	5.55	6.6
370	5.4	6.4
380	5.3	6.3
390	5.2	6.15
400	5.1	6.0
410	5.0	5.9
420	4.95	5.8
430	4.9	5.7
440	4.8	5.6
450	4.7	5.5
460	4.65	5.4
470	4.6	5.3
480	4.5	5.2
490	4.4	5.1
500	4.4	5.1

DANGER

DO NOT UNDER ANY CIRCUMSTANCES CHARGE THE SLS SYSTEM WITH AIR FOR DIVING PURPOSES. IF YOU DO NOT COMPREHEND THE REASON FOR THIS, YOU SHOULD NOT ATTEMPT TO USE THE SLS SYSTEM.

3.1.1.1 Example

Use of Table 3.1: SLS System gas mixtures versus diving depth.

1 A saturation dive is to be conducted at a working depth from 195 to 205 msw.

2 The divers will be living in Saturation at a depth of 190 msw.

3 The bell will normally be launched to a depth of around 190 msw.

4 Divers will be required to excurt down to the job site.

5 Check the heliox mix required for the proposed working depth.

From Table 3.1.

6 At 190 msw a heliox mix containing between 8.2 and 11.4% oxygen should be used within the SLS System.

7 If a 9.70% heliox mix is available on board the vessel.

8 Check that this heliox mix will be acceptable for the complete working depth range (including a safety factor to allow excursions outside the basic depth range).

From Table 3.1.

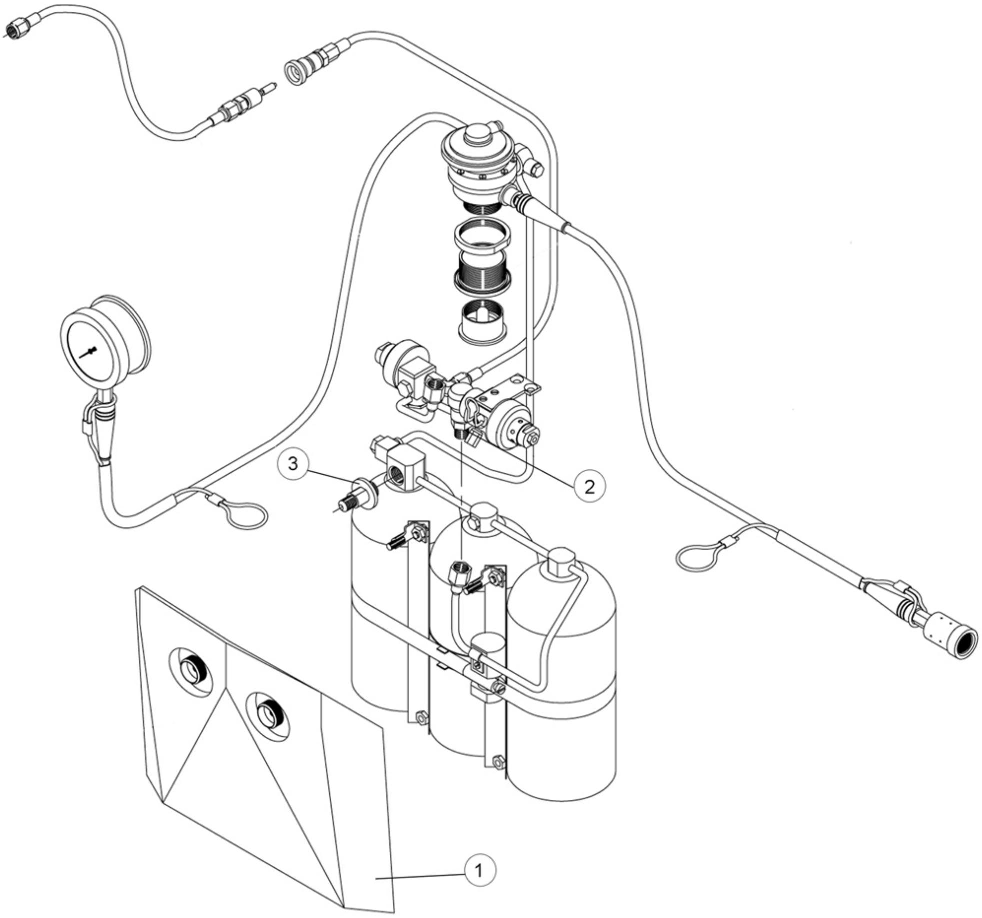
9 This mix will allow the diver a maximum downward excursion to 230 msw.

10 This mix will allow the diver a maximum upward excursion to 143 msw.

11 Both these depths are well beyond the proposed working depth range.

12 The proposed mix is therefore acceptable.

Figure 3.1 Gas Bottle Charging



Note ***The SLS System cylinders should not be charged whilst they are inside a dive system.***

1 Remove the SLS System backpack cover (Fig 3.1, Item 1).

2 Ensure that the spool valve (Fig 3.1, Item 2) is set in the stand-by position and the actuation cable bullet is visible (if the actuation cable is installed).

3 Identify the charging fitting (Fig 3.1, Item 3) on the left hand bottle end fitting (the fitting's thread is No.4JIC).

4 Remove the blanking cap from the fitting.

5 Connect securely to a gas supply, the mixture corresponding to Fig 3.1.

WARNING

MAXIMUM ALLOWABLE CHARGING PRESSURE WITH 100% OXYGEN IS 70 BAR.

6 Charge the SLS System to the required charging pressure (see Table 3.2 for details). Slowly pressurise the gas cylinders. Ensure, using torch, that an excessive temperature rise does not occur within the cylinders during this operation. If the cylinders become too warm to touch, stop charging and leave the cylinders to cool before continuing.

Notes 1 The use of a Divex portable booster skid (Divex Part No. DM1480) is recommended to assist in charging if the required cylinder charging pressure is greater than that available from storage.

2 When charging the SLS System using enriched oxygen mixes (mixes containing greater than 21% oxygen), the gas booster should not be required. These gases should be decanted directly into the SLS System. The required charging pressures are given on the Table 3.2.

3 After carrying out shallow training dives with the SLS System, care must be taken to ensure that the O2 rich mixture used is fully vented from the SLS System before recharging with the correct gas mix for the proposed working depth. After completion of training dives, the cylinders should be vented, then charged then vented again and then recharged to ensure the gas mix for the working depth has not been compromised.

7 Vent the charging whip and disconnect.

8 Replace the blanking cap on the charging point.

Table 3.2 Gas Cylinder Charging Pressures

Depth	Charging Pressure	Duration
50 msw	300 bar (max)	30 mins*
50 msw	175 bar	30 mins
50 msw	100 bar (min)	17 mins
100 msw	300 bar (max)	30 mins*
100 msw	250 bar	30 mins
100 msw	100 bar (min)	12 mins
150 msw	300 bar (max)	28 mins
150 msw	150 bar (min)	14 mins
200 msw	300 bar (max)	22 mins
200 msw	150 bar (min)	10 mins
250 msw	300 bar (max)	19.5 mins
250 msw	200 bar (min)	12.5 mins
300 msw	300 bar (max)	17.5 mins
300 msw	200 bar (min)	11 mins
350 msw	300 bar (max)	16 mins
350 msw	200 bar (min)	10 mins
400 msw	300 bar (max)	13.5 mins
400 msw	250 bar (min)	11 mins

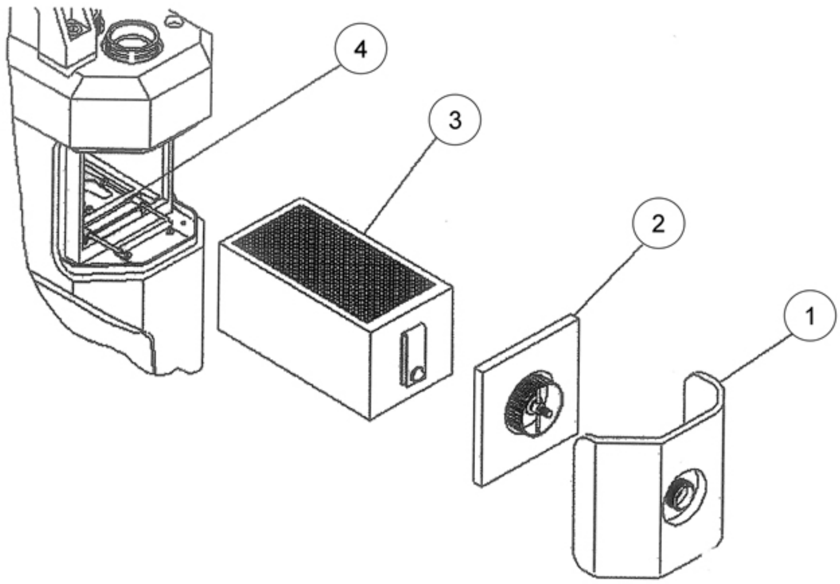
* Duration limited by CO_2 scrubber canister duration.

3.1.2 CO2 scrubber canister replacement

It is recommended that CO2 scrubber canisters are replaced with a freshly refilled canister every 24 hours even if the system has not been actuated. This is because of the possible aggregation (sticking together) of the sodalime granules within the moist bell environment. The sodalime should always be changed after any SLS System actuation.

The scrubber canister should be replaced using the following procedure:

Figure 3.2 Scrubber Canister Replacement



1 Remove the outer door (Fig 3.2, Item 1) by unscrewing its knurled knob.

2 Remove the scrubber door (Fig 3.2, Item 2) by unscrewing its knurled knob and rotating the tommy bar to the position indicated on the door.

3 Pull the handle of the scrubber lift mechanism (Fig 3.2, Item 4) sharply outwards and allow the scrubber canister to drop down.

4 Grasp the red retrieval tab and withdraw the scrubber canister (Fig 3.2, Item 3).

5 Insert a freshly charged scrubber canister into the scrubber housing.

6 Push the scrubber lift mechanism (Fig 3.2, Item 4) inwards until it locks over-centre.

7 Replace the scrubber door (Fig 3.2, Item 2) as follows:

8 With the tommy bar canted over to one side, the scrubber door should be installed into the scrubber housing.

9 The tommy bar should then be rotated into the vertical position.

10 There is a mark (indicated by white paint) on the inside rim of the handwheel.

11 This paint should be aligned with the white side of the tommy bar in when the handwheel is tightened to the correct torque.

12 The handwheel should now be tightened to the position indicated.

13 Replace the outer door by installing it in position and engaging the knurled knob.

Notes 1 Always ensure the CO2 scrubber canister is correctly installed prior to diving.

2 Ensure that the scrubber door is not over-tightened (see section 4.5.1, page 78).

3 Do not pressurise or de-pressurise the scrubber canister too rapidly during transfer in and out of the equipment lock or medi-lock, otherwise damage may occur.

4 Do not fit the CO2 scrubber canister inside a plastic bag or other sealed containers before locking it into the complex as the pressurisation will destroy the canister wire mesh during compression if the bag is sealed.

3.1.3 CO2 scrubber canister filling

Notes 1 The SLS System's CO2 canister endurance at 400 msw is demonstrated in Fig 1.11. All experimental testing during the SLS System's development was conducted using 797 grade sodalime (self indicating), Divex Order Code: CM007. The system has been specifically designed to use this high efficiency product. Use of alternatives could seriously compromise the system's performance.

2 Care should be taken at all times to avoid getting the CO2 scrubber canister wet.

1 Remove the scrubber canister from the SLS System (section 3.1.2).

2 Remove the screw cap, the foam pad and the cap gasket.

3 Half fill the canister with sodalime.

4 Snake and tap the canister until the sodalime settles.

5 Completely fill the canister with sodalime to the top of the neck.

6 Fit the foam pad and the screw cap and invert the canister to settle the sodalime.

7 Remove the screw cap and foam pad.

8 Repeat steps 5., 6. and 7.

9 Top up the sodalime to halfway up the neck.

10 Repeat sets 5. and 6. until the canister is full.

11 Fit the cap gasket making sure that the blade is horizontal (to align with the canister rib) insert the foam pad and do up the screw cap.

3.2 Pre-dive Procedures (Bell Checks)

1. With personnel in the bell, ensure that the actuation cable is in place, the counterlungs are properly packed and that the spoon valve is in the stand-by position with the cable bullet visible.

2. Ensure that the gas cylinders are charged with the correct gas mix for the dive depth (see section 3.1.1 for details).

3. Ensure that the gas cylinders are charged to the correct minimum pressure for the diving depth (see Table 3.2 for details).

4. Remove the outer side door and the CO_2 scrubber door.

5. Remove the CO_2 scrubber canister and check that the inside of the SLS System is dry.

6. Check the CO_2 scrubber canister serial number with the Dive Supervisor.

7. If all is ok, replace the scrubber canister. If wet, replace the CO_2 scrubber canister with a spare.

Note ***Canisters should be routinely replaced with a refilled canister after 24 hours in the SLS System.***

8. Replace the CO_2 scrubber door, ensuring that it is correctly sealed. Replace the outer side door.

9. Ensure that the SLS System mouthpiece is stowed correctly within the helmet interface.

10. Check that gauge and overpressure indicator hose lanyards are secured to harness (see Fig 3.3 for details)

11. Ensure that gas is available at the helmet primary demand regulator then don the backpack and helmet.

12. Connect the inhale / exhale hoses on the backpack to the helmet.

13. Connect the single stage regulator hose to the helmet side-block quick-connect.

14. Check that the overpressure indicator is indicating green.

Note ***Do not dive the SLS System if the overpressure indicator remains red.***

15. Connect the SLS System hot water supply hose to the splitter block just prior to the diver leaving the bell.

16. Connect the gas heating hose from the SLS System to the shroud if diving at depths in excess of 200 msw or if required by conditions.

17. The diver should now be ready to leave the bell.

Figure 3.3 Hose Lanyards

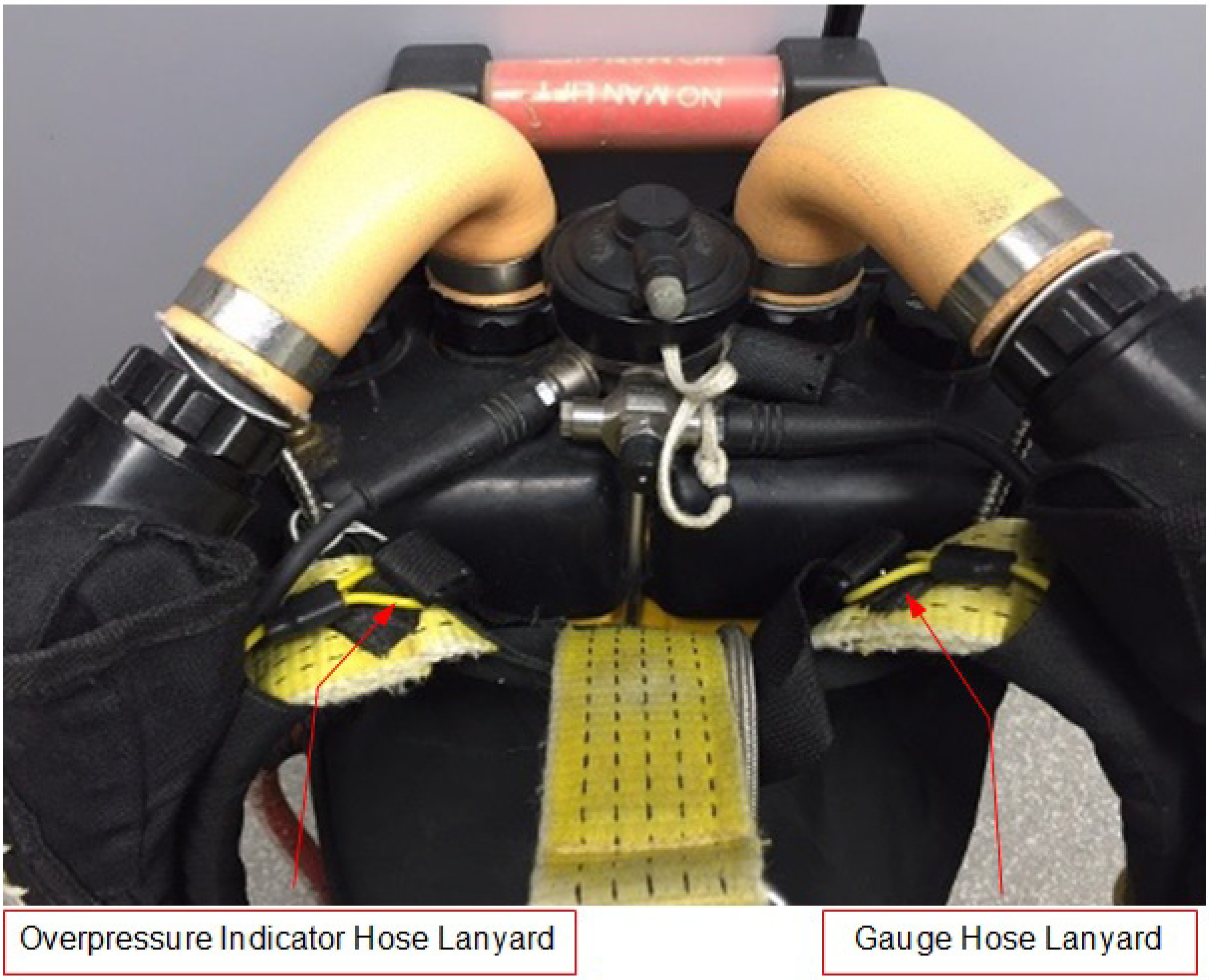
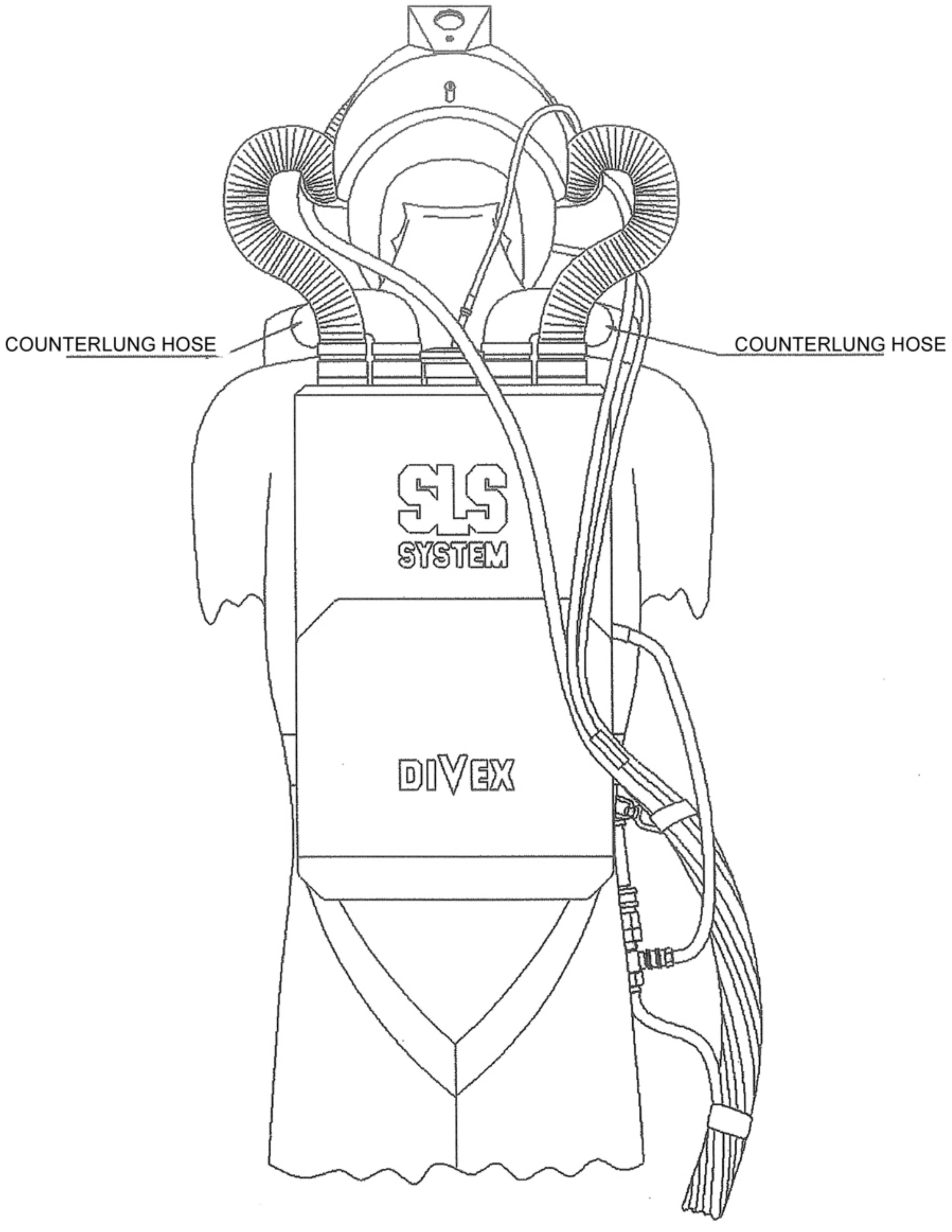


Figure 3.4 SLS System Mk IV - Rear View



DIVER REAR VIEW

Figure 3.5 SLS System Mk IV - Front View

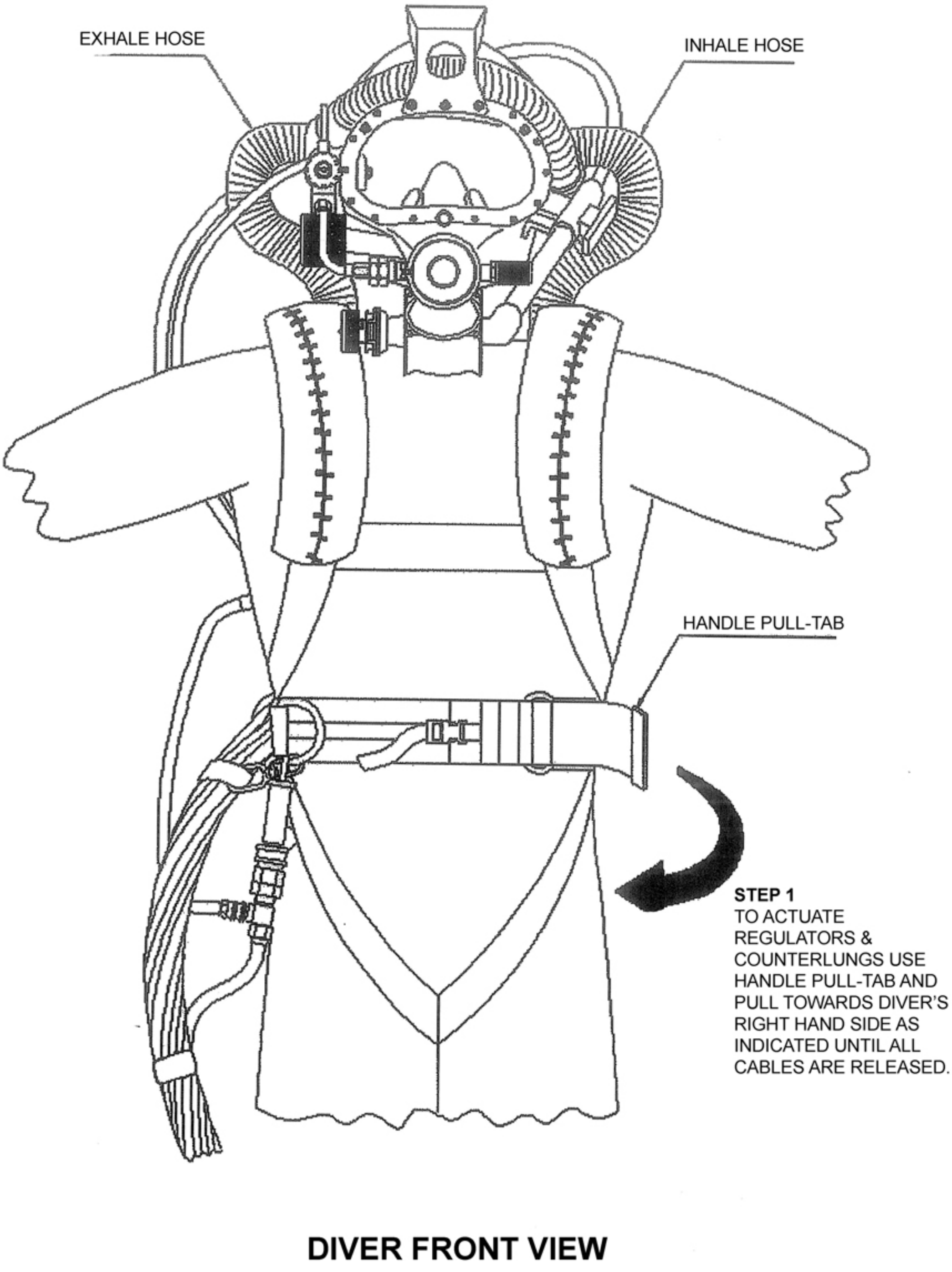
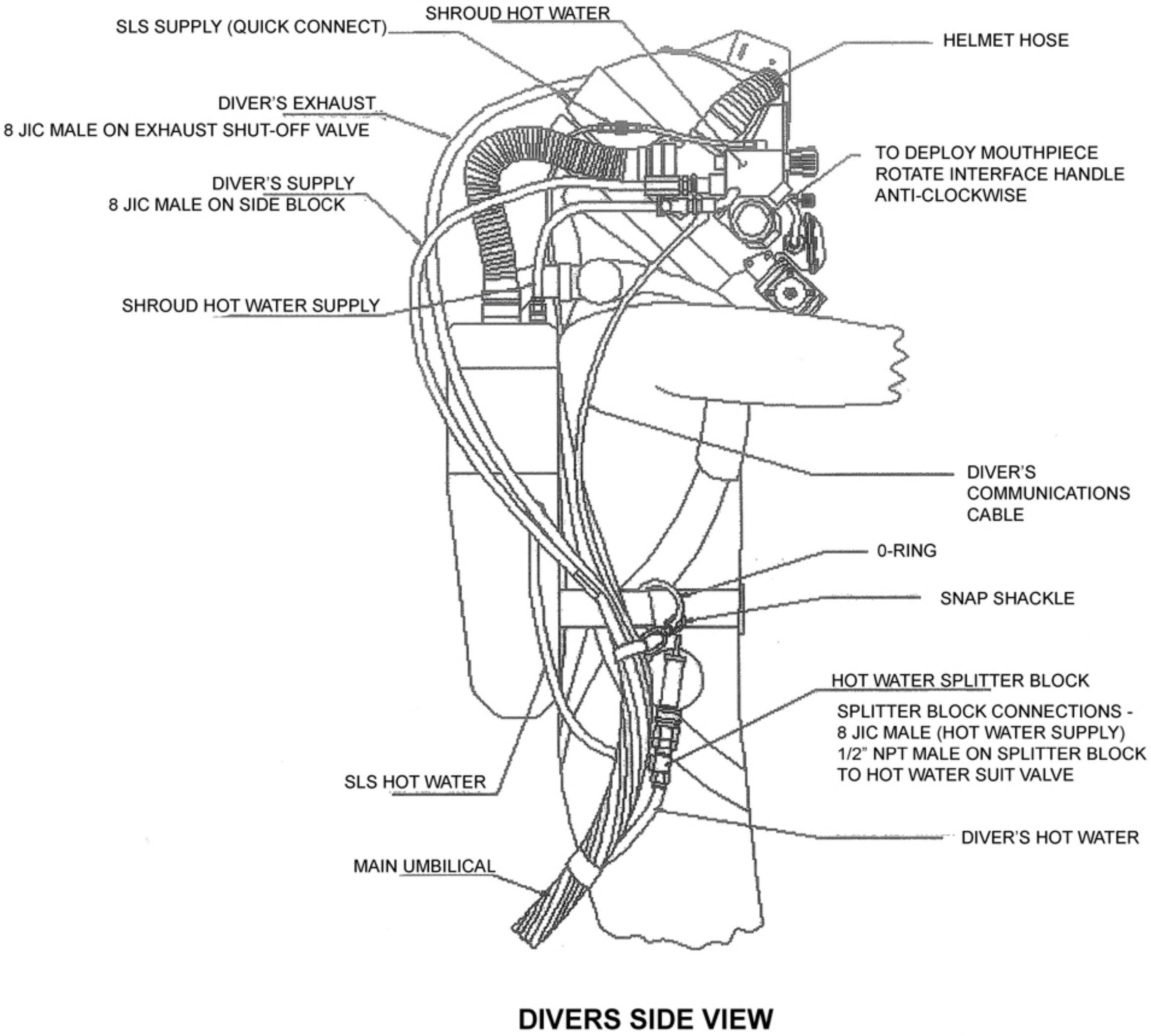


Figure 3.6 SLS System Mk IV - Side View



3.3 Operational Procedures

3.3.1 Actuation

The SLS System Mk IV is shown in Fig 3.4, Fig 3.5 and Fig 3.6. It is shown 'as rigged' for operational use, and may be actuated in the event of:

1 Loss of primary gas supply.

2 Contamination or other problem with the primary gas supply.

3 Loss of primary gas heating.

4 Incorrect gas mix connected to primary gas supply.

5 Loss of helmet integrity, e.g. flooding.

6 Other situations requiring that the diver resort to his bailout procedure.

The SLS System is actuated by the following actions:

1 Rotate the interface handle on the helmet and grasp the mouthpiece in the mouth.

2 Pull the actuation handle on the backpack harness.

Note ***If the actuation handle is not pulled the diver will run out of breathing gas as the system has now become open circuit.***

Following actuation, the diver should breathe normally through the mouthpiece. He should avoid breathing through his nose. The nose block device in the helmet may be helpful for this purpose.

The first inhalation by the diver on the SLS System may require a little effort in order to activate the demand regulator (biased 26 cm WG negative). However, once the counterlungs have filled, breathing resistance is slight.

The sound of the exhaust valve (a distinctive ‘chip’) should be heard frequently, at the end of exhalation. This confirms that bleed of make up gas is on line to the SLS system from the gas cylinders.

Note ***This may take a couple of minutes to first occur following actuation.***

3.3.2 Equipment Lock Transfer Procedures

The SLS System backpack must be disconnected from the helmet prior to locking the system in or out of a chamber complex or prior to compression / de-compression of a diving bell / chamber with the SLS System inside. Disconnection must be carried out to prevent external compression which could result in damage to the SLS System.

Gas cylinders should be charged prior to compression of the backpack to prevent the possibility that external pressure could be applied to the cylinders and pipework. This could cause damage to the o-rings.

Note ***Always use the supplied hose connector protection caps (Divex part no: D311) when moving the helmet or backpack. These should be kept in pairs on a lanyard in the bell.***

Do not rapidly pressures or de-pressurise the SLS system in equipment-locks or medi-lock. This will permit gas spaces and voids to equalise safety and not damage the equipment.

3.3.3 Compression (Lock in) Procedure for the CO_2 Scrubber Canister

1 Place the refilled CO2 scrubber canister into the equipment lock and compress it.

2 Once inside, place the CO2 scrubber canister into a plastic bag for storage prior to use. This will keep the sodalime dry.

3 Care must be taken to ensure spare canisters are kept dry at all times.

Note ***Do not fit the CO2 scrubber canister inside a plastic bag or other sealed containers before locking it into the complex as the pressurisation will destroy the canister wire mesh during compression if the bag is sealed.***

3.4 Post-dive Procedures

3.4.1 Post-dive Check List (Normal Operations)

1 Check the SLS System contents gauge. Recharge the cylinders if any loss of gas is indicated. Check also against Table 1.1, page 12 or Table 3.2 or SLS System duration at working depths to ascertain if charging is required.

Note ***The backpack must be removed from the dive complex in order to recharge the cylinders.***

2 Remove the outer side door.

3 Remove the inner door and extract the CO2 scrubber canister (section 3.1.2). Check for the presence of moisture.

4 Replace the CO2 scrubber canister if the sodalime is damp or if the SLS System has been actuated and used. The scrubber canister must be replaced or refilled after 24 hours in the SLS System (section 3.1.3).

5 Replace the CO2 scrubber canister into the backpack (section 3.1.2).

6 Replace and secure the outer door.

7 Check the packaging of the counterlungs and wash the actuation cable assembly, counterlung enclosures and cable sleeves with fresh water as necessary.

8 Stow the SLS System ready for the next dive.

3.4.2 Post-dive Check List (After SLS System Activation)

1 Remove the SLS System backpack from the dive complex.

2 If necessary, fully discharge the gas cylinders (section 3.4.3).

3 Remove the outer side door.

4 Remove the CO2 scrubber door and extract the CO2 scrubber canister (section 3.1.2). Check inside for water.

5 Remove the CO2 scrubber lift mechanism by pressing down on the centre and sliding it towards the door opening to release it from the locating feature in the penetrators.

6 Remove the sponge pad (Fig 3.7, Item 5) and rinse with freshwater. Squeeze out any surplus water before installation. If the sponge material is too dry, it is very slow to absorb water.

7 Remove the thermal regenerator (Fig 3.7, Item 1) by releasing the wing nut.

8 Clean the gas space above the thermal regenerator.

9 Remove the counterlungs and the counterlung hoses from the backpack. Wash everything in warm, soapy water, then rinse and allow to dry.

10 Re-install the thermal regenerator (Fig 3.7, Item 1) and secure it in place with the wing nut.

11 Replace the counterlungs and their hoses.

12 Re-install the sponge pad (Fig 3.7, Item 5) and scrubber lift mechanism.

13 Reload the actuation cable assembly (section 3.4.4).

14 Recharge the cylinders with the appropriate heliox gas mix for the diving depth (section 3.1.1).

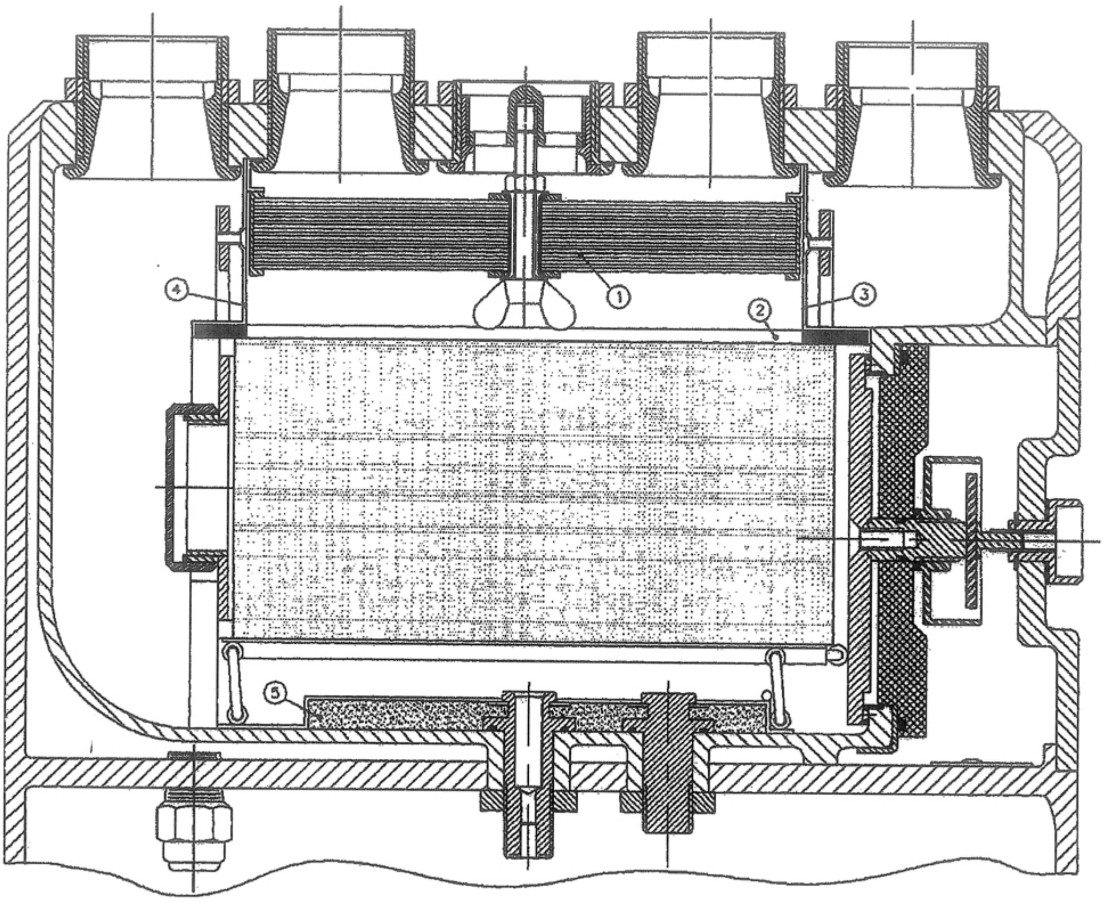
15 Install a refilled scrubber canister and check the door seal (section 3.1.2 and section 3.1.3).

16 Replace and secure the outer door.

17 The backpack is now ready for further use.

3.4.3 Thermal Regenerator Removal

Figure 3.7 Thermal Regenerator



Item	Description	Part No
1	Thermal Regenerator	D2498C
2	Gasket	D2477C
3	RH Regenerator Housing	D2474E

Item	Description	Part No
4	LH Regenerator Housing	D2473D
5	Absorbent Sponge Pad	D300

3.4.4 Discharging the gas cylinders

Prior to filling the gas cylinders with a new mix or performing regulator or bottle maintenance, discharge the gas cylinders as follows:

1 Actuate the SLS System by pulling the rip cord to discharge the gas cylinders.

The time required to complete this task maybe reduced by pressing down onto the demand valve diaphragm with the demand valve activating tool (Divex part no: M2922) from the Tool and Test Kit.

Note ***The gas mix within the cylinders is not breathable at atmospheric pressure therefore venting must be carried out in a well-ventilated area to avoid hazards.***

2 Leave the SLS System for at least 5 minutes until the last of the gas is vented. Check that the contents gauge reads ‘zero’ before disconnecting pipework for maintenance.

3.4.5 Reloading the Actuation Cable Assembly

After actuation of the SLS System, the actuation cable assembly will require reloading. Reload the actuation cable assembly as follows.

1 Ensure that the spool valve is in the actuated position before attempting to reload the Actuation Cable (section 3.4.5).

2 Push the ‘long’ counterlung cable back into the actuation handle until it reaches the stop.

3 Enter all three actuation cables into the cable sleeve at the entry point on the harness waistband.

Note ***Ensure that the individual cables are not crossed, i.e. arrange for the handle to lie naturally against the block at the entry point to the cable sleeve.***

4 Push the cables fully home until the handle is against the block on the cable sleeve, thereafter, press the Velcro pads on the harness together to retain the handle.

5 Reset the spool valve on the two stage regulator (section 3.4.5).

6 Repack the counterlungs using the two actuation cable tails protruding from the actuation sleeve, by lacing the cable through Teflon bushes from left to right (in an alternate manner, starting with the Teflon bush closest to the cable wiper) then pull the cable tight until the Teflon bushes naturally interface and align.

7 Check that the actuation bullet is visible at the end of the regulator spool valve then reset the spool.

Notes 1 ***When this is being carried out, the internal cover flap should be arranged in position and the tongue at the lower end of the enclosure should be folded in place as the lacing up is finalised.***

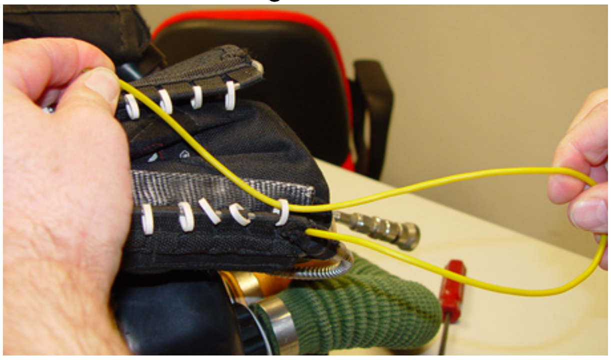
2 The flap and tongue provide protection for the counterlungs against abrasion.

8 Finally push the tongue of the counterlung pouch material up inside the pouch to protect the bottom end of the counterlungs.

3.4.6 Counterlungs Lacing Procedure

1 Thread the actuation cable through the first white sheathing loop.

Figure 3.8



2 Continue threading the actuation cable through the sheathing loops proceeding down the cover.

Figure 3.9

3 At two to three inches (50 to 75 mm) from the end of the sheathing, fold in the bottom protection flap.

Figure 3.10

4 Continue lacing the sheathing until all the loops are laced.

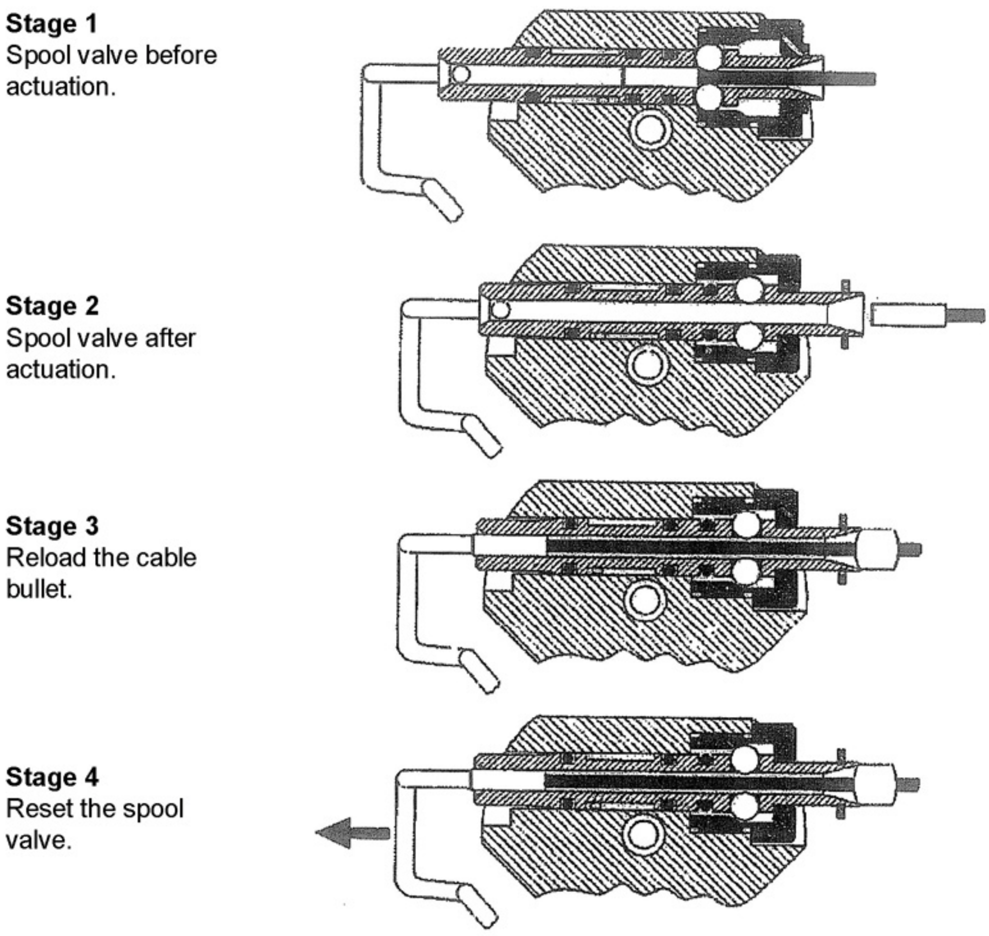
Figure 3.11

3.4.7 Reloading the Spool Valve

1. Actuate spool valve by pushing on the pull ring (Fig 3.9, stages 1 and 2).

2. Re-thread the actuation cable into the armoured sheathing (Fig 3.9, stage 2).

Figure 3.12 Reloading the Spool Valve



Note ***A second bullet located further along the cable limits the travel and prevents the cable from projecting beyond the spool valve.***

3. Ensure end of the bullet on the cable can be seen through the hole in the end of the spool (Fig 3.9, stage 3).

4. Pull the spool to the stand-by position (Fig 3.9, stage 4).

Chapter 4 - Maintenance Instructions

Contents

Title **page**

4.1 Storage

Do not store under positive pressure, leave inner side door lightly closed.

On removal from storage carry out the following checks:

1 Check spool valve actuation (See section 4.4.3 for details).

2 Scrubber door torque setting (See section 4.9.1 for details).

4.2 Maintenance Schedules

4.2.1 Weekly Maintenance Schedule

1 Clean (See section 4.4.1 for details).

2 Visual Inspection (See section 4.4.2 for details).

3 Check spool valve actuation (See section 4.4.3 for details).

4 Check gas flow from single stage regulator (See section 4.4.4 for details).

5 Scrubber door torque setting (See section 4.9.1 for details).

4.2.2 Monthly Maintenance Schedule

Note These checks must be carried out outwith the Dive system.

1 Perform weekly maintenance (see above).

2 Check scrubber door operation and sealing (See section 4.5.2 for details).

3 Check scrubber canister seal (See section 4.5.3 for details).

4 Check operation of two stage regulator (See section 4.5.4 for details).

5 Check operation of single stage regulator (See section 4.5.5 for details).

6 Check operation of demand regulator (See section 4.5.6 for details).

7 Replace actuation cable wiper sleeves (See section 4.5.7 for details).

8 Strip & Service the overpressure indicator (See section 4.5.8 for details).

9 Perform leak test (See section 4.5.9 for details).

4.2.3 Six Monthly Maintenance Schedule

1 Perform monthly maintenance (see above).

2 Visual internal inspection of gas cylinders (See section 4.6.2 for details).

4.2.4 Annual Maintenance Schedule

1. Visual inspection and testing of gas cylinders and HP pipework (See section 4.7.1 for details).
2. Strip down and service of two stage regulator (See section 4.7.2 for details).
3. Strip down and service of single stage regulator (See section 4.7.3 for details).
4. Strip down and service of demand regulator (See section 4.7.4 for details).
5. Perform six monthly maintenance (see above).

4.3 Preventative Maintenance Procedures

Non-conformance with any of the following procedures should be fully investigated (See section 4.8 of this Manual for guidance on fault finding).

4.4 Weekly Maintenance Procedures

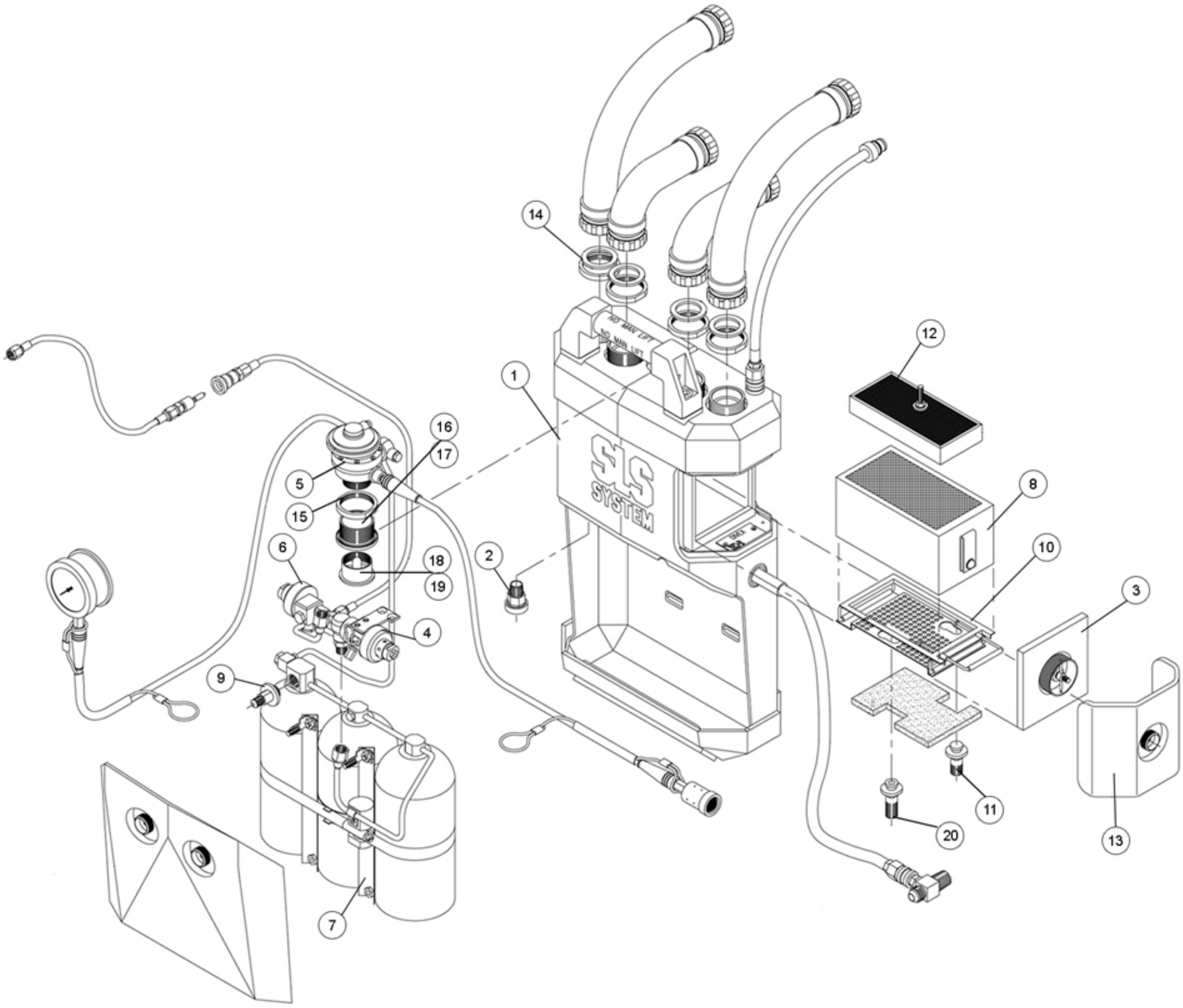
4.4.1 Cleaning

1. Wash the actuation cable assembly, counterlung enclosures and cable sleeves with fresh water to remove any build up of grit or silt etc.
2. Immerse the overpressure indicator in a cup of warm freshwater for a time to dissolve any build up of salt crystals.

4.4.2 Visual inspection

1. Inspect the main housing, shown in Figure 4.1, for damage or wear. Replace any damaged or worn components as necessary.
2. Inspect the hoses for damage or wear, and replace any damaged or worn components as necessary.
3. Inspect the harness and counterlungs, shown in Figure 4.2, for damage or wear. Replace any damaged or worn components as necessary.

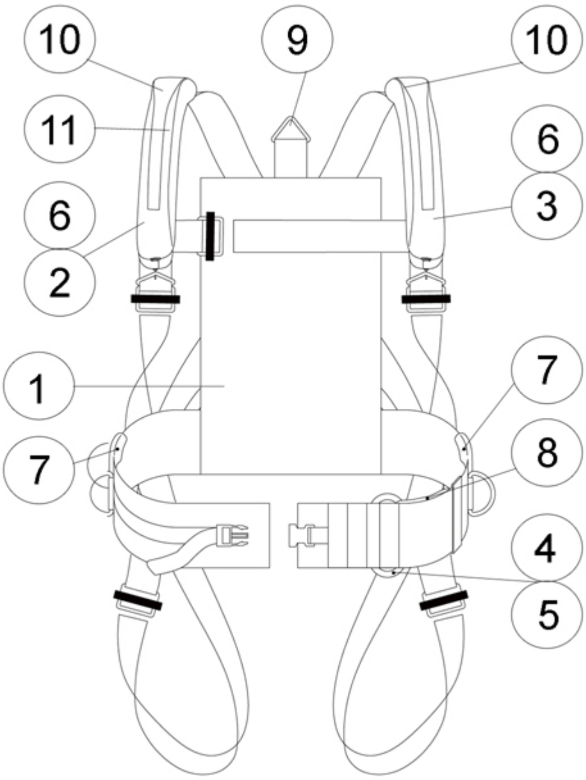
Figure 4.1 Weekly Maintenance - Main Housing



Item	Description	Part No
1	Backpack Housing Moulding	D294
2	Relief Valve	VR300
3	Lid Screw Assembly	C2606D
4	Two Stage Regulator	CA2602
5	Demand Regulator (inc. Protective Cover D313)	CA2604
6	Single Stage Regulator	CA2603
7	Gas Cylinder Retainer	J2489B
8	Refillable Sodalime Canister	C32540
9	Gas Cylinder Manifold	DM4511
10	Canister Lift Mechanism	C2893B
11	Penetrator Body	D291
12	Thermal Regenerator Assembly	D2498C

Item	Description	Part No
13	Housing Side Door	D281
14	Sealing Washer	DM217
15	Locknut	D275
16	O-Ring	RN031-7
17	Duct	D2480
18	Duct Insert	D276
19	Retaining Nut	D2939A
20	Penetrator Body	D277

Figure 4.2 Weekly Maintenance - Harness and Counterlungs (Part No. CA2604)



Item	Description	Part No
1	Harness	C35650
2	Counterlung Enclosure (Divers Right Hand)	DM46630B
3	Counterlung Enclosure (Divers Left Hand)	DM36010B
4	Actuation Sleeve Assembly	C45540B
5	Actuation Cable Assembly	C2937
6	Counterlung Assembly	CA2607

Item	Description	Part No
7	Weight Pocket	D308
8	Handle Retaining Band	D302
9	Rescue Lifting Point	-
10	Cable Wiper Sleeve	D328
11	Bush	D322

4.4.3 Check actuation of SLS system backpack

1. Remove the outer door, scrubber door and CO_2 scrubber canister.
2. Actuate the SLS System by pulling the actuation handle.

Note ***The actuation effort should not exceed 10 kg if the equipment is well maintained.***

3. Check that the spool valve has actuated and that there is a bleed of gas into the SLS System, by listening for a flow.

4.4.4 Check gas flow from single stage regulator

Note ***This should be done with the supply hose connected to the Helmet to ensure that the single stage regulator inlet filter and the helmet side-block connector filter are not contaminated and restricting the flow.***

1. Connect the SLS System Backpack single stage regulator hose to the SLS System Helmet sideblock and connect an AIR supply to the helmet.
2. Remove the blanking plug from the first stage regulator test port and insert the test gauge (Divex Part No. DM32540) from the Tool and Test Kit.
3. Remove the scrubber door and CO_2 scrubber canister.
4. Insert the flowmeter connector (Divex Part No. DM32580) from the Tool and Test Kit into the main supply penetrator.
5. Connect a breathing quality AIR supply directly to the umbilical hose on the SLS System and set a supply pressure equal to the expected helmet supply pressure from the tables in chapter 3 of the SLS Helmet Manual OM112.
6. Blank the top port on the test flowmeter (Divex Part No. DM32580).
7. Allow the test hose to pressurise until the pressure stabilises.
8. Check the pressure gauge, which should read 138 mbar (2 psi).
9. If not adjust regulator by slackening locknut (Figure 4.8, Item 17, page 4.24) and using the Allen key provided, move the regulator adjustment screw, until 138 mbar (2 psi) is reached and tighten the locknut.

Note ***As this regulator is non-venting the internal pressure should be released before adjustment and be allowed to build up again after adjustment.***

10 Check the flow through the regulator using the test flowmeter with the test connector plug inserted in the injection orifice penetrator. With the supply set at 10 to 15 bar, the flowmeter ball should lie between 1.0 and 2.0 lpm on the scale.

11 If not, check the condition of the inlet filter on the single stage regulator and if it is corroded or clogged, replace the inlet filter fitting (Figure 4.8, Item 22) and repeat Step 9. to verify the correct flow. If the problem persists check the condition of the filter on the helmet sideblock elbow. Replace if necessary and repeat step 9.

4.4.5 Check scrubber door torque setting

1 Check scrubber door torque setting in accordance with section 4.9.1.

4.4.6 Repack the SLS System

1 If no further maintenance is to be performed, repack the SLS System ready for diving as follows:

   a Reload the actuation cable assembly (See section 3.4.5, page 3.16).

   b Recharge the gas cylinders with the appropriate heliox gas mix for the diving depth (See Section 3.1.1, page 32).

   c Install a refilled scrubber canister and check the door seal (See section 3.1.3 and section 3.1.2, page 3.6).

   d Replace and secure the outer door.

4.5 Monthly Maintenance Procedures

Note ***The following checks can be conducted using breathing quality compressed air, thereafter the SLS System should be purged with Heliox and prepared for re-use. Do not under any circumstance attempt to dive with air as a gas mixture in SLS. Diver will become hypoxic very quickly.***

4.5.1 Perform weekly maintenance

1 Carry out the weekly maintenance schedule in accordance with section 4.4 of this Manual.

4.5.2 Check scrubber door operation and sealing

1 Inspect the scrubber door, which is shown in Figure 4.10, for damage or wear. Replace any damaged or worn components as necessary.

2 Lightly lubricate the main sealing O-ring (Figure 4.10, Item 7) on the scrubber door using an oxygen compatible lubricant (e.g. Christo-lube fluorinated grease - Divex Part No SM034).

3 Visually check the scrubber door operation and the sealing arrangement.

Notes 1 Always ensure the CO_2 scrubber canister is correctly installed prior to diving.

2 Ensure that the scrubber door is not over-tightened.

3 Do not swap scrubber doors between different backpack housings'. Scrubber doors are individually factory set and marked with the SLS System's serial number.

4.5.3 Check scrubber canister seal

1 Check the condition of the scrubber canister sealing gasket (Figure 3.7, Item 2, page 3.15) inside the CO_2 scrubber housing. Replace it if damage is observed in accordance with section 4.9.3, instructions 8. to 13.

4.5.4 Check operation of two stage regulator

1 Ensure that the gas cylinders are empty by activating the SLS System and pressing down on the demand valve diaphragm with the demand valve activating tool (Divex Part No M2922) from the Tool and Test Kit.

2 Remove the blanking plug from the single stage regulator test port and insert the test gauge (Divex Part No DM32540) from the Tool and Test Kit.

3 Reset the spool valve to close it.

4 Charge the SLS System to at least 150 bar with breathing quality AIR.

5 Insert the flowmeter connector (Divex Part No. DM32580) from the Tool and Test Kit into the main supply penetrator on the inside of the CO_2 Scrubber Housing.

6 Actuate the spool valve by pressing on it.

7	Check that the pressure gauge reads between 0.96 and 1.03 bar (14 and 15 psi) and that the centre of the flowmeter ball lies between the red bands on the flowmeter (3.7 - 4.8 L/min).

8	If not slacken the locknut (Figure 4.7, Item 22) and using the allen key provided move the regulator adjustment screw (Figure 4.7, Item 23) until the settings are correct. Tighten the locknut (Figure 4.7, Item 22) to lock this setting.

9	If it is not possible to achieve the flow rate when the regulator pressure is correctly set, then the injection orifice penetrator should be removed and either ultrasonically cleaned or replaced.

10	Reset the spool valve. Blank off the end of the injection orifice with a finger and check that the test gauge remains at zero. If gauge reading increases the 1st stage piston o-rings or the spool valve o-rings are damaged and must be replaced.

***Note	Always fully discharge the air from the SLS System immediately after completing the above procedure.***

4.5.5 Check operation of single stage regulator

***Note	This should be done with the supply hose connected to the Helmet to ensure that the single stage regulator inlet filter and the helmet side-block connector filter are not contaminated and restricting the flow.***

1	Connect the SLS System Backpack single stage regulator hose to the SLS System Helmet sideblock and connect an AIR supply to the helmet.

2	Remove the blanking plug from the first stage regulator test port and insert the test gauge (Divex Part No. DM32540) from the Tool and Test Kit.

3	Remove the scrubber door and CO_2 scrubber canister.

4	Insert the flowmeter connector (Divex Part No. DM32580) from the Tool and Test Kit into the main supply penetrator.

5	Connect a breathing quality AIR supply to the SLS System Helmet and set a supply pressure equal to the expected helmet supply pressure from the tables in chapter 3 of the SLS Helmet Manual OM112.

6	Blank the top port on the test flowmeter (Divex Part No. DM32580).

7	Allow the test hose to pressurise until the pressure stabilises.

8	Check the pressure gauge, which should read 138 mbar (2 psi).

9	If not adjust regulator by slackening locknut (Figure 4.8, Item 17) and using the Allen key provided, move the regulator adjustment screw, until 138 mbar (2 psi) is reached and tighten the locknut.

***Note	As this regulator is non-venting the internal pressure should be released before adjustment and be allowed to build up again after adjustment.***

10	Check the flow through the regulator using the test flowmeter with the test connector plug inserted in the injection orifice penetrator. With the supply set at 10 to 15 bar, the centre of the flowmeter ball should lie between the black bands on the scale (1.0 - 2.0 L/min).

11 If not, check the condition of the inlet filter on the single stage regulator and if it is corroded or clogged, replace the inlet filter fitting (Figure 4.8, Item 22) and repeat step 9. to verify the correct flow. If the problem persists check the condition of the filter on the helmet sideblock elbow. Replace if necessary and repeat step 9.

4.5.6 Check operation of demand regulator

Note ***Do not carry out this test whilst the SLS System is charged with heliox gas mixtures as they act as asphyxiants at normal atmospheric pressures.***

1 Discharge any mixed gas and charge the gas cylinders with breathing quality AIR to a pressure of at least 200 bar.

2 Connect the manometer (Divex Part No. DM32570) from the Tool and Test Kit to one of the hose spigots.

3 Ensure that the scrubber door is in place and closed tight.

4 Connect one of the main hoses to the other spigot and inhale on the other end - the demand regulator should start to flow gas with a differential pressure of -26 to -27 cm WG showing on the manometer.

5 If the regulator requires adjustment, remove the cap (Figure 4.9, Item 11) and using a screwdriver move the adjustment screw (Figure 4.9, Item 10).

6 Repeat step 4. until the correct negative pressure is set (turn the screw clockwise to achieve a more negative pressure setting).

7 Pack the end cap and spring housing with Christo-lube fluorinated grease (Divex Part No SM034). This will prevent seawater freezing within the spring chamber.

4.5.7 Replace actuation cable wiper sleeves (Divex Part No. D328)

1 Actuate the SLS System Backpack by pulling its actuation handle.

2 Remove the old wiper sleeves from the counterlungs. These are located at the ends of the actuation cable sleeves where the counterlung actuation cable enters the sleeve.

3 Fit new wiper sleeves (Divex Part No D328) using cable tie DST034 or suitable equivalent.

4 Repack the counterlungs.

4.5.8 Strip and service the overpressure indicator

1 Disconnect the overpressure indicator for washing, noting whether it is Type 1 or Type 2, as there are two versions in service.

2 For the overpressure indicator Type 1, which is shown in Figure 4.3, proceed as follows:

a Remove the grub screws (Figure 4.3, Item 7) using a suitable Allen key, and top cap (Figure 4.3, Item 2) and bottom cap (Figure 4.3, Item 3) using a strap wrench.

b Dismantle all other component parts.

c Rinse all components in fresh water, paying particular attention to the Rotowink cartridge and mesh screen, to ensure that they are totally free of foreign matter and salt crystallisation.

d Inspect all O-rings and replace as necessary.

e Reassemble in reverse order of a and b above. Before re-assembly, lightly lubricate the O-ring seals with a breathing gas compatible lubricant (e.g. Christo-lube fluorinated grease - Divex Part No: SM034).

3 For the overpressure indicator Type 2, which is shown in Figure 4.4, proceed as follows:

a Remove the top cap (Figure 4.4, Item 2) using pliers.

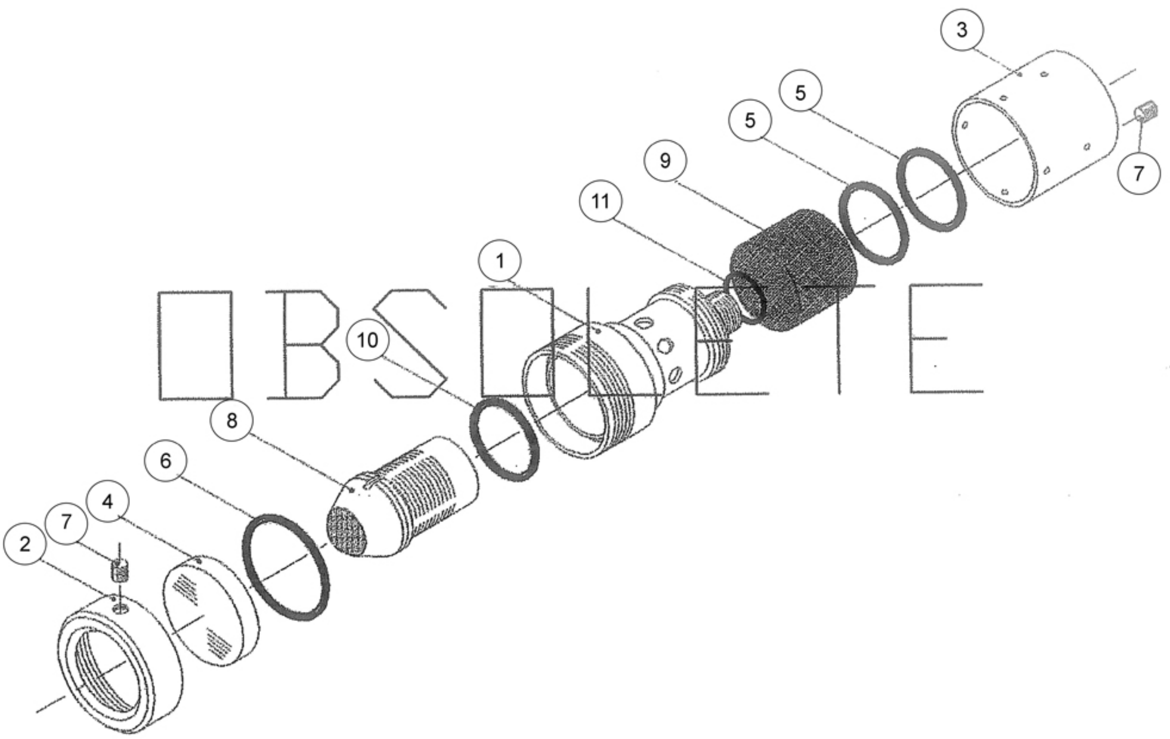
b Dismantle all component parts.

c Rinse all components in fresh water, paying particular attention to the Rotowink cartridge and mesh screen, to ensure that they are totally free of foreign matter and salt crystallisation.

d Inspect all O-rings and replace as necessary.

e Reassemble in reverse order of a and b above. Before re-assembly, lightly lubricate the O-ring seals with a breathing gas compatible (e.g. Christo-lube fluorinated grease - Divex Part No: SM034).

Figure 4.3 Over Pressure Indicator Type 1

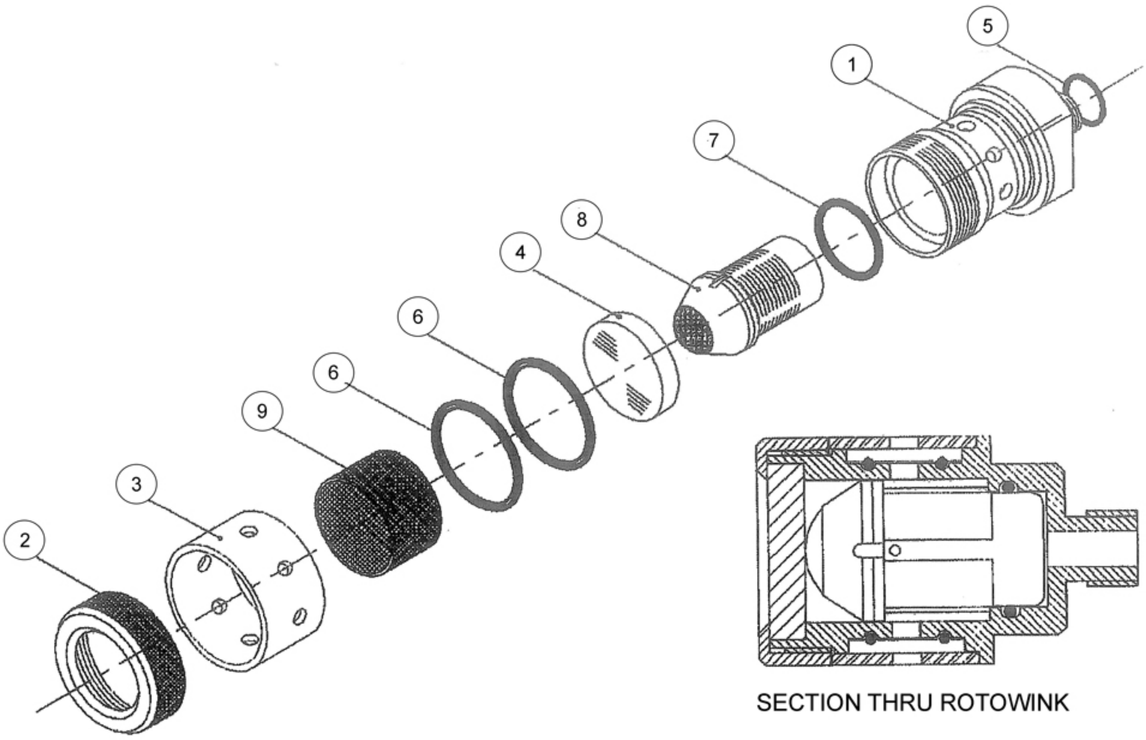


Item	Description	Part No
1	Overpressure Indicator Main Body	D263
2	Overpressure Indicator Top Cap	D264

Item	Description	Part No
3	Overpressure Indicator Bottom Cap	D265
4	Overpressure Indicator Lens	D266
5	O-ring	RN016-7
6	O-ring	RN020-7
7	Flat Bottom Grubscrew, 6 UNF x 1/8”	FB079
8	Rotowink	DM263
9	Mesh	MC354
10	O-ring	E14783
11	O-ring	E14629

Note ***This assembly has now been superseded in preference to the type 2 assembly. Most of the parts are common to both types other than the main body (item 1). When ordering spare parts type 2 bodies (D263) and Mesh Retaining Sleeves (D321) will be supplied by Divex.***

Figure 4.4 Over Pressure Indicator Type 2 (Part No: DM262)



Item	Description	Part No
1	Overpressure Indicator Main Body	D263
2	Overpressure Indicator Top Cap	D264

Item	Description	Part No
3	Mesh Retaining Sleeve	D321
4	Overpressure Indicator Lens	D266
5	O-ring	E14629
6	O-ring	E14738
7	O-ring	E14783
8	Rotowink	DM263
9	Mesh	D319

4.5.9 Perform Leak Test

1 Perform a leak check on the SLS System Backpack as follows:

a Connect a single hose between the inhale and exhale hose spigots.

b Ensure that the scrubber door is in place and closed tight.

c Connect a 10 bar supply to the single stage regulator hose.

d Ensure that the gas cylinders are charged to a minimum pressure of 20 bar.

e Check for leaks by submerging the SLS System in a tank of water.

2 If no further maintenance is to be performed, repack the SLS System ready for diving as follows:

a Reload the actuation cable assembly (section 3.4.5).

b Recharge the gas cylinders with the appropriate heliox gas mix for the diving depth (section 3.1.1).

c Install a refilled scrubber canister and check the door seal (section 3.1.3 and section 3.1.3).

d Replace and secure the outer door.

4.6 Six Monthly Maintenance Procedures

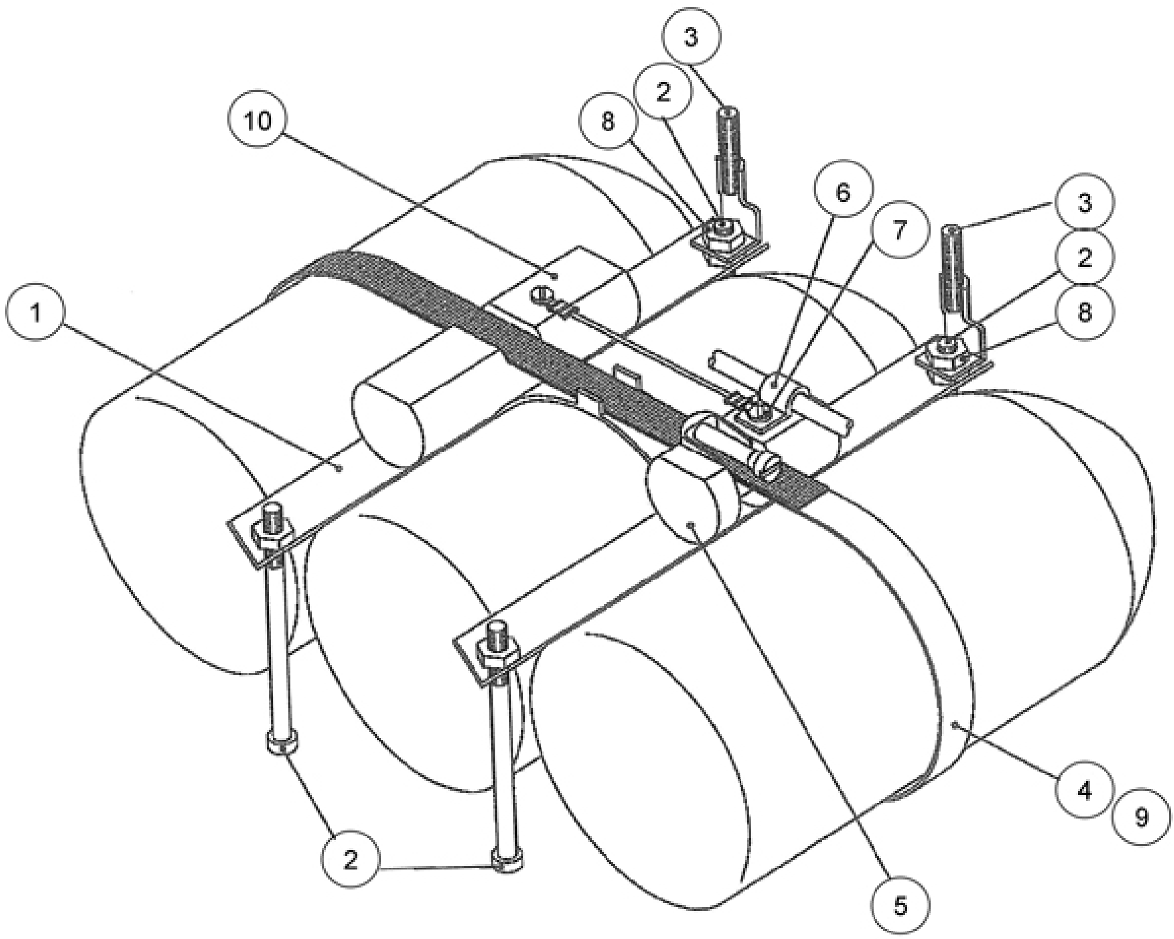
4.6.1 Perform monthly maintenance

1 Carry out the monthly maintenance schedule in accordance with section 4.6.1 of this Manual.

4.6.2 Visual inspection of gas cylinders

Note ***For use in UK waters, the current legislation for cylinders is detailed in SI 1981:399. This requires for; a six (6) monthly internal examination by competent personnel, a two (2) yearly hydraulic test in accordance with BS 5430:1990 and a two (2) yearly pressure leak test in accordance with BS 5430:1990.***

Figure 4.5 Gas Cylinders (Part No: C2626)



Item	Description	Part No
1	Bracket	J2489B
2	Bolt (long)	FB075
3	Securing Stud	D305
4	Jubilee Clip	FC047

Item	Description	Part No
5	Pipework Bracket	MC406
6	Pipework Clip	MC407
7	Screw	FB248
8	Nut	FN001
9	Heatshrink (Black)	EM190
10	Andoe Kit	DM2945

1 Ensure that the gas cylinders are empty by activating the SLS System and pressing down on the demand valve diaphragm with the demand valve activating tool (Divex Part No. M2922) from the Tool and Test Kit.

2 Remove the gas cylinders for inspection by a competent person, as follows:

   a Remove the single stage regulator and two stage regulator from the SLS System Backpack (section 4.7.3 step 1 and section 4.7.2 step 1 to step 7).

   b Remove the banjo bolt from the demand regulator supply manifold.

   c Unscrew the four retaining bolts (Figure 4.5, Items 2 and 3).

   d Withdraw the cylinders and manifold from the SLS System Backpack.

   e Loosen Jubilee clip.

   f Unscrew each bottle from its fitting.

   g Lightly lubricate new O-rings before re-assembly using an oxygen compatible lubricant (e.g. Christo-lube fluorinated grease - Divex Part No. SM034).

3 If no further maintenance is to be performed, repack the SLS System Backpack ready for diving as follows:

   a Tighten brackets and Jubilee clip.

   b Reload the actuation cable assembly (section 3.4.5).

   c Recharge the gas cylinders with the appropriate heliox gas mix for the diving depth (section 3.1.1).

   d Install a refilled scrubber canister and check the door seal (section 3.1.3 and section 3.1.3).

   e Replace and secure the outer door.

4.7 Annual Maintenance Procedures

4.7.1 Visual inspection and testing of gas cylinders and HP pipework

1 All high pressure pipework and gas cylinders should be inspected and tested by an authorised test house.

4.7.2 Strip down and service of two stage regulator

1 Remove the two stage regulator from the SLS System Backpack as follows:

a Ensure that the gas cylinders are empty by activating the SLS System and pressing down on the demand valve diaphragm with the demand valve activating tool (Divex Part No. M2922) from the Tool and Test Kit.

b Disconnect the pipework from the main supply penetrator.

c Cut cable tie holding two stage regulator to the manifold pipework.

d Disconnect gas supply pipework, from the gas cylinders, at the regulator inlet banjo.

e Remove the single stage regulator and two stage regulator complete with the interconnecting pipework and withdraw to the extent that the retaining screws for the actuating sleeve can be reached.

f Remove the screws from the actuating sleeve block.

***Note** The screws securing the mounting plate (Figure 4.7, Item 37) to the regulator body (Figure 4.7, Item 1) should not be removed as they are secured in place using Studlock (Loctite 601).*

g Remove the banjo bolt (Figure 4.7, Item 5) on the two stage regulator and release the regulator completely.

h It should now be possible to remove the regulator from the Backpack.

2 Service the regulator’s first stage as follows:

a Unscrew the first stage end cap (Figure 4.7, Item 3) and remove the spring (Figure 4.7, Item 20).

b Wrap the first stage piston in thin card as a protective sleeve and use long nose pliers to carefully withdraw the first stage piston (Fig 4.7, Item 4). Check the seat for wear and replace as necessary.

c Replace all O-rings. Lightly lubricate O-rings before re-assembly using an oxygen compatible lubricant (e.g. Christo-lube fluorinated grease - Divex Part No SM034).

d Re-assembly is the reverse of the above.

3 Service the regulator’s second stage as follows:

a Unscrew the end cap (Figure 4.7, Item 2,) and remove the spring adjustment plate (Figure 4.7, Item 7) the spring support plate (Figure 4.7, Item 6) and the spring (Figure 4.7, Item 19).

b Remove the slip ring (Figure 4.7, Item 10) the diaphragm (Figure 4.7, Item 31) and the diaphragm support plate (Figure 4.7, Item 11).

c Unscrew and remove the valve seat retainer (Figure 4.7, Item 12).

d Remove the valve pin (Figure 4.7, Item 16).

e Remove the spring (Figure 4.7, Item 38).

f Remove valve seat from the retainer using thin rod through the holes in the seat retainer.

g Check the valve seat (Figure 4.7, Item 13) for wear and replace as necessary.

h Replace all O-rings. Lightly lubricate O-rings before re-assembly using an oxygen compatible lubricant (e.g. Christo-lube fluorinated grease - Divex Part No SM034).

i Re-assembly is the reverse of the above.

Note ***Ensure that the square edge on the seat is the sealing face for the valve pin, when installing a new seat in the seat retainer.***

4 Service the spool valve as follows:

a With the two stage regulator removed from the SLS System.

b Remove the circlip, discard and replace. (Figure 4.7, Item 32).

c Remove the grub screw (Figure 4.7, Item 33).

d Unscrew the cap (Figure 4.7, Item 15).

e Allow the ball bearings (Figure 4.7, Item 36) to drop out.

f Remove the pull ring (Figure 4.7, Item 17).

g Withdraw the spool (Figure 4.7, Item 14) from the circlip end.

h Inspect all components for damage or wear and replace as necessary.

i Replace all O-rings. Lightly lubricate O-rings before re-assembly using an oxygen compatible lubricant (e.g. Christo-lube fluorinated grease - Divex Part No SM034). Lightly lubricate the diaphragm support plate faces which contact the diaphragm with christo-lube. The edge of the diaphragm must remain dry.

j Re-assembly is the reverse of the above.

Notes 1 ***Fit new O-rings to the spool from the pull ring end as the sharp edges on the recesses for the ball bearings may cut the O-rings.***

2 ***Once maintenance is complete loop an appropriate cable tie (e.g. FC195) round the 2nd stage end cap and the manifold pipework. Tighten firmly to hold the regulator in position and snip off excess.***

Figure 4.6 Regulator with cable tie

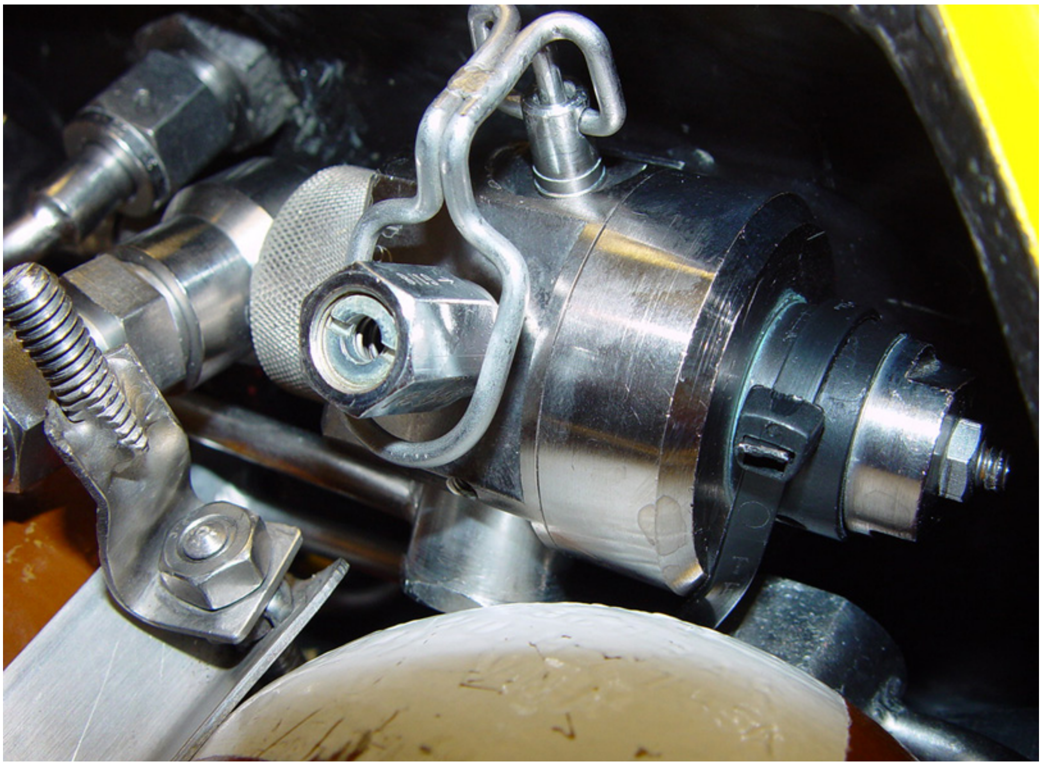
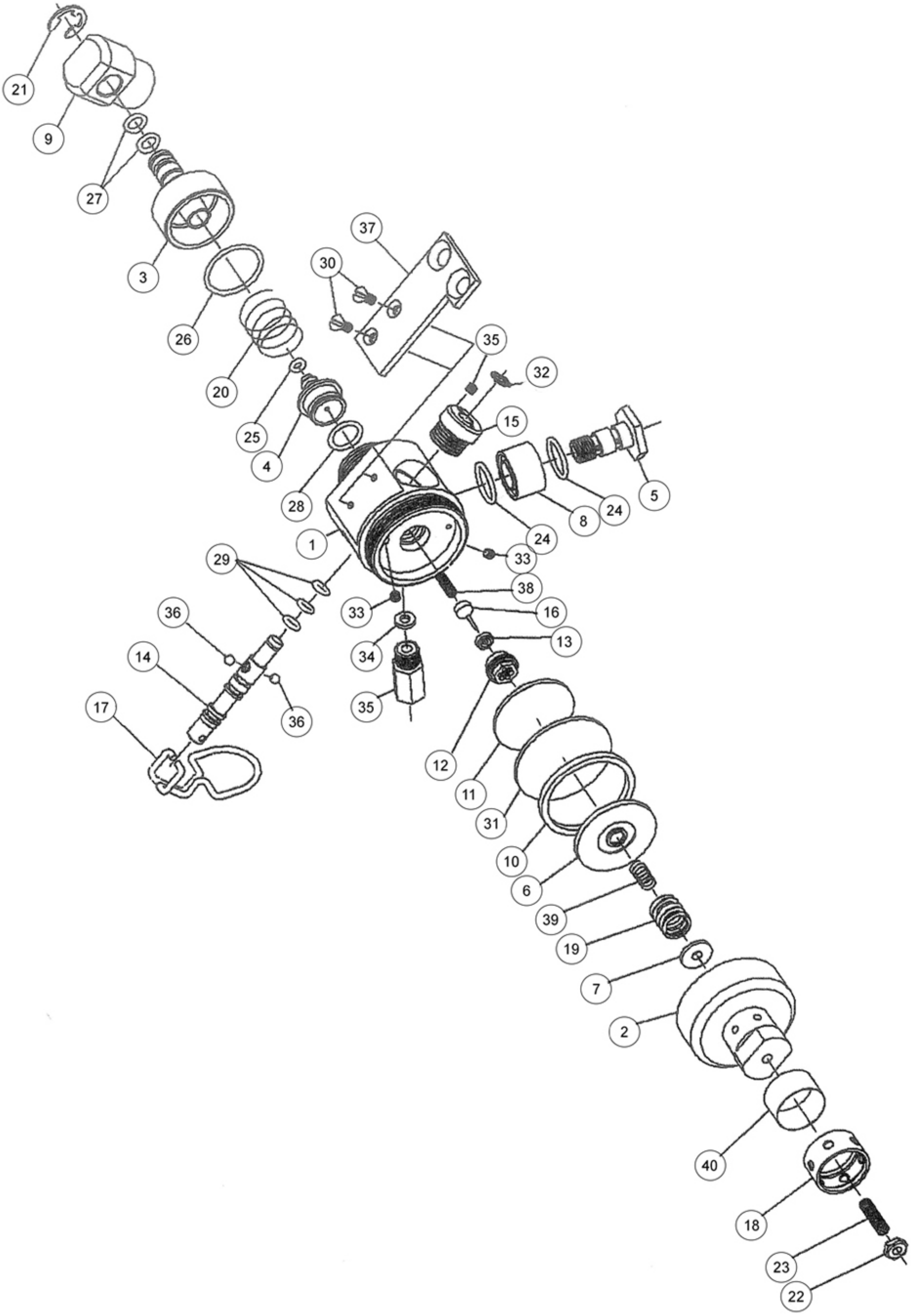


Figure 4.7 Two Stage Regulator



Item	Description	Part No
1	Body Sub Assembly	D2792
2	End Cap (2nd Stage)	D2285
3	End Cap (1st Stage)	D2691F
4	Piston	D2203E
5	Banjo Bolt	D2640
6	Spring Support Plate	D2281
7	Spring Adjustment Plate	D2212B
8	Banjo Fitting	-
9	1st Stage Banjo	D4541A
10	Slip Ring	D2282
11	Diaphragm Support Plate	D22070
12	Valve Seat Retainer	D2210G
13	Valve Seat	RK221
14	Spool Valve	D2794E
15	Spool Valve Cap	-
16	Valve Pin	D2206F
17	Pull Ring	D2891C
18	Sleeve	D32860
19	Spring	RK230
20	Spring	RK225
21	Circlip	MC121
22	Locknut	FN015
23	Grub Screw	FB080
24	O-ring	RN015-7
25	O-ring	RN801-7
26	O-ring	RN020-7
27	O-ring	RN010-7
28	O-ring	RN806-7
29	O-ring	E13991
30	Screw	FB042

Item	Description	Part No
31	Diaphragm	D22830
32	Circlip	MC112
33	Grub Screw	FB079
34	Gasket	VM052
35	Relief Valve	PO20640
36	Ball Bearing	RK231
37	Mounting Plate	D29010
38	Spring	RK223
39	Spring	RK235
40	Mesh	D32870

4.7.3 Strip down and service of single stage regulator

1. Ensure that the gas cylinders are empty by activating the SLS System and pressing down on the demand valve diaphragm with the demand valve activating tool (Divex Part No. M2922) from the Tool and Test Kit.

2. Disconnect the pipework from the SLS System main supply penetrator.

3. Disconnect the supply pipework, from the gas cylinders at the regulator inlet banjo.

4. Remove the single stage regulator and two stage regulator complete with the interconnecting pipework and withdraw to the extent that the retaining screws for the actuating sleeve can be reached.

5. Remove screws from actuating sleeve block.

Note ***The screws securing the mounting plate to the regulator body should not be touched as they are secured by Loctite 601.***

6. Remove the banjo mounting bolt (Figure 4.8, Item 10) from the regulator.

7. Undo the bracket and withdraw the single stage regulator from the SLS System.

8. Disconnect the flexible gas supply hose at the regulator inlet port.

9. Remove the regulator from the SLS System.

10. Unscrew the end cap (Figure 4.8, Item 2) and remove the spring adjustment plate (Fig 4.8, Item 5) the spring support plate (Figure 4.8, Item 4) and the spring (Figure 4.8, Item 14).

11. Remove the slip ring (Figure 4.8, Item 11) the diaphragm (Figure 4.8, Item 20) and the diaphragm support plate (Figure 4.8, Item 3).

12. Unscrew and remove the valve seat retainer (Figure 4.8, Item 6) and valve seat (Figure 4.8, Item 7).

13 Lift out the valve pin (Figure 4.8, Item 8).

14 Remove the spring (Figure 4.8, Item 15).

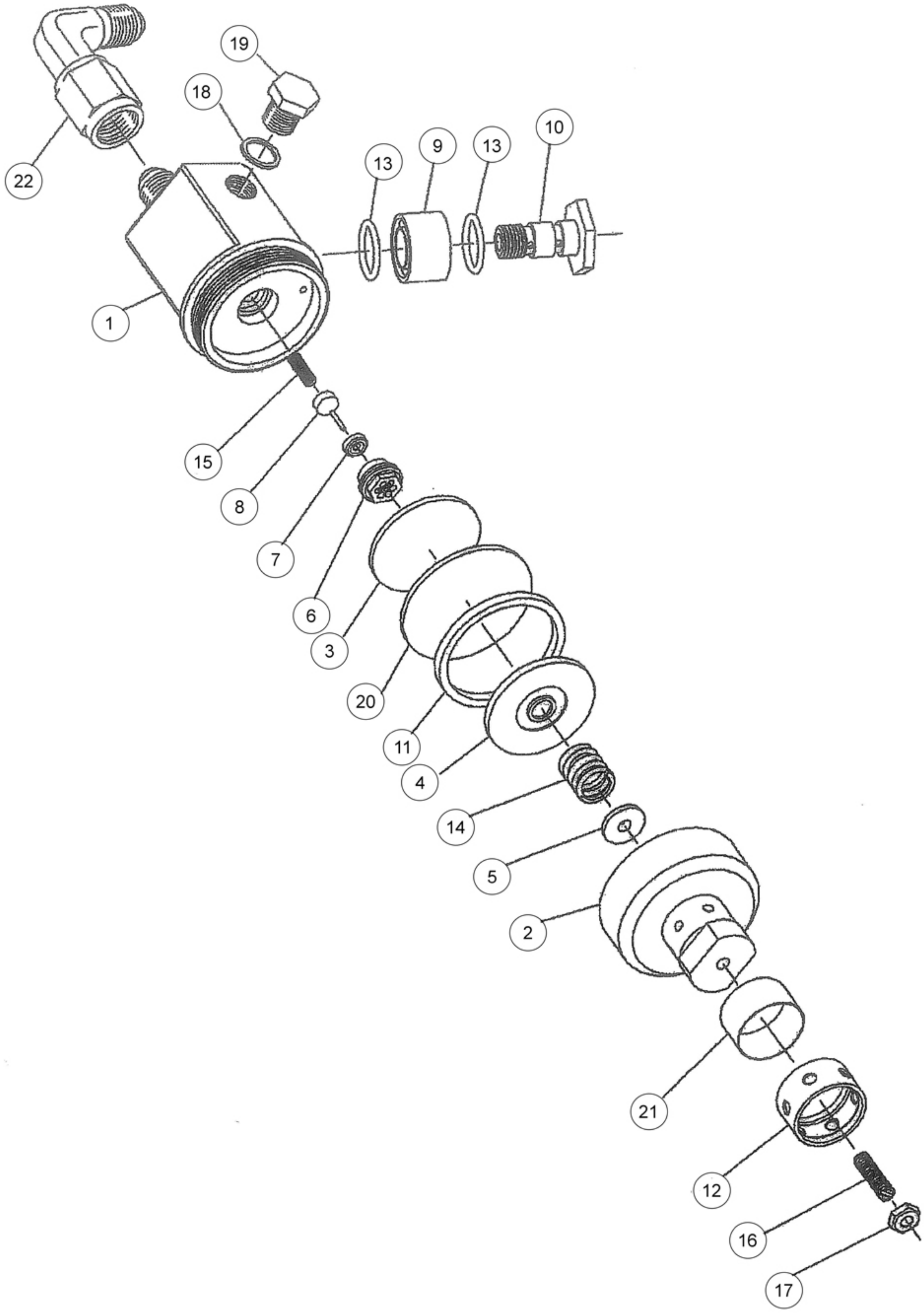
15 Check the valve seat (Figure 4.8, Item 7) for wear and replace as necessary.

16 Replace all O-rings. Lightly lubricate O-rings before re-assembly using an oxygen compatible lubricant (e.g. Christo-lube fluorinated grease - Divex Part No SM034). Lightly lubricate the diaphragm support plate faces which contact the diaphragm, with christo-lube. The edge of the diaphragm must remain dry.

17 Re-assembly is the reverse of the above.

Note ***The valve seat (Figure 4.8, Item 7) is installed in the valve seat retainer (Figure 4.8, Item 6) with the chamfer end in the retainer and the square edge to the valve pin. (Figure 4.8, Item 8).***

Figure 4.8 Single Stage Regulator



Item	Descriptions	Part Nos
1	Single Stage Regulator Body	D2284
2	Regulator End Cap	D2285
3	Diaphragm Support Plate	D22070
4	Spring Support Plate	D2281
5	Spring Adjustment Plate	D2212B
6	Valve Seat Retainer	D2286
7	Valve Seat	RK221
8	Valve Pin	D22020
9	Banjo Fitting	Ref only
10	Banjo Mounting Bolt	D26940
11	Slip Ring	D2282
12	Sleeve	D32860
13	O-ring	RN015-7
14	Compression Spring	RK446
15	Compression Spring	HK021
16	Cone Pointed Grub Screw	FB080
17	Locknut	FN015
18	Gasket	MC124
19	Plug	NP103
20	Diaphragm	D22830
21	Mesh	D32870
22	Inlet Filter Fitting (inc. Filter - FE012)	DM180

4.7.4 Strip down and service of demand regulator

1. Ensure that the gas cylinders are empty by activating the SLS System and pressing down on the demand valve diaphragm with the demand valve activating tool (Divex Part No. M2922) from the Tool and Test Kit.
2. Remove the lid (Figure 4.9, Item 2) and diaphragm (Figure 4.9, Item 15).
3. Unscrew the cap (Figure 4.9, Item 11).
4. Slacken the demand valve adjustment screw (Figure 4.9, Item 10).
5. Unscrew the regulator seat retainer (Figure 4.9, Item 6) and withdraw.

6 Using pliers pull the valve stem (Figure 4.9, Item 4) to remove the valve seat (Figure 4.9, Item 3).

7 Remove the spring (Figure 4.9, Item 5) and O-ring (Figure 4.9, Item 14).

8 Check the valve seat (Figure 4.9, Item 3) for wear and replace as necessary. If the valve seat or valve stem (Figure 4.9, Item 4) has been replaced then the roller fork (Figure 4.9, Item 12,) may require adjustment, as follows:

   a With the regulator mechanism assembled check the play on the roller fork (Figure 4.9, Item 12). It should be slack and have approximately 2 mm of movement without allowing the regulator to flow.

   b If the movement is greater than this, adjust by tightening the grub screw (Figure 4.9, Item 21).

Notes 1 This screw is locked in place with a thread retaining compound and must therefore be resealed if adjustment is made.

2 Ensure that NO thread locking compound is located NEAR the roller fork for the shuttle as this will cause the regulator to malfunction.

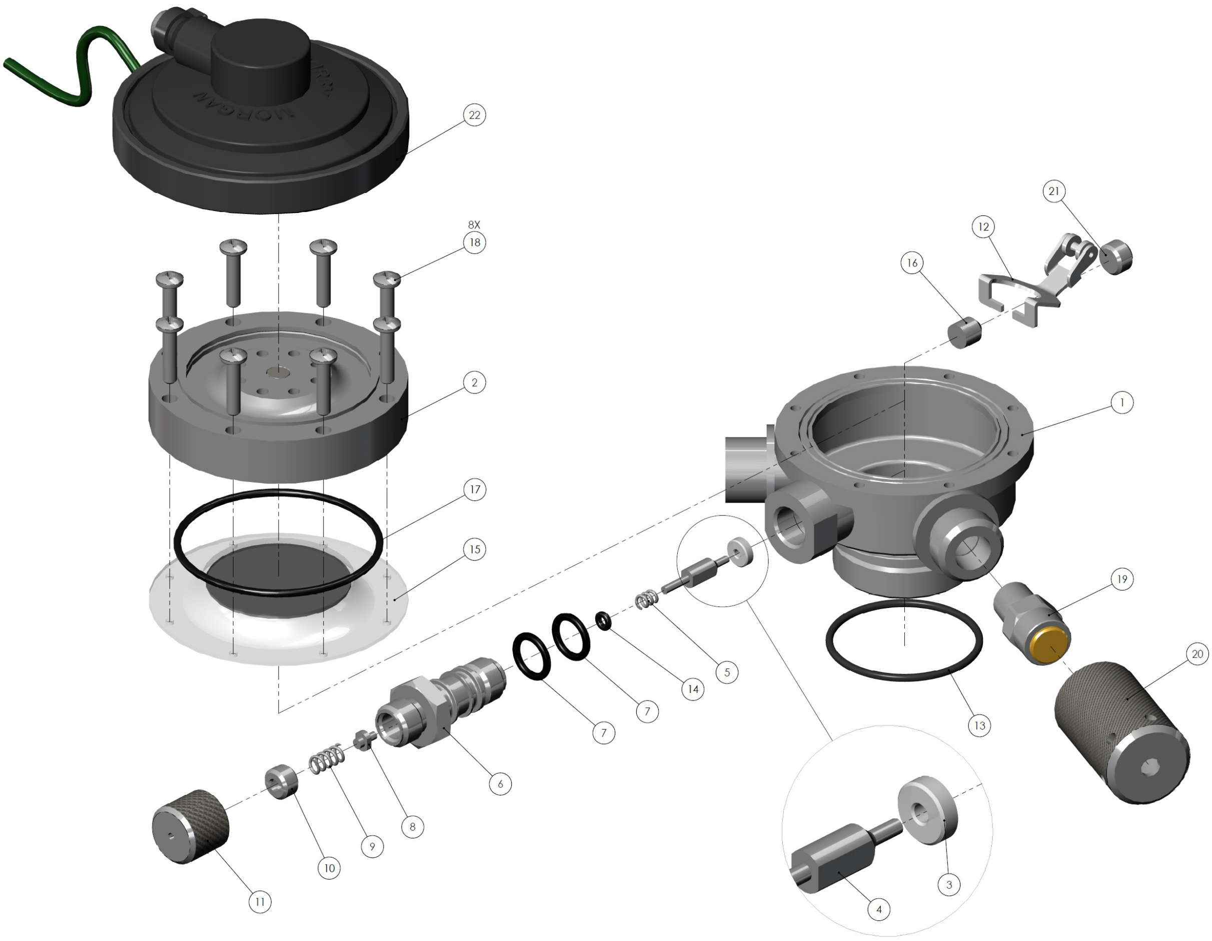
   c By using a straight edge across the top of the regulator body (Figure 4.9, Item 1) check that the roller on the roller fork (Figure 4.9, Item 12) lies approximately 1mm above the top face of the regulator. If not then gently bend the roller fork until it is.

9 Replace all O-rings. Lightly lubricate O-rings before re-assembly using an oxygen compatible lubricant (e.g. Christo-lube fluorinated grease - Divex Part No SM034).

10 Re-assembly is the reverse of the above.

Note The valve seat is installed with its chamfer towards the valve stem.

Figure 4.9 Demand Regulator



Item	Descriptions	Part Nos
1	SLS,REGULATOR BODY ASSY. WELDED & PLATED	D2291
2	DEMAND REGULATOR LID, S/ASSY	DM2613
3	VALVE SEAT	RK221
4	PIN,VALVE	RK222
5	SPRING,COMPRESSION, 0.41 WIRE, 4.57 OD X 6.35 F/L	RK220
6	SEAT RETAINER, SLS DEMAND REGULATOR	D2611E
7	O-RING	RN611-7
8	DVR EQP, SLS DEM V/V SPRING PAD,	D2617B
9	SPRING,COMPRESSION, 0.81 WIRE, 4.57 OD X 12.7 F/L	RK219
10	DVR EQP, SLS DEM V/V SCREW ADJ,	D2618
11	CAP, SLS DEMAND REGULATOR	D2615B
12	LEVER, ROLLER, MODIFIED	DM058
13	O-RING	RN028-7

Item	Descriptions	Part Nos
14	O-RING	RN004-9
15	DIAPHRAGM,DEMAND REGULATOR,SLS	DM222
16	SLS DEMAND VALVE SHUTTLE,	D2616A
17	O-RING	RN032-7
18	SCREW,M/C,PAN HD, 6UNC X 5/8",A2-70 SS,POSIDRIVE	FB032
19	RELIEF VALVE (SET AT 2.5 PSI),1/8"MNPT(O2 CLEANED)	VR101
20	VENT CAP,RELIEF VALVE,SLS MKIII	D2619
21	FSTR, GRUB SCREW, 5/16" UNF X 5MM	M29260
22	PROTECTION COVER ASSY	D313

4.7.5 Perform six monthly maintenance

1. Carry out the six monthly maintenance schedule in accordance with section 4.6 of this Manual.

4.8 Fault Diagnosis

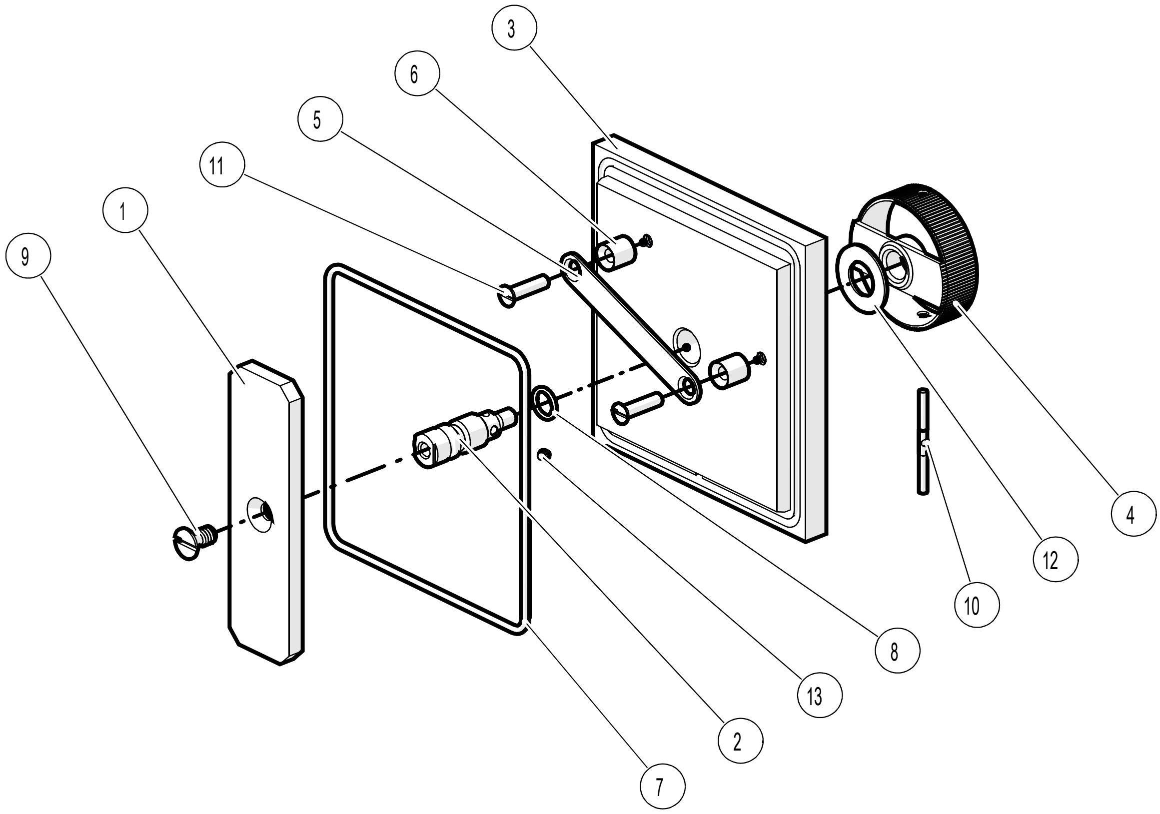
A schedule of possible faults and remedies for various conditions of reduced performance of the Backpack is shown below to aid fault diagnosis.

Fault	Probable Cause	Solution
External gas leak from scrubber door.	Main O-ring cut or torn.	Replace main O-ring seal on scrubber door.
	Scrubber door damaged.	Replace scrubber door. (See Section 4.5.1)
Internal gas leak from scrubber canister.	Sealing gasket cut or torn.	Replace gasket.
	Scrubber lift mechanism not providing sufficient sealing.	Replace scrubber lift mechanism.
External gas leak from upper part of main housing.	Leak from one of the upper penetrators.	Replace upper penetrator o-rings. (See Section 4.5.2)
External gas leak from lower part of main housing.	Leak from one of the lower penetrators.	Replace lower penetrator o-rings. (See Section 4.5.3)
External air leak from charging point.	Check valve seat cut or damaged.	Replace charging point check valve seat. (See Section 4.5.4)
External leak from burst disc.	Burst disc ruptured.	Replace burst disc. (See Section 4.5.5)
Failure to pass flow test.	Restriction in injection orifice.	Ultrasonically clean injection orifice and retest.
External gas leak from demand regulator.	Sealing O-ring cut or torn.	Replace O-ring. (See Section 4.5.6)
	Damaged Diaphragm.	Replace Diaphragm. (See Section 4.5.6)
	Leaking Relief Valve	Replace Relief Valve. (See Section 4.5.6)
	Demand regulator body damaged.	Replace regulator body. (See Section 4.5.6)
Harness damaged.	Various.	Replace harness. (See Section 4.5.7)
External air leak from counterlung.	Counterlung cut or torn.	Replace counterlung. (See Section 4.5.8)
Overpressure indicator not operating.	Various.	Return to Divex Ltd for repair.

4.9 Corrective Maintenance

4.9.1 Scrubber door replacement and torque setting

Figure 4.10 Scrubber Door Assembly (Part No: C2606D)



Item	Description	Part No
1	Strong Back	D2621
2	Screw	D2485
3	Door	D2605H
4	Handwheel	D2483F
5	Guard	D2884A
6	Spacer	D2283A
7	O-ring	RN1245-7
8	O-ring	RN611-7
9	Screw	FB068
10	Tommy Bar	D35130
11	Screw	FB040
12	Washer	FW007
13	Grub Screw	FB079

1 Remove the old scrubber door from the Backpack.

2 Lightly lubricate the main O-ring (Figure 4.10, Item 7) on the new scrubber door using an oxygen compatible lubricant (e.g. Christo-lube fluorinated grease - Divex Part No SM034).

3 Install the new scrubber door into the Backpack and rotate the tommy bar clockwise to turn the strong back to the closed position.

4 Tighten the handwheel lightly to just 'finger tight' only.

5 Release the thumb screws on the special torque adapter tool (Divex Part No. TA51193) (Figure 4.11), fit to the handwheel and tighten the thumb screws to locate the pins in the holes provided.

6 Using an appropriate torque wrench fitted to the adaptor tool, tighten the handwheel clockwise until a torque of 2.7 to 2.9 Nm (24 to 26 lb-in) is reached.

7 Remove the adaptor tool and mark the inside of the handwheel outer rim with white paint, in line with the white side of the tommy bar.

8 If this is a new setting on a door that has previously been marked, always remove the existing mark with wire wool or similar abrasive material.

Note ***If the main assembly is removed the screw (Figure 4.10, Item 9) must be fixed in place using a thread retainer compound.***

Figure 4.11 Torque Adapter Tool - TA51193

4.9.2 Upper penetrator replacement

<u>Counterlung and demand valve penetrators</u>

1 Release the wing nut and remove the thermal regenerator.

2 Using the duct spanner (Divex Part No. M2921B) engaged in upper penetrator slots and the locknut spanner (Divex Part No. M2920) from the Tool and Test Kit, undo the locknut (Figure 4.12, Item 2 & Figure 4.1, Item 15) and remove.

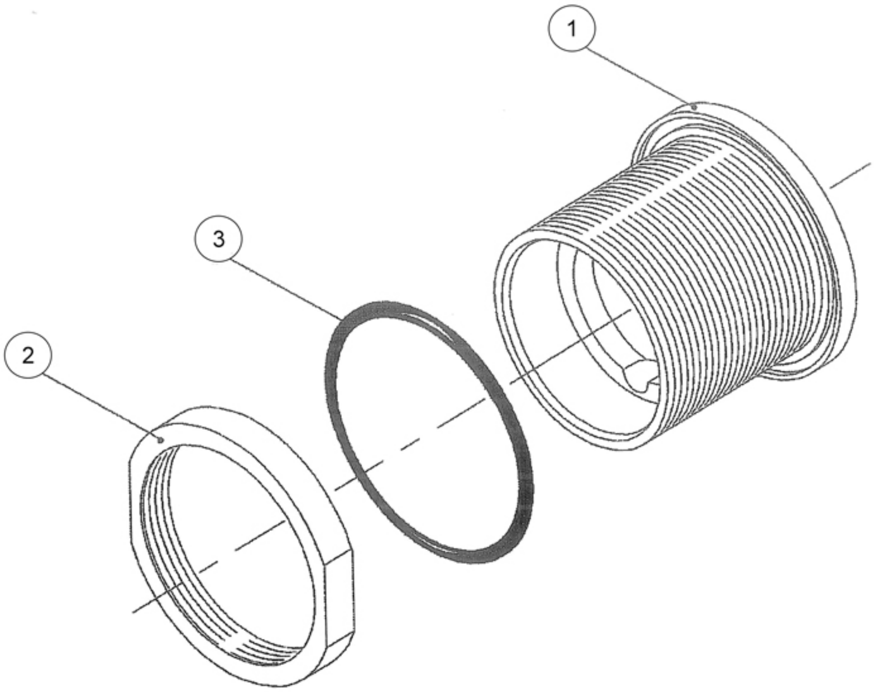
3 Push down on the upper penetrator to break the hold of the silicone sealant and remove.

4 Clean off the old silicone and wipe the contact areas with silicone primer (Divex Part No. SM021).

5 Fit a new O-ring (Figure 4.12, Item 3) to the upper penetrator (Figure 4.12, Item 1) and apply a bead of silicone sealant (Divex Part No. SM006) around the sealing face of the penetrator.

6 Re-install the penetrator into the scrubber housing and refit the locknut (Figure 4.12, Item 2) using the tools described in step 2 above, and with a moistened finger carefully wipe the excess silicone sealant smooth before it sets.

Figure 4.12 Upper Penetrator (Typical)



Counterlung Hose Penetrators:

Item	Description	Part No
1	Duct	D2487G
2	Locknut	D275
3	O-ring	RN031-7

Inhale / Exhale Hose Penetrators:

Item	Description	Part No
1	Duct	D2437
2	Locknut	D270
3	O-ring	RN031-7

4.9.3 Inhale / exhale hose penetrators

1. Release the wing nut and remove the thermal regenerator (Figure 3.7, Item 1, page 3.15).

2. Peel off the scrubber canister gasket (Figure 3.7, Item 2) and carefully remove the RH / LH regenerator housing (Figure 3.7, Item 3 / 4) as required.

3. Using the duct spanner (Divex Part No. M2921B) engaged in the upper penetrator slots and the locknut spanner (Divex Part No. M2920) from the Tool and Test Kit, undo the locknut (Figure 4.12, Item 2) and remove.

4. Push down on the upper penetrator to break the hold of the silicone sealant and remove.

5. Clean off the old silicone and wipe the contact areas with silicone primer (Divex Part No. SM021).

6. Fit a new O-ring (Figure 4.12, Item 3) to the upper penetrator (Figure 4.12, Item 1) and apply a bead of silicone sealant (Divex Part No. SM006) around the sealing face of the penetrator.

7. Re-install the penetrator into the scrubber housing and refit the locknut (Figure 4.12, Item 2) using the tools described in step 3 above, and with a moistened finger carefully wipe the excess silicone sealant smooth before it sets.

8. Carefully clean off the old silicone sealant from the regenerator housing, gasket sealing area and the regenerator housing sealing area, and wipe all these areas with silicone primer (Divex Part No. SM021).

9. Re-install the regenerator housing with a generous bead of silicone sealant (Divex Part No. SM006) ensuring a gas tight seal.

10. Inspect the sealing area for the scrubber canister gasket (Figure 3.7, Item 2). Check that all traces of silicone sealant have been removed.

Note ***Check the orientation of the gasket - the narrowest end goes in first.***

11. Prime the gasket and the sealing area with silicone primer (Divex Part No. SM021) and apply a bead of silicone sealant (Divex Part No. SM006) to the face of the gasket. Insert the gasket carefully, ensuring that the gasket is sitting flat and that the rectangular cut-out aligns with the inner edges of the regenerator housing.

12. While the sealant is still wet insert a scrubber canister and engage the canister lift mechanism to squeeze the gasket into place. Allow the sealant at least eight (8) hours to cure before releasing the canister lift mechanism.

13. After the sealant has cured for at least twelve (12) hours, check the regenerator housing sealing by pressure testing to 68 mbar (1 psi) using a dummy blank canister.

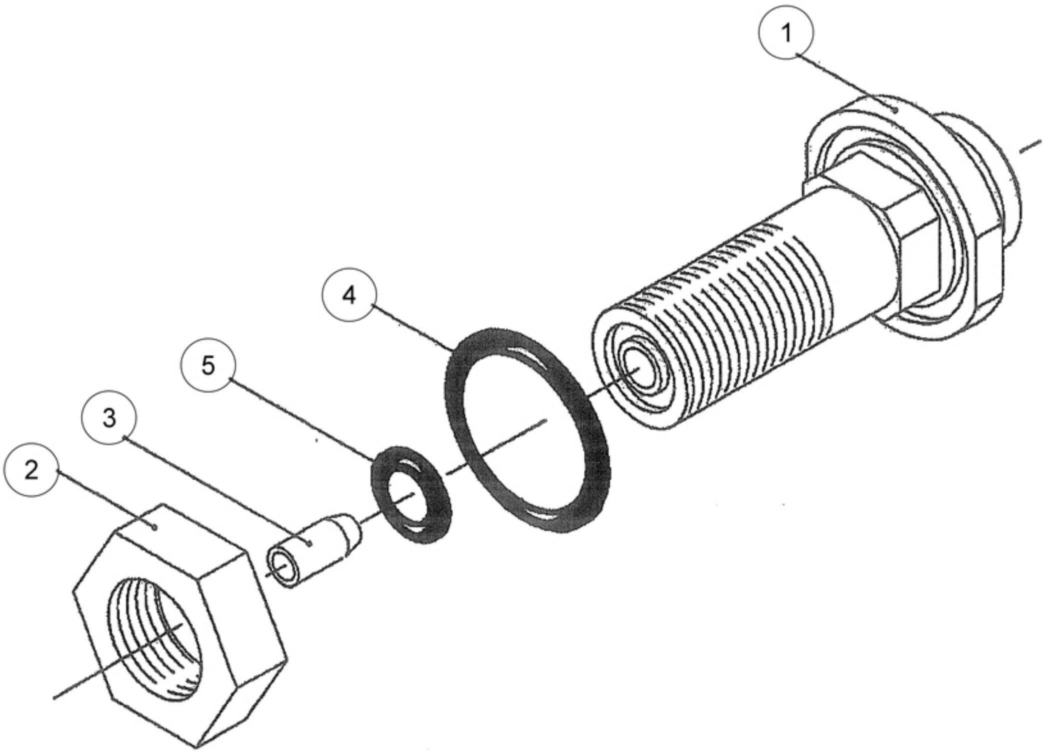
Note ***The SLS System should not be dived for a period of twenty four (24) hours after the silicone sealant has been applied, to allow it to fully cure.***

4.9.4 Lower penetrator replacement

Notes 1 ***Both lower penetrators can be easily removed from the SLS System for replacement or cleaning.***

2 ***Removal of the internal components on the main supply penetrator is not recommended.***

Figure 4.13 Lower Penetrator



Item	Description	Part No
1	Penetrator - Supply	D277
	Penetrator - Blank	D291
2	Locknut	FN016
3	Injection Orifice	MC109
4	O-ring	RN018-7
5	O-ring	RN010-7

1. Undo the locknut (Figure 4.12, Item 2).
2. Withdraw the penetrator (Figure 4.12, Item 1) from the hole.
3. Check the O-rings (Figure 4.12, Items 4 and 5) for wear and replace as necessary.
4. On re-assembly seal the penetrator in place with silicon sealant (Divex Part No. SM006) and the leak test the housing.

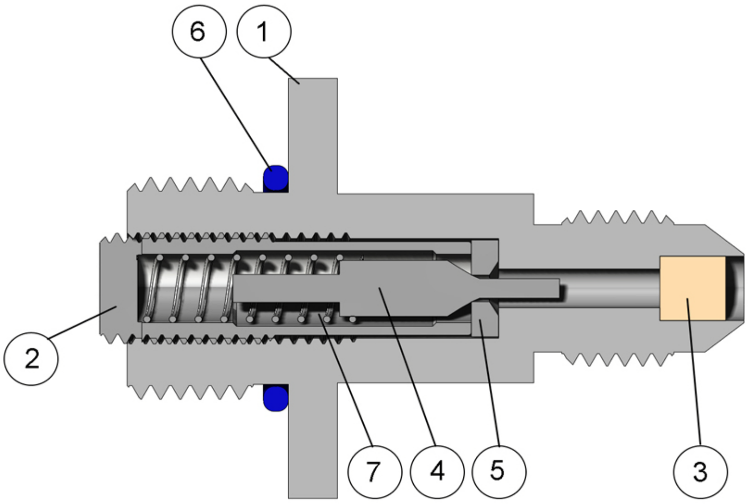
Note ***The SLS System should not be dived for a period of twenty four (24) hours after the silicone sealant has been applied to allow it to fully cure.***

4.9.5 Charging point check valve seat replacement

1 Ensure that the gas cylinders are empty by activating the SLS System and pressing down on the demand valve diaphragm with the demand valve activating tool (Divex Part No. M2922) from the Tool and Test Kit.

2 Remove the cylinders and manifold (section 4.6.2).

Figure 4.14 Charging Point Check Valve



Item	Description	Part No
1	Body	D2384H
2	Spring Retainer	D2385I
3	Sintered Filter	FE012
4	Valve Pin	RK222
5	Valve Seat	RK221
6	O-ring	RN015-9
7	Spring	RK227

3 Unscrew the first gas bottle from its manifold (the charging point cannot be turned until the bottle is removed).

4 Unscrew the check valve.

5 Unscrew the spring retainer (Figure 4.13, Item 2) and withdraw.

6 Take out the spring (Figure 4.13, Item 7) and valve pin (Figure 4.13, Item 4).

7 Remove the valve seat (Figure 4.13, Item 5) using a small stud extractor.

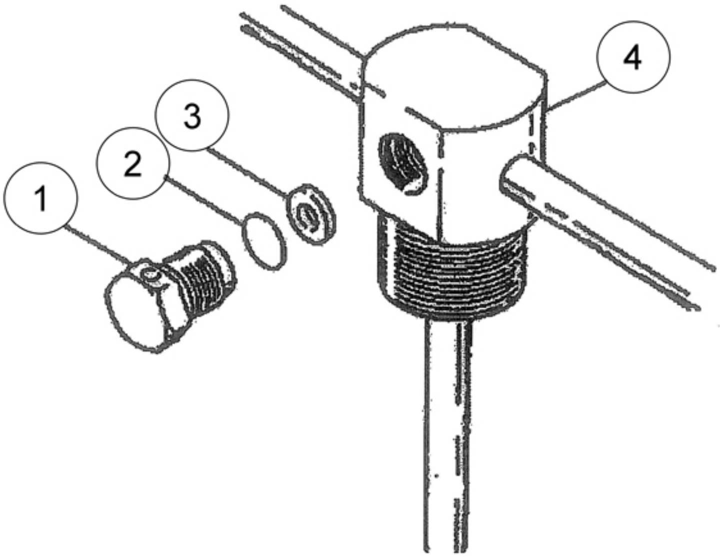
8 Fit a new valve seat (Figure 4.13, Item 5) countersink end first into the body (Figure 4.13, Item 1). Use a 1.5 mm pin (such as a welding rod) to ensure that the valve seat does not turn during installation.

9 Re-assembly is the reverse of above.

10 Lightly lubricate O-rings before re-assembly using an oxygen compatible lubricant (e.g. Christo-lube fluorinated grease - Divex Part No SM034).

4.9.6 Burst disc replacement

Figure 4.15 Burst Disc Assembly



Item	Description	Part No
1	Plug	DD041719/VM049
2	Burst Disc	VM050
3	Seat	VM051
4	Gas Manifold	DM4511

1 Ensure that the gas cylinders are empty by activating the SLS System and pressing down on the demand valve diaphragm with the demand valve activating tool (Divex Part No. M2922) from the Tool and Test Kit.

2 Remove the plug (Figure 4.14, Item 1) taking care to avoid damaging the face of the plug contacting the burst disc (Figure 4.14, Item 2).

Notes 1 A new burst disc must be fitted every time the plug is removed.

2 Inspect for burrs, sharp edges etc before replacing the burst disc.

3 Check the condition of the seat (Figure 4.14, Item 3).

4 Tighten the plug (Figure 4.14, Item 1) to the recommended torque setting of 6.78 Nm (5 lb-ft).

5 Charge the gas cylinders to 300 bar after re-assembly and leak test with Snoop (or equivalent).

4.9.7 Demand regulator body replacement

Note ***All normal maintenance can be carried out without having to remove the regulator body from the SLS System. This should only be carried out if there has been damage to the body.***

1 Release the wing nut and remove the thermal regenerator (Figure 3.7, Item 1).

2 Dismantle the regulator (section 4.7.4).

3 Using the duct spanner (Divex Part No. M2921B) unscrew the inner sleeve from the duct, whilst holding the demand regulator until the demand regulator body (Figure 4.9, Item 1) comes off.

4 Replacement is the reverse of the above.

5 Lightly lubricate O-rings before re-assembly using an oxygen compatible lubricant (e.g. Christo-lube fluorinated grease - Divex Part No SM034).

6 Check the operation of the demand regulator (section 4.5.6).

4.9.8 Harness replacement

1 Disconnect the counterlung hoses and inhale / exhale hoses from the Backpack.

2 Remove the counterlung enclosures complete with counterlungs.

3 Ensure that the gas cylinders are empty by activating the SLS System and pressing down on the demand valve diaphragm with the demand valve activating tool (Divex Part No. M2922) from the Tool and Test Kit.

4 Remove the two stage regulator (section 4.7.2).

5 Remove the single stage regulator (section 4.7.3).

6 Remove the actuation sleeve, which is shown in Figure 4.16, as follows:

a Remove the two screws (Figure 4.16, Item 7) that secure the actuation sleeve to the harness waistband, and pull the actuation sleeve from the harness via the webbing duct on the left hand side of the harness waistband, ensuring that it does not snag inside the double thickness harness backplate.

b With the actuation sleeve removed, any damaged components may be replaced.

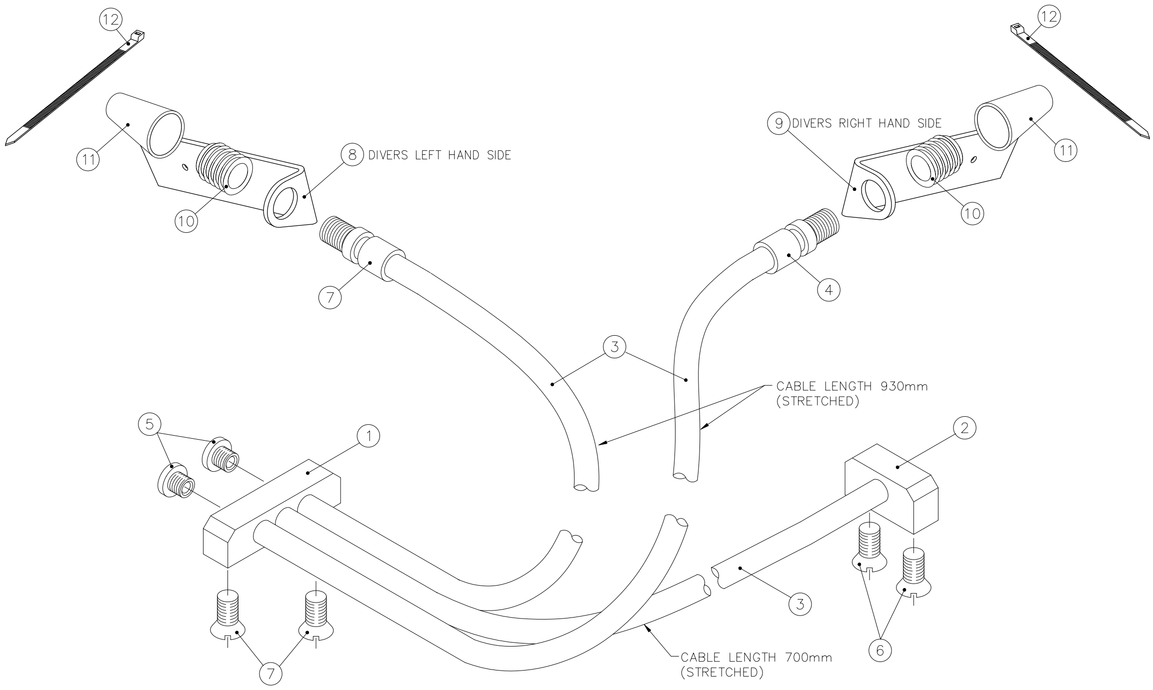
7 Detach the contents gauge hose whip and overpressure indicator hose whip from the harness.

8 Undo the two buckles and unthread the webbing securing straps from the Backpack.

9 Reassemble the harness in the reverse of the above.

Note ***See section 4.9.8 for correct routine of securing webbing harness to backpack.***

Figure 4.16 Actuation Sleeve (Part No: C45540B)



Item	Description	Part No
1	Treble Termination	DM45540
2	Single Termination	DM45540
3	Seamless Tube	DM45540
4	Counterlung Connector Sleeve	DM45540
5	Counterlung Guide Plug	D45550
6	Screw, C’sk Slotted, 1/4” UNC x 1/2” Long	FB068
7	Screw, C’sk Slotted, 1/4” UNC x 1/2” Long	FB132
8	Reaction Bracket, Divers Right	D323
9	Reaction Bracket, Divers Left	D325
10	Hose Barb	D324
11	Wiper Sleeve*	D328
12	Cable Tie*	DST034
*Reference only. Not included in C45540B		

4.9.9 Fitting of SLS harness assembly

The correct procedure for fitting the SLS MkIV Harness Assembly (order code C35650) is detailed below the following captions:

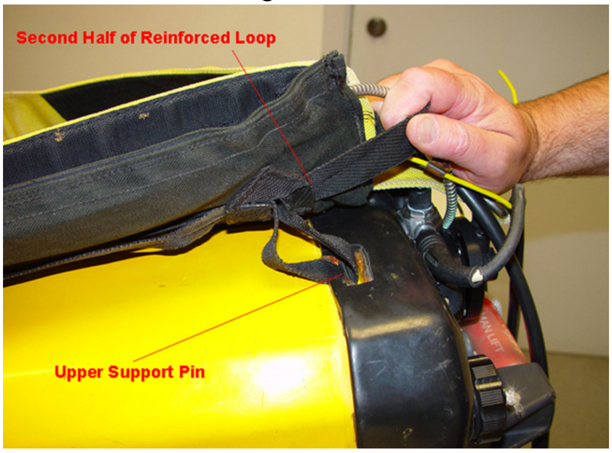
Figure 4.17

1 Pass the webbing strap under the backpack lower support pin and through the reinforced webbing loop.

Figure 4.18

2 Take the webbing strap and pass it under the first half of the reinforced loop at the top of the harness.

Figure 4.19



3 Take the webbing strap and pass it under the support pin at the top of the backpack, and then through the second half of the reinforced loop at the top of the harness

Figure 4.20

4 Pass the webbing through top buckle.

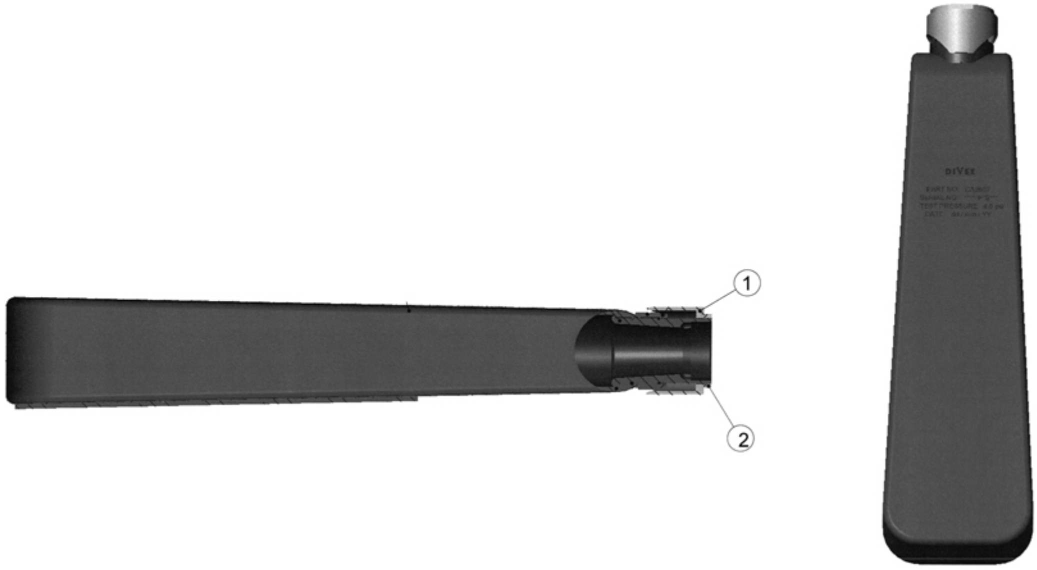
Figure 4.21

5 Take the remaining portion of webbing and loop it back through the top buckle to prevent slippage and tidy the loose end.

Note ***Incorrect fitting of the harness will lead to excessive movement of the backpack potentially causing discomfort to the diver as well as premature wear and failure of the webbing straps.***

4.9.10 Counterlung and enclosure replacement (Part no: CA2607)

Figure 4.22 Counterlung



Item	Description	Part No
1	Outer Washer	D279
2	Retaining Nut	D2488A

Note ***Counterlung bag and internal components are only available as part of assembly CA2607.***

1. Disconnect the counterlung hoses.
2. Remove the counterlung and enclosure assembly from the harness.
3. Undo the attachment webbing strap beneath the counterlung.
4. Dismantle the counterlung from the counterlung enclosure using the duct spanner (Divex Part No. M2921B) from the Tool and Test Kit.
5. Reassemble the counterlung and enclosure in the reverse of the above.

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Chapter 5 - References

Contents

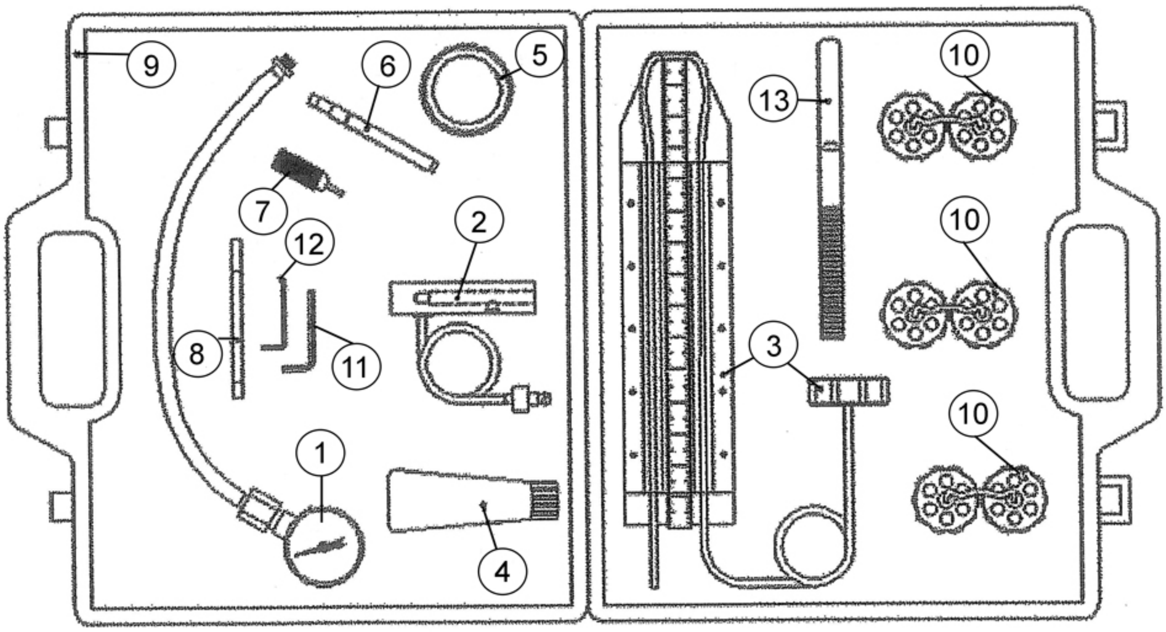
Title **page**

5.1 Tool and test kit

The Tool and Test Kit for the SLS System Mk IV contains specialised tools required to supplement the standard tools of the Maintainer, and is shown in Fig 5.24.

The contents of the Tool and Test Kit are listed below.

Figure 5.1 Tool and Test Kit - SLS System Mk IV (Part No: C10203)



Item	Description	Part No	Qty
1	Pressure Gauge Assembly	DM32540	1
2	Flowmeter Assembly	DM32580	1
3	Manometer Assembly	DM32570	1
4	Christo-lube Grease	SM034	1
5	Locknut Spanner	M2920	1
6	Duct Spanner	M2921B1	-
7	Demand Valve Actuating Tool	M2922	
8	Spanner 5/16” AF	TA097	1
9	Storage Case	MC328	1
10	Inhale/Exhale Duct Protection Cover	D311	3
11	Allen Key (3/32”)	TA024	1
12	Allen Key (1/16”)	TA182	1
13	Strap Wrench	TA009	1

5.2 Spares

5.2.1 Spares Kit SLS Mk IV (Part No. C10202)

Part No	Description	Qty
C28500	Helmet Hose Assy, SLS	1
C28700	Hose Assy, In/Exhale, SLS MKIV	2
C2937	SLS, Actuation Handle/Cable Assembly	1
DM29300	Kit, SLS Demand Regulator Spares (see below)	1
DM29310	Gas System Pipework Spares Kit (see below)	1
DM29340	Interface Assy Spares Kit, SLS (see below)	1
DM29350	Flap Valve Spares Kit (see below)	1
DM29360	Kit, SLS Main Regulator Spares (see below)	1
DM29370	Kit, SLS Umbilical Regulator Spares (see below)	1
DM29380	Scrubber Housing Spares Kit, SLS (see below)	1
DM29390	Side Door Spares Kit, SLS MKIV (see below)	1

5.2.2 Kit, SLS Demand Regulator Spares (Part No. DM29300)

Part No	Description	Qty
DM222	Diaphragm, Demand	1
FB032	Screw	8
RK221	Valve Seat	1
RK222	Pin, Valve	1
RN004-9	O-ring	1
RN028-7	O-ring	1
RN611-7	O-ring	2
VR101	Relief Valve	1
RN032-7	O-ring	1

5.2.3 Gas System Pipework Spares Kit (Part No. DM29310)

Part No	Description	Qty
FE012	Filter, Sintered	3
E14951	O-ring	1

Part No	Description	Qty
FJ295	Cap, 4-JIC, SS, MWP620BAR	1
RK221	Valve Seat	1
RK228	Ball Bearing	1
RN010-7	O-ring	1
RN015-7	O-ring	1
RN904-7	O-ring	1
RN908-7	O-ring	3
VM050	Burst Disc, 5600 PSI	1
VM051	Seat, Burst Disc	1
D267	Seal, Gauge, Hose, SLS	2

5.2.4 Interface Assy Spares Kit, SLS(Part No. DM39340)

Part No	Description	Qty
C2927A	SLS Interface Mouthpiece Assy	1
FB241	Screw	3
RN024-7	O-ring	4
RN027-7	O-ring	8
RN130-7	O-ring	4

5.2.5 Flap Valve Spares Kit (Part No. DM39350)

Part No	Description	Qty
DM2494A	Mushroom Flap Valve, 3MM Hole	6
DE109	Mushroom Flap Valve, C/W Tail	6
RN026-7	O-ring	2
RN028-7	O-ring	4
RN030-7	O-ring	4

5.2.6 Kit, SLS Main Regulator Spares (Part No. DM39360)

Part No	Description	Qty
D2206F	DVR EQP, SLS V/V Pin 2nd Stage	1
D22830	Diaphragm, 2nd Stage Regulator, SLS	1
E13991	O-ring	3
MC112	Circlip, External	1
MC121	Circlip, External, 8MM	1
RK221	Valve Seat	1
RN010-7	O-ring	2
RN015-7	O-ring	2
RN020-7	O-ring	1
RN801-7	O-ring	1
RN806-7	O-ring	1
VM052	Gasket, Relief Valve, SLS	1

5.2.7 Kit, SLS Umbilical Regulator Spares (Part No. DM39370)

Part No	Description	Qty
D2202	Pin Valve SLS	1
D22830	Diaphragm, 2nd Stage Regulator, SLS	1
MC124	Gasket	1
RK221	Valve Seat	1
RN015-7	O-ring	2

5.2.8 Scrubber Housing Spares Kit, SLS (Part No. DM39380)

Part No	Description	Qty
D2477C	Gasket, SLS Scrubber Housing	1
D300	Moisture Absorbent Pad, SLS	10
RN018-7	O-ring	2
RN028-7	O-ring	16
RN031-7	O-ring	5

5.2.9 Side Door Spares Kit, SLS MKIV (Part No. DM39390)

Part No	Description	Qty
D2486D	Nut, Retaining, Housing	1
FW007	Washer	2
MC111	Circlip, External, 9MM	1
RN1245-7	O-ring	4
RN611-7	O-ring	4

5.2.10 Other useful part numbers:

Part No	Description
CA2607	Counterlung
C45800	Counterlung Hose Assembly
C32540	Refillable Sodalime Canister
D328	Cable Wiper Sleeve
D322	Counterlung Enclosure Bush
D267	Valve Seat

Notes 1 These parts are not included in the spares kits. They are noted here for convenience, these parts should be order as required to replace worn or damaged equipment.

5.3 Guidance on Perishable Items

Soft and perishable components have a limited shelf life provided that they are stored in clean, dry conditions out of direct sunlight and have not been removed from their original packaging.

The total storage period for nitrile rubber goods is 7 years from the rubbers cure date.

The total storage period for viton rubber goods is 10 years from the rubbers cure date.

Rubber goods should be periodically inspected to ensure that no degradation has taken place.

5.4 Torque Settings

Part No	Description	Torque		
			grm m	Nm
FB032	Demand Regulator Screw (Straight Slot)	2 lbf /in	23	0.23
D2611E	Demand Regulator Seat Retainer Bolt (5/8” AF)	12 lbf / ft	1660	16.3
D4538	Bottle Manifold Banjo Plug (15mm)	10 lbf / ft	1383	13.6
FM299	Bottle Manifold Hex Plug (7/16” AF)	5 lbf / ft	692	6.8
D310	Demand Regulator Banjo Blanking Plug (7/16” AF)	5 lbf / ft	692	6.8
NP103	Umbilical Regulator Plug (14mm)	3 lbf / ft	415	4.1
VM049	Plug	5 lbf / ft	692	6.8
-	Inner Side Door	2 lbf / ft	277	2.7
D2385I	Charge Point Spring Retainer	14 lbf / in	162	1.6

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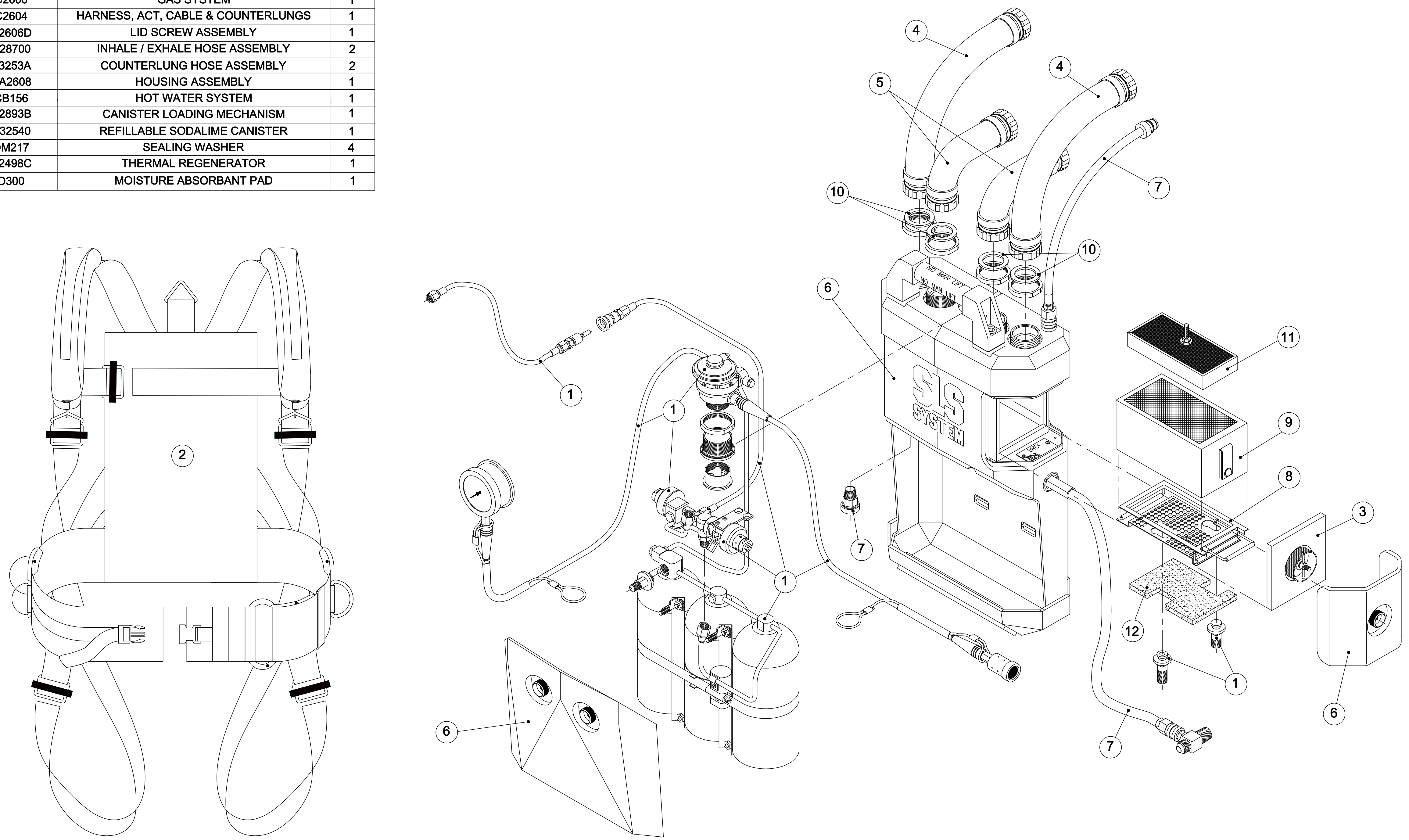
APPENDIX A SYSTEM DRAWINGS

Drawing Title Page

Backpack Assembly

ITEM	PART No.	DESCRIPTION	QTY
1	C2600	GAS SYSTEM	1
2	C2604	HARNESS, ACT, CABLE & COUNTERLUNGS	1
3	C2606D	LID SCREW ASSEMBLY	1
4	C28700	INHALE / EXHALE HOSE ASSEMBLY	2
5	C3253A	COUNTERLUNG HOSE ASSEMBLY	2
6	CA2608	HOUSING ASSEMBLY	1
7	CB156	HOT WATER SYSTEM	1
8	C2893B	CANISTER LOADING MECHANISM	1
9	C32540	REFILLABLE SODALIME CANISTER	1
10	DM217	SEALING WASHER	4
11	D2498C	THERMAL REGENERATOR	1
12	D300	MOISTURE ABSORBANT PAD	1



NOTES

ALL DIMENSIONS SHOWN ARE IN MM (UOS)
ALL DIMENSIONS BEFORE PLATING (UOS)
REMOVE ALL SHARP EDGES AND BURRS

DIMENSIONAL TOLERANCES

MACHINING		FABRICATION	
NO DECIMAL PLACES	±1.0	SIZE >0 <100	±0.5
ONE DECIMAL PLACE	±0.2	SIZE >100 <500	±1.5
TWO DECIMAL PLACE	±0.05	SIZE >500	±3.0
ANGULAR TOLERANCE	±0.5°	ANGULAR TOLERANCE	±0.5°

MATERIAL: SEE PARTS LIST

FINISH: N/A

THIRD ANGLE PROJECTION

REV	DESCRIPTION	ECN No	BY	DATE	AUTH. BY
R06					
R05					
R04					
R03					
R02	CONNECTED SHROUD SUPPLY HOSE TO HOUSING ASSEMBLY & PARTS LIST ADDED	13345	ZD	23/03/10	CC
R01	UPDATED (ECN 3657)	3657	PW	06/12/01	RTW
R00	ISSUED FOR MANUFACTURE		IHY	12/09/96	DRS

DO NOT SCALE DRAWING

TITLE: BACKPACK ASSEMBLY

DRAWING No.: P1939229S1 REV: R02

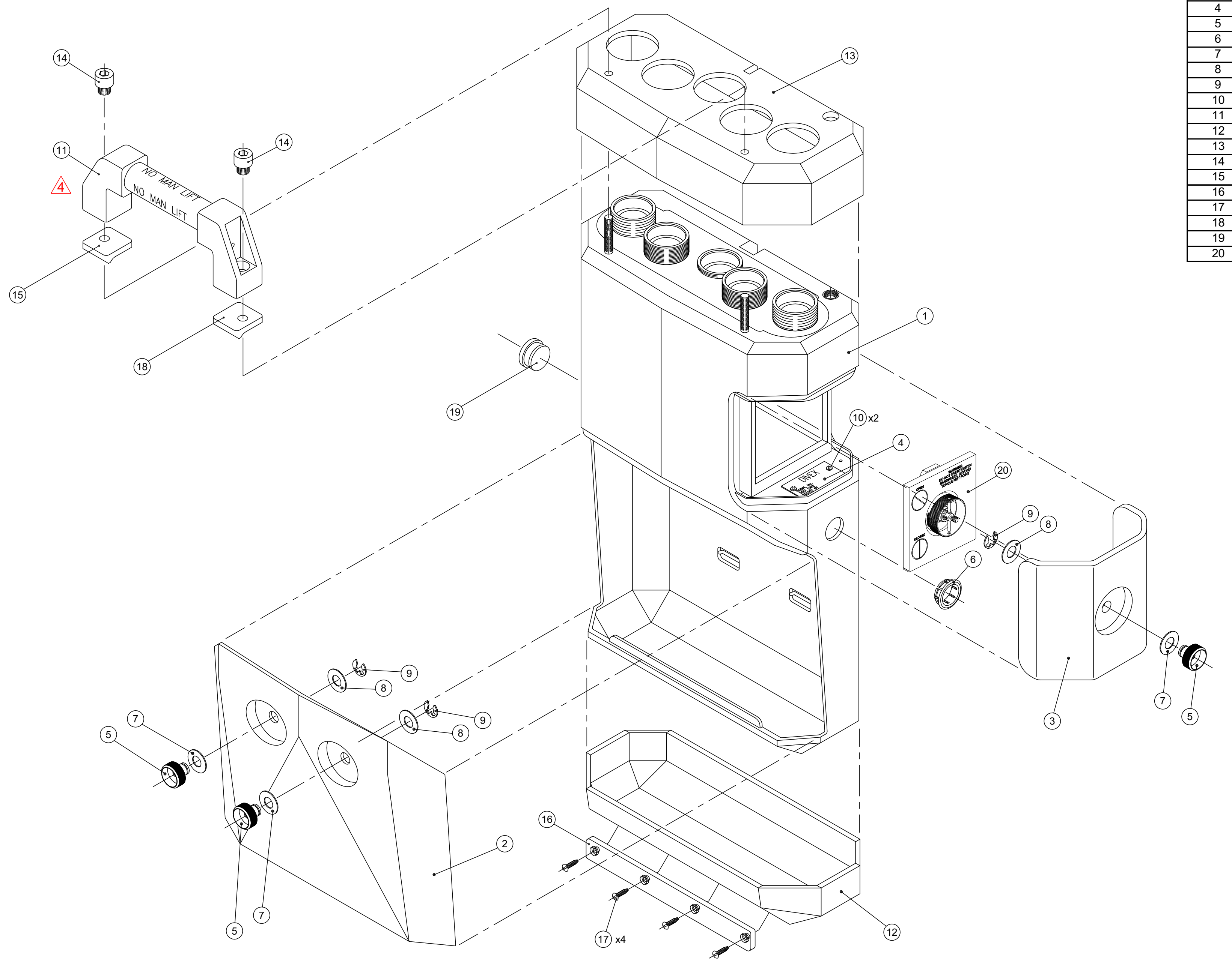
PART No.: B44771 PRODUCT / PROJECT No.: SLS SYSTEM

SIZE: A1 SCALE: NTS SHT 1 OF 1

DIVEX
DIVEX LIMITED
ENTERPRISE DRIVE
WESTHILL
ABERDEEN
AB32 6TQ
UNITED KINGDOM
Tel : +44(0)1224 740145
Fax : +44(0)1224 740172
Email : info@divexglobal.com
www.divexglobal.com

SLS System (MK IV) Housing Assembly

ITEM NO.	PART NO.	DESCRIPTION	QTY.	MANUFACTURER/SUPPLIER
1	D294	HOUSING	1	P1939-DG-182
2	D280	HOUSING LID	1	P1939-DG-082
3	D281	HOUSING SIDE DOOR	1	P1939-DG-088
4	D283	SERIAL NUMBER PLATE	1	P1939-DG-130
5	D2486	RETAINING NUT	3	82486
6	D32960	HOT WATER HOSE SURROUND	1	83296
7	D33070	WASHER	3	83307
8	FW007	Ø1/2" PLAIN WASHER	3	
9	MC111	EXTERNAL CIRCLIP	3	D1500/0090
10	FB073	1/8" x 1/4" LG SELF TAPPING SCREW	2	
11	D290	HOUSING HANDLE	1	P1939-DG-200
12	D2874B	PROTECTIVE BOOT	1	82874
13	D3578	UPPER BOOT	1	83578
14	D286	HANDLE RETAINING SCREW	2	P1939-DG-160
15	D2874B	HANDLE WASHER (L.H.)	1	P1939-DG-161
16	MC408	LOWER BOOT RESTRAINT	1	P1939-DG-203
17	FB220	No.8 x 20 LG SELF TAPPING SCREW	4	521-478
18	D314	HANDLE WASHER (R.H.)	1	P1939-DG-222
19	D315	BLANKING PLUG	1	P1939-DG-219
20	C2606D	LID SCREW ASSEMBLY	1	P1939-DG-82606



TORQUE SCRUBBER DOOR HANDWHEEL TO 2.7 - 2.9Nm. MARK WHEEL WITH WHITE PAINT OPPOSITE THE WHITE END OF THE TOMMY BAR.

NOTES

1. PRESSURE TEST SCRUBBER HOUSING ASSEMBLY TO AN INTERNAL PRESSURE OF 4psi (100% HELIUM)
2. SEE SHEET 2 FOR SERIALISATION.

4 - DENOTES CHANGES MADE AT THIS REVISION.

ALL DIMENSIONS SHOWN ARE IN MM (UOS)
ALL DIMENSIONS BEFORE PLATING (UOS)
REMOVE ALL SHARP EDGES AND BURRS

DIMENSIONAL TOLERANCES

MACHINING		FABRICATION	
NO DECIMAL PLACES	±1.0	SIZE >0 <100	±0.5
ONE DECIMAL PLACE	±0.2	SIZE >100 <500	±1.5
TWO DECIMAL PLACE	±0.05	SIZE >500	±3.0
ANGULAR TOLERANCE	±0.5°	ANGULAR TOLERANCE	±0.5°

MATERIAL: SEE PARTS LIST

FINISH: N/A

THIRD ANGLE PROJECTION

REV	DESCRIPTION	ECN No	BY	DATE	AUTH. BY
R04	ITEMS REMOVED FROM BOM	16974	TS	10/11/14	SC
R03	ITEM 23, NOTES AND SHEET 2 ADDED	16207	MJ	04/02/14	MS
R02	UPDATED	2351	IHY	01/08/96	AR
R01	UPDATED	2254	IHY	09/05/96	AR
R00	ISSUED FOR MANUFACTURE		IHY	19/03/96	DRS

DO NOT SCALE DRAWING

TITLE: SLS SYSTEM (MKIV) HOUSING ASSEMBLY

DRAWING No. P1939110S1 — REV R04

PART No. CA2608 — PRODUCT / PROJECT No. SLS SYSTEM

SIZE A1 — SCALE 1 : 2.5 — SHT 1 OF 2

DIVEX
DIVEX LIMITED
ENTERPRISE DRIVE
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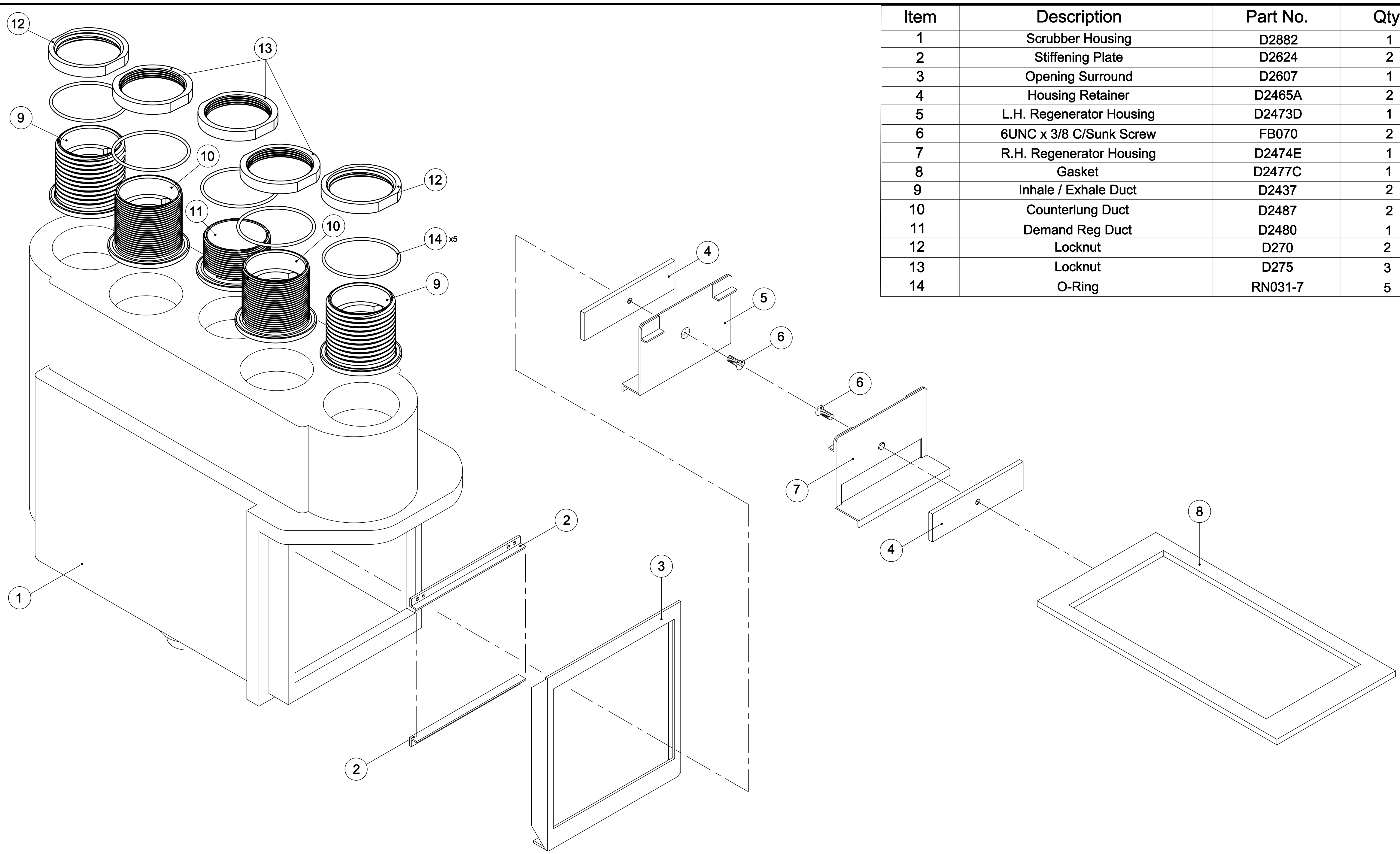
Tel : +44(0)1224 740145
Fax : +44(0)1224 740172
email : info@divexglobal.com
www.divexglobal.com

Scrubber Housing Assembly



Item	Description	Part No.	Qty.
1	Scrubber Housing	D2882	1
2	Stiffening Plate	D2624	2
3	Opening Surround	D2607	1
4	Housing Retainer	D2465A	2
5	L.H. Regenerator Housing	D2473D	1
6	6UNC x 3/8 C/Sunk Screw	FB070	2
7	R.H. Regenerator Housing	D2474E	1
8	Gasket	D2477C	1
9	Inhale / Exhale Duct	D2437	2
10	Counterlung Duct	D2487	2
11	Demand Reg Duct	D2480	1
12	Locknut	D270	2
13	Locknut	D275	3
14	O-Ring	RN031-7	5

NOTES

ALL DIMENSIONS SHOWN ARE IN MM (UOS)
ALL DIMENSIONS BEFORE PLATING (UOS)
REMOVE ALL SHARP EDGES AND BURRS

DIMENSIONAL TOLERANCES

MACHINING		FABRICATION	
NO DECIMAL PLACES	±1.0	SIZE >0 <100	±0.5
ONE DECIMAL PLACE	±0.2	SIZE >100 <500	±1.5
TWO DECIMAL PLACE	±0.05	SIZE >500	±3.0
ANGULAR TOLERANCE	±0.5°	ANGULAR TOLERANCE	±0.5°

MATERIAL: SEE PARTS LIST

FINISH: N/A

THIRD ANGLE PROJECTION

REV	DESCRIPTION	ECN No	BY	DATE	AUTH. BY
R06					
R05					
R04					
R03	REFER TO ECN	13401	ZD	02/04/10	CC
R02	UPDATED (ECN 3657)	3657	PW	6/12/01	RTW
R01	UPDATED (DCN 2311)	N/A	IHY	24/06/96	AR
R00	ISSUED FOR MANUFACTURE		IHY	21/11/95	DRS

DO NOT SCALE DRAWING

TITLE: SCRUBBER HOUSING ASSEMBLY

DRAWING No. P1939131S1 REV R03

PART No. CA288 PRODUCT / PROJECT No. SLS SYSTEM

SIZE A1 SCALE NTS SHT 1 OF 1

DIVEX
DIVEX LIMITED
ENTERPRISE DRIVE
WESTHILL
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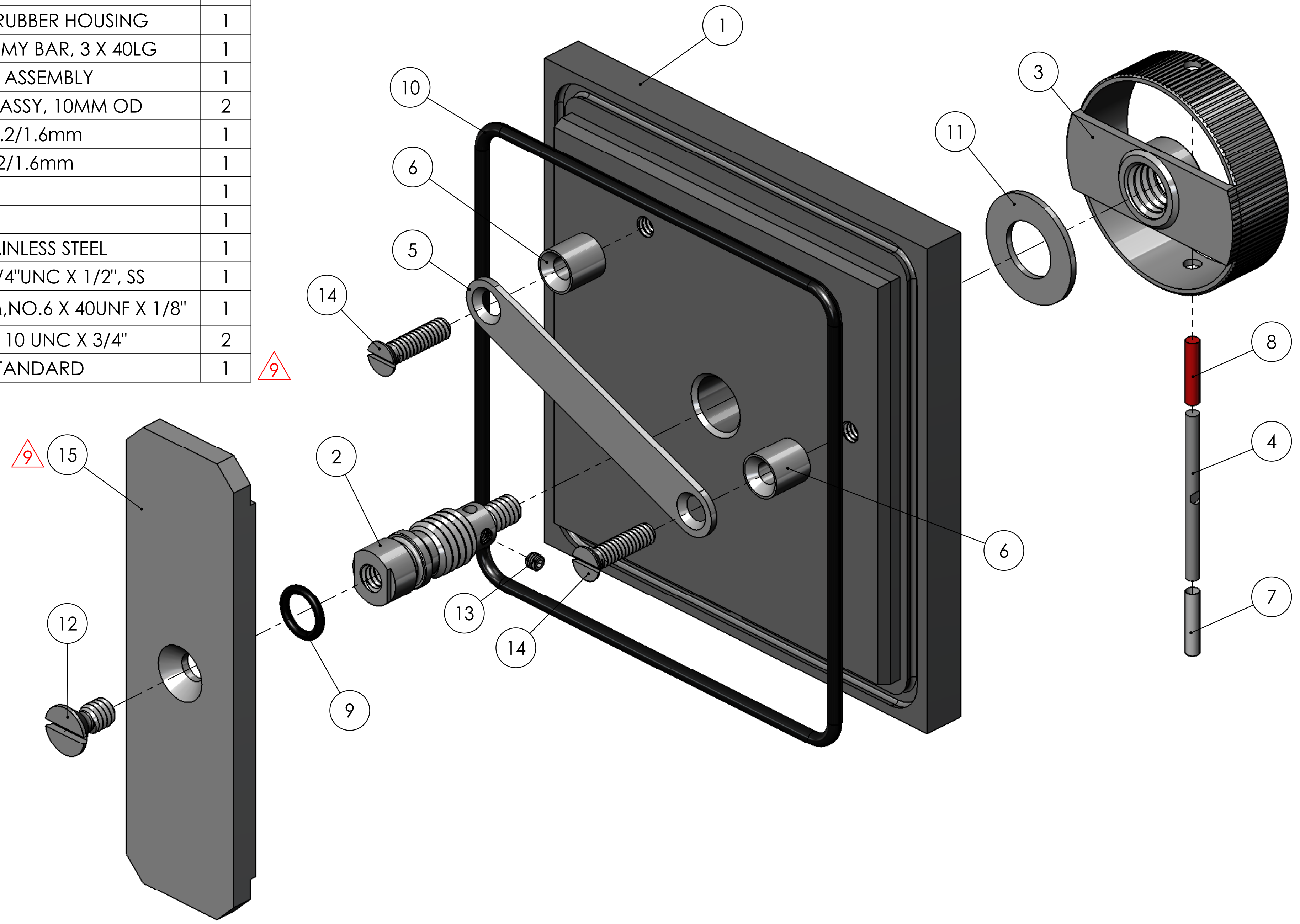
UNITED KINGDOM
Tel : +44(0)1224 740145
Fax: +44(0)1224 740172
Email : info@divexglobal.com
www.divexglobal.com

Lid Screw Assembly

ITEM No.	PART No.	DESCRIPTION	QTY.
1	D2605H	INNER DOOR, SCRUBBER HSG	1
2	D2485	DVR EQP, SLS LID SCRW ASSY,SCRW	1
3	D2483F	HANDWHEEL,PLATED, SLS SCRUBBER HOUSING	1
4	D3513	DVR EQP, SLS LID SCREW TOMMY BAR, 3 X 40LG	1
5	D2884A	GUARD,SLS LID SCREW ASSEMBLY	1
6	D2883A	DVR EQP, SLS SPACR L/SRW ASSY, 10MM OD	2
7	EM501	HEATSHRINK, WHITE, 3.2/1.6mm	1
8	EM502	HEATSHRINK, RED, 3.2/1.6mm	1
9	RN611-7	O-RING	1
10	RN1245-7	O-RING	1
11	FW007	WASHER,PLAIN, 1/2", STAINLESS STEEL	1
12	FB068	SCREW,M/C,CSK,SLOTTED, 1/4"UNC X 1/2", SS	1
13	FB079	SCREW,SOCKET SET,FLAT BOTTOM,NO.6 X 40UNF X 1/8"	1
14	FB040	SCREW,M/C,CSK,SLOTTED, 10 UNC X 3/4"	2
15	D2621	SLS,STRONG BACK, STANDARD	1

9



NOTES

9 DENOTES CHANGES MADE AT THIS REVISION

ALL DIMENSIONS SHOWN ARE IN MM (UOS)
ALL DIMENSIONS BEFORE PLATING (UOS)
REMOVE ALL SHARP EDGES AND BURRS

DIMENSIONAL TOLERANCES

MACHINING		FABRICATION	
NO DECIMAL PLACES	±1.0	SIZE >0 <100	±0.5
ONE DECIMAL PLACE	±0.2	SIZE >100 <500	±1.5
TWO DECIMAL PLACE	±0.05	SIZE >500	±3.0
ANGULAR TOLERANCE	±0.5°	ANGULAR TOLERANCE	±0.5°

MATERIAL: SEE PARTS LIST

FINISH: N/A

THIRD ANGLE PROJECTION

REV	DESCRIPTION	ECN No.	BY	DATE	AUTH. BY
R11					
R10					
R09	D2632 REPLACED WITH D2621	16825	MJ	14/07/14	MS
R08	SETSCREW ADDED	5204	PW	08/10/04	RTW
R07	UPDATED	3343	PW	11/01/01	RTW
R06	UPDATED	2271	IHY	21/05/96	AR
R00	ISSUED FOR MANUFACTURE		MF	20/11/86	HS

DO NOT SCALE DRAWING

TITLE: LID SCREW ASSEMBLY

DRAWING No.: P193982606S1 | REV: R09

PART No.: C2606D | PRODUCT / PROJECT No.: SLS SYSTEM

SIZE: A3 | SCALE: NTS | SHEET 1 OF 1

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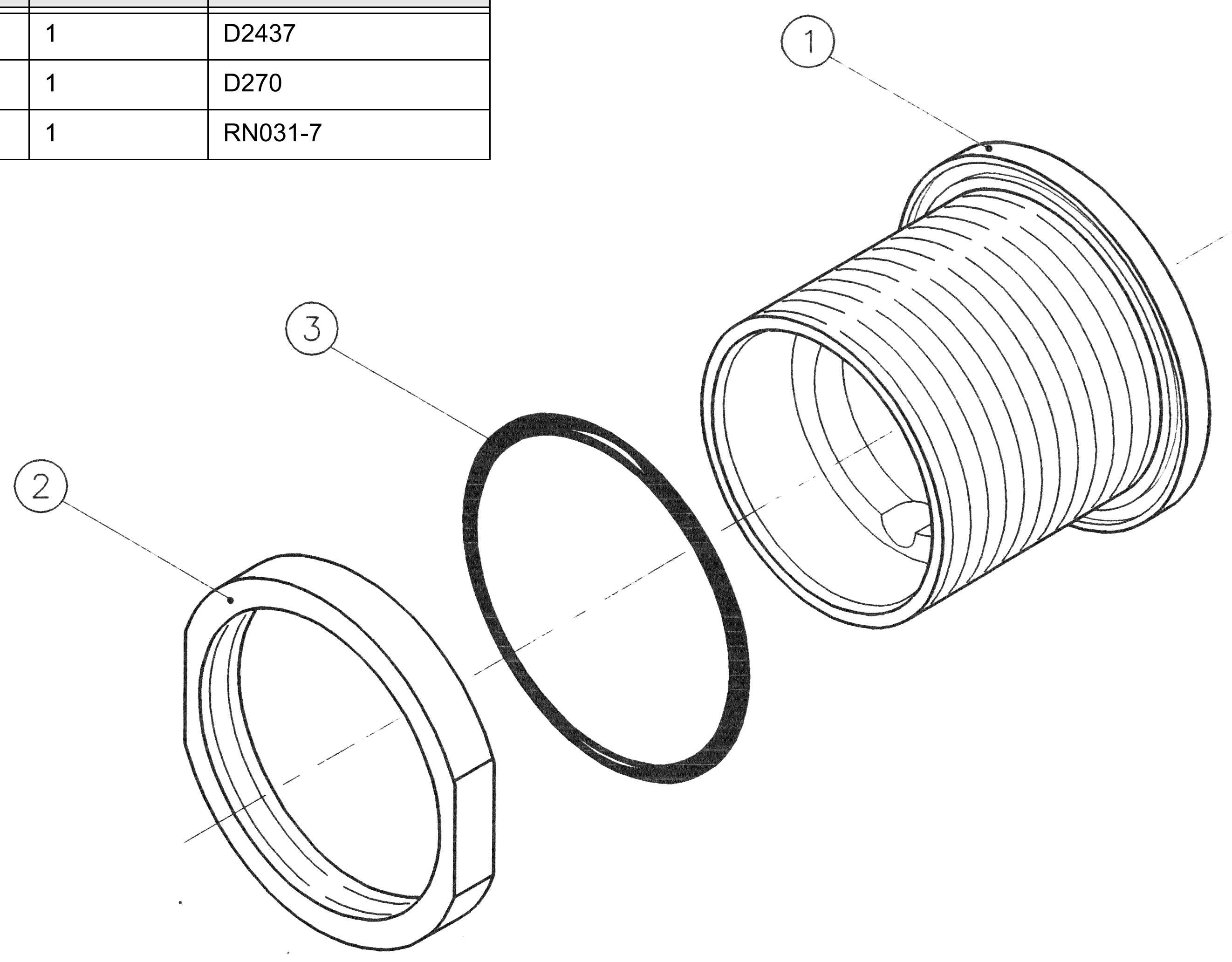
Item	Description	Qty	Part No
1	Duct	1	D2437
2	Locknut	1	D270
3	O-ring	1	RN031-7



THIRD ANGLE PROJECTION

MTO :– P1939–MT–142

A3

DIVEX
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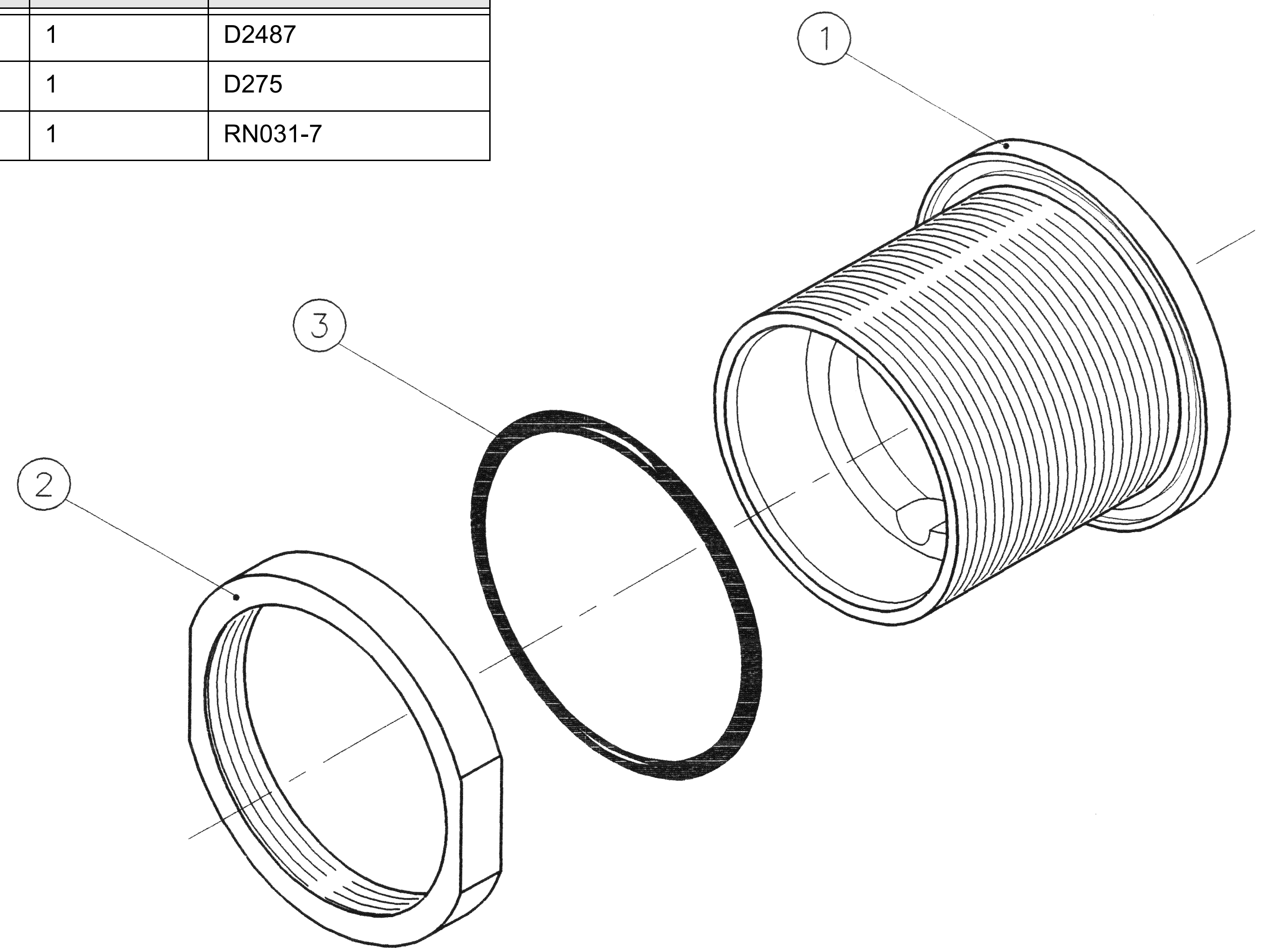
REV	DESCRIPTION OF REVISION	BY	DATE	CHKD	APPD

DRAWN IHY	DATE 13.11.95	SCALE 1 : 1	CAD REF No 9666–0
CHKD	DATE 19.1.96		PART No
APPD	DATE 23/1/96		
PROJECT SLS SYSTEM		CLIENT	

TITLE
SLS SYSTEM (MKIV)
INHALE/EXHALE DUCT ASSEMBLY

DRAWING No	SHT	OF	REV
P1939–DG–142	1	1	0

Item	Description	Qty	Part No
1	Duct	1	D2487
2	Locknut	1	D275
3	O-ring	1	RN031-7



THIRD ANGLE PROJECTION

MTO :- P1939-MT-159

A3

REV	DESCRIPTION OF REVISION	BY	DATE	CHKD	APPD

DIVEX
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DRAWN IHY	DATE 20.11.95	SCALE 1 : 1	CAD REF No 9663-0
CHKD AR	DATE 19.1.96		PART No
APPD DRS	DATE 23/1/96		
PROJECT SLS SYSTEM		CLIENT	

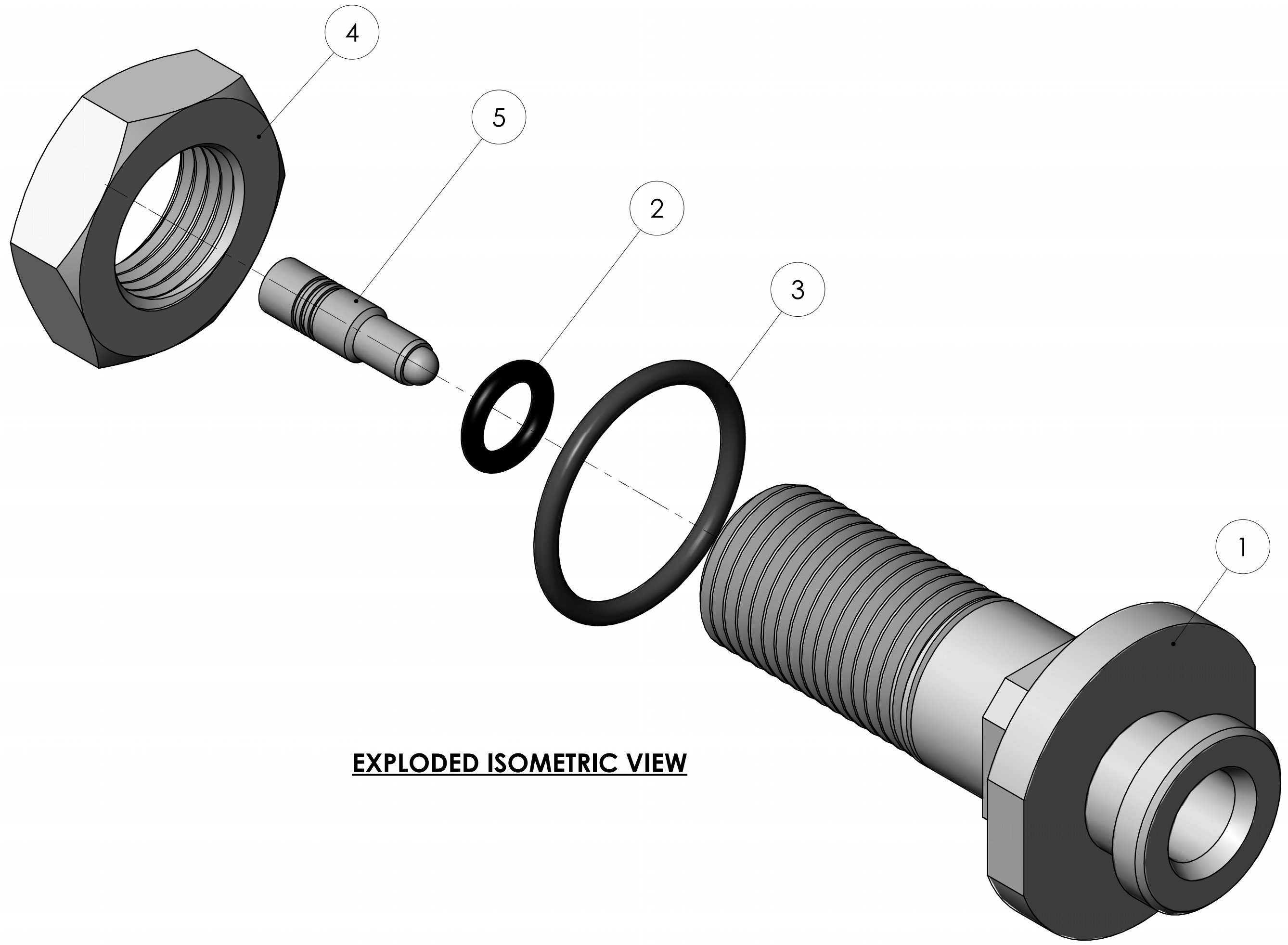
TITLE
SLS SYSTEM (MKIV)
COUNTERLUNG DUCT ASSEMBLY

DRAWING No	SHT	OF	REV.
P1939-DG-159	1	1	0

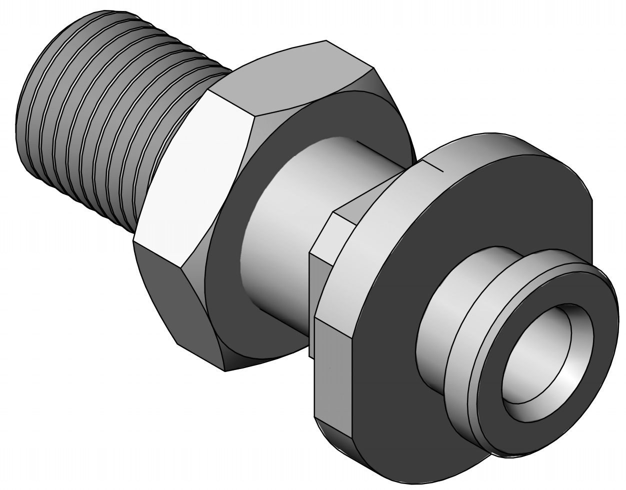
Penetrator Assembly, Supply, SLS

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	D277	BODY,PENETRATOR,SLS	1
2	RN010-7	O-RING	1
3	RN018-7	O-RING	1
4	FN016	NUT, HEX, SPECIAL, 7mm THICK, 9/16" x 18UNF, 316SS	1
5	MC109	LEE JET, 2400 LOHM	1

3



EXPLODED ISOMETRIC VIEW



ISOMETRIC VIEW

NOTES

3 DENOTES CHANGES MADE AT THIS REVISION

ALL DIMENSIONS SHOWN ARE IN MM (UOS)
ALL DIMENSIONS BEFORE PLATING (UOS)
REMOVE ALL SHARP EDGES AND BURRS

DIMENSIONAL TOLERANCES

MACHINING		FABRICATION	
NO DECIMAL PLACES	±1.0	SIZE >0 <100	±0.5
ONE DECIMAL PLACE	±0.2	SIZE >100 <500	±1.5
TWO DECIMAL PLACE	±0.05	SIZE >500	±3.0
ANGULAR TOLERANCE	±0.5°	ANGULAR TOLERANCE	±0.5°

MATERIAL: SEE PARTS LIST

FINISH: N/A

THIRD ANGLE PROJECTION

REV	DESCRIPTION	ECN No.	BY	DATE	AUTH. BY
R06					
R05					
R04					
R03	ITEM 5 DESCRIPTION UPDATED	18909	MJ	16/12/15	PB
R02	REDRAWN ON SOLIDWORKS	6672	MM	28/08/06	RTW
R01	UPDATED	2261	IHY	20/05/96	AM
R00	ISSUED FOR MANUFACTURE		IHY	13/11/95	DRS

DO NOT SCALE DRAWING

TITLE: PENETRATOR ASSY, SUPPLY, SLS

DRAWING No. P1939129S1 REV R03

PART No. CB129 PRODUCT / PROJECT No. SLS SYSTEM

SIZE A3 SCALE 1:1 SHEET 1 OF 1

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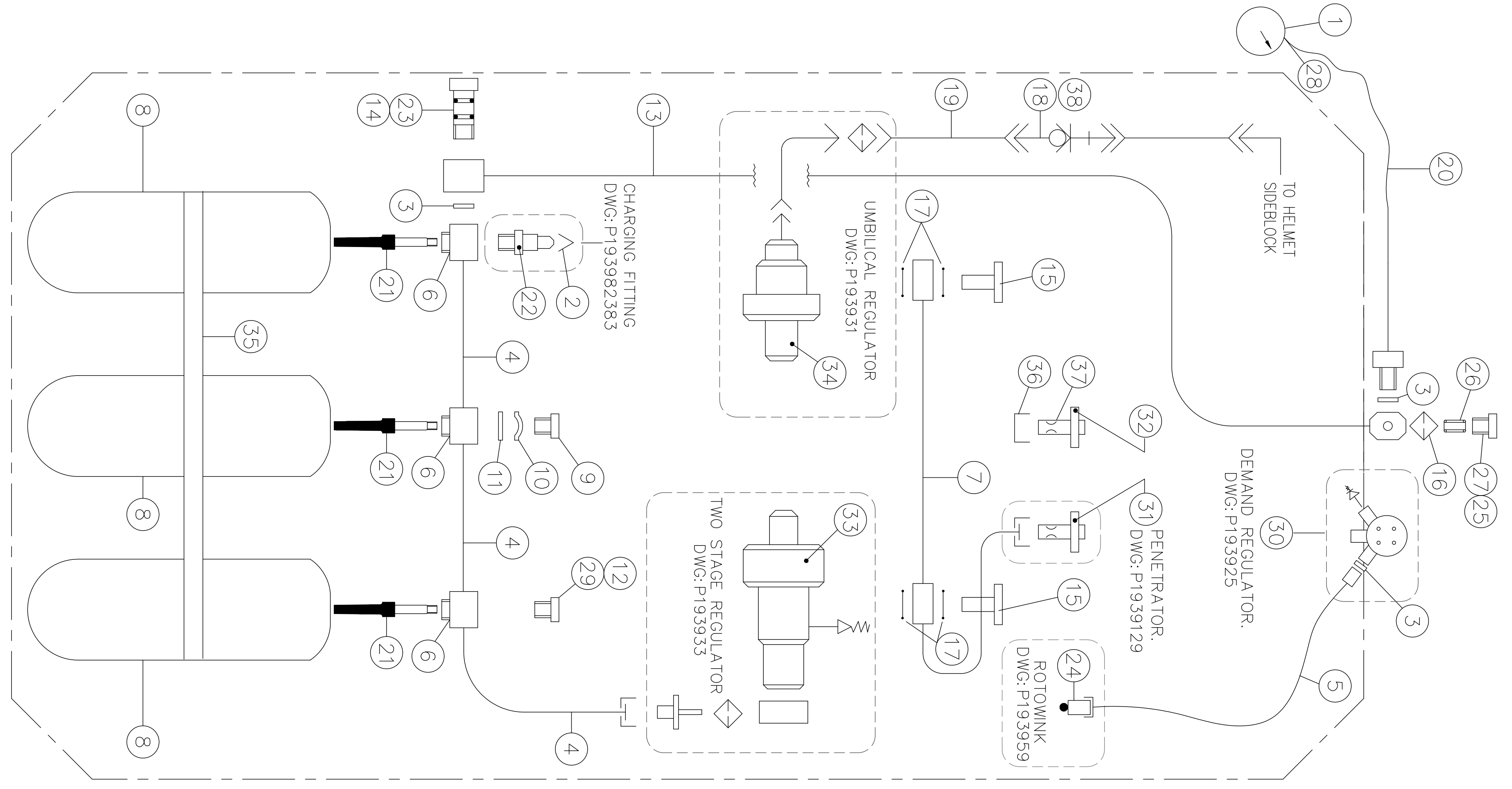
SLS System (MK III & IV) SLS Gas Schematic



ITEM	PART No.	DESCRIPTION	QTY
1	GP400	CONTENTS GAUGE	1
2	FJ295	CAP (4 JIC)	1
3	D267	VALVE SEAT	3
4	DM4511	BOTTLE MANIFOLD ASSY.	1
5	DM261	ROTOWINK WHIP ASSY.	1
6	RN908-7	O-RING	3
7	DM2941A	REGULATOR INTERCON. PIPEWORK ASSY.	1
8	M275A	GAS CYLINDERS	3
9	DD041719	BLANKING PLUG	1
10	VM050	BURST DISC	1
11	VM051	BURST DISC SEAT	1
12	FM299	PLUG, HEX	1
13	DM4469	DEMAND REGULATOR INTERCON. PIPEWORK ASSY.	1
14	RN803-7	O-RING	2
15	D26940	REGULATOR CONNECTION BOLT	2
16	FE012	SINTERED ELEMENT	1
17	RN015-7	O-RING	4
18	FS2018	QUICK CONNECT BODY	1
19	D2751	REGULATOR WHIP (LONG)	1
20	DM260	GAUGE WHIP ASSY.	1
21	FE014	FILTERING DIP TUBE	3
22	C2383D	CHARGING FITTING	1

ITEM	PART No.	DESCRIPTION	QTY
23	D4538	BOTTLE MANIFOLD BANJO BOLT	1
24	DM262	ROTOWINK ASSY.	1
25	E13583	O-RING	1
26	RK220	SPRING	1
27	D310	BLANKING PLUG	1
28	RN510-7	O-RING	1
29	E14951	O-RING	1
30	CA2604	REGULATOR, DEMAND	1
31	CB129	PENETRATOR ASSY, SUPPLY	1
32	D291	BODY, PENETRATOR BLANK	1
33	CA2602	2 STAGE REGULATOR	1
34	CA2603	SINGLE STAGE REGULATOR ASSY	1
35	C2626B	BOTTLE, RETAINER ASSY	1
36	FN016	NUT, HEX, SPECIAL, 7mm THICK, 9/16" x 18 UNF, 316SS	1
37	RN018-7	O-RING	1
38	FJ979	4 JIC - 1/4 NPT CONNECTOR	1
39	D26940	MOUNTING BOLT BANJO	1
40	D276	DEMAND REGULATOR DUCT INSERT	1
41	D2939A	DEMAND REGULATOR RETAINING NUT	1
42	DM2945	ANODE KIT	1
43	VR300	RELIEF VALVE (HOT WATER)	1

NOTES:

ITEMS 39 - 43 NOT SHOWN FOR CLARITY

ALL DIMENSIONS SHOWN ARE IN MM (UOS)
ALL DIMENSIONS BEFORE PLATING (UOS)
REMOVE ALL SHARP EDGES AND BURRS

DIMENSIONAL TOLERANCES

MACHINING		FABRICATION		
NO DECIMAL PLACES	±1.0	SIZE >0	<100	±0.5
ONE DECIMAL PLACE	±0.2	SIZE >100	<500	±1.5
TWO DECIMAL PLACE	±0.05	SIZE >500		±3.0
ANGULAR TOLERANCE	±0.5°	ANGULAR TOLERANCE		±0.5°

MATERIAL: SEE PARTS LIST

FINISH: N/A

THIRD ANGLE PROJECTION

REV	DESCRIPTION	ECN No.	BY	DATE	AUTH. BY
R06					
R05					
R04	PARTS LIST ADDED & UPDATED TO REFLECT BOM	13367	ZD	10/05/10	CC
R03	UPDATED (DCN 2463)	N/A	IHY	12/02/97	HS
R02	UPDATED (DCN 2334)	N/A	IHY	15/07/96	AR
R01	UPDATED (DCN 1901)	N/A	IHY	12/10/95	AR
R00	ISSUED FOR MANUFACTURE		MB	11/12/92	JR

DO NOT SCALE DRAWING

TITLE: SLS SYSTEM (MKIII & MKIV) SLS GAS SCHEMATIC

DRAWING No.	REV
P193940S1	R04

PART No.	PRODUCT / PROJECT No.
C2600	SLS SYSTEM

SIZE	SCALE	SHT	OF
A2	NTS	1	1

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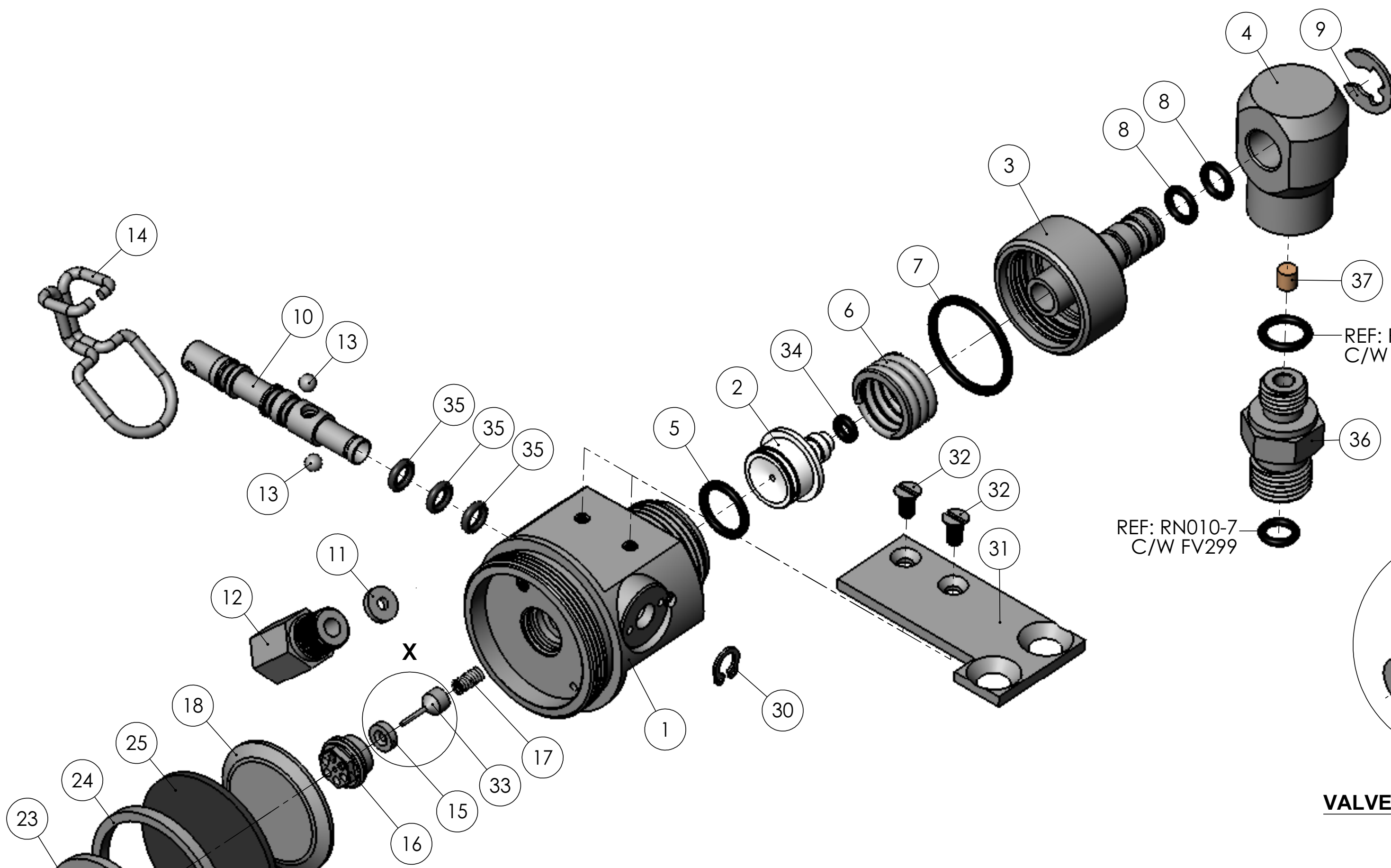
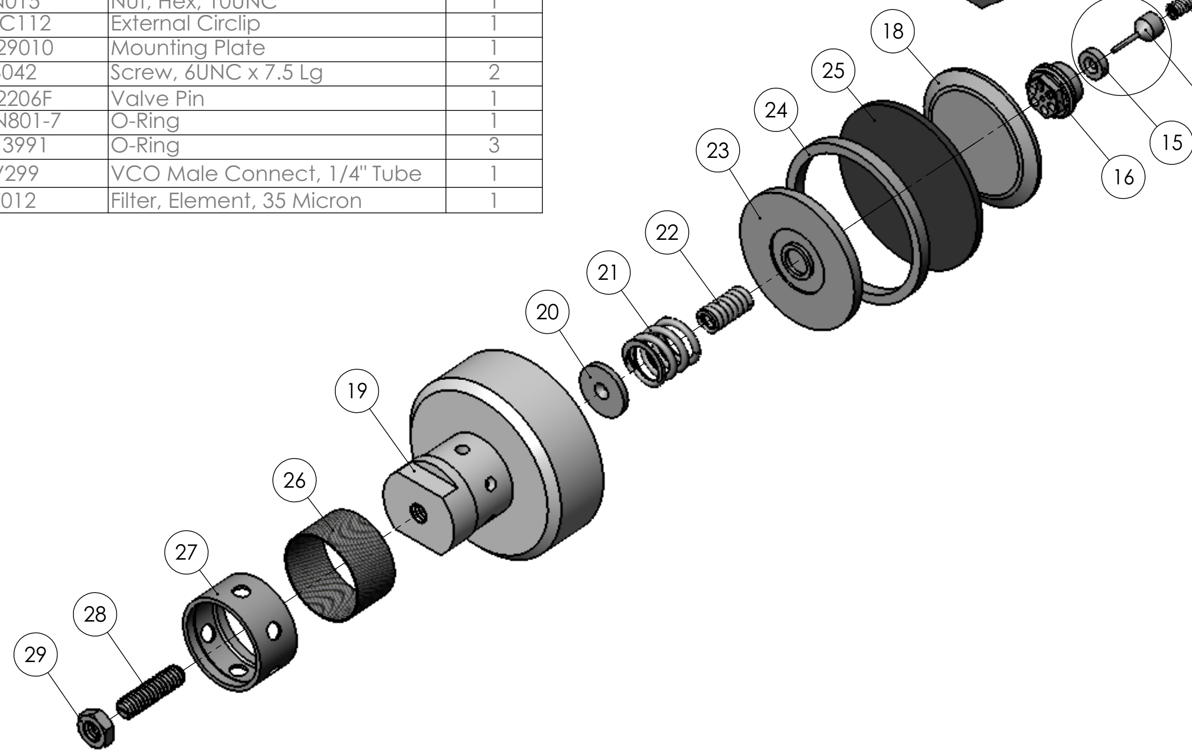
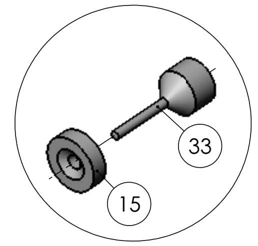
Two Stage Regulator Assembly

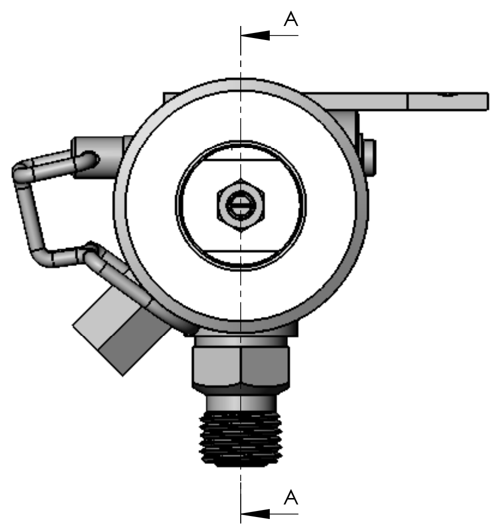
ITEM	PART No.	DESCRIPTION	QTY.
1	D2792	Two Stage Regulator Body	1
2	D2203E	Piston	1
3	D2691F	End Cap	1
4	D4541A	Inlet Banjo Fitting	1
5	RN806-7	O-Ring	1
6	RK225	Compression Spring	1
7	RN020-7	O-Ring	1
8	RN010-7	O-Ring	2
9	MC121	8mm Circlip, External	1
10	D2794E	Valve, Shuttle	1
11	VM052	Gasket, Relief Valve	1
12	DM399	Valve, Safety Relief	1
13	RK231	Ball Bearing, 5/32" Dia.	2
14	D2891C	Load Ring, 3mm Dia.	1
15	RK221	Valve Seat	1
16	D2210G	Valve Seat Retainer	1
17	RK223	Compression Spring	1
18	D2207	Plate, Diaghragm Support	1
19	D2285	End Cap	1
20	D2212B	Adjustment Plate, Spring	1
21	RK230	Compression Spring	1
22	RK235	Compression Spring	1
23	D2281	Support Plate, Spring	1
24	D2282	Slip Ring	1
25	D22830	Diaphragm	1
26	D32870	Regulator Mesh	1
27	D32860	Cap Sleeve, Regulator	1
28	FB080	Screw, Grub, 10UNC x 3/4" Lg	1
29	FN015	Nut, Hex, 10UNC	1
30	MC112	External Circlip	1
31	D29010	Mounting Plate	1
32	FB042	Screw, 6UNC x 7.5 Lg	2
33	D2206F	Valve Pin	1
34	RN801-7	O-Ring	1
35	E13991	O-Ring	3
36	FV299	VCO Male Connect, 1/4" Tube	1
37	FE012	Filter, Element, 35 Micron	1

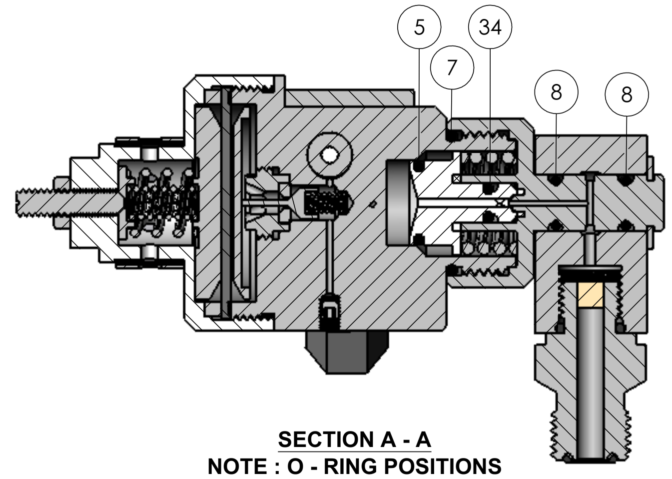






DETAIL 'X'
VALVE SEAT ORIENTATION
(Scale2:1)





SECTION A - A
NOTE : O - RING POSITIONS
(Scale 1.25:1)

NOTES

1. ASSEMBLE IN ACCORDANCE WITH AITP-AP-34.
2. ENSURE VALVE SEAT (ITEM 15) IS FITTED WITH NON - CHAMFERED SIDE AGAINST VALVE PIN (ITEM 33).

ALL DIMENSIONS SHOWN ARE IN MM (UOS)
ALL DIMENSIONS BEFORE PLATING (UOS)
REMOVE ALL SHARP EDGES AND BURRS

DIMENSIONAL TOLERANCES

MACHINING		FABRICATION	
NO DECIMAL PLACES	±1.0	SIZE >0 <100	±0.5
ONE DECIMAL PLACE	±0.2	SIZE >100 <500	±1.5
TWO DECIMAL PLACE	±0.05	SIZE >500	±3.0
ANGULAR TOLERANCE	±0.5°	ANGULAR TOLERANCE	±0.5°

MATERIAL: SEE PARTS LIST

FINISH: N/A

THIRD ANGLE PROJECTION

REV	DESCRIPTION	ECN No	BY	DATE	AUTH.BY
R07					
R06					
R05	O-RINGS SUPPLIED WITH PART No. FV299 SHOWN FOR REFERENCE	13506	ZD	12/5/10	CC
R04	SECTION VIEW ADDED	13426	ZD	14/04/10	CC
R03	REDRAWN TO SOLIDWORKS	5204	PW	08/10/04	JM
R02	UPDATED	3183	IHY	31/03/00	JR
R00	ISSUED FOR MANUFACTURE		MB	05/03/92	HS

DO NOT SCALE DRAWING

TITLE: **TWO STAGE REGULATOR ASSEMBLY**

DRAWING No.: **P193933S1** REV: **R05**

PART No.: CA2602 PRODUCT / PROJECT No.: SLS SYSTEM

SIZE: A2 SCALE: 1:1 SHT 1 OF 1

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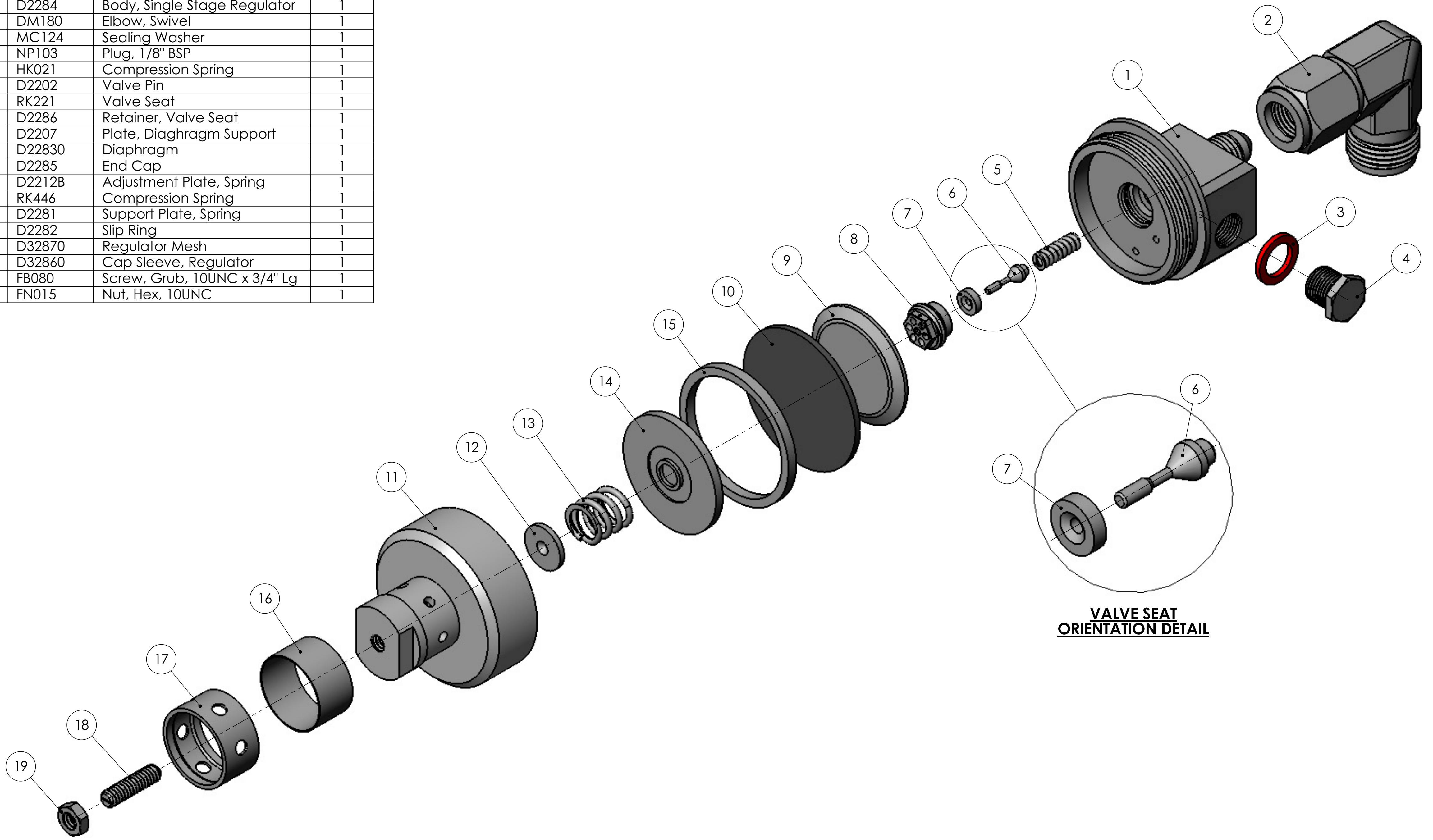
Single Stage Regulator Assembly

ITEM	PART No.	DESCRIPTION	QTY.
1	D2284	Body, Single Stage Regulator	1
2	DM180	Elbow, Swivel	1
3	MC124	Sealing Washer	1
4	NP103	Plug, 1/8" BSP	1
5	HK021	Compression Spring	1
6	D2202	Valve Pin	1
7	RK221	Valve Seat	1
8	D2286	Retainer, Valve Seat	1
9	D2207	Plate, Diaghragm Support	1
10	D22830	Diaphragm	1
11	D2285	End Cap	1
12	D2212B	Adjustment Plate, Spring	1
13	RK446	Compression Spring	1
14	D2281	Support Plate, Spring	1
15	D2282	Slip Ring	1
16	D32870	Regulator Mesh	1
17	D32860	Cap Sleeve, Regulator	1
18	FB080	Screw, Grub, 10UNC x 3/4" Lg	1
19	FN015	Nut, Hex, 10UNC	1



VALVE SEAT
ORIENTATION DETAIL

NOTE: ENSURE VALVE SEAT (ITEM 7) IS FITTED WITH NON-CHAMFERED SIDE AGAINST VALVE PIN (ITEM 6).

THIRD ANGLE PROJECTION

MATERIAL: SEE ABOVE

FINISH: -

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A2

REV	DESCRIPTION OF REVISION	ECN	DRAWN BY	DATE	DRAFTING CHECK BY	DATE	ENGINEER CHECK BY	DATE	APPROVAL BY	DATE
3	REDRAWN ON SOLIDWORKS	5204	PW	01.10.04	JM	25.10.04	JM	25.10.04	JM	25.10.04
2	UPDATED	3183	IHY	03.04.00	JR	03.04.00	JR	03.04.00	JR	03.04.00
0	ISSUED FOR MANUFACTURE	N/A	MB	05.11.92	HS	11.11.92	HS	11.11.92	HS	11.11.92

ALL DIMENSIONS IN MM (UOS)

ALL DIMENSIONS BEFORE PLATING (UOS)

REMOVE SHARP EDGES & BURRS

DIMENSIONAL TOLERANCES :
NO DECIMAL PLACES ±1.0
ONE DECIMAL PLACE ±0.2
TWO DECIMAL PLACES ±0.05
ANGULAR TOLERANCE ±0.5°

SCALE	PRODUCT
NTS	SLS SYSTEM

PART No. CA2603

CAD REF No. 13613

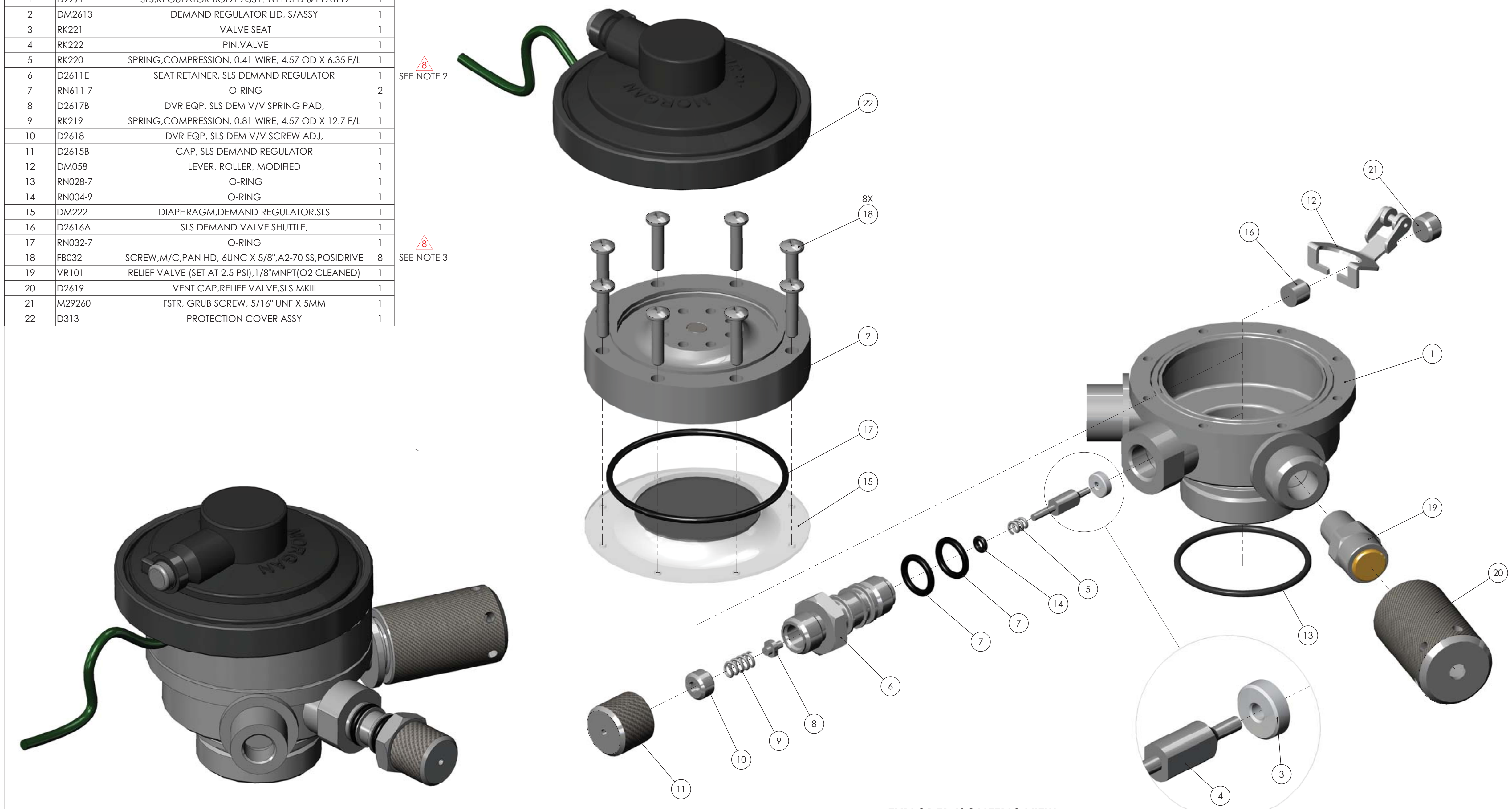
TITLE

SINGLE STAGE
REGULATOR ASSEMBLY

DRG No.	SHT	REV
P1939-DG-031	1	3

Regulator, Demand, SLS (Mk IV)

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.	
1	D2291	SLS,REGULATOR BODY ASSY. WELDED & PLATED	1	
2	DM2613	DEMAND REGULATOR LID, S/ASSY	1	
3	RK221	VALVE SEAT	1	
4	RK222	PIN,VALVE	1	
5	RK220	SPRING,COMPRESSION, 0.41 WIRE, 4.57 OD X 6.35 F/L	1	8
6	D2611E	SEAT RETAINER, SLS DEMAND REGULATOR	1	SEE NOTE 2
7	RN611-7	O-RING	2	
8	D2617B	DVR EQP, SLS DEM V/V SPRING PAD,	1	
9	RK219	SPRING,COMPRESSION, 0.81 WIRE, 4.57 OD X 12.7 F/L	1	
10	D2618	DVR EQP, SLS DEM V/V SCREW ADJ,	1	
11	D2615B	CAP, SLS DEMAND REGULATOR	1	
12	DM058	LEVER, ROLLER, MODIFIED	1	
13	RN028-7	O-RING	1	
14	RN004-9	O-RING	1	
15	DM222	DIAPHRAGM,DEMAND REGULATOR,SLS	1	
16	D2616A	SLS DEMAND VALVE SHUTTLE,	1	
17	RN032-7	O-RING	1	8
18	FB032	SCREW,M/C,PAN HD, 6UNC X 5/8",A2-70 SS,POSIDRIVE	8	SEE NOTE 3
19	VR101	RELIEF VALVE (SET AT 2.5 PSI),1/8"MNPT(O2 CLEANED)	1	
20	D2619	VENT CAP,RELIEF VALVE,SLS MKIII	1	
21	M29260	FSTR, GRUB SCREW, 5/16" UNF X 5MM	1	
22	D313	PROTECTION COVER ASSY	1	



ISOMETRIC VIEW

EXPLODED ISOMETRIC VIEW

VALVE SEAT ORIENTATION DETAIL

NOTES

1. ENSURE VALVE SEAT (ITEM 3) IS FITTED WITH CHAMFERED SIDE AGAINST VALVE PIN (ITEM 4)
2. TORQUED TO 12 LBF/16.4Nm
3. TORQUED TO 2" LBF/ 0.23Nm 8

8 DENOTES CHANGES MADE AT THIS REVISION

ALL DIMENSIONS SHOWN ARE IN MM (UOS)
ALL DIMENSIONS BEFORE PLATING (UOS)
REMOVE ALL SHARP EDGES AND BURRS

DIMENSIONAL TOLERANCES

MACHINING		FABRICATION	
NO DECIMAL PLACES	±1.0	SIZE >0 <100	±0.5
ONE DECIMAL PLACE	±0.2	SIZE >100 <500	±1.5
TWO DECIMAL PLACE	±0.05	SIZE >500	±3.0
ANGULAR TOLERANCE	±0.5°	ANGULAR TOLERANCE	±0.5°

MATERIAL: SEE PARTS LIST

FINISH: N/A

THIRD ANGLE PROJECTION

REV	DESCRIPTION	ECN No	BY	DATE	AUTH.BY
R10					
R09					
R08	NOTES ADDED TO DRAWING	19426	MJ	27/04/16	AN
R07	PROTECTION COVER ASSEMBLY REVISED	5718	PW	08/06/05	JM
R06	LID SUB ASSEMBLY NOW ONE ITEM NUMBER	5204	PW	20/10/04	JM
R05	PROTECTION COVER ASSEMBLY REVISED	4940	PW	17/05/04	RTW
R00	ISSUED FOR MANUFACTURE		MB	27/10/92	HS

DO NOT SCALE DRAWING

TITLE: REGULATOR,DEMAND, SLS (MKIV)

DRAWING No.: P193925S1 REV: R08

PART No.: CA2604 PRODUCT / PROJECT No.: SLS SYSTEM

SIZE: A2 SCALE: 1.3:1 SHT 1 OF 1

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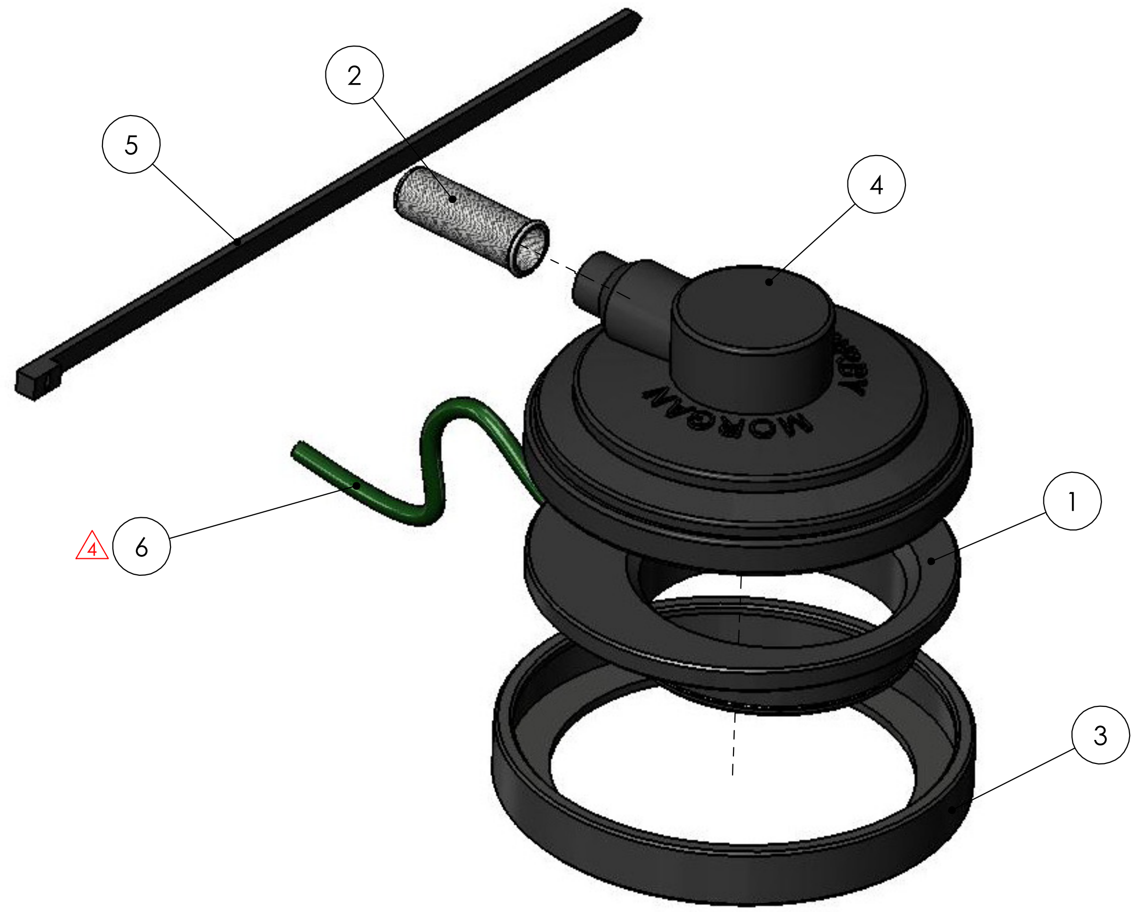
Protection Cover Assembly

ITEM	PART No.	DESCRIPTION	Qty.
1	D304	SPIGOT	1
2	FE013	FILTER ELEMENT	1
3	D2219	RING, RETAINING	1
4	DE924	COVER SET, EARPHONE	1
5	DST034	CABLE TIE BLACK	1
6	DD330303	WHIPPING TWINE,GREEN BRAID	400mm 5



NOTES

5 DENOTES CHANGES MADE AT THIS REVISION.

ALL DIMENSIONS SHOWN ARE IN MM (UOS)
ALL DIMENSIONS BEFORE PLATING (UOS)
REMOVE ALL SHARP EDGES AND BURRS

DIMENSIONAL TOLERANCES

MACHINING		FABRICATION	
NO DECIMAL PLACES	±1.0	SIZE >0 <100	±0.5
ONE DECIMAL PLACE	±0.2	SIZE >100 <500	±1.5
TWO DECIMAL PLACE	±0.05	SIZE >500	±3.0
ANGULAR TOLERANCE	±0.5°	ANGULAR TOLERANCE	±0.5°

MATERIAL: SEE PARTS LIST

FINISH: -

THIRD ANGLE PROJECTION

REV	DESCRIPTION	ECN No.	BY	DATE	AUTH. BY
R06					
R05	DST098 REPLACED WITH DD330303	16180	MJ	01/11/13	MS
R04	DE077 REPLACED WITH DE924	15509	MJ	21/02/13	MS
R03	DD330303 REPLACED WITH DST098	13124	SJ	20/01/10	GMcC
R02	ITEM 1 ROTATED 180°	5718	PW	24/05/05	RTW
R01	SECURITY CORD QTY. REVISED	5204	PW	29/09/04	RTW
R00	ISSUED FOR MANUFACTURE		PW	17/05/04	RTW

DO NOT SCALE DRAWING

TITLE: PROTECTION COVER ASSEMBLY

DRAWING No.: P1939272S1 | REV: R05

PART No.: D313 | PRODUCT / PROJECT No.: SLS SYSTEM

SIZE: A3 | SCALE: 1:1 | SHEET 1 OF 1

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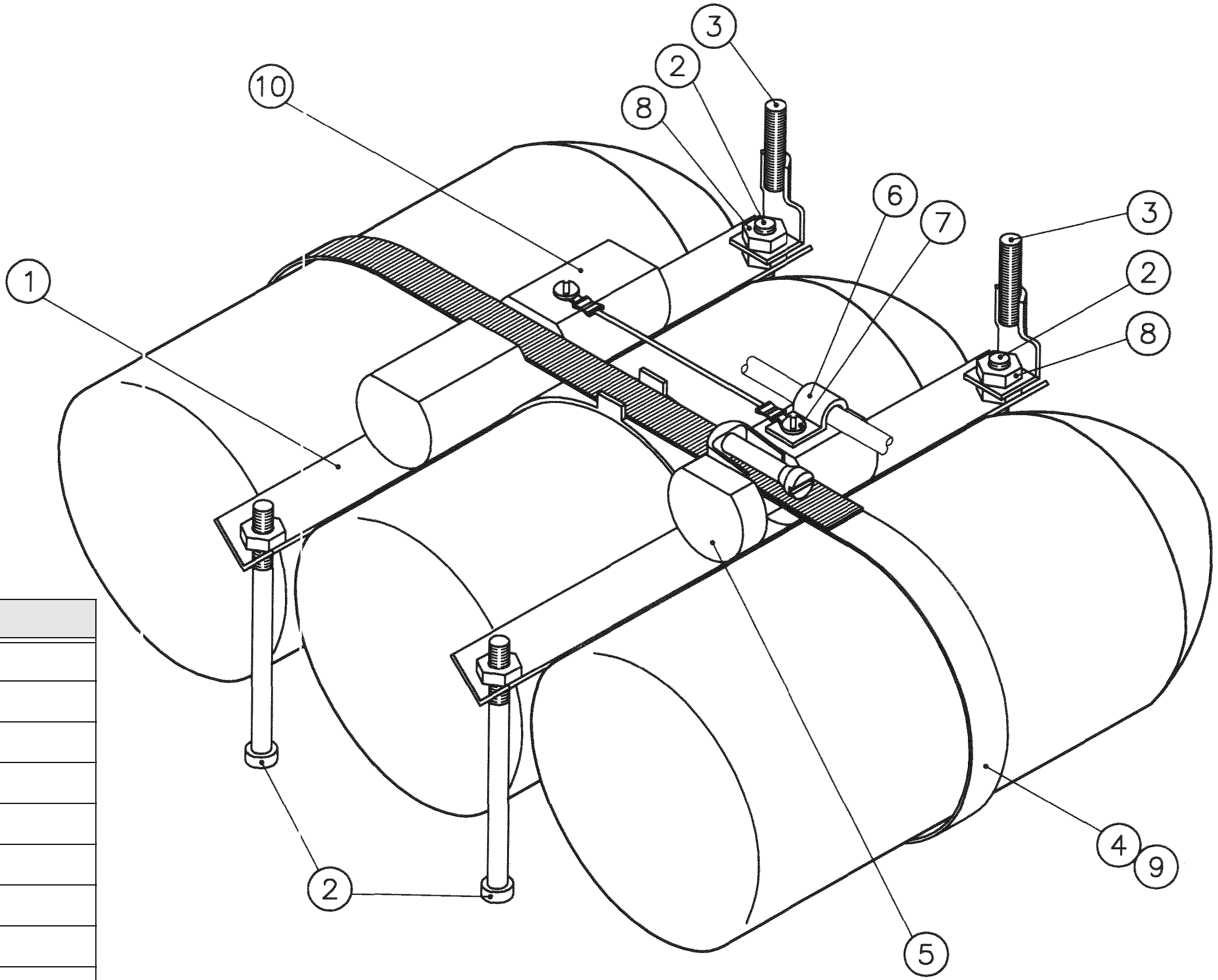
ASSEMBLY NOTES :

1. JUBILEE CLIP (ITEM 4) SHORTENED BY 60mm PRIOR TO ASSEMBLY WITH BOTTLES.
2. SECURING STUD (ITEM 3) CUT UPON ASSEMBLY TO ENSURE MAXIMUM 4 FULL THREAD ENGAGEMENT WITH THE HOUSING LID RETAINING NUT.



Item	Description	Qty	Part No
1	Bottle Retainer	1	J2489B
2	Bolt, Panhead	4	FB075
3	Securing Stud	2	D305
4	Jubilee Clip	1	FC047
5	Bracket, Pipework Support	1	MC406
6	Pipework Securing Clip	2	MC407
7	Screw, Self Tapping	1	FB248
8	1/4”-20 UNC Hex Nut	1	FN001
9	Heatshrink (Black)	1	EM190
10	Anode Kit	1	DM2945

THIRD ANGLE PROJECTION

MATERIAL: MTO :– 82626–MT

FINISH:

DIVEX A3

REV	DESCRIPTION OF REVISION	BY	DATE	DRAFT CHECK	ENG CHECK	APPD
6	UPDATED (DCN 3727)	PGB	07.3.02			
5	UPDATED (DCN 3563)	PGB	27.8.01	GG	GG	GG
4	UPDATED (DCN 2332)	IHY	11.7.96	AR	AR	AR
3	UPDATED (DCN 2255)	IHY	14.5.96	AR	AR	AR

ALL DIMENSIONS IN MM (UOS)

REMOVE SHARP EDGES & BURRS

DIMENSIONAL TOLERANCES:
NO DECIMAL PLACES ±1.0
ONE DECIMAL PLACE ±0.2
TWO DECIMAL PLACES ±0.05
ANGULAR TOLERANCE ±0.5°

DRAWN:	GB	DATE	7.5.86	SCALE 1 : 2
DRAFT. CHECK:	MF	DATE	24.4.87	
ENG. CHECK:	HS	DATE	30.4.87	CAD REF No. 10480–6
APPROVED:	HS	DATE	30.4.87	

PRODUCT: SLS SYTEM

PART No.: C2626

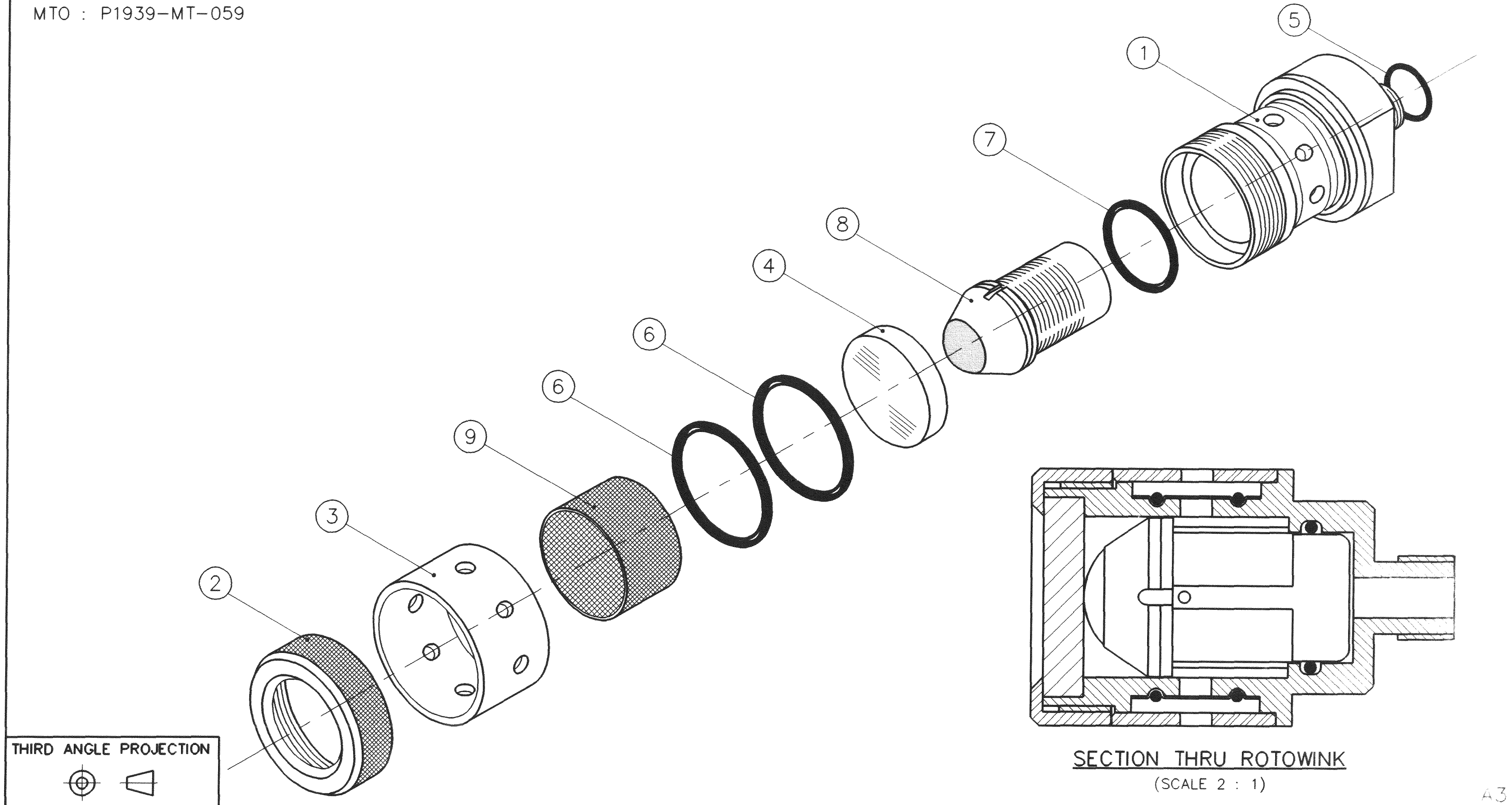
TITLE: SLS SYSTEM (MKIV) BOTTLE RETAINER ASSEMBLY

DRG No.: 82626

SHT 1 OF 1

REV 6

SLS System Rotowink General Assembly



REV	DESCRIPTION OF REVISION	BY	DATE	DRAFT CHECK	ENG CHECK	APPD
2	UPDATED (DCN 2379)	IHY	17.2.97	[illegible]	[illegible]	[illegible]
1	UPDATED (DCN 2167)	IHY	4.4.96	AR	AR	AR

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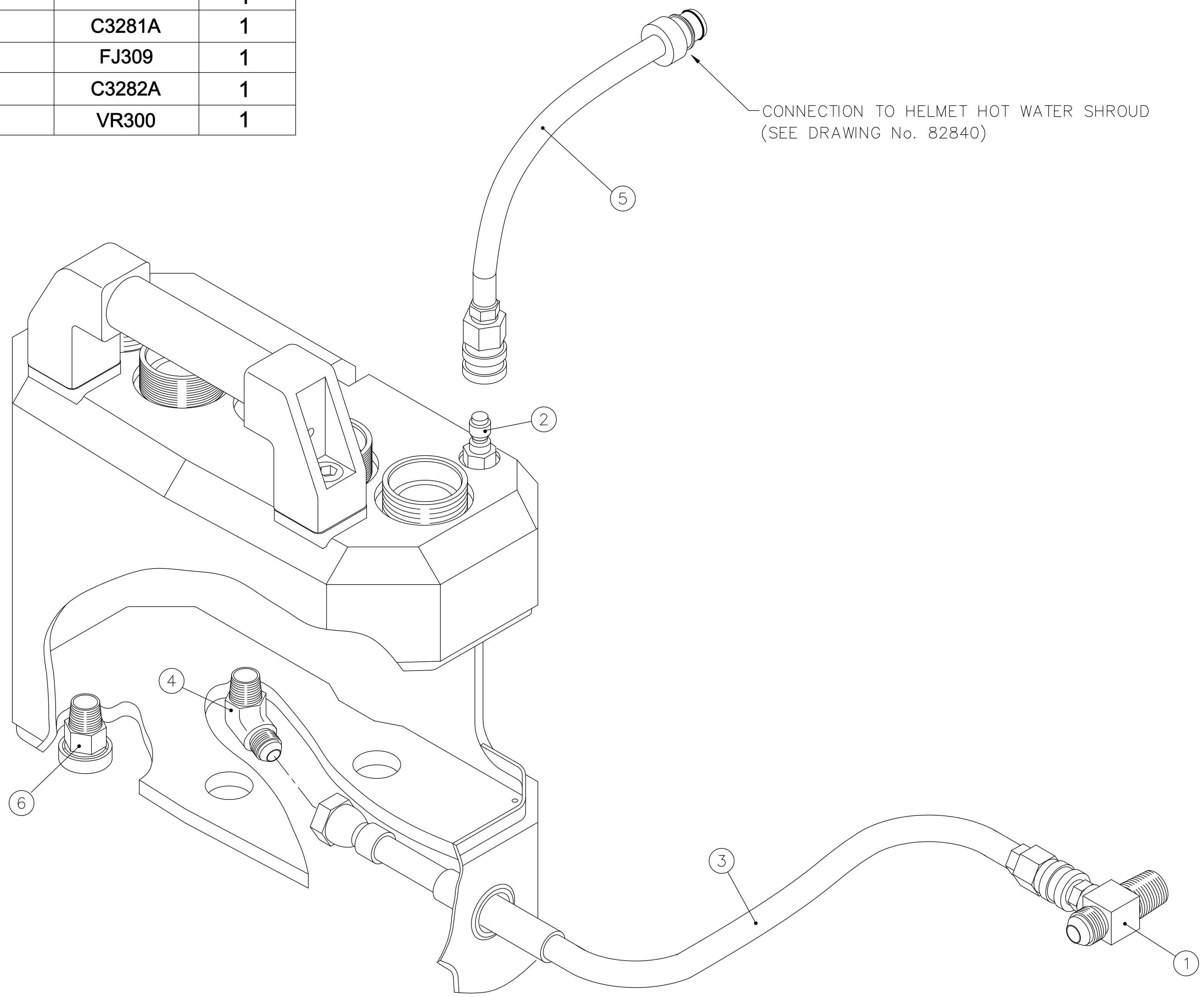
DRAWN:	MB	DATE	25.4.94
DRAFTING CHECK:	JR	DATE	10.5.94
ENG CHECK:	JR	DATE	10.5.94
APPROVED:	GSH	DATE	10.5.94

SCALE: 1 : 1
CAD REF No: 6603-2
PART No: DM262
TITLE: SLS SYSTEM ROTOWINK GENERAL ASSEMBLY
PROJECT: SLS SYSTEM
CLIENT:
DRAWING No: P1939-DG-059
SHT 1 OF 1
REV 2

SLS System (Mk IV) Hot Water System

Item	Description	Part No.	Qty.
1	SPLITTER BLOCK ASSY, H/W SUPPLY, (0-450MSW)	D2665	1
2	FTG, PLUG, QUICK CONNECT	FM202	1
3	SET HOT WATER HOSE ASSY	C3281A	1
4	FTG, MALE ELBOW	FJ309	1
5	SHROUD HOT WATER HOSE ASSY	C3282A	1
6	RELIEF VALVE	VR300	1



NOTES

ALL DIMENSIONS SHOWN ARE IN MM (UOS)
ALL DIMENSIONS BEFORE PLATING (UOS)
REMOVE ALL SHARP EDGES AND BURRS

DIMENSIONAL TOLERANCES

MACHINING		FABRICATION	
NO DECIMAL PLACES	±1.0	SIZE >0 <100	±0.5
ONE DECIMAL PLACE	±0.2	SIZE >100 <500	±1.5
TWO DECIMAL PLACE	±0.05	SIZE >500	±3.0
ANGULAR TOLERANCE	±0.5°	ANGULAR TOLERANCE	±0.5°

MATERIAL: SEE PARTS LIST

FINISH: N/A

THIRD ANGLE PROJECTION

REV	DESCRIPTION	ECN No	BY	DATE	AUTH. BY
R08					
R07					
R06					
R05					
R04	REFER TO ECN	13339	ZD	22/03/10	CC
R03	UPDATED (ECN 3183)	3183	IHY	03/04/00	JR
R00	ISSUED FOR MANUFACTURE		IHY	07/02/96	DRS

DO NOT SCALE DRAWING

TITLE: SLS SYSTEM (MKIV) HOT WATER SYSTEM

DRAWING No. P1939156S1 | REV R04

PART No. CB156 | PRODUCT / PROJECT No. SLS SYSTEM

SIZE A2 | SCALE NTS | SHT 1 OF 1

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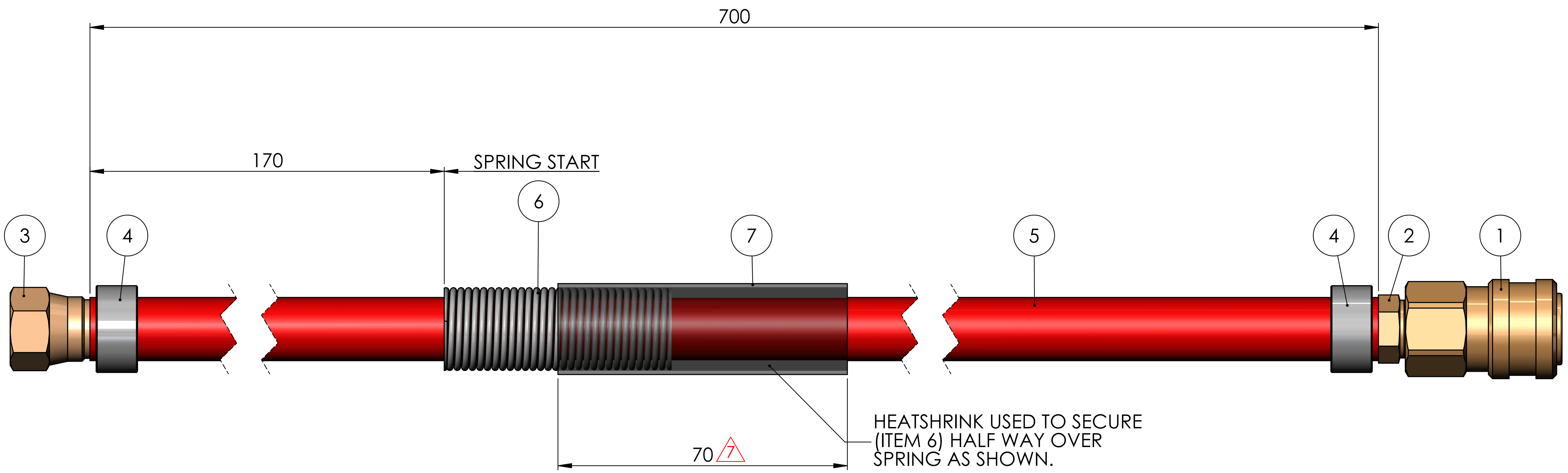
SLS System Set Hot Water Hose Assembly

ITEM	PART No.	DESCRIPTION	QTY.
1	FM203	FTG,SOCKET,QUICK CONNECT, 1/4"FNPT, MODIFIED	1
2	FM303	FTG,MISC. HOSE CONNECTOR, 1/4"MNPTX3/8" HOSE	1
3	FJ310	FITTING, HOSE, PUSHLOK, 6JIC FEMALE x 3/8" TAIL	1
4	D3272	CRIMP,HOT WATER HOSE,SLS, 1/2"NB X SCH5	2
5	HM008	HOSE, HOT WATER, RED, 3/8" BORE	1
6	D35820	DVR EQP, ANTI COLLAPSE SPRING, 21.59 O/D X 1.6 WIR	1
7 ⚠7	H30140	HEATSHRINK, BLACK, ADHESIVE LINED, 24/8 MM	0.07M



NOTES
1. ASSEMBLE IN ACCORDANCE WITH AITP P1939-AP-8.
2. ASSEMBLY TEST PRESSURE :-10 BAR.

⚠7 - DENOTES CHANGES MADE AT THIS REVISION.

ALL DIMENSIONS SHOWN ARE IN MM (UOS)
ALL DIMENSIONS BEFORE PLATING (UOS)
REMOVE ALL SHARP EDGES AND BURRS

DIMENSIONAL TOLERANCES

MACHINING		FABRICATION	
NO DECIMAL PLACES	±1.0	SIZE >0 <100	±0.5
ONE DECIMAL PLACE	±0.2	SIZE >100 <500	±1.5
TWO DECIMAL PLACE	±0.05	SIZE >500	±3.0
ANGULAR TOLERANCE	±0.5°	ANGULAR TOLERANCE	±0.5°

MATERIAL: SEE PARTS LIST

FINISH: N/A

THIRD ANGLE PROJECTION

REV	DESCRIPTION	ECN No.	BY	DATE	AUTH. BY
R07	REDUCE HEATSHRINK LENGTH	16901	TS	29/10/14	SC
R06	DIMENSIONS UPDATED	14719	SC	23/04/12	MS
R05	REMOVE CRIMPING DETAILS & UPDATE DRAWING	13407	ZD	13/05/10	CC
R04	UPDATED (DCN 2350)	N/A	-	01/08/96	AR
R03	UPDATED (DCN 2197)	N/A	-	08/05/96	AR
R02	UPDATED (DCN 2115)	N/A	-	31/01/96	AR
R00	ISSUED FOR MANUFACTURE		MF	03/03/87	HS

DO NOT SCALE DRAWING

TITLE: **SLS SYSTEM SET HOT WATER HOSE ASSEMBLY**

DRAWING No. P193983281S1 REV R07

PART No. C3281A PRODUCT / PROJECT No. SLS SYSTEM

SIZE A3 SCALE 1 : 1 SHEET 1 OF 1

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Shroud Hot Water Hose Assembly

ITEM	PART No.	DESCRIPTION	QTY.
1	FM203	Socket, Q/C, 1/4" NPT(F)	1
2	FM303	Hose Connector, 1/4" NPT(M) x 3/8" Hose	1
3	HP302	Hose, Pressure, 3/8" ID	0.5m
4	MC324	Plug, Quick Connect, Hose Barb, Straight	1
5	MC323	Socket, Quick Connect, Hose Barb, Straight	1
6	FC029	Cable Tie	1

THIRD ANGLE PROJECTION

MATERIAL: SEE ABOVE

FINISH: -

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A3

REV	DESCRIPTION OF REVISION	ECN	DRAWN BY	DATE	DRAFTING CHECK BY	DATE	ENGINEER CHECK BY	DATE	APPROVAL BY	DATE
6	BALL BEARINGS REMOVED	5204	PW	22.10.04	[illegible]	22.10.04	[illegible]	22.10.04	[illegible]	22.10.04
5	CRIMP REMOVED	4869	JG	25.03.04	RTW	25.03.04	RTW	25.03.04	RTW	25.03.04
4	UPDATED	2987	IHY	28.10.99	RTW	28.10.99	RTW	28.10.99	RTW	28.10.99
0	ISSUED FOR MANUFACTURE	N/A	MF	03.03.87	GB	29.04.87	HS	30.04.87	HS	30.04.87

ALL DIMENSIONS IN MM (UOS)

ALL DIMENSIONS BEFORE PLATING (UOS)

REMOVE SHARP EDGES & BURRS

DIMENSIONAL TOLERANCES:
NO DECIMAL PLACES ±1.0
ONE DECIMAL PLACE ±0.2
TWO DECIMAL PLACES ±0.05
ANGULAR TOLERANCE ±0.5°

SCALE: NTS

PRODUCT: SLS SYSTEM

PART No.: C3282A

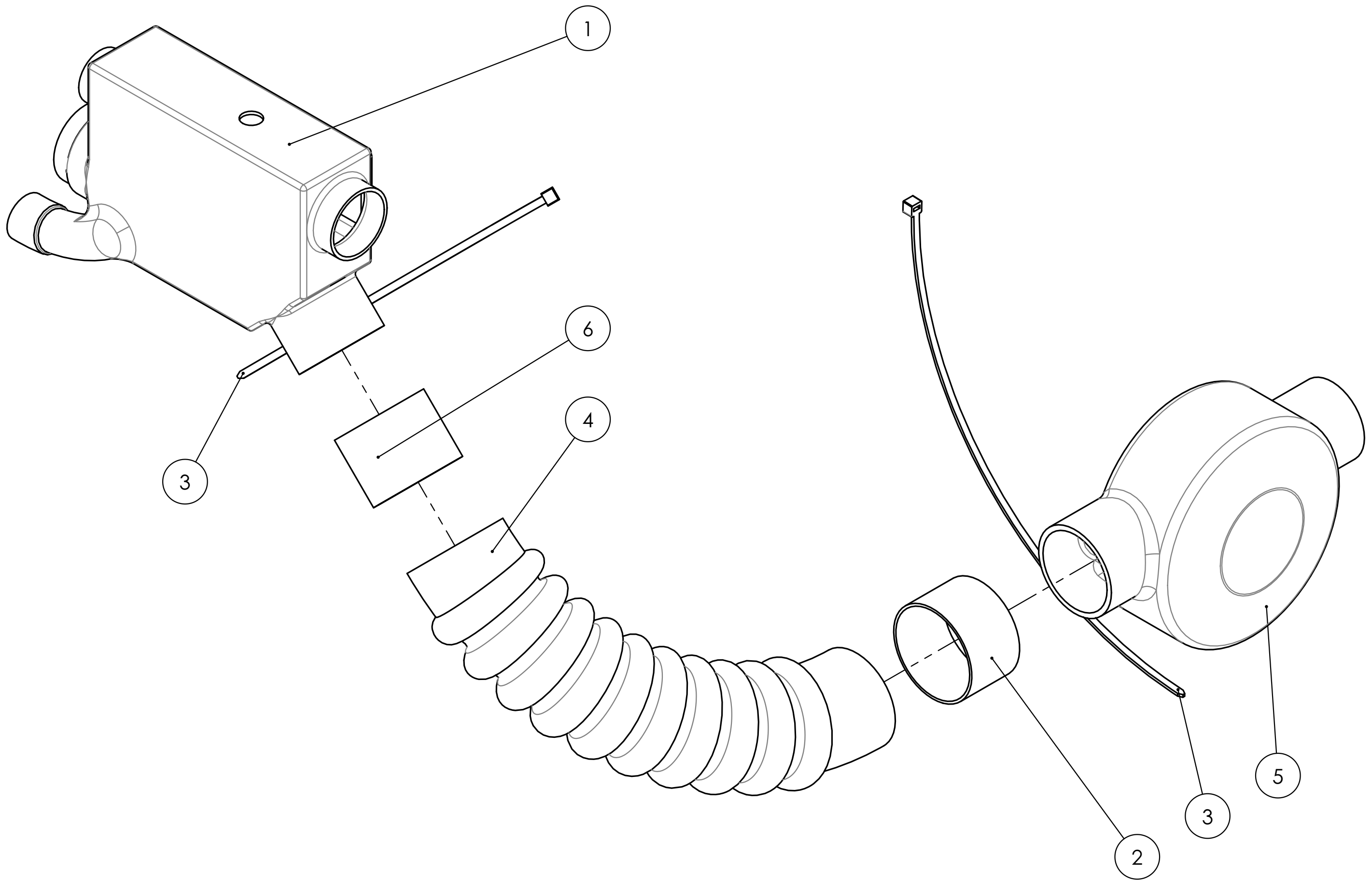
CAD REF No.: 10682

TITLE: SHROUD HOT WATER HOSE ASSEMBLY

DRG No.: 83282 SHT: 1 REV: 6

SLS System Hot Water Shroud Assembly

ITEM NO.	PART NO.	DESCRIPTION	QTY.
1	D28380	DVR EQP, SLS MODS TO SHROUD	1
2	D28390	COLLAR, SLS/ULTRAFLOW SHROUD SUPPORT	1
3	FC041	FSTR, TIE WRAP, 197 X 2.4MM	2
4	DE115	TUBE, CORRUGATED	1
5	DE116	SHROUD, REGULATOR	1
6	DE117	FLANGE	1



EXPLODED ISOMETRIC VIEW

NOTES:

DENOTES CHANGES MADE AT THIS REVISION

REV	DESCRIPTION	ECN	BY	DATE	AUTH.
R03					
R02	UPDATED TO NEW FORMAT	20209	RC	01/02/17	AN
R01	UPDATED (DCN2167)	-	MF	08/04/96	AR
R00	ISSUED FOR MANUFACTURE		MF	22/09/86	AN

THIRD ANGLE PROJECTION

DO NOT SCALE DRAWING

TITLE: HOTWATER SHROUD KIT, (SLS HELMET ONLY)

DRAWING NO. B82840S1 | REV R02

PART NO. DM28400 | PRODUCT / PROJECT No. P1939

SIZE A3 | SCALE (UOS) 1:2 | SHEET 1 OF 1

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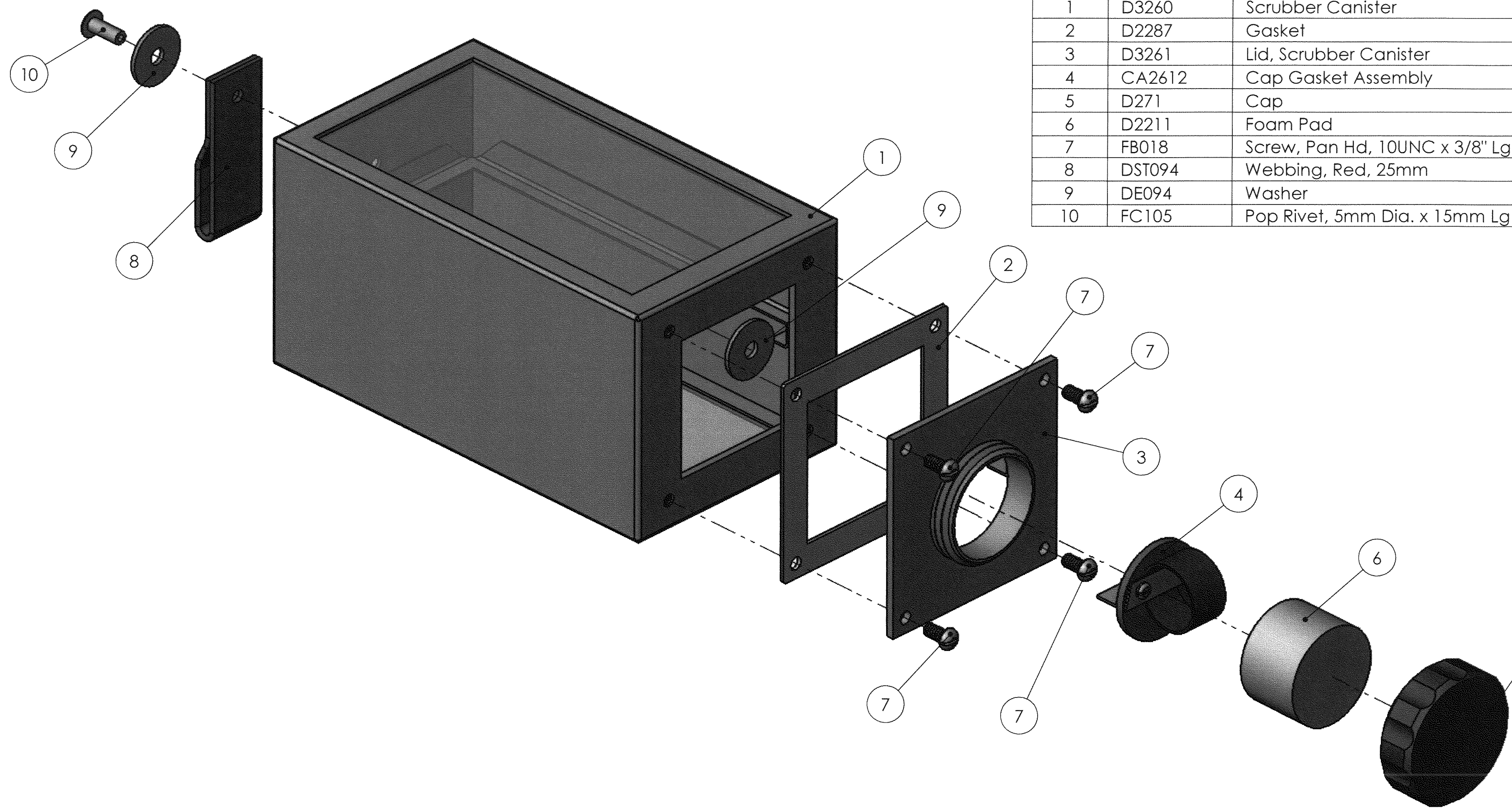
W: jfdglobal.com

Refillable Canister Assembly



ITEM	PART No.	DESCRIPTION	QTY.
1	D3260	Scrubber Canister	1
2	D2287	Gasket	1
3	D3261	Lid, Scrubber Canister	1
4	CA2612	Cap Gasket Assembly	1
5	D271	Cap	1
6	D2211	Foam Pad	1
7	FB018	Screw, Pan Hd, 10UNC x 3/8" Lg	4
8	DST094	Webbing, Red, 25mm	1
9	DE094	Washer	2
10	FC105	Pop Rivet, 5mm Dia. x 15mm Lg	1

THIRD ANGLE PROJECTION

MATERIAL: SEE ABOVE

FINISH: -

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A3

REV	DESCRIPTION OF REVISION	ECN	DRAWN BY	DATE	DRAFTING CHECK BY	DATE	ENGINEER CHECK BY	DATE	APPROVAL BY	DATE
5	REDRAWN TO SOLIDWORKS	5204	PW	03.11.04	JM	7/11/04	JM	4/11/04	JM	4/11/04
4	UPDATED	3343	PW	11.01.01	IHY	11.01.01	IHY	11.01.01	RTW	11.01.01
3	UPDATED	2226	IHY	13.05.96	AR	13.05.96	AR	13.05.96	AR	13.05.96
0	ISSUED FOR MANUFACTURE	N/A	MB	25.11.92	HS	26.11.92	HS	26.11.92	HS	26.11.92

ALL DIMENSIONS IN MM (UOS)
ALL DIMENSIONS BEFORE PLATING (UOS)
REMOVE SHARP EDGES & BURRS
DIMENSIONAL TOLERANCES:
NO DECIMAL PLACES ±1.0
ONE DECIMAL PLACE ±0.2
TWO DECIMAL PLACES ±0.05
ANGULAR TOLERANCE ±0.5°

SCALE	PRODUCT
1 : 1.5	SLS SYSTEM

PART No. C32540

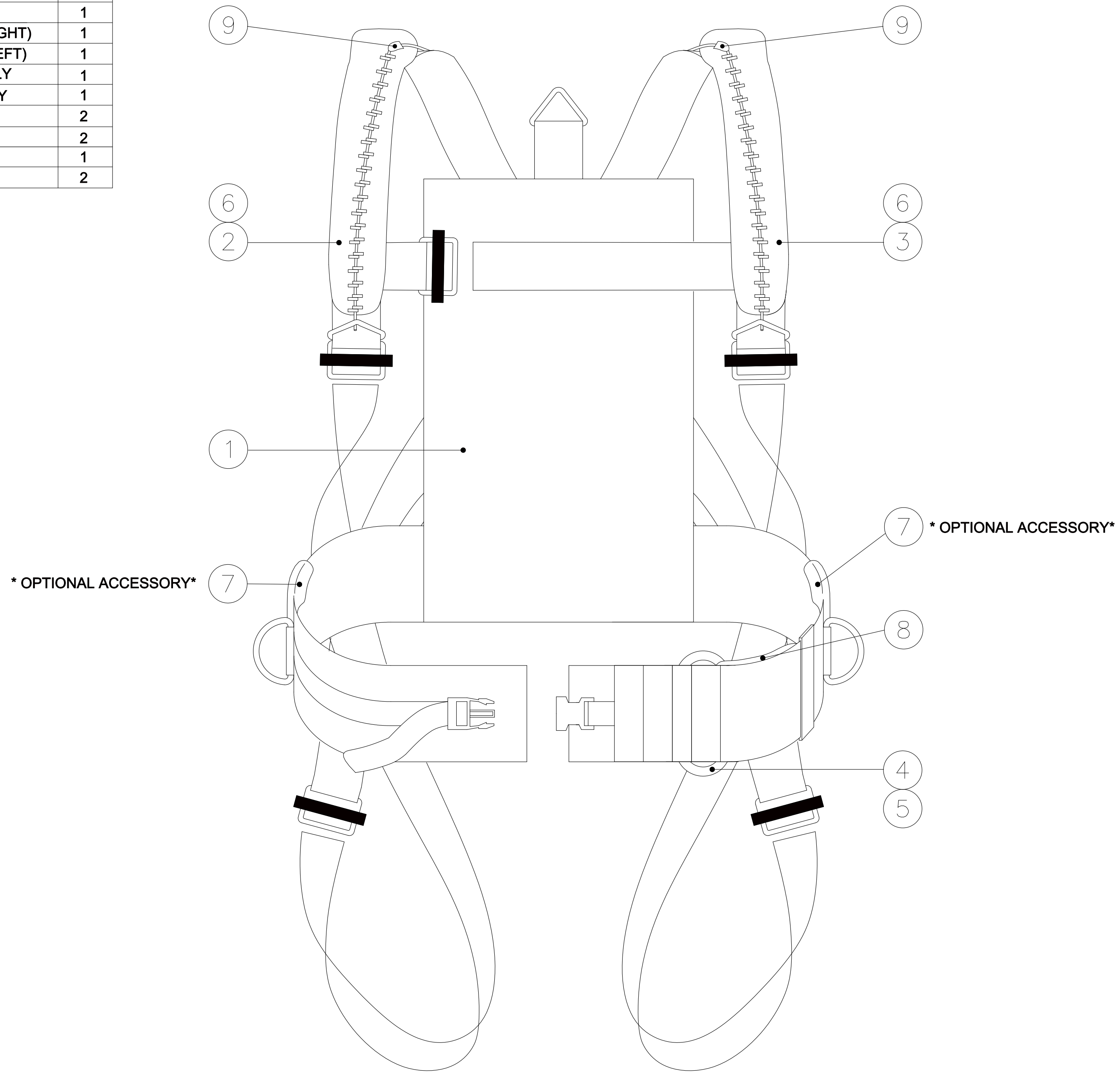
CAD REF No. 4892

TITLE: REFILLABLE CANISTER ASSEMBLY

DRG No. P1939-DG-035 SHT 1 REV 5

SLS System (Mk IV) Harness Assembly

ITEM	PART NUMBER	DESCRIPTION	QTY
1	C35650	HARNESS	1
2	DM46630B	C/LUNG ENCLOSURE (DIVERS RIGHT)	1
3	DM36010B	C/LUNG ENCLOSURE (DIVERS LEFT)	1
4	C45540B	ACTUATION SLEEVE ASSEMBLY	1
5	C2937	ACTUATION CABLE ASSEMBLY	1
6	CA2607	COUNTERLUNG ASSEMBLY	2
7	D308	WEIGHT POCKET	2
8	D302	HANDLE RETAINING BAND	1
9	D328	CABLE WIPER SLEEVE	2



NOTES

ALL DIMENSIONS SHOWN ARE IN MM (UOS)
ALL DIMENSIONS BEFORE PLATING (UOS)
REMOVE ALL SHARP EDGES AND BURRS

DIMENSIONAL TOLERANCES

MACHINING		FABRICATION	
NO DECIMAL PLACES	±1.0	SIZE >0 <100	±0.5
ONE DECIMAL PLACE	±0.2	SIZE >100 <500	±1.5
TWO DECIMAL PLACE	±0.05	SIZE >500	±3.0
ANGULAR TOLERANCE	±0.5°	ANGULAR TOLERANCE	±0.5°

MATERIAL: SEE PARTS LIST

FINISH: N/A

THIRD ANGLE PROJECTION

REV	DESCRIPTION	ECN No	BY	DATE	AUTH. BY
R06					
R05					
R04					
R03					
R02	DRAWING BORDER UPDATED & PARTS LIST ADDED	13337	ZD	19/03/10	CC
R01	UPDATED (DCN 2481)	2481	IHY	13/03/97	HS
R00	ISSUED FOR MANUFACTURE		IHY	18/07/96	DRS

DO NOT SCALE DRAWING

TITLE: SLS SYSTEM (MKIV) HARNESS ASSEMBLY

DRAWING No. P1939137S1 REV R02

PART No. C2604 PRODUCT / PROJECT No. SLS SYSTEM

SIZE A3 SCALE 1 : 1 SHT 1 OF 1

DIVEX

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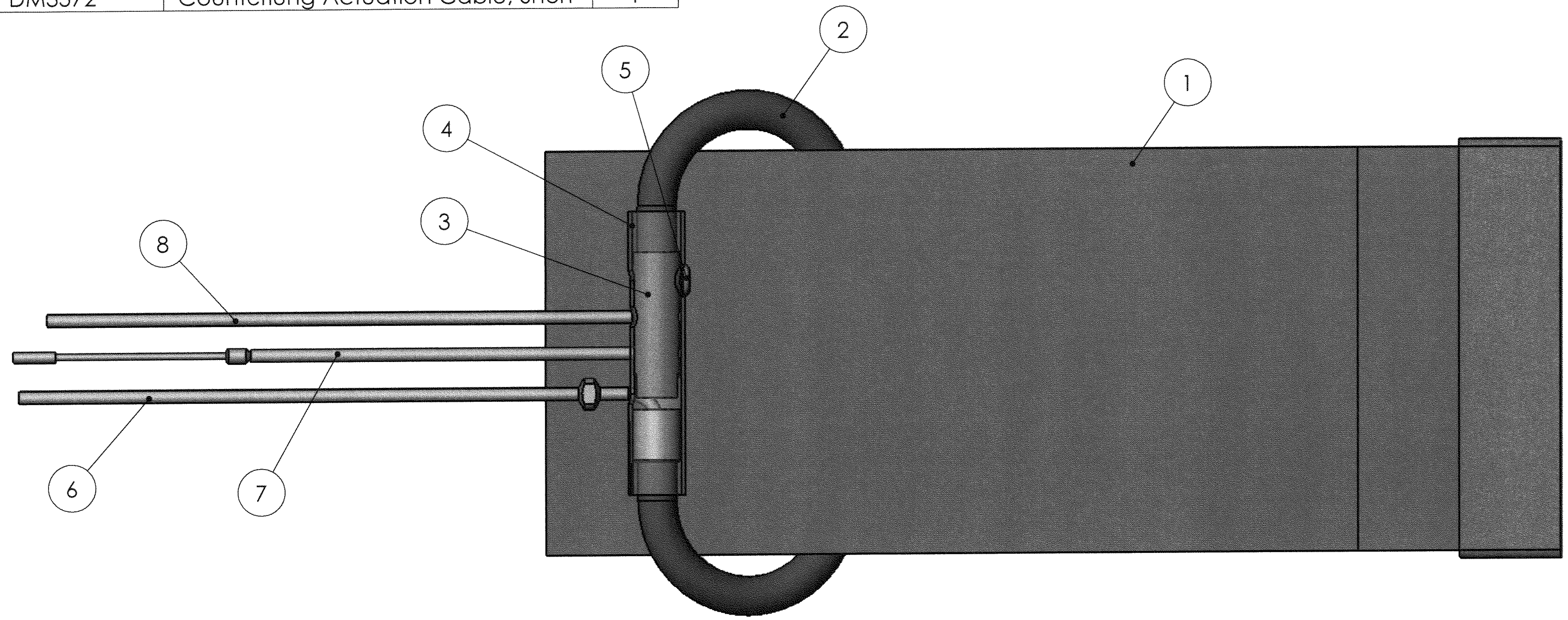
Actuation Handle / Cable Assembly

ITEM	PART No.	DESCRIPTION	QTY.
1	D34901	Webbing	1
2	DM3574	Actuation Handle	1
3	D3273	Actuation Handle Cable Holder	1
4	D3274	Actuation Handle Sleeve	1
5	FB312	Screw, Pan Hd, M4 x 12 Lg	1
6	DM3573	Actuation Cable, Long	1
7	DM3571	Regulator Actuation Cable	1
8	DM3572	Counterlung Actuation Cable, Short	1



THIRD ANGLE PROJECTION

MATERIAL: SEE ABOVE

FINISH: -

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A3

REV	DESCRIPTION OF REVISION	ECN	DRAWN BY	DATE	DRAFTING CHECK BY	DATE	ENGINEER CHECK BY	DATE	APPROVAL BY	DATE
2	ACTUATION HANDLE REVISED	5204	PW	02.11.04	[illegible]	7.2.05	[illegible]	7.2.05	[illegible]	7.2.05
1	UPDATED	1971	IHY	13.10.95	AR	13.10.95	AR	13.10.95	AR	13.10.95
0	ISSUED FOR MANUFACTURE	N/A	RAS	21.04.95	HS	26.04.95	HS	26.04.95	HS	26.04.95

ALL DIMENSIONS IN MM (UOS)
ALL DIMENSIONS BEFORE PLATING (UOS)
REMOVE SHARP EDGES & BURRS
DIMENSIONAL TOLERANCES:
NO DECIMAL PLACES ±1.0
ONE DECIMAL PLACE ±0.2
TWO DECIMAL PLACES ±0.05
ANGULAR TOLERANCE ±0.5°

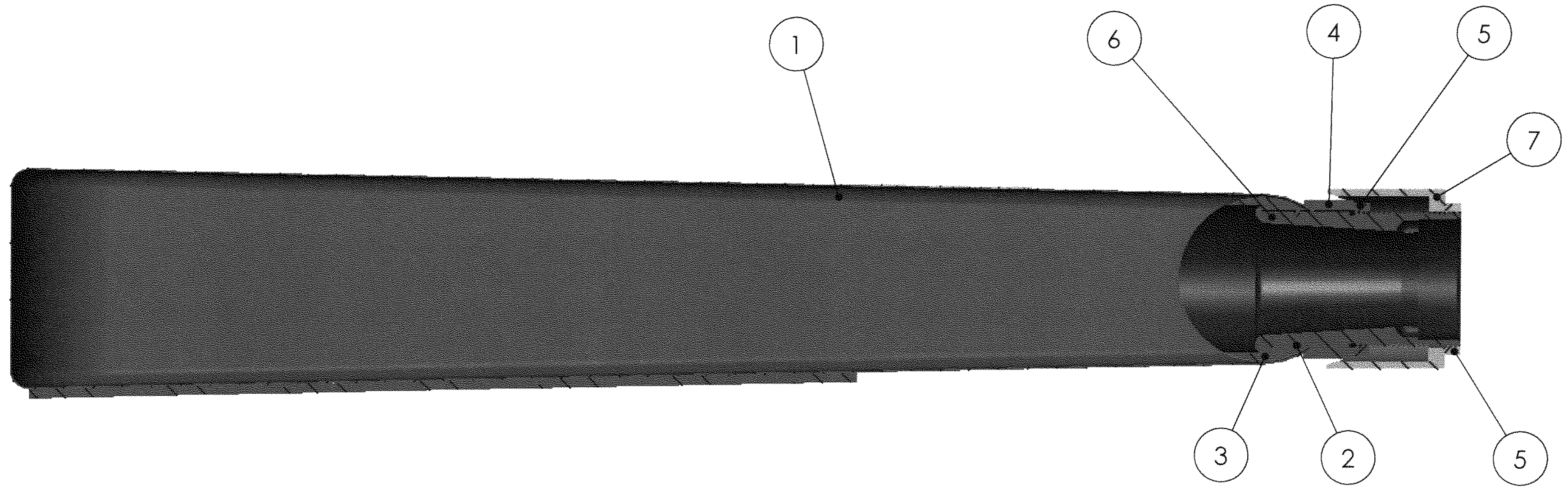
SCALE: NTS
PRODUCT: SLS SYSTEM
PART No.: C2937
CAD REF No.: 8774

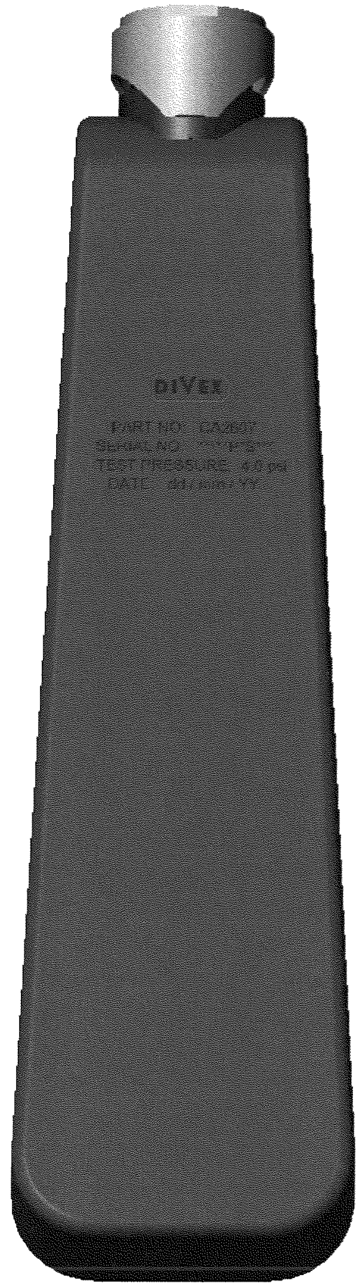
TITLE: **ACTUATION HANDLE / CABLE ASSEMBLY**

DRG No.: P1939-DG-115 SHT: 1 REV: 2

Counterlung Assembly

ITEM	PART No.	DESCRIPTION	QTY.
1	D36850	Counterlung	1
2	RN028-7	O-Ring	1
3	D36450	Counterlung Ins. Body	1
4	D2333C	Counterlug Ext. Washer	1
5	D2488A	Locknut, Duct	2
6	D278	Insert, Counterlung Duct	1
7	D279	Washer, Outer, C/Lung Ins.	1





THIRD ANGLE PROJECTION	MATERIAL: SEE PARTS LIST	FINISH: -

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email : info@divex.co.uk
www.divex.co.uk

A3

REV	DESCRIPTION OF REVISION	ECN	DRAWN BY	DATE	DRAFTING CHECK BY	DATE	ENGINEER CHECK BY	DATE	APPROVAL BY	DATE
4	REDRAWN ON SOLIDWORKS	5408	PW	22.12.04	[illegible]	22.12.04	[illegible]	22.12.04	[illegible]	22.12.04
3	MATERIAL COLOUR CHANGE	3721	KB	26.02.02	IHY	26.02.02	IHY	26.02.02	GG	26.02.02
2	DRAWING UPDATED	2500	ML	06.10.97	IHY	06.10.97	HS	06.10.97	HS	06.10.97
0	ISSUED FOR MANUFACTURE	N/A	MB	22.04.94	JR	22.04.94	JR	22.04.94	GSH	22.04.94

ALL DIMENSIONS IN MM (UOS)
ALL DIMENSIONS BEFORE PLATING (UOS)
REMOVE SHARP EDGES & BURRS
DIMENSIONAL TOLERANCES:
NO DECIMAL PLACES ±1.0
ONE DECIMAL PLACE ±0.2
TWO DECIMAL PLACES ±0.05
ANGULAR TOLERANCE ±0.5°

SCALE	PRODUCT
1 : 2	SLS SYSTEM

PART No. CA2607

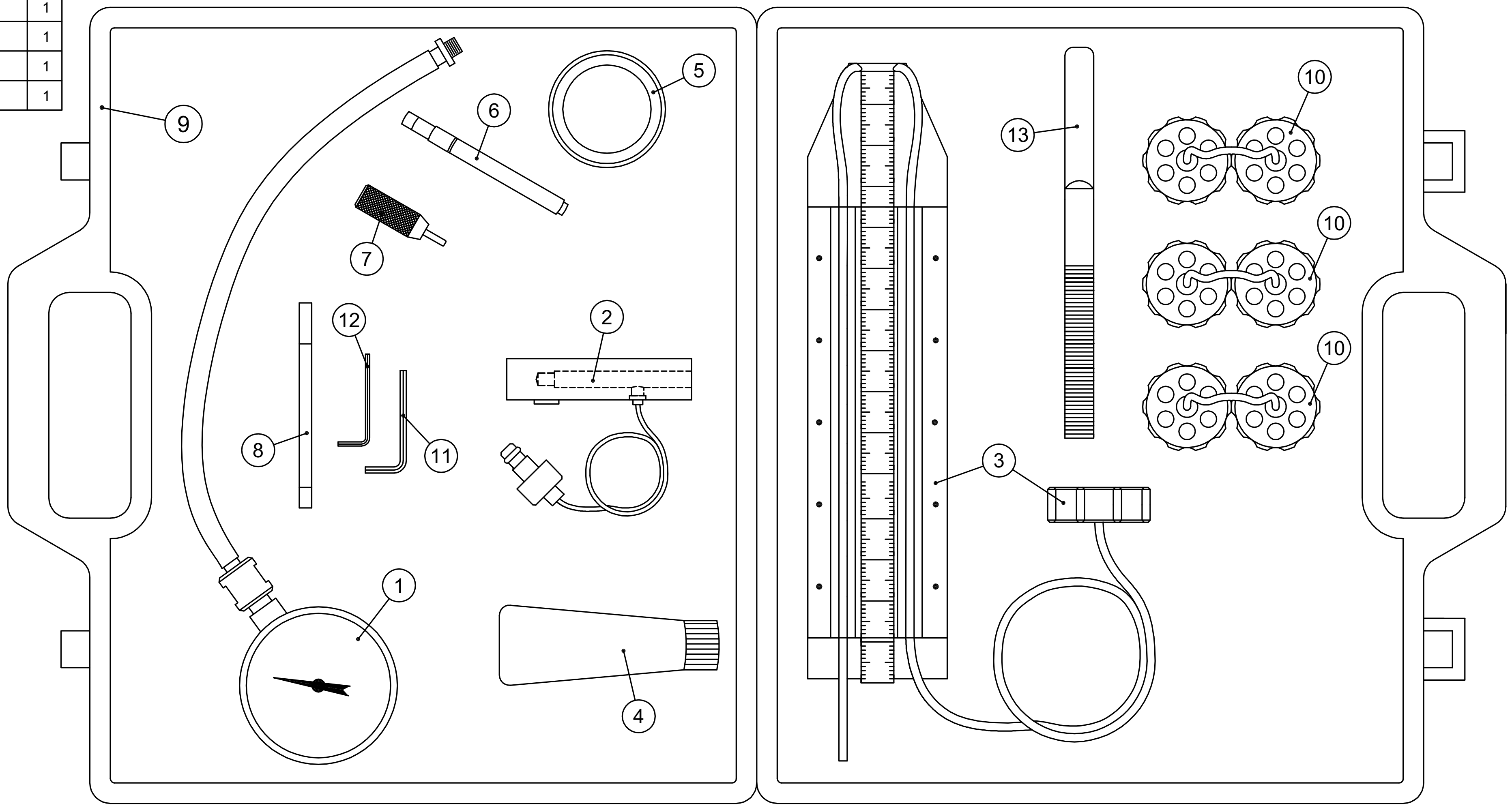
CAD REF No. 6590

TITLE
COUNTERLUNG ASSEMBLY

DRG No.	SHT	REV
P1939-DG-056	1	4

Tool & Test Kit Layout

ITEM	PART No.	DESCRIPTION	Qty.
1	DM3254	REGULATOR PRESSURE TEST KIT	1
2	DM32580	FLOWMETER ASSEMBLY	1
3	DM32570	MANOMETER ASSEMBLY	1
4	SM034	CHRISTO-LUBE GREASE	1
5	M2920	LOCKNUT SPANNER	1
6	M2921B	DUCT SPANNER	1
7	M2922	DEMAND VALVE ACTUATING TOOL	1
8	TA097	TOOL, SPANNER, COMBINATION, 5/16" AF	1
9	MC328	STORAGE CASE	1
10	D311	IN/EXHALE DUCT PROTECTION COVER ASSEMBLY	3
11	TA024	ALLEN KEY (3/32")	1
12	TA182	ALLEN KEY (1/16")	1
13	TA009	STRAP WRENCH	1
14	T1087	LABEL, SLS TOOL & INSTRUMENT SET	1



NOTES

ITEM 14 TO BE POSITIONED CENTRALLY ON THE FRONT OF THE BOX. (ITEM NOT SHOWN)

ALL DIMENSIONS SHOWN ARE IN MM (UOS)

ALL DIMENSIONS BEFORE PLATING (UOS)

REMOVE ALL SHARP EDGES AND BURRS

DIMENSIONAL TOLERANCES

MACHINING		FABRICATION	
NO DECIMAL PLACES	±1.0	SIZE >0 <100	±0.5
ONE DECIMAL PLACE	±0.2	SIZE >100 <500	±1.5
TWO DECIMAL PLACE	±0.05	SIZE >500	±3.0
ANGULAR TOLERANCE	±0.5°	ANGULAR TOLERANCE	±0.5°

MATERIAL: SEE PARTS LIST

FINISH: -

THIRD ANGLE PROJECTION

REV	DESCRIPTION	ECN No	BY	DATE	AUTH. BY
R07					
R06					
R05	ITEM No. 10 REPOSITIONED & BOM ADDED	13073	SJ	01/12/2009	RTW
R04	ITEM No. 14 ADDED	5228	PW	23/09/2004	RTW
R03	LAYOUT REVISED	4807	JG	01/03/2004	RTW
R02	ITEM No. 8 REVISED	4544	JG	09/10/2003	RTW
R00	ISSUED FOR MANUFACTURE		IHY	24/05/1996	DRS

DO NOT SCALE DRAWING

TITLE: TOOL & TEST KIT LAYOUT

DRAWING No.: P1939204S1 | REV: R05

PART No.: C10203 | PRODUCT / PROJECT No.: SLS SYSTEM

SIZE: A2 | SCALE: NTS | SHT 1 OF 1

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