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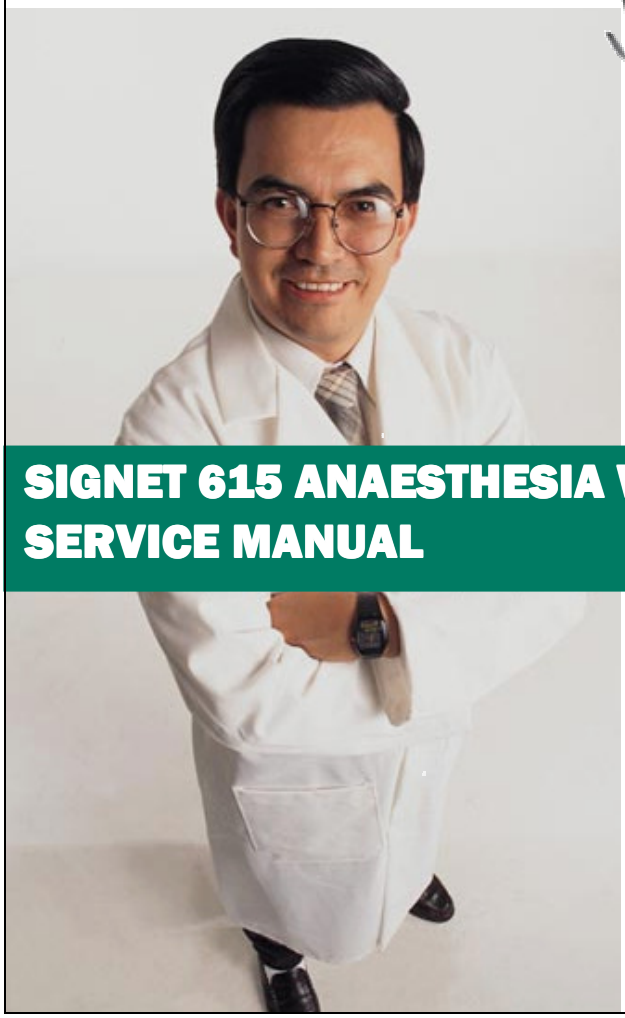

SIGNET 615 ANAESTHESIA WORKSTATION SERVICE MANUAL

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All Ulco products are subject to a program of continuous development and the manufacturer reserves the right to make alterations in design and equipment without prior notice.

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1 Introduction

1.1 About this manual

This manual provides information for the preparation, assembly and maintenance of the Signet 615 anaesthesia machine, together with suitable equipment from the Ulco range. Although this equipment has been carefully designed for simplicity of assembly and use, it is recommended that the contents of this manual be studied before attempting preparation or maintenance of the equipment. Explanatory diagrams are provided in order to help the reader understand the concepts described.

This service manual should be read in conjunction with the Signet 615 user manual and the manual(s) for the vaporisers and ventilator (if attached).

1.2 Qualifications for Servicing

All personnel who service or repair Ulco products must have a current valid Ulco Training Certificate for the product being serviced or repaired.

1.3 Units

Current .....Amperes (A)
Flow .....Litres per Minute (L/min or LPM)
Frequency .....Kilohertz (kHz)
.....Gigahertz (GHz)
.....Megahertz (MHz)
Lengths ..... Millimetres (mm)
Pressure (airway) .....centimetres of water (cmH2O)
Pressure (High).....Kilopascals (kPa)
Voltage ....Volts (V)
Weight .....Kilograms (kg)

2 Workstation Overview

Anaesthesia machines such as the Signet 615 are engineered to very high standards of design and finish and all units are able to accommodate the most comprehensive specifications required in modern anaesthesia. Ulco machines are manufactured from non-ferrous materials such as stainless steel, anodised aluminium and chromed brass or acetal, with moulded covers made from Kydex.

The construction of the frames provides a stable and unobstructed unit for the mounting of a wide range of anaesthesia equipment accessories. The Signet 615 can be easily upgraded from its basic configuration with optional accessories and attachments including a full range of patient monitors to provide a comprehensive anaesthesia workstation.

If equipment that has not been specifically designed or supplied by Ulco is to be attached to the Ulco machine, it is recommended that customers consult Ulco as to the suitability of the equipment and necessary modifications to the apparatus.

Ulco and its agents provide a comprehensive regular maintenance service and it is recommended that advantage be taken for the safe and reliable upkeep of this equipment. Refer to this service manual for details on how to maintain your Ulco machine. There is a service contract included with the equipment – please fill it in and return it to Ulco.

Customers requiring further service or advice with operating problems should contact Ulco or one of their accredited agents.

2.1 Major features

- all working surfaces are designed to be easy to clean and front wheels are lockable to prevent unwanted movement
- A monitor shelf for mounting at the top of the machine is available as an option
- An aluminium accessory rail is fitted to the sides of the working area for easy attachment of many options

- An absorber mounting post is mounted either on the left or right hand side of the machine, allowing the absorber to be swapped from side to side
- Optional internally mounted mains outlets used for supplying power to optional accessories (compliant with IEC 60601-1-1)
- One mains outlet mounted on the side of the machine for use with powered vaporisers

2.2 Overall strengths

- sturdy, strong, durable and easy to understand construction
- high quality and quantity of patient safety features
- pure flexibility of design allowing tailoring of options to exact requirements

2.3 Typical configuration

- Signet 615 - 3 gas 5 Tube machine fitted with anti-hypoxic device as standard
- 4 internally mounted mains power outlets
- 1 external mains outlet for use with powered vaporisers
- EV500 ventilator (OPTIONAL)
- Auxiliary power outlet board APB70 (OPTIONAL)
- 2kg absorber AB800 (OPTIONAL)
- Vaporiser(s) (OPTIONAL)
- Auxiliary flowmeter (OPTIONAL)
- Writing table standard
- Universal arm (OPTIONAL)
- 3 drawers standard
- Second absorber mounting post standard

3 Description

3.1 Device Classification

The Signet 615 Anaesthesia Machine is classified as follows:

- Class I equipment for the purposes of electrical safety
- Type CF applied part
- Continuous Operation

3.2 Electromagnetic Environment

The Signet 615 anaesthetic workstation is suitable for use in the electromagnetic environment specified in the table below. The user must ensure that it is used in such an environment.

Emissions test	Compliance	Avoiding Electromagnetic Interference
Radio Frequency (RF) emissions	Group 1	The anaesthetic workstation uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class A	The anaesthetic workstation is suitable for use in all establishments other than domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Not applicable	
Voltage fluctuations IEC 61000-3-3	Not applicable	

3.3 Gas Supply System

3.3.1 Gas Controls

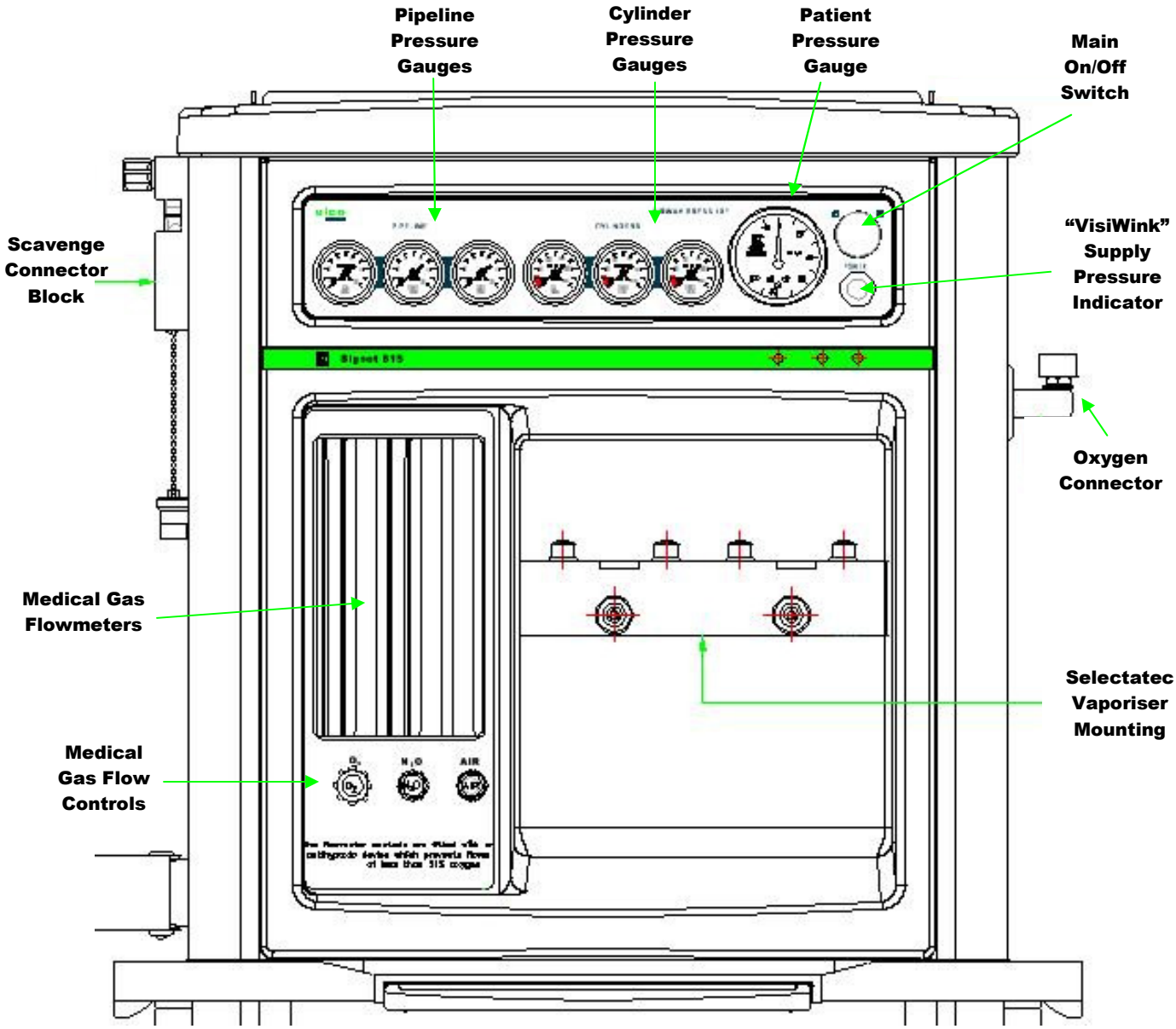

Figure 1: Gas controls on front of Signet 615

The ON/OFF switch is mounted on the top right hand side and when activated allows for the supply of gases to be made available for use. The ON/OFF switch also turns on the power to the flowmeter backlight when gas supply pressure is present.

On the left hand side of the control console are the gas flow controls and rotameters. Gas controls can be differentiated by their shape and colour. The white oxygen (O_2) control is furthest to the left and to international design standards. The nitrous oxide (N_2O) control is dark blue and air is black and white.

The basic Signet 615 is a three gas five tube machine with two tubes each for nitrous oxide and oxygen.

3.3.2 Flowmeters

Having passed through the system, each gas enters the base of the anti-hypoxic device via the flow control valve into the flowmeter. The flow control valves allow for fine adjustment of the flow rate through each of the flowmeter tubes (rotameters). This ensures that accurate gas mixtures are achieved.

When the flow control valve(s) is (are) opened, the gas continues at low pressure upward through the flowmeter tube, whose float responds to indicate the rate of flow in litres per minute or parts thereof.

Note that the rate of flow is indicated by the top edge of the float (bobbin) against the flowmeter scale. Indicated flows are accurate to within ±1.875% of indicated flow +0.625% of the full scale.

Therefore, for a flowmeter with a full scale reading of 10 L/min set to deliver 7.5 L/min, the maximum permissible error is:

$$\pm \frac{((7.5 \times 1.875) + (10.0 \times 0.625))}{100} \text{ L/min}$$
$$= \pm((0.141) + (0.063)) \text{ L/min}$$
$$\equiv \pm 0.204 \text{ L/min}$$

Gases passing through the flowmeter mix together at rates of flow selected by the anaesthetist. Passing along the back bar, part of the combined gases enter the vaporiser inlet (if selected). If the vaporiser is fitted and is in the OFF position, the gases bypass the vaporising chamber and pass directly to the common gas outlet via the non-return valve fitted in the terminating block of the back bar. From here they pass to the anaesthetic equipment and to the patient.

If the vaporiser is selected ON, gas mixtures entering the vaporiser collect a proportion of the anaesthetic agent from the vaporising chamber within. The percentage volume is determined by setting the vaporiser control at the percentage figure calculated by the anaesthetist. Having passed through the vaporiser, the gas mixture now combined with the anaesthetic agent again enters the back bar and is delivered to the patient as described previously (see the vaporiser manual for further details).

The flowmeters are replaced on defect only. See section 5.8 for replacement instructions

3.3.3 Vaporisers

Various methods of mounting vaporisers are currently used such as the 'off line' or 'fixed' systems. The most common is the 'Selectatec' type mounting system in which a mounting block is permanently attached to the back bar, and the vaporiser is locked on by means of DZUS (aircraft type) quick release fastener. Gas flow is diverted through the vaporiser via the ports when the Vaporiser is placed on the mounting block. The Selectatec system allows for interchange ability of vaporiser(s), either for the use of an alternate volatile agent or for maintenance and servicing, as well as rendering the machine 'vapour free' if necessary.

Vaporisers can be easily mounted on the back bar via the Selectatec mounting and should be securely locked into place.

Vaporisers not attached to the anaesthesia machine must be prevented from tipping over. Storage racks are available to store unused vaporisers. Vaporisers should be emptied prior to being moved.

Note: It is important to read the relevant instruction manual issued with each vaporiser prior to use.

3.3.4 Patient Block

The patient block is mounted on the side rail of the working area. In its entirety it houses the common gas outlet, the emergency oxygen flush, a patient safety relief valve set to relieve at 60cm/H_20 pressure. The common gas outlet is a 22/15mm male stainless steel cone with a weight bearing thread for attaching items such as the fresh gas connecting hose to the CO_2 absorber or a Bain's adaptor. The patient block can slide along the side rail to the most convenient position where it can be locked into position.

Fresh gas from the back bar is supplied to the patient block via the one way valve direct to the back of the common gas outlet. This is in turn connected to the patient safety valve housing a safety valve that is adjusted to relieve at 60cm/H20 pressure. The emergency oxygen flush is supplied with oxygen direct from the oxygen manifold in the console. When depressed, the oxygen flush flow is set by a metered orifice that leads from the high pressure oxygen side of the flush valve to the common gas outlet. The flow is normally 35 to 75 L/min.

The patient block is replaced on defect only. See section 5.11 for replacement instructions.

3.3.5 The anti-hypoxic device

The Signet 615 contains many features to ensure patient well-being. The first of these is the anti-hypoxic device. This is now a mandatory device in Australia and many overseas markets. This allows the anaesthetist to deliver 100% oxygen to the patient but never less than 21% oxygen in the presence of nitrous oxide in the mix. This also means that no nitrous oxide can flow without oxygen. Other devices sometimes allow oxygen flow once nitrous oxide has been turned on. No Ulco machines allow this, meaning that oxygen flow must be established before nitrous oxide is able to flow.

The device has been designed to eliminate inherent faults common in other similar products. In some such devices, both the oxygen and nitrous oxide begin to flow as soon as the nitrous oxide control is turned on. The operator can thus become accustomed to setting all flows whilst only using the nitrous oxide flow control. This is a safe practise assuming the anaesthesia machine is fitted with an anti-hypoxic device. Many machines both in Australia and overseas, however, do not have such a device, enabling the operator to deliver a 100% nitrous oxide flow inadvertently.

The Ulco anti-hypoxic device prevents this by ensuring that no nitrous oxide is permitted to flow unless the oxygen flow control is first turned on. The nitrous oxide needle valve is held in place by the oxygen flow control. The nitrous oxide flow control knob is free to rotate, however, in order to prevent damage if force is applied trying to achieve a flow when no flow is allowed. When correctly adjusted and calibrated, the device will prevent the delivery of hypoxic mixtures, and oxygen flow will be maintained at 21% nominal flow (±5%).

The device itself is tamper proof and cannot be interfered with by the operator, but is easy to adjust and calibrate by trained technical staff. Refer to Section 5.6 for service and calibration instructions.

3.3.6 Gas manifold

The gas manifold is fitted to the rear of the machine. All gases that supply the machine are connected via the manifold. Pipeline air, nitrous oxide and oxygen are connected from the wall, as well as all pin index reserve cylinders. All yokes are pin-indexed, and once cylinders are located, can be secured into position. The Signet 615 is fitted with diameter ring indexed gas fittings, and colour-coded hoses for wall gas supply: white for oxygen, blue for nitrous oxide and black and white for air.

Refer to Section 5.2 for service and calibration instructions.

3.3.7 Main regulators

The regulator and yoke for each gas are assembled in line to reduce the risk of high pressure leaks. The gauge for each gas is connected by a copper tube in parallel. The brass yoke bolt (RG203) which has the Bodok seal (RG204) attached to it and is fitted with a sintered bronze filter (RG2031), passes through the yoke assembly and is screwed into the yoke adaptor body (RG201). A stainless steel banjo bolt (RG206) is used to mount the regulator main body (RG101) to the adaptor body (RG201) and the use of Dowty Seals (RG205) prevent any leaks from occurring. A pressure relief valve is fitted to the underside of the regulator body (RG101) and is set to start relieving at 600 kPa.

Note: Bodok seals must be examined and replaced if necessary every time the cylinders are replaced.

Refer to Section 5.2 for calibration instructions.

3.3.8 Second stage regulators

There are two, second stage regulators fitted, one each for the oxygen and nitrous oxide supplies. These regulators are situated down stream from the anti-hypoxic device and flowmeter assembly. They are used to calibrate and fine tune the anti-hypoxic device (see separate instructions).

The second stage regulators are also used as a buffer to protect the anti-hypoxic device against any pressure fluctuations that may occur in both the pipeline and the cylinder regulated pressure:

Pipeline pressure ..... 415 kPa
Cylinder regulated pressure ..... 350-370 kPa

Second stage regulator pressures when set to deliver the correct mixtures on the anti-hypoxic device are usually less than 220 kPa. This allows for fluctuations in supply pressure of more than 100 kPa before the set flows are affected.

These regulators are serviced as part of the service and calibration of the anti-hypoxic device, described in section 5.6.

3.3.9 Pressure gauges

Pressure gauges are well placed at eye level for ease of viewing. The left 3 show pipeline pressure, while the right 3 show the pressure in the reserve gas cylinders.

A simple visible indicator called the Visiwink is mounted below the ON/OFF control. When green, it indicates oxygen is ON. When red it indicates that oxygen pressure is OFF.

These items should not require calibration during the lifetime of the machine and should be replaced on defect only.

3.3.10Scavenging

On the left-hand upright of the frame is the scavenging block, which should be connected to wall suction. Adequate scavenging flow can be achieved by adjusting the yellow knob so that the ball in the clear flow tube lies near the marked line.

The vacuum reservoir for scavenging is integrated into the frame of the machine using frame upright. The scavenging block has two locations for pink/red scavenging tubing to be connected. If only one is being used, the other can be sealed by using a bung (supplied). The wall vacuum tubing is then connected to the connector on the back of the block. The flow meter tube has a filter silencer fitted, this may require replacement after constant use as the filter can become blocked.

Refer to Section 5.10 for service instructions.

3.3.11Auxiliary Oxygen Outlet

An auxiliary oxygen outlet is mounted on the right-hand frame upright where an oxygen flowmeter can be used. This oxygen flow meter can be used to deliver oxygen to the patient, instead of using the rotameters and standard common gas outlet. This is used, for example, with neurolipse, relative analgesia and local anaesthesia, safely bypassing the possibility of accidental vaporiser delivery or in-circuit complications.

The 0 - 15 L/min flowmeter can then be connected to the auxiliary outlet. It should be tested to make sure it is operating correctly.

See section 5.9 for replacement instructions

3.3.12Pipeline Hose Assemblies

The pipeline hose assemblies are fitted with non-interchangeable connectors (handwheels) at both ends of the hose. They are suitable for Australian wall outlets or cylinder regulators. Each type of gas hose and handwheel is colour coded and diameter size indexed to the ISO (International Standards Organisation) standard for that particular gas. Each hose must be connected to the correct gas inlet and sufficiently tightened to prevent gas leaks. The anaesthesia machine is provided with hooks at the top rear of each leg for hanging the hoses.

3.3.13Oxygen failure warning device

This is a nitrous oxide cut-off and whistle alarm. In the event of a complete loss of oxygen from both the wall gas and cylinder gas supply, the machine and the ventilator will continue to operate. Once the pressure drops to approximately 225kPa, an audible alarm will sound and the nitrous oxide supply through the rotameter will be cut off. At the same time the supply of oxygen to the ventilator will cease, ensuring all oxygen is available for the patient. The flow of oxygen can still be seen at the rotameter. At 220kPa there is only about 3 litres of oxygen left in the reservoir cylinder, giving some time for the operator to rectify the pressure problems. This can be achieved by turning on the reserve cylinders amongst other alternatives. Once normal pressure is re-established, the alarms turn off, nitrous oxide will start to flow, and the ventilator will start to cycle again.

The Visiwink only turns red below 125kPa. At this stage, if oxygen is not being supplied, an alternative supply source should be established. If air is connected, there is a safe reserve with a content of around 21% oxygen.

Refer to Section 5.4 for calibration instructions.

3.4 Electrical System

3.4.1 General

Five IEC outlets are mounted internally in the machine. Normally one outlet is used to power the electroluminescent (EL) backlight for the medical gas flow sensors. One is reserved for powering the external outlet in the side of the machine; the remaining outlets are available for powering Ulco-supplied options such as monitors or ventilators.

All outlets are switched at the main workstation switch on the front panel. The EL backlight is only switched on by a pressure sensor in the main gas supply (Oxygen or air).

The circuit for the power distribution system is shown in Section 6.8.

3.4.2 Serviceable Parts

Under normal circumstances, the electrical components require no servicing however the following components may be replaced on defect.

- Power inlet and supply available lamp (APB20)
- Main electro-pneumatic switch assembly (APB40)
- Inlet power cord
- Inlet circuit breakers
- Outlet fuses (2A)

3.4.3 Auxiliary Power Outlets

The Signet mains power supply is switched by the main front panel on/off switch and is then distributed to 5 IEC outlets mounted internally in the rear of the machine. One of the outlets is used to power the electro-luminescent backlight for the flow tubes, one is allocated to power the external outlet in the side of the machine and the other 3 are available to power additional options such as monitors and ventilators. These outlets can only be accessed by removing the rear cover; they should only be used with equipment supplied by Ulco in order to ensure compliance with the relevant electrical safety standards (IEC 60601-1-1).

One external IEC outlet is mounted in the side strip of the machine for use in powering vaporisers. The Signet has been safety tested in conjunction with TEC-4 Desflurane vaporisers only.

If a flexible external outlet solution is required, the APB70 4-outlet power board may be purchased as an option, but system testing to the safety standard will become the responsibility of the purchaser.

3.5 Ventilator

The ventilator can be mounted to the left hand upright of the machine. The ventilator mount fits into the bracket. All parts can be tightened into position with locking screws. The base plate is fitted to the mount, and the ventilator is then secured to the base plate with the four nylon screws supplied.

The ventilator drive hose can then be connected. The drive gas connection for the ventilator is the last gas inlet on the right of the gas manifold. Air or oxygen drive are optional. The ventilator drive gas inlet is supplied with the correct gas hose and ring index for the drive gas specified e.g. Oxygen.

Note that the ventilator silencer is connected to the back of the ventilator and that the 30mm male scavenging outlet is on the top of the exhaust.

Further information regarding the operation of the EV500 ventilator can be found in its user manual.

3.6 Soda-lime absorber

The soda-lime absorber mount bracket attaches to the post towards the front of the machine. The absorber mount sits over the upright and should be allowed to seat itself into position. The top locking screw and side

locking screw can then be fastened to hold in position. The exhaust hose can then be attached to the 30mm exhaust valve scavenging outlet. The absorber fresh gas hose from the common gas outlet can now be connected to the fresh gas inlet on the side of the absorber. This connection hose is made from strong reinforced hose so it will not perish. No latex tubing is used in Ulco machines.

Further information regarding the operation of the absorber can be found in its user manual.

3.7 Other accessories

Suction apparatus

A mounting exists which accepts a special swivel bracket that supports the suction receivers from Abbott or other similar brands. The bracket is an optional item and can be ordered direct from Ulco as P/N ASU203

Writing Tray

Another accessory which can be supplied on the side is a fold-down writing tray. This is attached by a simple quick locking mounting block on the rail on the side of the work area. The tray can be secured in a horizontal position by swinging the arm brace out from under the tray. Many other accessories can be mounted on the rail via this method, for example, a universal circuit support arm able to swivel in many directions. The lock screw on the side can control excessive movement.

Hooks are mounted to the bottom back panel and a movable sphygmomanometer mount is positioned on the top monitor tray. An aneroid or mercurial sphygmomanometer can then be used.

3.8 Accessory power

The Signet 615 can be fitted with an optional 4 outlet power board at the top rear of the machine. The power board is designed to prevent items other then monitors to be plugged in and is protected by an earth leakage circuit breaker or ELCB. On the bottom right hand corner is a fitting for E P Earth.

If the 4 outlet power board is supplied, a short connector cable is used to power some of the rotameter backlighting. Second, the ventilator power cord may also be connected here leaving the other 3 outlets for the operator's own requirements, eg. Patient monitoring.

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4 Servicing Overview

4.1 Warnings and Cautions

Warning indicates a potentially life threatening situation:

- Never oil or grease any anaesthesia or oxygen equipment unless the lubricant used is made and approved for this type of service.
- Never connect the scavenging valves directly to vacuum source. The vacuum may remove required gases from the patient circuit.
- Never cover anaesthesia equipment with any type of fabric or plastic covering. Removing the cover may cause a build up of static electricity, which can cause fire or explosion.

Caution indicates condition which can lead to equipment damage or malfunction

- Avoid using excessive force when closing flow controls valves.
- Turn OFF anaesthesia machine when not used, to minimise possibility of depleting oxygen supply
- Ensure that all gas flow control valves are turned fully clockwise before system ON/OFF switch is turned on to avoid damage to flow tubes by sudden surge of gases.

4.2 Responsibilities of Service Personnel

It is recommended that service procedures should only be performed by ULCO certified technicians at the recommended intervals. A service record should be kept by Hospital and the service provider.

4.3 Risks

Only personnel certified by ULCO should attempt to repair and service ULCO Equipment to minimize risk of malfunction and/or patient injury.

4.3.1 Explosion

The Signet 615 is restricted to use with non-flammable anaesthetic agent only in order to minimise the possibility of an explosion.

4.3.2 Electrical

Before removing any of the machines covers, the power cord must be detached from the mains supply in order to prevent the possibility of electric shock.

4.3.3 Contamination

A bacterial filter should be used to prevent contamination of anaesthesia equipment.

4.4 Preparation and Completion of Service

4.4.1 Preparation

Anaesthesia equipment should be cleaned and sterilized.

Genuine ULCO spare parts for all critical assemblies should be available.

Read the section of this manual appropriate to the service procedure to be performed. Procedures for servicing the gas supply system are to be found in Section 5 of this manual.

It is recommended that a leak test be performed on the system prior to performing any service procedures in order to determine that the machine is in an acceptable state before the service. Then if any new leaks are introduced to the system during the service procedure, they may be more quickly identified.

4.4.2 Removing the rear access panels

Access to the bulk of the gas supply system is achieved by removing the rear plastic moulded cover by turning the single hex key retaining clip to free the cover as shown in Figure 2.

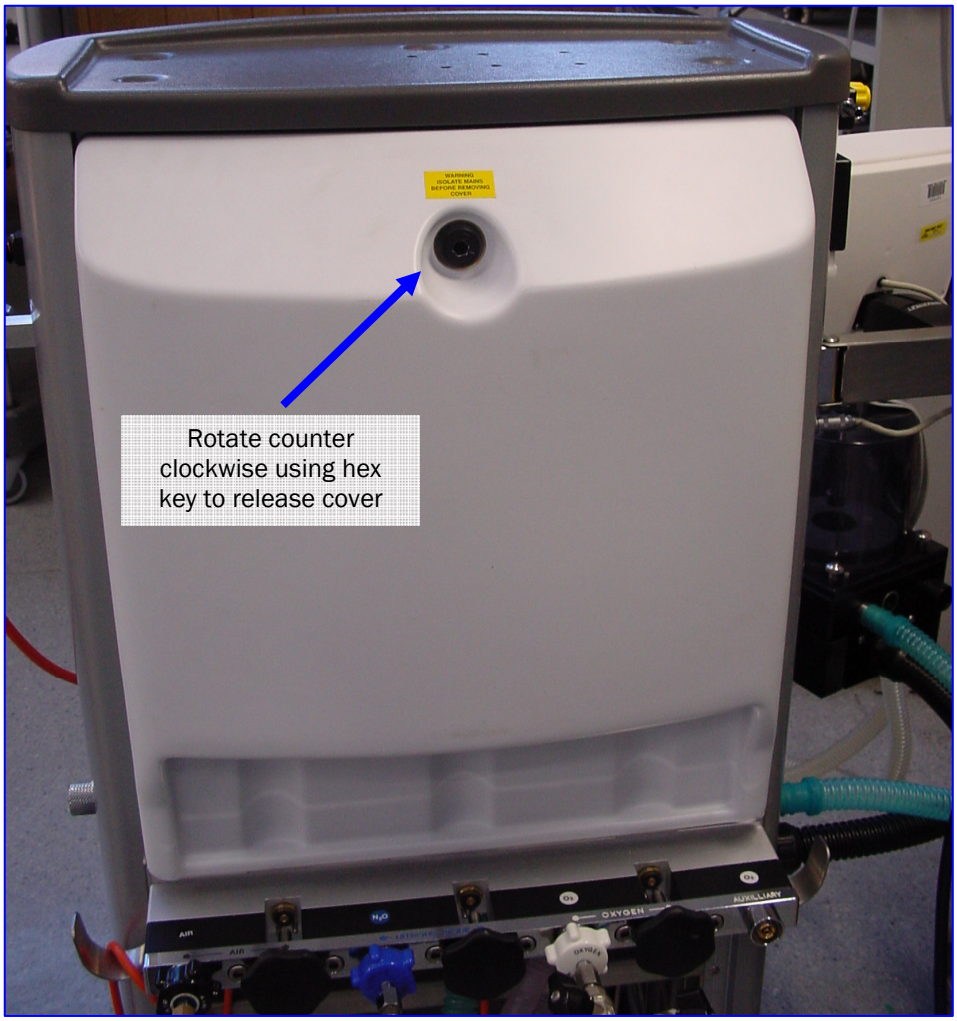


Figure 2: Rear top cover of Signet 615

Access to the some of the gas supply system is achieved by removing the rear metal cover plate in the lower half of the machine. This can be done by removing the four screws affixing the cover plate in place using a 4mm Allen key, as shown in Figure 3.

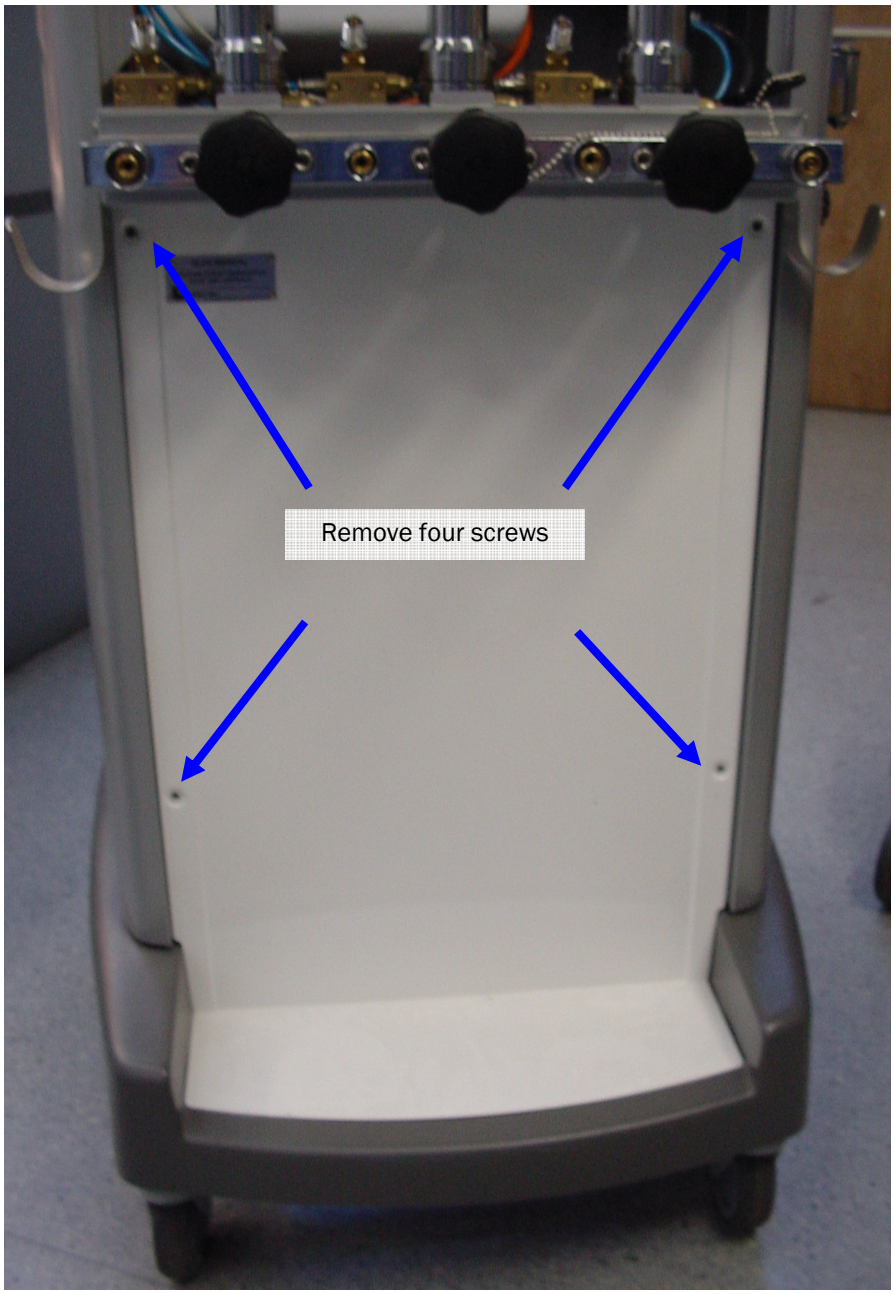


Figure 3: Rear metal cover

4.4.3 After Service

Anaesthesia Equipment should be tested according to Ulco's recommended procedures and a service sticker signed off by a certified technician before releasing the machine into operation.

Test and calibration procedures for all serviceable items are to be found in Section 5 of this manual. After servicing any item, a full Level 1 check of the machine should be performed. The procedure for performing the Level 1 check is available from Ulco; document QA-SERVICE-A600. Similarly, the test record sheet for this procedure is available as FM75-50.

4.5 General Servicing and Information

ULCO recommend twelve monthly service periods. This should include the change over of all service kits for critical assemblies.

In addition to regular servicing of the equipment ULCO also recommends that performance and calibration tests are carried out as often as necessary, but at minimum every six months.

4.6 Seals

All seals on high pressure components such as the first stage regulators must be lightly greased with Krytox or similar grease certified safe for use in high pressure oxygen environments. Low pressure components in the patient airway may use standard silicone greases.

4.7 Spare Parts & Service Intervals

Item No.	Product	Interval in Months	Qty	Service Procedure	Part. No.
1.	Anti Hypoxic device (AHD60)	12	1	5.6	AHD60-99
2.	Rotameter 5 Tube (A5047)	12	1	5.8	A5047-99
3.	Selectatec Block (A605)	12	1	5.7	A605-99 or A605-9
4.	Regulator (Primary) (RG1)	12	3	5.2	RG1-99
5.	Regulator (Secondary) (RO7-1)	12	2	5.6	RO7-99
6.	Ventilator Cutoff (A6056)	12	1	5.5	A3056-99
7.	Oxygen Failure Alarm (A6055)	12	1	5.4	A3055-99
8.	Manifolds (A6072, A6073, A6074)	12	3	5.2	A3057-99
9.	Patient Block (A7085)	12	1	5.11	A307-99
10.	Scavenge Block (A7027)	12	1	5.10	A3027-99
11.	Signet 615 Service kit (includes all gas supply system service kits 1-10)	12	1		A600-99

4.8 Tools

The following table details special tools which may be ordered from Ulco:

	Part Number
Regulator spanner	RG1-SP
System pressure gauge	AB500S
Circuit pressure manometer	AB500

In addition, the following commonly available tools are required to complete most of the service procedures in this manual:

Oxygen analyser
Trim tool, small flat blade screwdriver or similar
Phillips head screwdriver
Voltage meter, accuracy <1 mvolt
Long nose pliers
Metric Allen key set

5 Service of the Gas Supply System

5.1 Overview

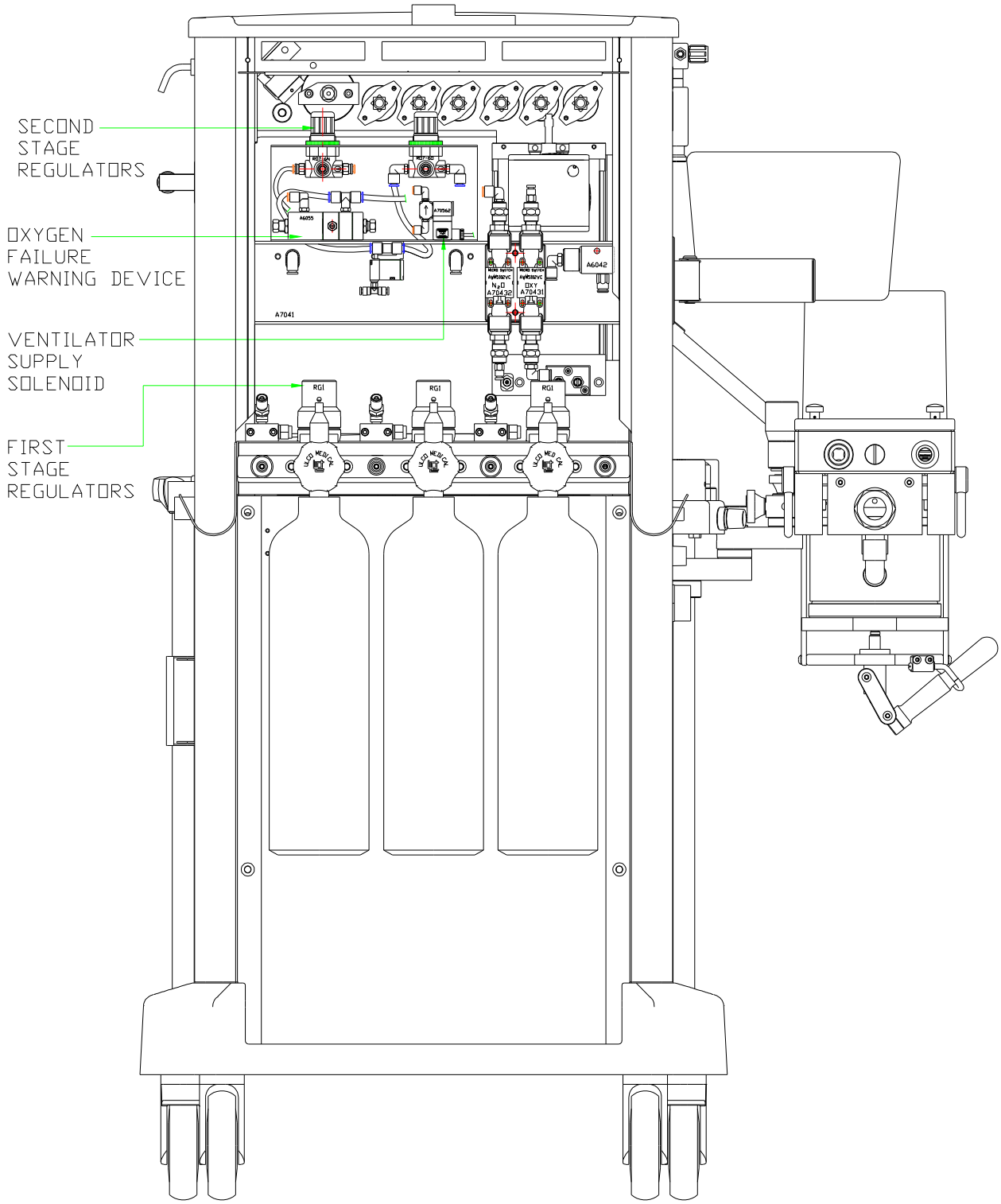


Figure 4: Rear view of gas supply system

5.2 Gas manifolds A6072, A6073 and A6074

The gas manifold is at the rear of the machine. Bodok seals (RG204) should be checked for damage every time new cylinders are fitted.

5.2.1 A3057-99 Service kit

- 6 off OR-5005 O-ring
- 3 off OR-5006 O-ring
- 3 off OR-5013 O-ring
- 12 off RG205 Dowty seal
- 3 off RG204 Bodok seal

5.2.2 Tools to be used

- 16mm spanner.
- Silicone grease Molykote 111.
- Allen key 4mm.

5.2.3 Preparation to service A607X manifolds

1. Make sure that the anaesthetic machine is OFF.
2. Remove gas cylinders from the back of the machine.
3. Remove medical gas supply piping lines from the back of the machine.

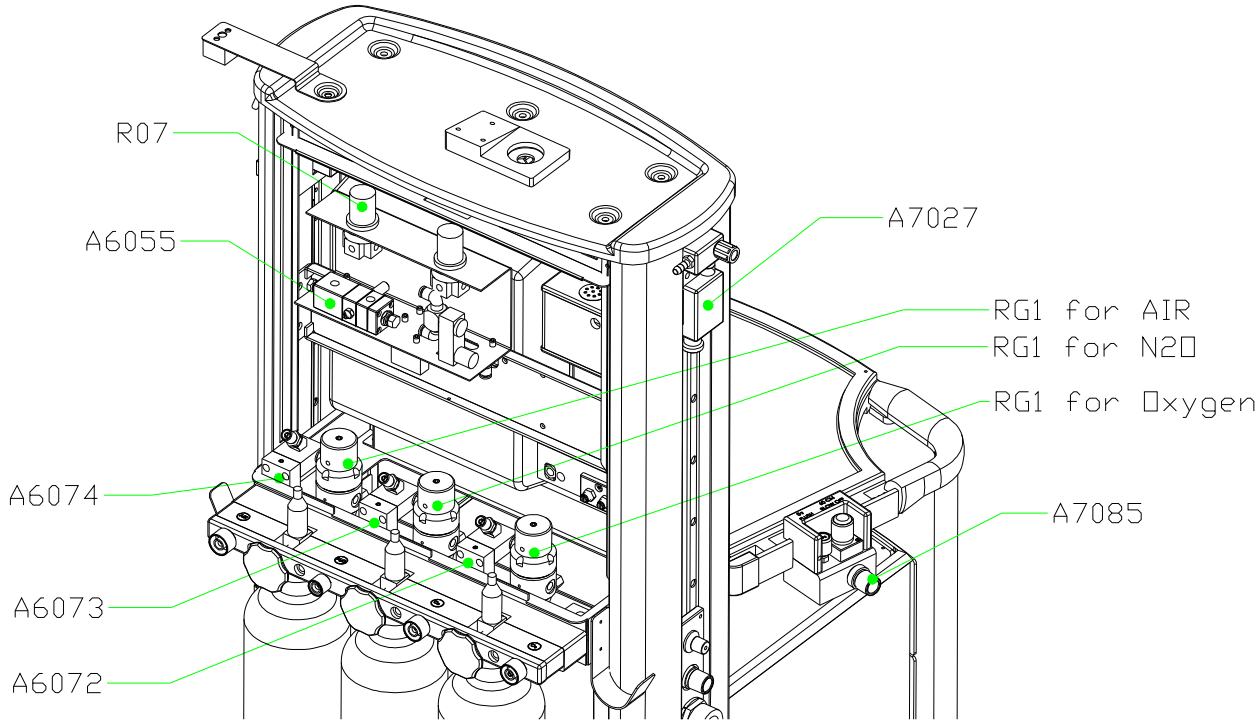


Figure 5: Location of A607X Manifolds on Anaesthetic machine

5.2.4 Service Procedure

To service the manifolds we must follow Figure 6.

1. **Replacement of RG205 Dowty Seal and O-ring OR-5006 on test point.**
   a. Remove GCN001 gas connector by using a 16mm spanner. By doing this remove the non return valve NRV001, RG205 Dowty seal and o-ring OR-5006.
   b. Replace o-ring OR-5006 assemble into NRV001 non return valve and smear with silicone grease Molykote 111.
   c. Reassemble NRV001 non return valve, OR-5006 o-ring, RG205 Dowty seal and GCN001 gas connector into manifold body.

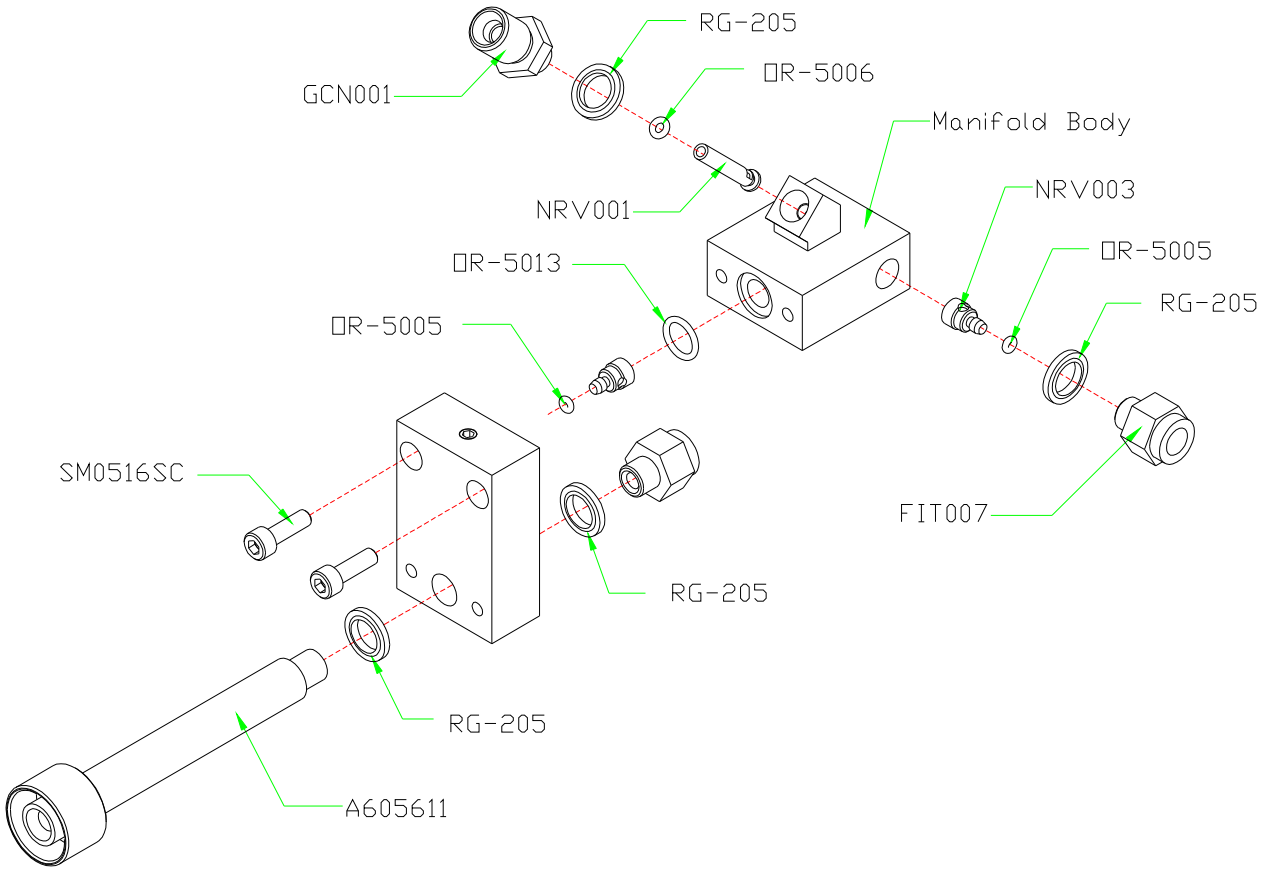


Figure 6: Components to replace in Manifold A607X

2. **Replacement of RG205 and o-ring OR-5005 at regulator connection.**
   a. Remove FIT007 by using a 16mm spanner.
   b. Remove RG205 and NRV003 non return valve with its o-ring OR-5005
   c. Replace RG205 and o-ring OR-5005 and smear it (only o-ring) with silicone grease Molykote 111.
   d. Reassemble NRV003, OR-5005, RG205 and FIT007 into the manifold body. Use a 16mm spanner for it.

3. **Replacement of remaining o-rings OR-5013 and OR-5005**
   a. Remove the two screws SM0516SC by using a 4mm Allen key.
   b. Replace o-rings OR-5005 and OR-5013 and smear them with silicone grease Molykote 111.
   c. Reassemble o-rings OR-5005 and OR-5013 into manifold body and then screw SM0516SC back.

4. **Replacement of remaining RG205 Dowty seals along gas connector A605611. These Dowty seals RG205 are rarely replaced, but if a need arrives this is the procedure.**
   a. The RG205 Dowty seal on the FIT007 fitting can be replaced by removing this fitting FIT007 (use a 16mm spanner for it). Then proceed to reassemble it.
   b. The Dowty seal RG205 along the gas connector A605611 is harder to replace. The only was is by removing the whole manifold from the console and to do this remove the yoke bar assembly A60753 and A60752, and only then unscrew the bolts that keep the manifold assembled to the console.
   c. Once the above is done unscrew the gas connector A605611 and replace the RG205 Dowty seal.
   d. Reassemble into the console and it is ready to be tested.

5.2.5 Test of A607X manifolds

1. **Preparation:**
   a. Put a test gauge on the test point.
   b. Connect the correspondent cylinder gas to the anaesthetic machine (not the medical gas supply pipelines from the walls). We must read 360 kPa in the test gauge.
   c. Check that there is no leak around manifold.
   d. Disconnect cylinder gas and connect the correspondent medical gas supply from the wall pipelines. We must read 450 kPa, which is the pressure from the wall pipelines.
   e. Check that there is no leak around the manifold.
   f. Connect correspondent cylinder gas and test gauge must still read 450 kPa.

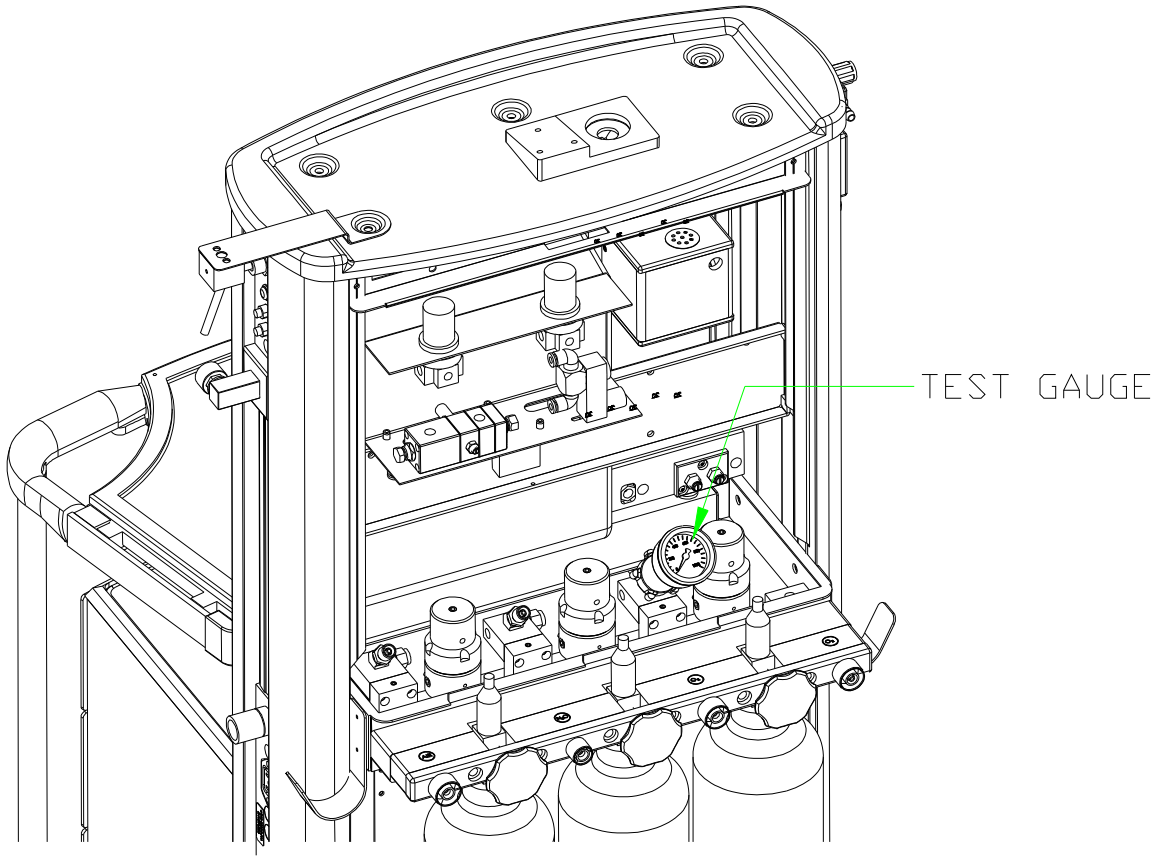


Figure 7: Location of test gauge for calibrating primary regulators

5.3 First Stage Regulators RG1

The regulator and yoke are assembled in line to reduce the risk of high pressure leaks. The brass yoke bolt (RG203) has the Bodok seal (RG204) attached to it and is fitted with a sintered bronze filter (RG2031). Bodok seals must be examined and replaced if necessary every time the cylinders are replaced.

5.3.1 RG1-99 Service Kit

- 1 off RG102 Cartridge and Washer
- 1 off RG10511 Spring
- 1 off OR021.5 O-ring
- 1 off RG103 Diaphragm
- 4 off RG205 Dowty seal
- 1 off RG204 Bodok seal

5.3.2 Tools to be used

- RG110 spanner
- Socket 11/16”
- Socket 5/8”
- Allen key 4mm
- Allen key 8mm
- Socket wrench
- Oxygen tape
- Grease Dupont Krytox GPL-205
- Calliper 0 – 150mm

5.3.3 Preparation to service RG1 regulators

1. Make sure that the anaesthetic machine is OFF.
2. Remove gas cylinders from the back of the machine.
3. Remove medical gas supply piping lines from the back of the machine.
4. Remove rear plastic cover using 8mm Allen key supplied with machine

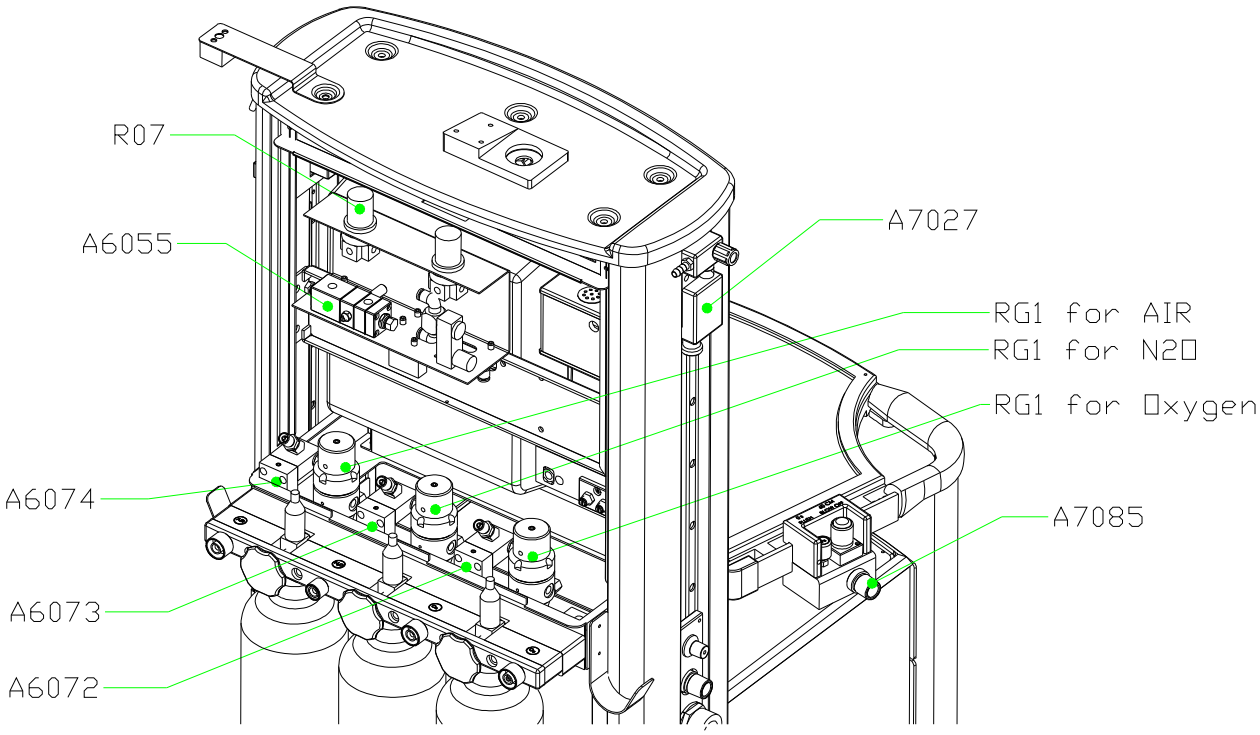


Figure 8: Location of RG1 Regulators on Signet 615 machine

5.3.4 Service Procedure

Refer to Figure 10

a. **Cartridge RG102, diaphragm RG103, washer cartridge RG1021.**
   a. With the regulator assembled to its base in the workstation proceed to remove the top cap of regulator RG106. Use the RG110 spanner for it.
   b. Remove diaphragm RG103.
   c. Unscrew cartridge RG102 by using a socket 11/16", and then remove washer RG1021.
   d. Replace washer and cartridge and reassemble. First the washer RG1021 and then the cartridge RG102. There is no need to put any oxygen tape to cartridge RG102.
   e. Unscrew the adjustment grub screw RG1061 to reset the regulator pressure
   f. Assemble top cap RG106 by using RG110 spanner.

b. **O-ring OR-021.5, spring RG10511, and Dowty seals RG205 along bolt RG206. (This section should only be performed if a leak is present between the cylinder and the regulator)**
   a. Unscrew RG206 bolt from the bottom of the console by using a 5/8" socket (Figure 9).
   b. Remove the RG1 regulator by pulling it upwards from its base RG201.
   c. With the calliper measure the distance between the grub screw RG10512 to the body of the regulator RG101. This is important, because this was set up during prior assembly, which will give us approximately the blow off pressure of 600 kPa.
   d. Unscrew the grub screw RG10512 (use 4mm Allen key). By doing this remove the spring RG10511 and the blow-off valve RG1051.
   e. Replace the o-ring OR-021.5 from blow off valve RG1051 and apply grease Dupont Krytox GPL-205.
   f. Remove any remaining oxygen tape from grub screw RG10512 and then re-tape it with new oxygen tape.
   g. Place the blow off valve RG1051, o-ring OR-021.5 and spring RG10511 in its cavity, and then screw the grub screw RG10512 (use 4mm Allen key) to the distance previously measured (use calliper fort it).
   h. Replace Dowty seals RG205 and reassemble regulator.

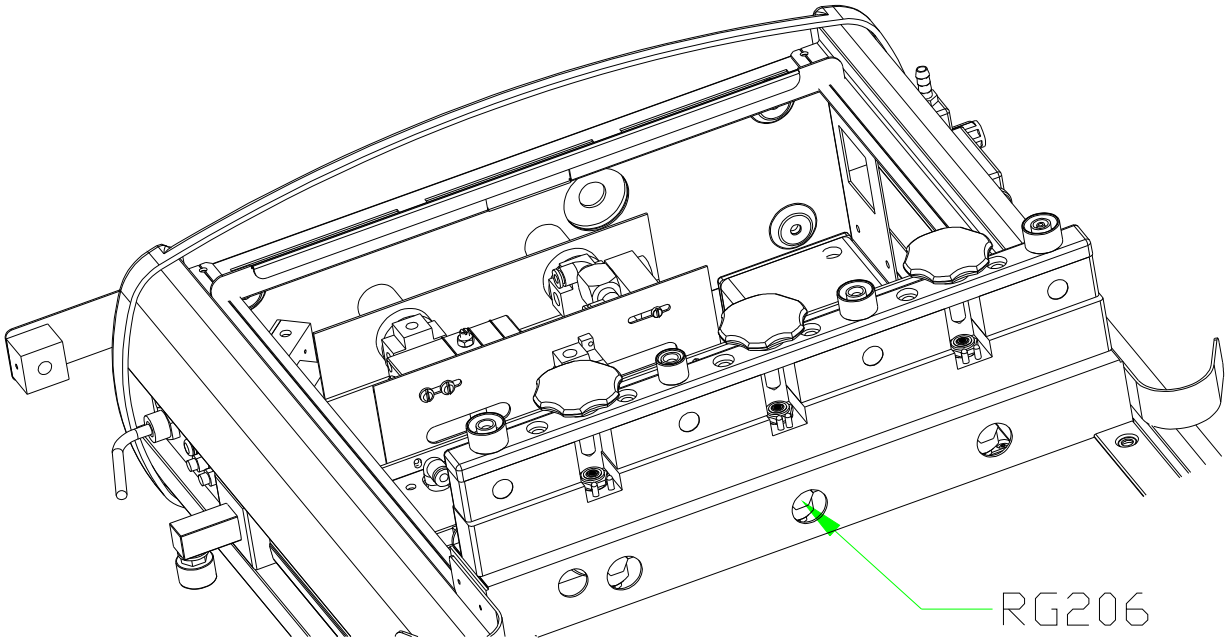


Figure 9: Removal of RG206 bolt

c. Dowty seal RG205 and Bodok seal RG204 (along cylinder connector RG203).
   a. To replace the Bodok seal RG204, remove it from RG203 cylinder connector and replace with a new Bodok seal RG204.
   b. To replace the Dowty seals RG205, unscrew RG203 cylinder connector by using 11/16" socket.
   c. Remove Dowty seals RG205 and replace them.
   d. Finally screw the RG203 cylinder connector back (no oxygen tape is needed).

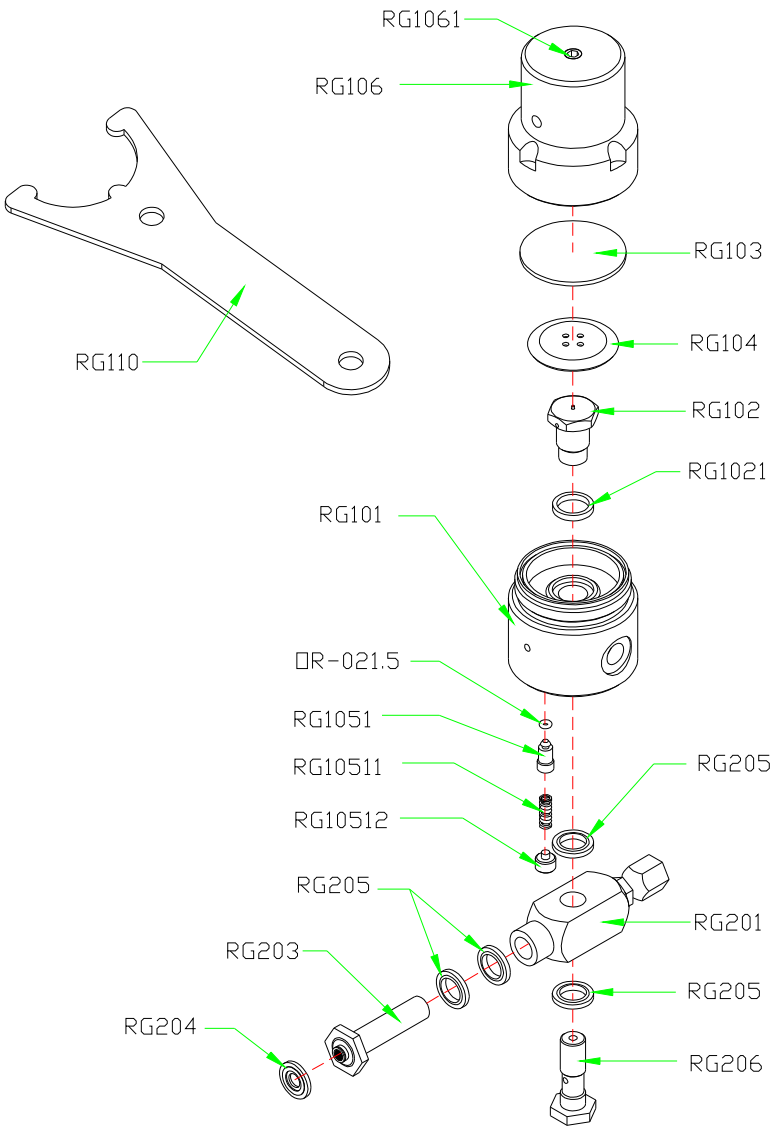


Figure 10: Components of RG1 First Stage Regulator

5.3.5 Calibration of Post Serviced RG1 First Stage Regulators

1. **Test of the blow off pressure**
   a. Connect a gas cylinder in the back of the machine and open its supply. Ensure that the cylinder is full or near full.
   b. Connect a test gauge manometer (1000 kPa) to the connector of manifold connected to RG1 under test (see Figure 11).
   c. By adjusting the grub screw RG1061 (in top of regulator RG1) with 4mm Allen key, set the pressure to 600 kPa.
   d. At this pressure the blow off valve must be venting, if it doesn't vent remove RG1 as described in Section a and unscrew the grub screw RG10512, which control the blow off valve until begin to exhaust at 600 kPa. To check this reassemble the RG1 on its base RG201 and test it. Turning the grub screw counter-clockwise (i.e. unscrewing it) will reduce the pressure at which the venting occurs. Turning the grub screw clockwise (i.e. screwing it in) will increase the pressure at which venting starts.
   e. If it vents too heavily the grub screw RG10512 needs to be screwed further in. The reason is that the blow off valve must start venting at pressures greater than 600 kPa not less.
   f. Once the correct blow-off pressure is achieved proceed to screw the grub screw RG1061 until the pressure is 360 kPa, which is the pressure required by the workstation. Note that the regulation system has some hysteresis, so if the adjustment grub screw is turned too far in and the pressure is too high, it may need to be unscrewed further is order to achieve the desired regulation pressure. When the regulator is working, correctly there should be no noise emitted.

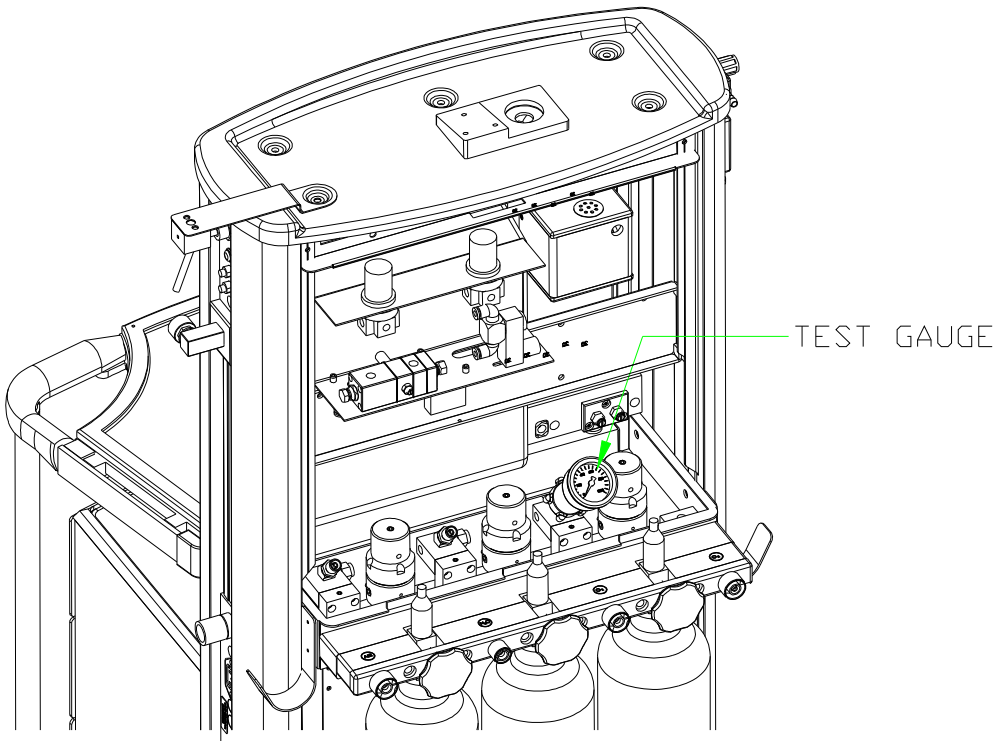


Figure 11: Test Gauge on Manifold

5.4 Oxygen Failure Alarm A6055

5.4.1 A3055-99 Service kit

- 1 off A305516 ..... N_2O Diaphragm
- 1 off A305522 ..... Gasket
- 1 off A305534 ..... Oxygen Diaphragm
- 1 off A305513 ..... N_2O Spring
- 1 off A305543 ..... Oxygen Spring
- 3 off OR-5006 ..... O-ring
- 1 off OR-5007 ..... O-ring
- 1 off OR-5011 ..... O-ring

5.4.2 Tools to be used

- Flat Screwdriver
- ½" Spanner
- 5/8" Spanner
- 10mm spanner
- Silicone grease Molykote 111.
- Allen key 8mm and 4mm.
- Calliper 0 -150mm.

5.4.3 Preparation to service A3055 oxygen failure alarm

1. Make sure that the anaesthetic machine is OFF.
2. Remove gas cylinders from the back of the machine.
3. Remove medical gas supply piping lines from the back of the machine.
4. Remove rear plastic cover using 8mm Allen key supplied with machine.
5. Disconnect tubing from A6055 Oxygen Failure Alarm.

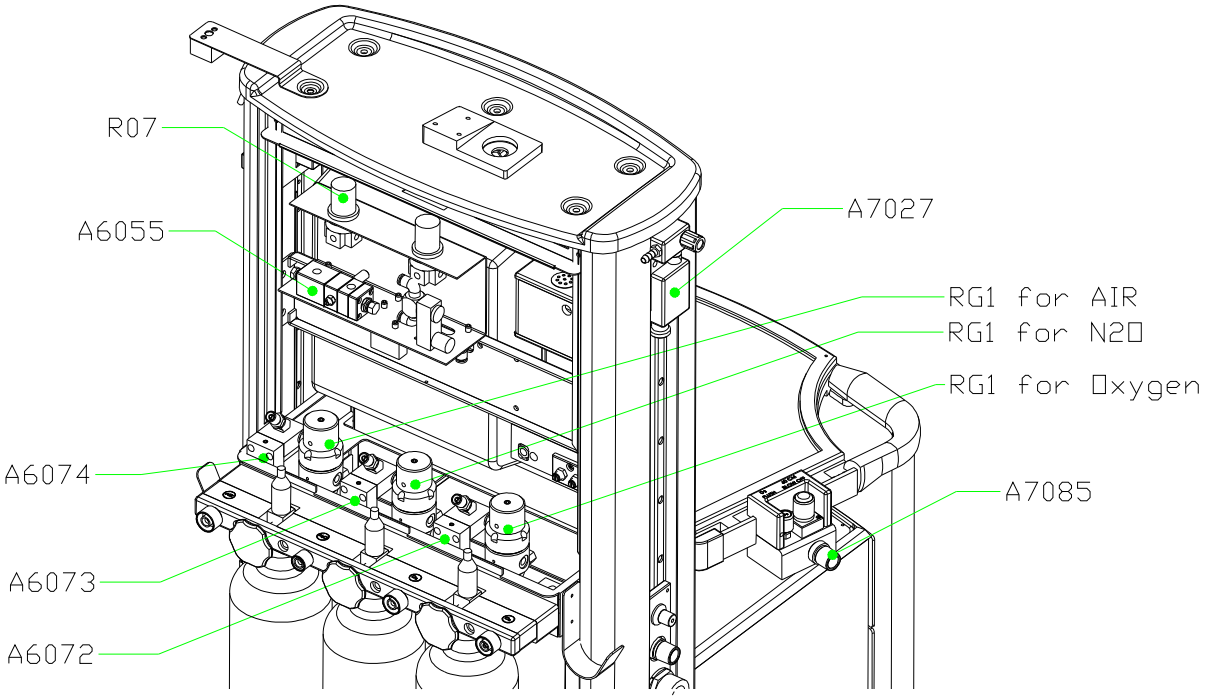


Figure 12: Location of A6055 Oxygen Failure Alarm on Anaesthetic machine

5.4.4 Service Procedure

Refer to Figure 14.

First, remove the A6055 Oxygen Failure Alarm from the Pneumatic Bracket Assembly A706. To do this, unscrew the two screws (use a flat screwdriver), which are located under the bracket (see Figure 13).
Once we have the A6055 valve, we must proceed to disassemble one side at a time, to prevent mixing of components.

Using a pencil or permanent marker, number each of the four brass sections in the A6055 assembly and note their orientation with respect to each other. This will reduce the chance of a mistake during reassembly.

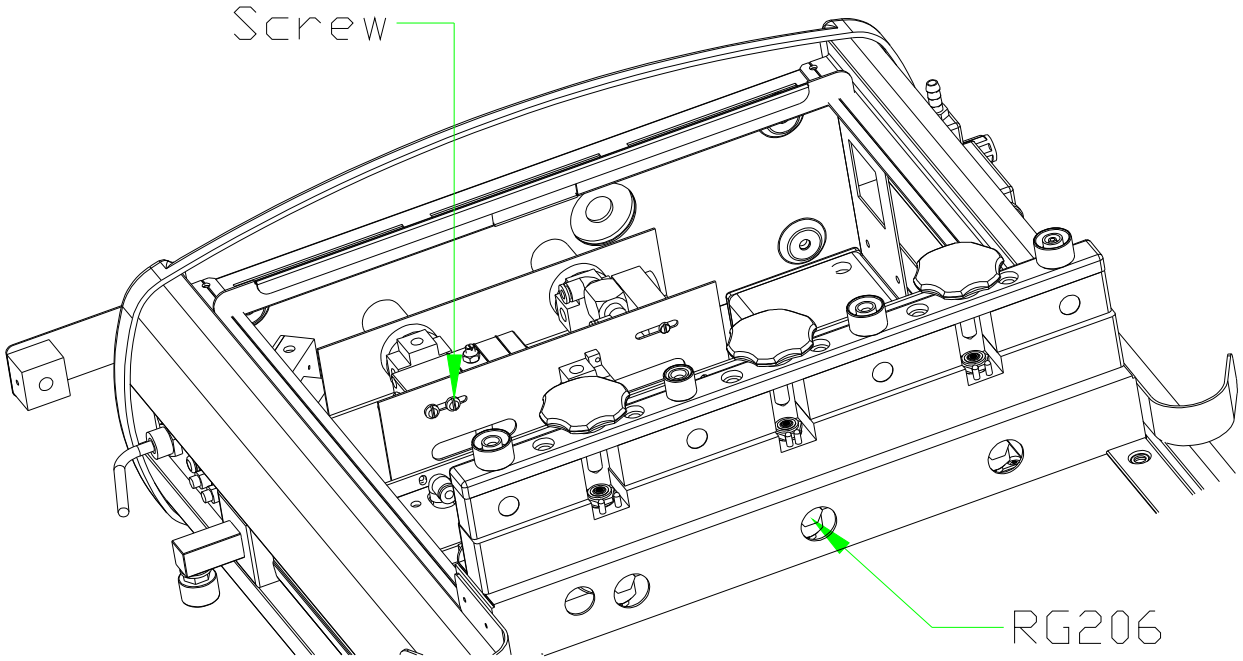


Figure 13: Screws to assemble A3055 on workstation

1. **Replacement on N_2O side. This is replacement of O-ring OR-5006, OR-5007, OR-5011, spring A305513, and diaphragm A305516.**

a. Unscrew the 4 screws M4 x 30 from body A30551 (see Figure 14).
b. Remove the body A30551 and the N2O spool A305514.
c. Replace its o-rings OR-5006 and OR-5007 and apply silicone grease Molykote 111 on them.
d. The diaphragm A305516 must also be changed, but assemble it dry (no grease on it).
e. The spring A305513 can also be replaced.
f. To replace the o-ring OR-5011, we must remove the adjustment stud A305511. First measure distance between the stud A305511 to the body A30551 (use calliper). This distance is important, because this was set up prior assembly.
g. Use a 5/8" spanner to unlock the nut A305512, and finally unscrew the adjustment stud A305511 by using a ½" spanner.
h. Apply silicone grease on the o-ring OR-5011 and reassemble the adjustment stud A305511 and measure distance as per step f and then assemble loose the nut A305512, so it can be adjusted on the set up of the valve.
i. Carefully clean each part with an oxygen jet or similar non-abrasive technique
j. Proceed to reassemble everything into the A6055. Take care when screwing in he adjustment stud to avoid cutting the O-ring.

2. **Replacement of the oxygen side. This is replacement of o-rings OR-5006, oxygen diaphragm A305534, gasket A305522 and spring A305543.**

a. Unscrew the 4 screws M4 x 30 from body A30554 (see Figure 14).
b. Disassemble this side by removing A30554 Oxygen block, A30553 body, A305531 spool whistle, gasket A305522, diaphragm A395534 and spring A305543.
c. Replace the o-ring OR-5006 and apply silicone grease Molykote 111 on it.
d. The diaphragm A305534 and gasket A305522 must also be changed, but assemble it dry (no grease on it). Make sure the 2mm hole of the gasket A305522 and A30552 body align when assemble.
e. The spring A305543 can also be replaced.
f. Proceed to reassemble into the A6055.

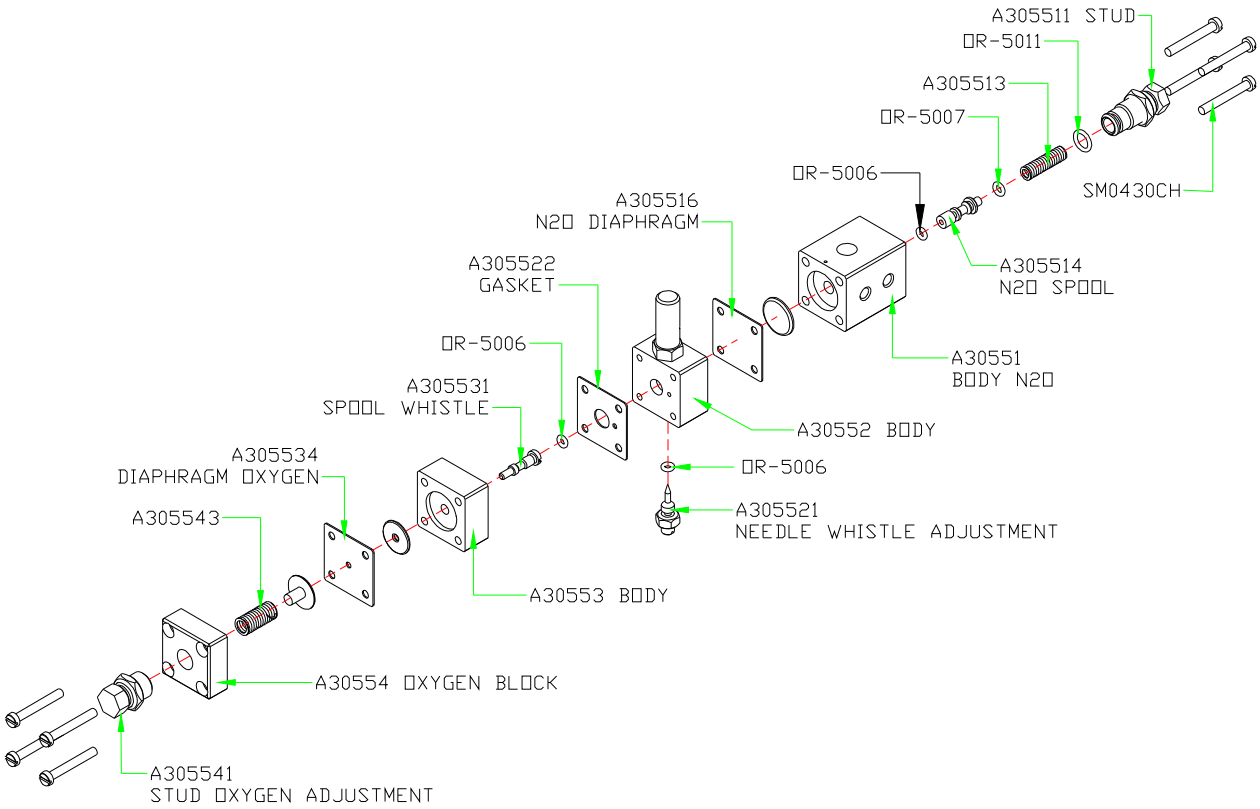


Figure 14: Exploded View A6055 Oxygen Failure Alarm

3. **Replacement of o-ring OR-5006 on needle whistles adjustment.**

a. Unscrew nut NU-M6 by using a 10mm spanner, then remove needle A305521.
b. Remove o-ring OR-5006, replace and grease it with silicone grease Molykote 111.

c. Reassemble it back leaving the NU-M6 nut. This nut will be lock during whistle test.

5.4.5 Calibration of A6055 Oxygen Failure Alarm

1. Preparation

a. Install the A6055 in the pneumatic bracket of the anaesthetic machine.
b. Connect tubing into the A6055 Oxygen Failure Alarm.
c. Connect the cylinder gases N2O and Oxygen to the anaesthetic machine (not the medical gas supply pipelines from the walls).
d. Switch ON the anaesthetic machine.
e. Open fully on the Anti-hypoxic device the N2O knob and set a flow of approximately 0.1 litre/min of oxygen.
f. Put the manometer on the oxygen test point as per Figure 15.

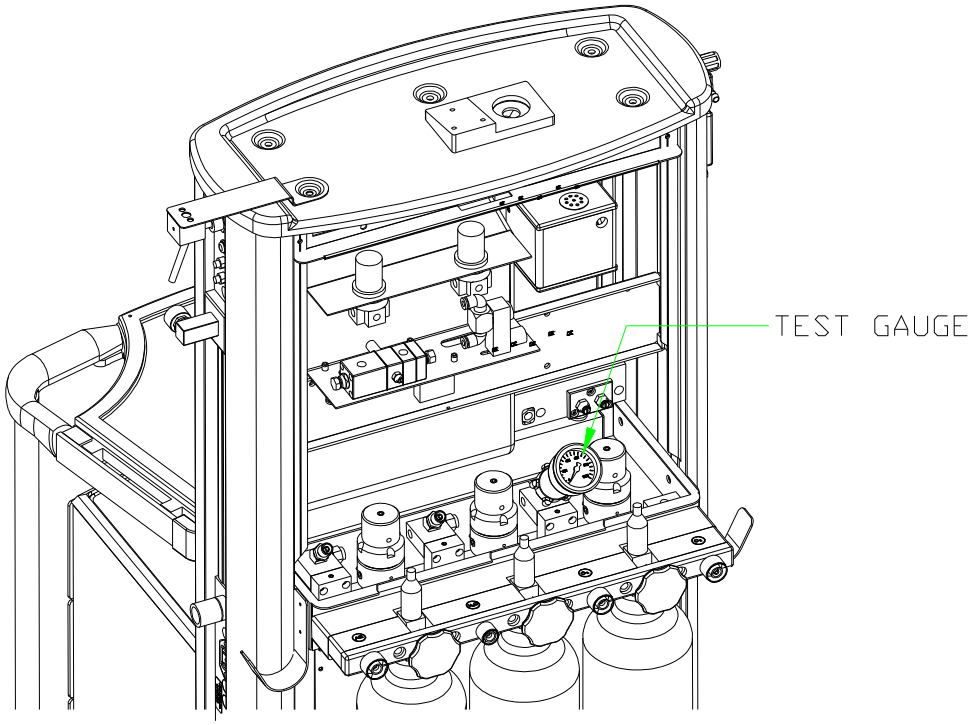


Figure 15: Test Gauge in Workstation

2. 3. Set up of operation of Oxygen Failure Alarm (see Figure 15)

a. With oxygen pressure between 220 to 230 kPa, and a flow of oxygen of 0.1 litre/min, adjust screw A305541 until whistle operates. To do this first unlock nut A305512 oxygen side (use spanner 5/8”), and then adjust A305541. One a clear sound is achieve, lock A305541 stud and A305512 nut.
b. Return pressure of oxygen to 250 kPa (whistle must stop)
c. Gradually reduce oxygen pressure to 220 – 230 kPa, the N2O flow must stop and whistle must sound clearly for a minimum of 7 seconds.
d. To get the sound of whistle we desire unlock the nut NU-M6 (use 10mm spanner) and adjust by using a flat screwdriver the A305521 needle, so once the sound is set, we lock it in that position.
e. Finally return oxygen pressure to 360 kPa, which is the pressure required by the RG1 regulator in the workstation.

Set up of the Nitrous Oxide Cutoff

a. By using the test gauge and an Allen key 4mm adjust RG1 for oxygen to reduce pressure to about 220 to 230 kPa.
b. Adjust stud A305511 (use ½” spanner) until the N2O flow stops (see the N2O flowmeter front of workstation). Lock this position with nut A305512 (use 5/8” spanner). The N2O flow must stop 3 to 5 seconds after the whistle first sounds.

5.5 Ventilator Cutoff A6056

5.5.1 A3056-99 Service kit

- 2 off OR-5006 O-ring
- 1 off OR-5007 O-ring
- 1 off OR-5011 O-ring
- 1 off RG205 Dowty seal
- 1 off A305516 Spring
- 1 off A305513 Spring

5.5.2 Tools to be used

- 16mm spanner.
- ½" spanner
- Silicone grease Molykote 111.
- Flat Screwdriver.
- Multigrip

5.5.3 Preparation to service A6056 Ventilator Cutoff

1. Make sure that the anaesthetic machine is OFF.
2. Remove gas cylinders from the back of the machine.
3. Remove medical gas supply piping lines from the back of the machine.

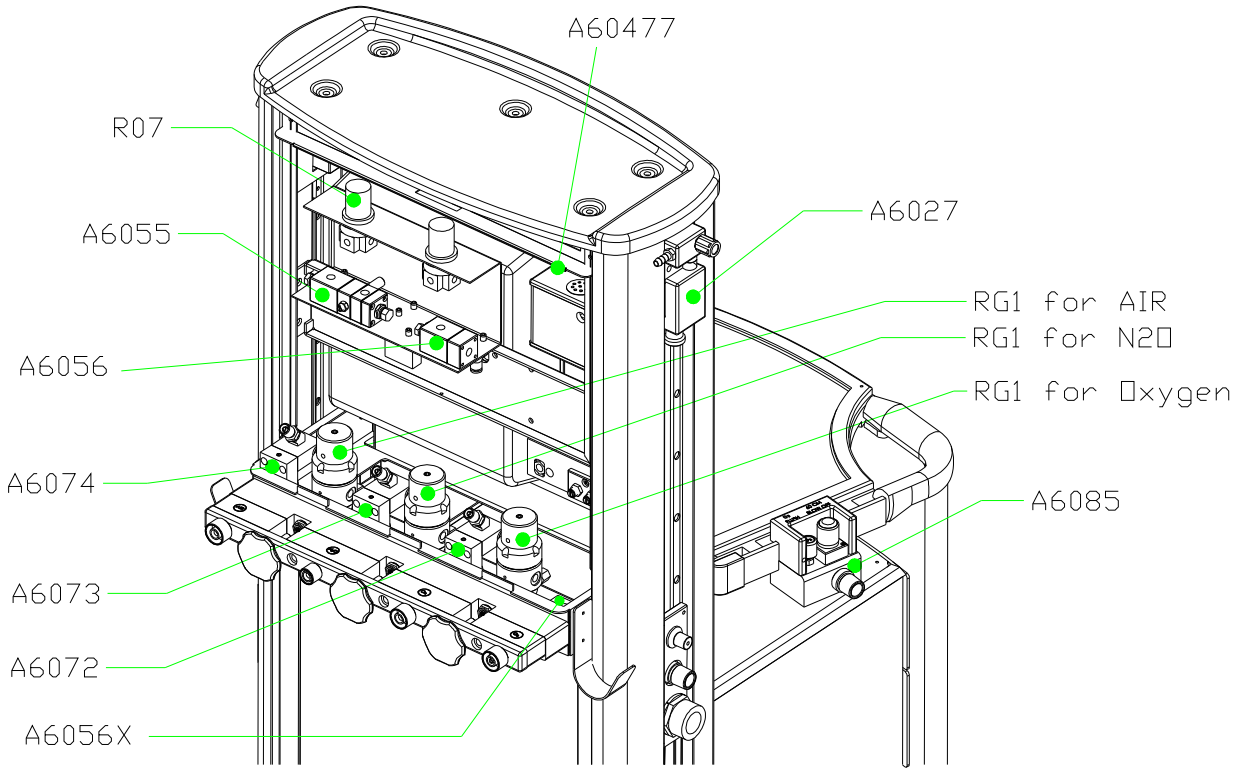


Figure 16: Location of A6056 and A6056X Ventilator Cutoff on Anaesthetic machine

5.5.4 Service Procedure

1. **To service the A6056 ventilator cut off we must follow Figure 17.**
   a. Use the flat screwdriver to remove the 2 screws that keeps the Ventilator Cut Off in the machine.
   b. Once the A6056 Ventilator Cut Off is out of the machine, proceed to remove the four screws SM0430CH with a screwdriver
   c. Once the screws are removed proceed to replace the diaphragm A305516.

d. By using the 16mm spanner unscrew the nut A305512, then by using the ½" spanner unscrew the stud A305511 and remove o-ring OR-5011 and spring A305513.
e. By using needle nose pliers, remove the spool A305514, and then replace its o-rings OR-5006 and OR-5007 smear them with silicone grease Molykote 111
f. Reassemble A305514 spool with its new o-rings, and then new spring A305513 and new o-ring OR-5011 smeared with Silicone grease Molykote 111.
g. Finally install stud A305511 and leave its nut A305512 loose ready for calibration.
h. Put this assembly back in the machine.

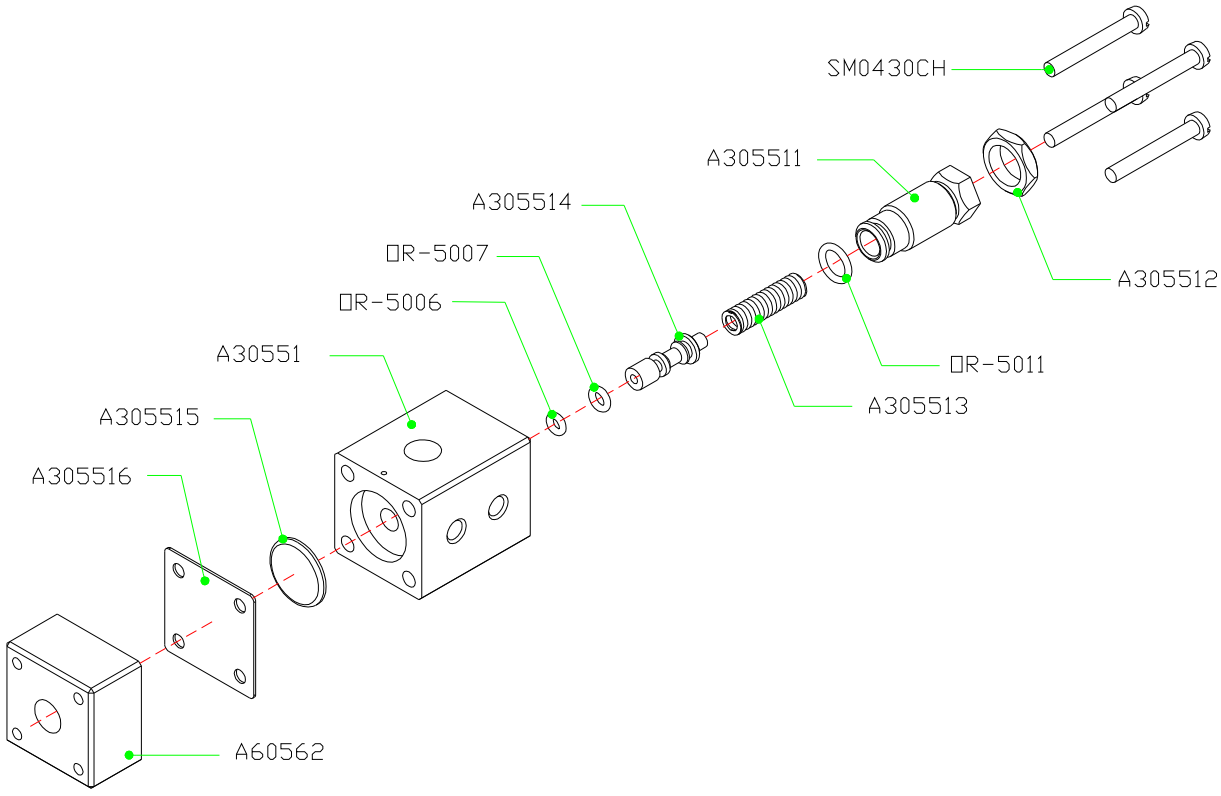


Figure 17: Components to replace in A6056 Ventilator Cut Off

2. To service the Ventilator Drive Valve A6056X we must follow Figure 18.

a. Remove IR001 Oxygen Index Ring by using a pair of multigrips taken care not to damage its surface. To prevent scratching the surface of the ring, Ulco suggests taping the teeth of the multigrips.
b. Once we remove IR001 we need to use two ¼" BSP nuts, so we can unscrew the Gas Connector A605611.
c. Once this A605611 gas connector is unscrewed we can proceed to remove the non-return valve A605612, o-ring OR-5006 and spring A3056121.
d. Replace o-ring OR-5006 and smear it (only o-ring) with silicone grease Molykote 111.
e. Reassemble A3056121 new replaced spring, new OR-5006, non-return valve A605612 and gas connector A605611. Use a multigrip tool.
f. Finally with the multigrip tool assemble the Oxygen Index Ring IR001.

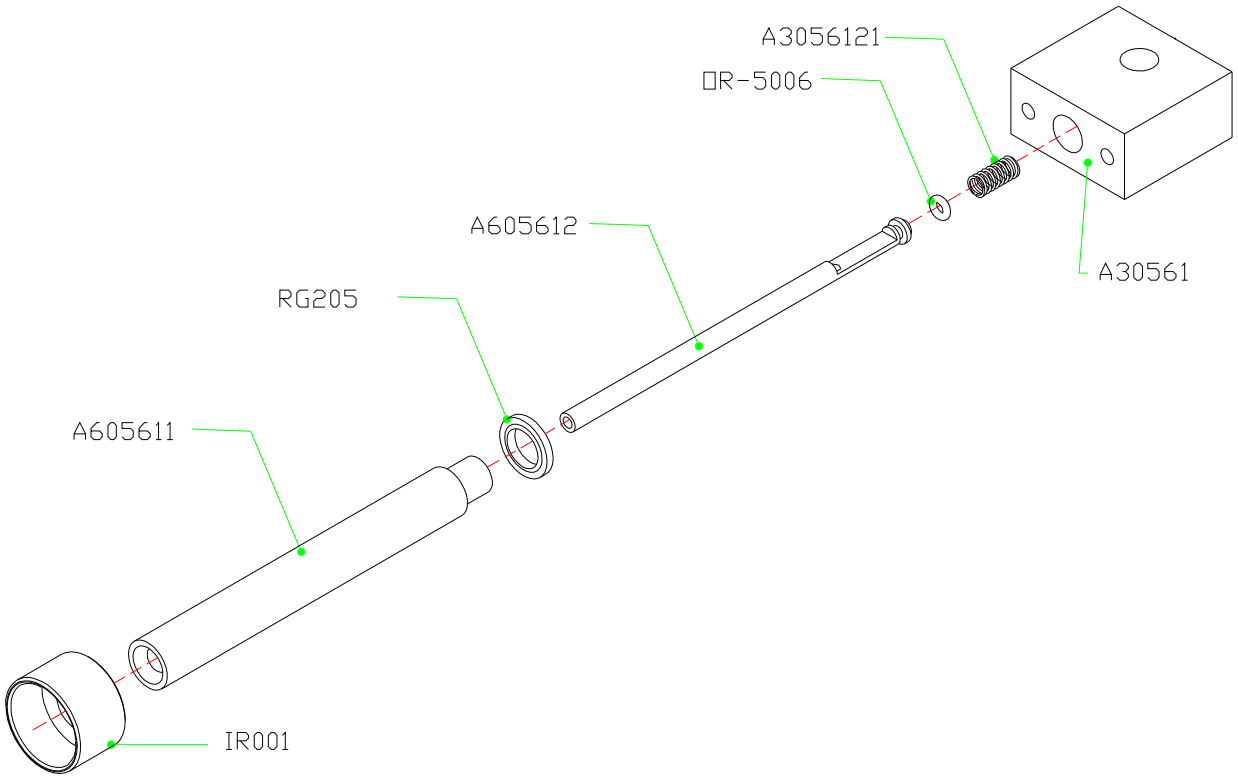
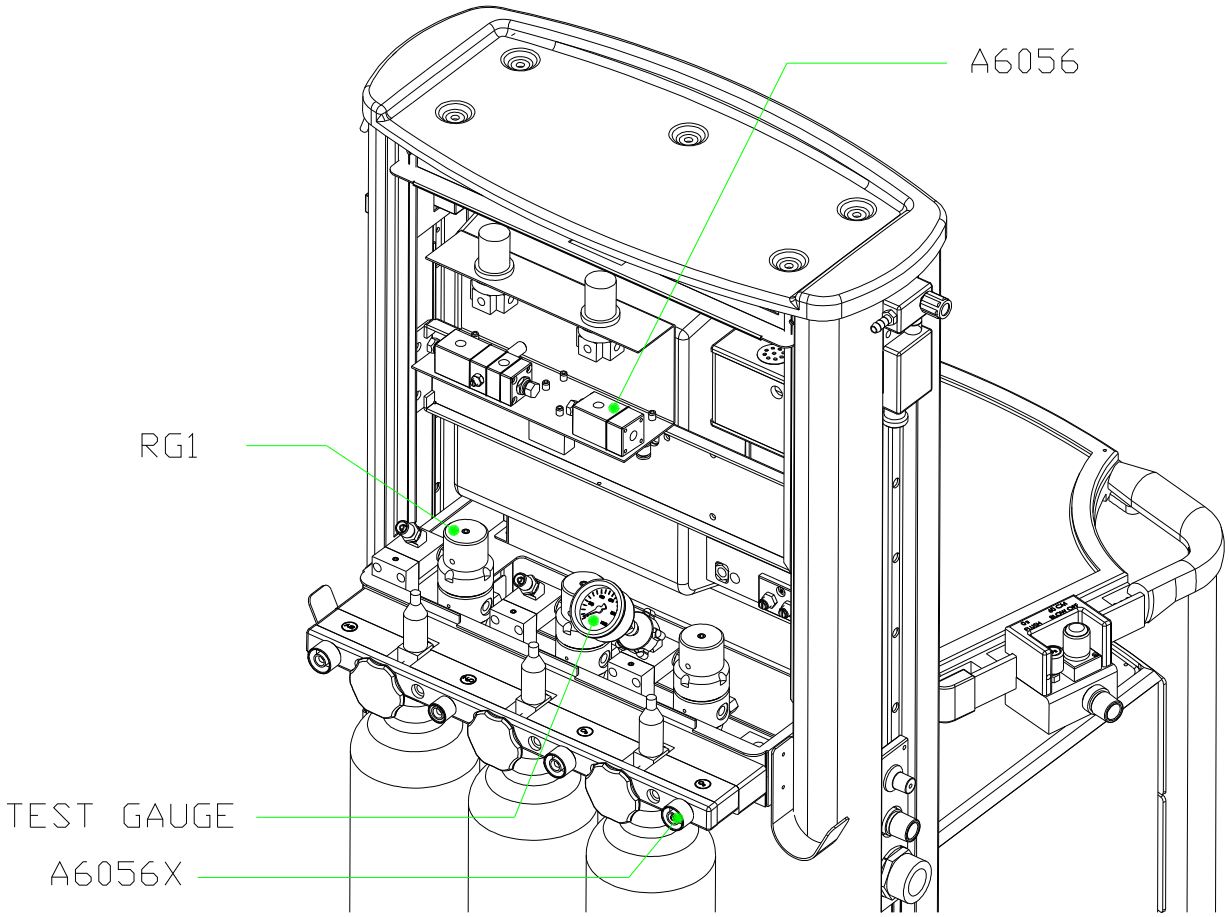


Figure 18: A6056X Ventilator Cutoff Valve

5.5.5 Test of A6056 Ventilator Cut Off valve

1. **Preparation:**
   a. Put a test gauge on the test point.
   b. Connect the oxygen cylinder gas to the anaesthetic machine and disconnect the medical gas supply pipelines from the walls. We must read 360 kPa in the test gauge.
   c. Check that there is no leak around the A6056 Ventilator Cut off and A6056X.
   d. By adjusting the RG1 oxygen regulator, we reduce the pressure to 220 kPa and check that there is no oxygen coming through the Ventilator Drive valve A6056X. To do this press the non return valve and no gas should come through.
   e. Again re-adjust the RG1 regulator to 250 kPa and check that the gas comes through the ventilator drive valve A6056X.
   f. Re-adjust RG1 to its setting pressure of 360 kPa.



5.6 Anti-hypoxic device

5.6.1 Technical description of the anti-hypoxic device

The device is factory set to deliver a minimum 21% nominal oxygen flow. Medical air flow (if fitted) is independent of the device and is not considered a hypoxic gas. It cannot dilute the mixture to less than 21% oxygen flow.

A needle valve is located behind each of the oxygen and nitrous oxide control knobs. Each of the needle valves may be depressed by a brass arm which in turn operates a control lever. When the control knob is closed, this depresses the lever which in turn depresses the needle valve, thereby closing it.

If the oxygen knob is opened, the lever behind the nitrous oxide knob continues to block the nitrous oxide needle valve. As the nitrous oxide control is opened, the needle valve will only open as far as the oxygen lever will allow it. The nitrous oxide knob is only capable of controlling the arm above the nitrous oxide needle valve whereas the oxygen arm is capable of controlling the oxygen needle valve as well as the nitrous oxide valve. This means that when the oxygen control is closed, it automatically closes the flow of nitrous oxide.

The distance from the fulcrum point of the oxygen arm to the oxygen needle valve is 1/3 the distance from the fulcrum point of the same arm to the nitrous oxide needle valve. This ensures that as oxygen is closed the flow of nitrous oxide is also closed, in a ratio of 1:3.

Due to differences in gas densities and machining tolerances, the second stage regulators are used to achieve the final desired settings.

WARNING	The anti-hypoxic device cannot recognise or differentiate between gases. It is therefore imperative that a calibrated oxygen analyser is used when setting and calibrating, and when in use with a patient.

The device is calibrated to deliver non-hypoxic mixtures of oxygen and nitrous oxide at a preset percentage of oxygen throughout the normal working range. The percentage may vary above or below the setting of the nominal 25% due to various factors, but it is normally set so that the oxygen is never less than 21% in the mix.

5.6.2 AHD60-99 Service kit

- 11 off OR-5012S O-ring
- 3 off OR-5006 O-ring
- 3 off AHD143 Spring
- 2 off R07-99 R07 kit
- 10 off OR-5114S O-ring

5.6.3 Tools to be used

- 8mm, 5 mm and 3mm Allen keys
- Philips screwdriver
- Flat screwdriver
- ½" and 9/16" spanner
- Adjustable wrench.
- Grease Dupont Krytox GPL-205

5.6.4 Preparation to service AHD60 anti hypoxic device

1. Make sure that the anaesthetic machine is OFF.
2. Remove gas cylinders from the back of the machine.
3. Remove medical gas supply piping lines from the back of the machine.
4. Remove rear plastic cover using 8mm Allen key supplied with machine.

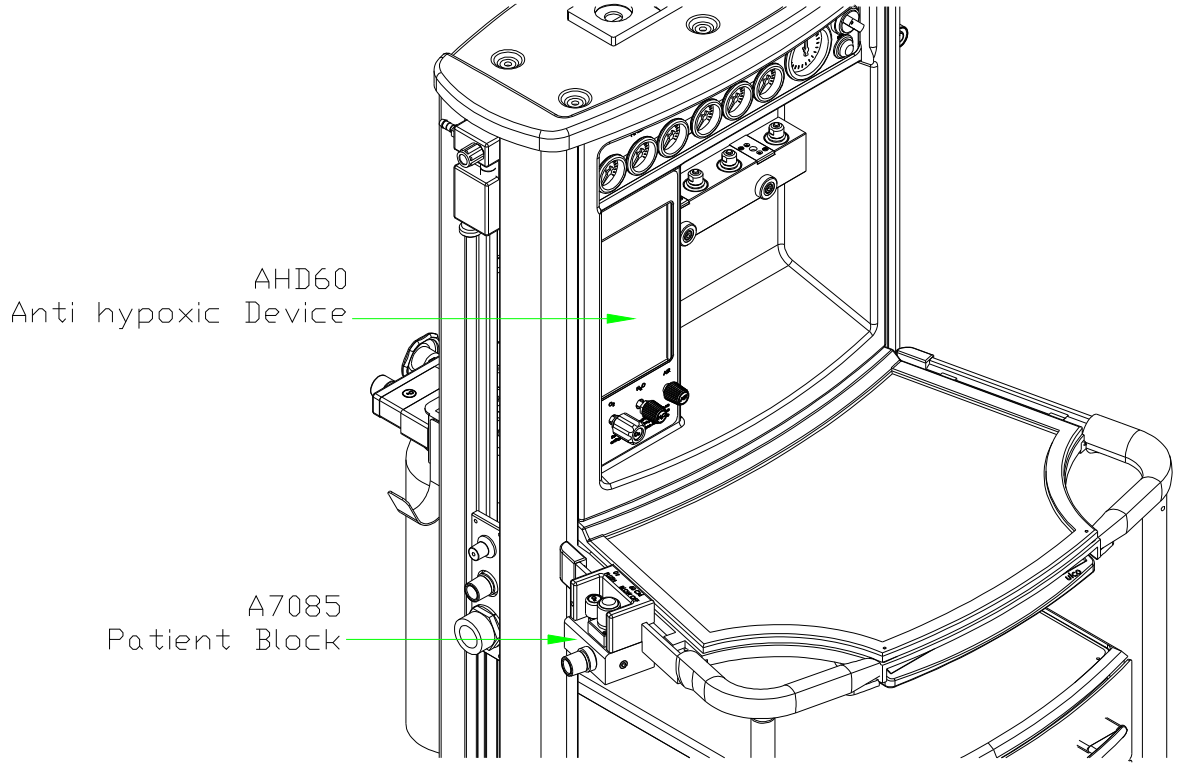


Figure 19: Location of AHD60 Anti hypoxic Device on Anaesthetic machine

5.6.5 Service Procedure

To service the AHD60 anti hypoxic device and/or flow meter assembly we must also service the R07 regulators.

1. **Replacement of o-rings OR-5012, OR-5006 and spring AHD143 on N2O and oxygen ports of anti hypoxic device.**

a. If we want to only remove the components to be serviced in the anti hypoxic device there is no need to remove the AHD60 assembly. Refer to Figure 20.
b. Unscrew the three screws SM0306B by using a 3mm Allen key.
c. Remove plate AHD113 and by doing this the subassemblies AHD141 bodies with their internal components of N_2O and oxygen ports will come out.
d. Remove the needle AHD142 on each AHD141 body and replace its spring AHD143 and o-ring OR-5006. Smear the o-ring OR-5006 with Krytox grease.
e. Replace o-rings OR-5012 from AHD141 bodies and smear them with silicone grease Polycyte 111.
f. Reassemble the subassembly on the AHD141 bodies and then reassemble it into AHD60 anti hypoxic device.
g. Screw the SM0306B into the AHD60 anti hypoxic device.

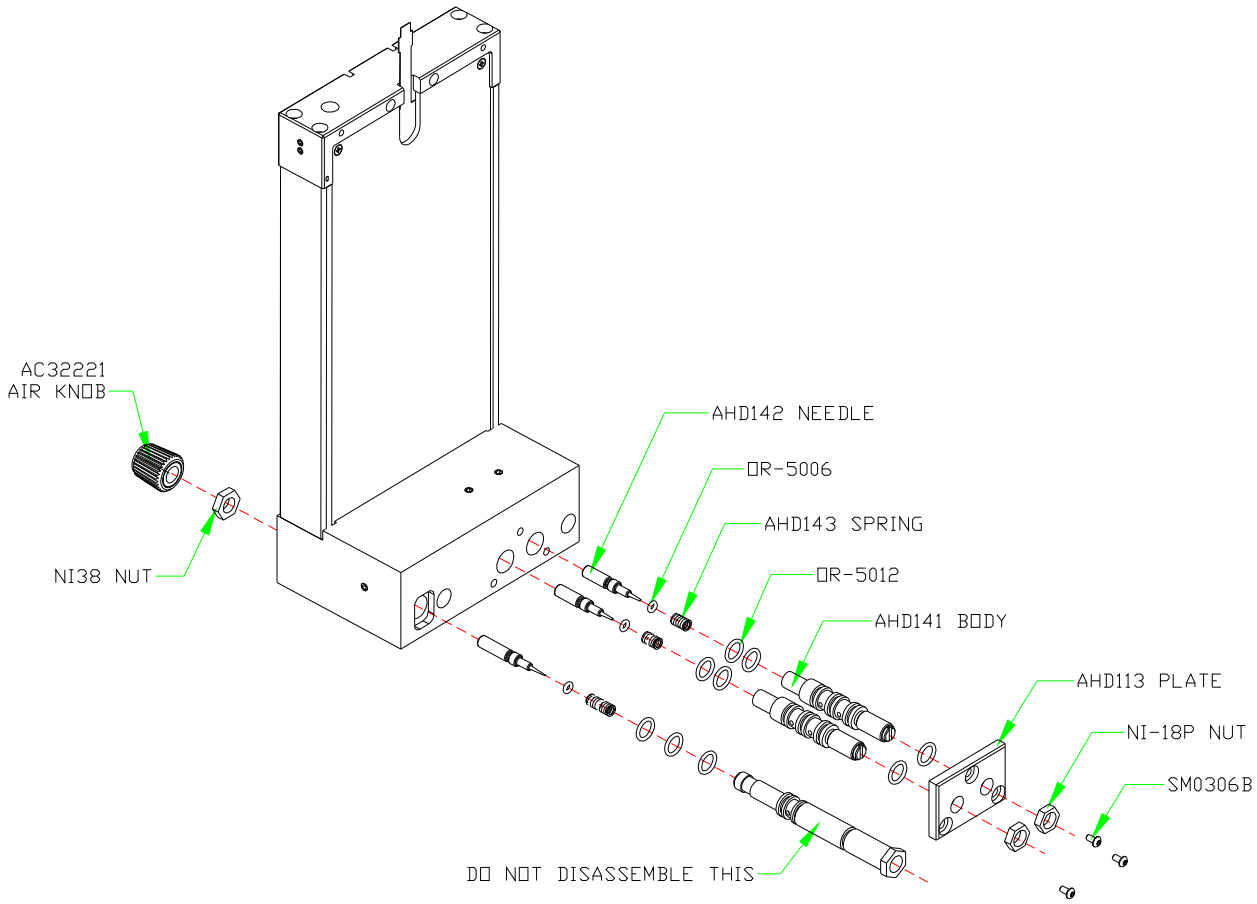


Figure 20: Components to replace in AHD60 Anti hypoxic Device

2. Replacement of o-rings OR-5012, OR-5006 and spring AHD143 on air port of anti hypoxic device.

a. Remove grub screw from the Air knob AC32221 with a flat screw driver, and then pull out the knob.
b. Remove nut NI38P by using a 9/16" spanner.
c. Push from the knob end the subassembly, which contain the parts to be serviced.
d. Replace spring AHD143 and o-rings OR-5006 and OR-5012. Smear o-rings with silicone grease Molykote 111.
e. Reassemble the subassembly into the AHD60 anti hypoxic device.
f. Screw nut NI38P and finally the air knob AC32221.

3. Replacement of o-rings from the flow meter or the flow meter tubes, we must remove the AHD60 from the anaesthesia workstation. Refer to Figure 21 and Figure 22.

a. Remove the tubes and electrical cable to back light from the AHD60 anti hypoxic device.
b. Remove the four M6 screws by using a 5mm Allen key.
c. Unscrew grub screws from the three knobs in front of machine by using a flat screwdriver.
d. Remove the knobs and then remove the nuts NI38P by using a 9/16" spanner.
e. Remove the AHD60 from the back of the workstation.

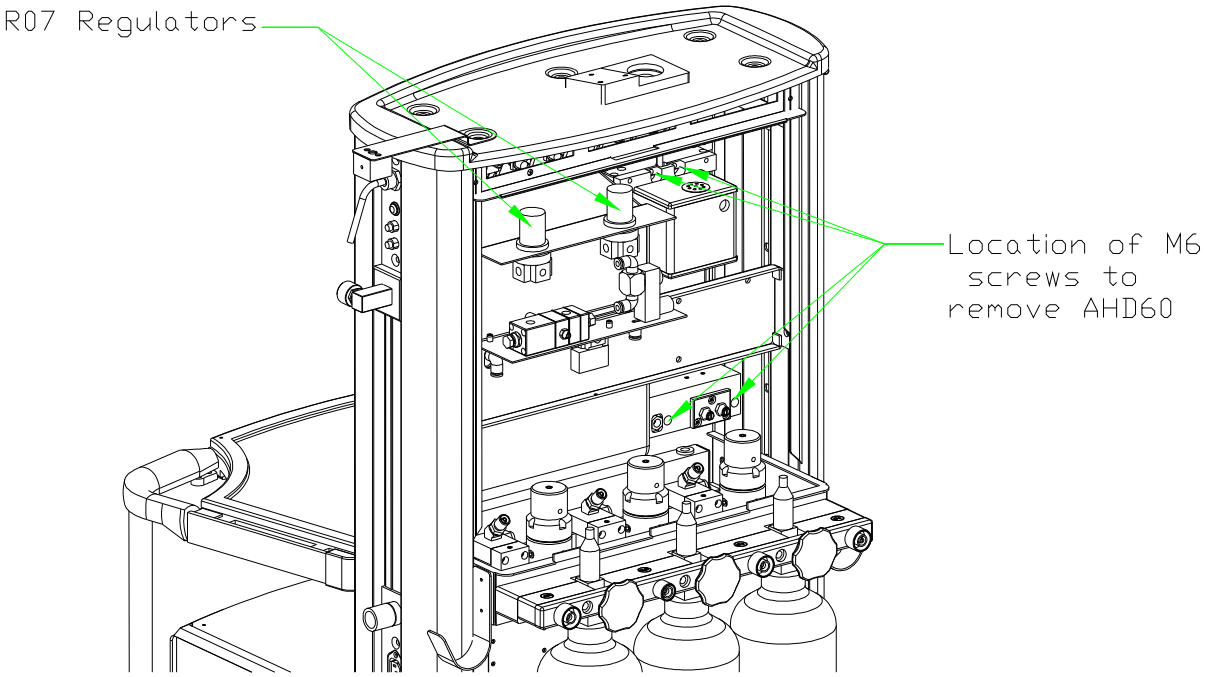


Figure 21: Location of AHD60 Anti hypoxic device and R07 regulators

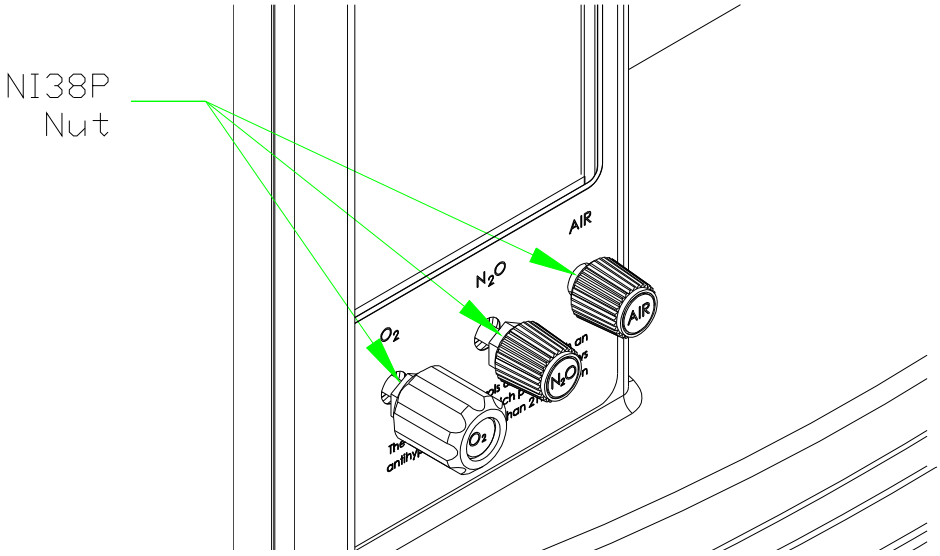


Figure 22: Knobs on front of AHD60 Anti hypoxic device

4. Service of o-rings OR-5012S and OR-5014 from AHD60 flow meter. Refer to Figure 23.

   a. Remove the screws SM0430P from the top of AHD60 flow meter by using a Philips screwdriver.
   b. Remove the top block A60473 by pulling it out.
   c. Remove the front and back screen of AHD60 flow meter.
   d. Remove flow tubes.
   e. Replace o-rings OR-5014 and OR-5012S and smear them with silicone grease Molykote 111.
   f. Reassemble flow tubes, front and back screen and finally put on the top block A60473. Ensure that the notch on the outer tubes are oriented correctly to the side where the connections to the sides containing the flow outlets on the anti-hypoxic block.
   g. Screw the 4 screws SM0430P with a Philips screwdriver.
   h. Install the AHD60 into the machine by screwing the M6 bolts on the back of the AHD60 anti hypoxic device. See Figure 21.
   i. Screw the nut NI38P by using a 9/16” spanner. See Figure 22.
   j. Put the knobs and then screw the grub screws for each knob by using a flat screwdriver.

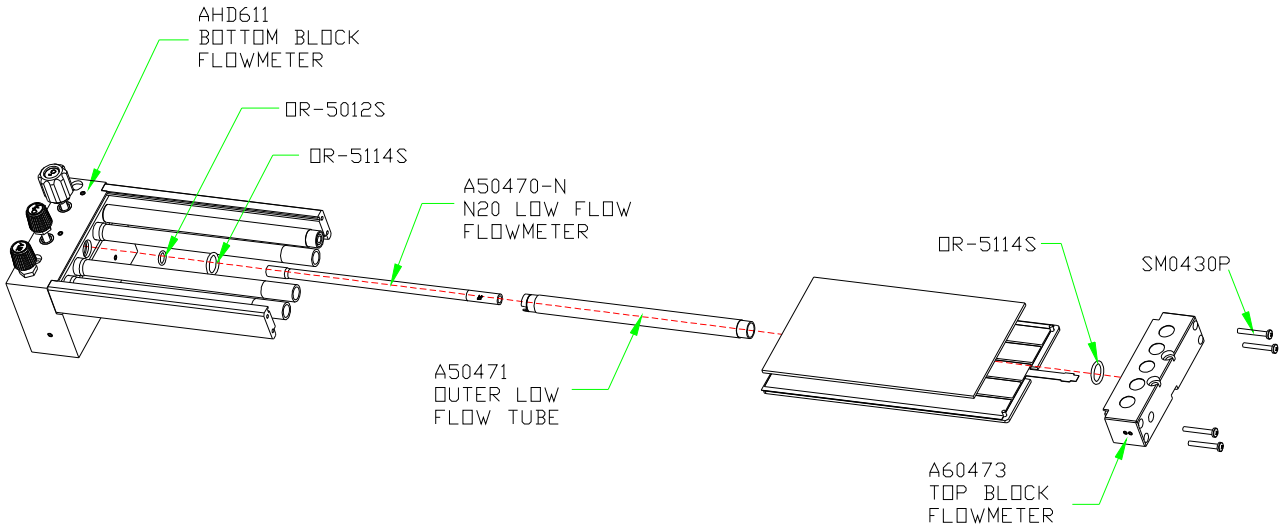


Figure 23: Components to be removed from AHD60 Flow meter

h. Connect electrical cable from back light to AHD60
i. Connect the tubing to the AHD60 anti hypoxic device.

5. Replacement of components to be serviced on R07 regulator. Refer to Figure 21 and Figure 24

b. Disconnect tubing of each R07 regulator.
c. Unscrew the nut that holds the R07 to the anaesthesia workstation.
d. Remove the R07 regulator from the workstation.
e. Unscrew the nut of the R07 regulator by using the adjustable wrench.
f. Replace diaphragm assembly and nylon washer.
g. Unscrew poppet valve holder with a Philips screwdriver.
h. Reassemble everything and put it back into the anaesthesia workstation.
i. Reconnect tubing to R07 regulators.

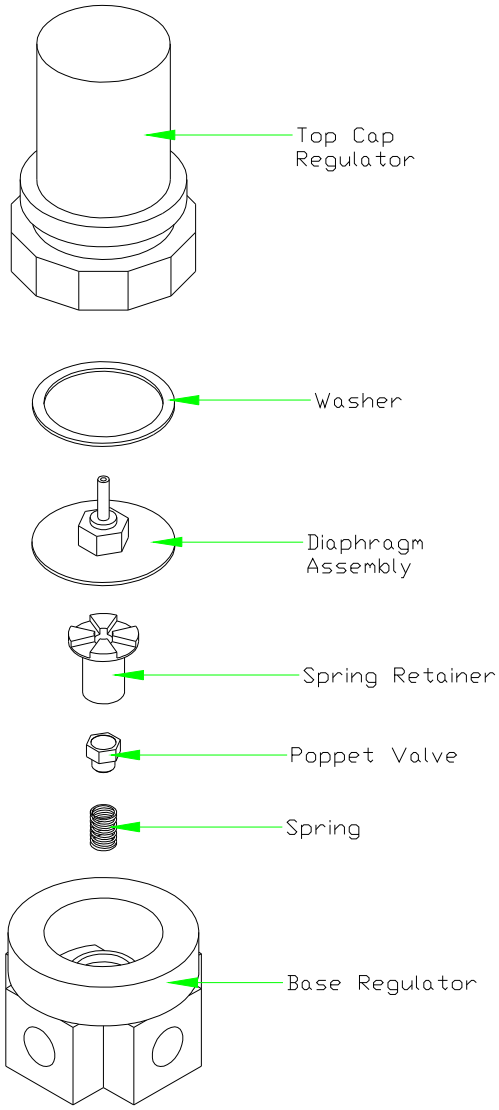


Figure 24: Exploded view of R07 Regulator

5.6.6 Test of AHD60 anti hypoxic device

1. Preparation:

a. Connect medical gas supply to the machine.
b. Connect a manometer on the fresh gas outlet of patient block.
c. Switch ON the anaesthetic machine.
d. Unscrew the NI-18P nuts from the back of AHD60 anti hypoxic device by using a ½" spanner.
e. Unscrew both AHD141 bodies fully.

2. Calibration of Anti hypoxic device

a. Zero both second stage regulators by unscrewing their adjustment caps completely.
b. Open Oxygen knob fully.
c. Close N_2O knob fully.
d. Adjust N_2O R07 second stage regulator to maximum pressure.
e. Adjust oxygen R07 second stage regulator to zero (no flow).
f. Screw N_2O AHD141 body until flow drops to zero. Check if there is any leak with the manometer in the patient fresh gas outlet.
g. Open N_2O knob fully.
h. Close oxygen knob fully.
i. Adjust N_2O R07 second stage regulator to zero (no flow).
j. Adjust oxygen R07 second stage regulator to maximum pressure.
k. Screw oxygen AHD141 body until flow drops to zero. Check if there is any leak with the manometer in the patient fresh gas outlet. Do not screw the body too far; only tighten sufficiently to achieve zero flow and no further.

l. Open oxygen knob 3 full turns, then adjust the flow to 10 litre/min by adjusting the oxygen RO7 second stage regulator. Once this is achieved lock the regulator at this position.
m. Set oxygen flow to 2 litre/min by using the oxygen knob.
n. Set the N2O flow to 6 litre/min by using the RO7 second stage regulator. The N2O control knob must be fully opened. Check the ratios across the entire range of flows.
o. Check the 1:3 ratio, if it is not correct then screw gently the N2O AHD141 body and increase pressure with N2O RO7 second stage regulator, until the correct flow is achieved on whole scale.
p. For correct ratio, read use an oxygen analyser for final calibration. It must read more than 22% of oxygen.

5.7 Selectatec Assembly A605

5.7.1 A605-99 Service kit

- 4 off A304622 Spring
- 4 off A304626 Spring
- 4 off OR-5113S O-ring
- 4 off A304623 Washer
- 8 off A304625 Ballsert
- 4 off OR-5020 O-ring
- 4 off OR-5014 O-ring
- 4 off OR-5012 O-ring

5.7.2 A605-9 Service kit

- 4 off A30462 Actuator

5.7.3 Tools to be used

- 14mm spanner and socket wrench.
- Silicone grease Molykote 111.
- Allen key 2.5mm.
- Knife
- Pair of tweezers

5.7.4 Preparation to service A605 selectatec

1. Make sure that the anaesthetic machine is OFF.
2. Remove gas cylinders from the back of the machine.
3. Remove medical gas supply piping lines from the back of the machine.

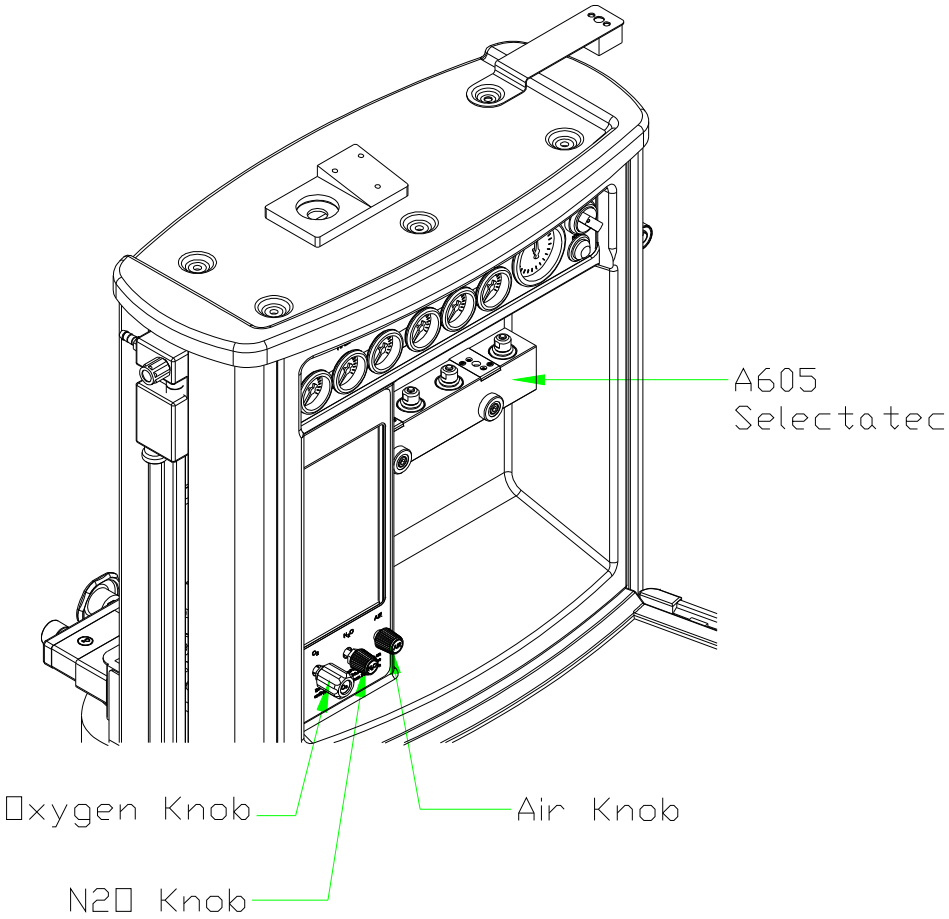


Figure 25: Location of A605 Selectatec on Anaesthetic machine

5.7.5 Service Procedure

The Selectatec A605 has 4 identical sub-assemblies along its body; therefore they contain same components that need replacement. Figure 26 shows an exploded view of one of these subassemblies. Using the A605-99 service kit, the individual springs, washers and O-rings inside the Selectatec actuator housing can be replaced. This is a delicate procedure, described below. Ulco recommends that service providers purchase the A605-9 kit which contains four complete actuator assemblies which have been tested by Ulco and may be simply screwed into the backbar. This will reduce the time for service and the possibility of introducing leaks to the system. Old actuator housings can then be serviced off-line or returned to Ulco for refurbishment.

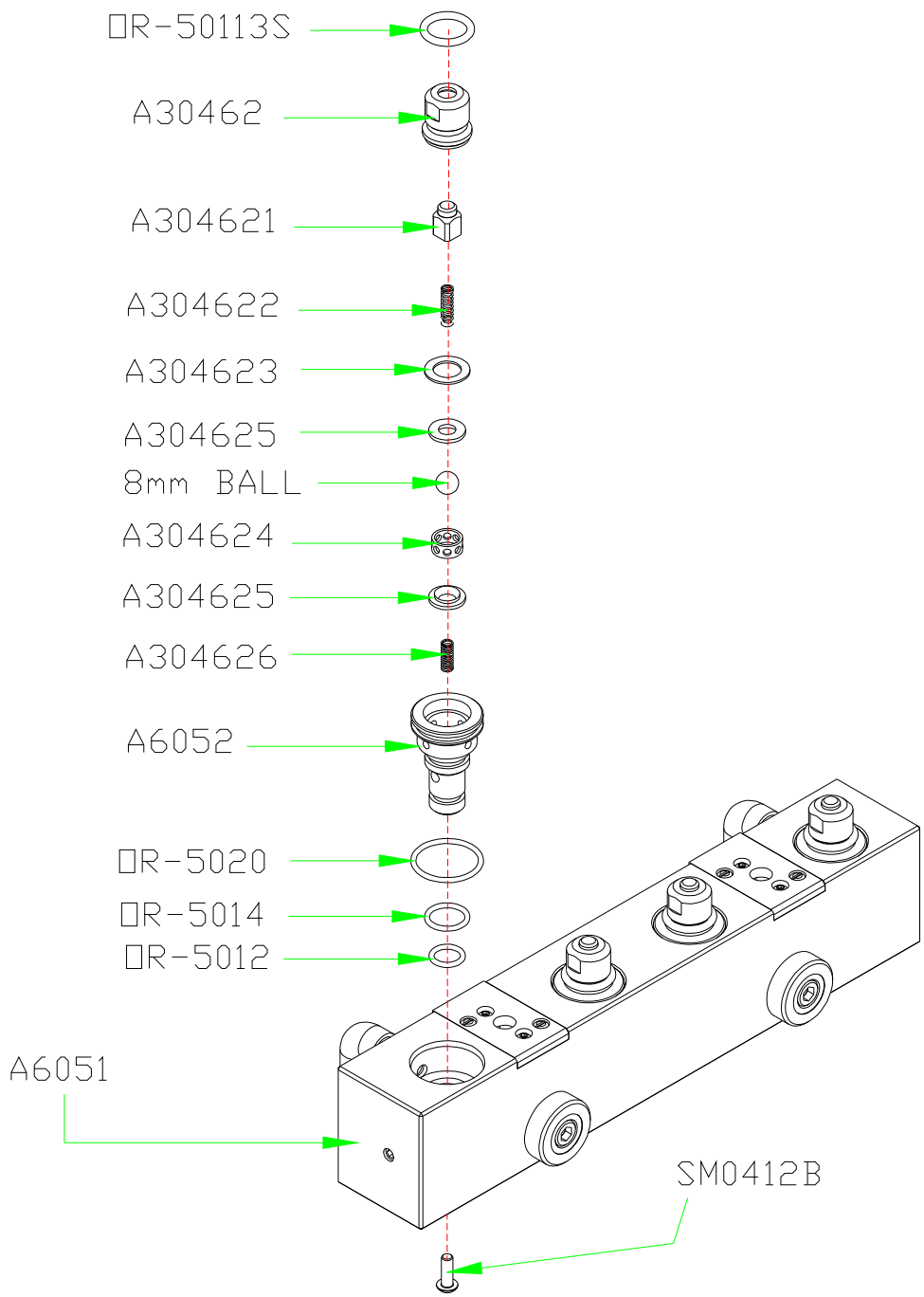


Figure 26: Components to replace in Selectatec A605

1. **Removal of components to be serviced from A605**
   a. Remove A30462 Actuator Housing. To do this use a 14mm socket and socket wrench.
   b. Once A30462 is out, proceed to unscrew SM01412B by using an Allen key 2.5mm. This will allow A6052 ballsert housing to be pulled out.
   c. If using A605-9 Service Kit, reassemble new A30462 Actuator Housing into the backbar A6051, and go direct to Step 2h.
   d. Replace all o-rings, springs, washers and ballserts.

2. **Reassembly of components on A605 Selectatec. Refer to Figure 26. The reassembly of the subassembly into the selectatec body A6051 is a very delicate operation, because any misalignment of the springs or ball will make the selectatec to leak. Therefore follow these instructions step by step.**
   a. Assemble o-rings OR-5020, OR-5014 and OR-5012 into the ballsert housing A6052.
   b. Assemble ballserts A304625, 8mm ball and cage A304624 together.

c. Put the ballsert A6052 on a horizontal base, and then put spring A304626 on top of A6052. Make sure the spring A304626 is straight as possible.
d. Put on top of spring A304626 the subassembly b by placing the subassembly on top of a knife, placing the knife on top of the spring and sliding the knife out. With the fingers or tweezers, gently push the ball and make sure the spring exerts some force on the 8mm ball.
e. Put together A30462 Actuator housing, A304621 actuator gas, spring A304622 and washer A304623.
f. Carefully and quickly put and screw subassembly e on subassembly d. Don't screw it too tight, this will be done later.
g. Proceed to put o-rings OR-5020, OR-5014, OR-5012 and OR-5113S and smear them with silicone grease Molykote 111.
h. Install subassembly g into body A6051, and then fix it into it by using screw SM0412B and a 2.5mm Allen key.

5.7.6 Calibration of A605 Selectatec

a. Connect the cylinder gases N_2O and Oxygen to the anaesthetic machine (not the medical gas supply pipelines from the walls).
b. Put a manometer on the fresh gas outlet of the patient block.
c. Switch ON the anaesthetic machine.
d. Open fully on the anti-hypoxic device the N_2O knob and set a flow of approximately 0.1 litre/min of oxygen.
e. The manometer will show some pressure, and then make sure the A605 selectatec doesn't leak. To check this we can use some leak detector spray or soapy water.

5.8 Flowmeters A5047

5.8.1 5047-99 Service kit

- 2 off OR-5110S O-ring
- 10 off OR-5114S O-ring

5.8.2 Tools to be used

- 8mm, 5 mm and 3mm Allen keys
- Philips screwdriver
- Flat screwdriver
- ½" and 9/16" spanner
- Adjustable wrench.
- Grease Dupont Krytox GPL-205

5.8.3 Preparation to service A5047 flowmeters

1. Make sure that the anaesthetic machine is OFF.
2. Remove gas cylinders from the back of the machine.
3. Remove medical gas supply piping lines from the back of the machine.
4. Remove rear plastic cover using 8mm Allen key supplied with machine.

5.8.4 Service Procedure

1. Replacement of o-rings from the flow meter or the flow meter tubes, we must remove the AHD60 from the anaesthesia workstation. Refer to Figure 21 and Figure 22.

a. Remove the tubes and electrical cable to back light from the AHD60 anti hypoxic device.
b. Remove the four M6 screws by using a 5mm Allen key.
c. Unscrew grub screws from the three knobs in front of machine by using a flat screwdriver.
d. Remove the knobs and then remove the nuts NI38P by using a 9/16" spanner.
e. Remove the AHD60 from the back of the workstation.

2. Service of o-rings OR-5012S and OR-5014 from AHD60 flow meter. Refer to Figure 23.

a. Remove the screws SM0430P from the top of AHD60 flow meter by using a Philips screwdriver.
b. Remove the top block A60473 by pulling it out.
c. Remove the front and back screen of AHD60 flow meter.
d. Remove flow tubes.
e. Replace o-rings OR-5014 and OR-5012S and smear them with silicone grease Molykote 111.

f. Reassemble flow tubes, front and back screen and finally put on the top block A60473. Ensure that the notch on the outer tubes are oriented correctly to the side where the connections to the sides containing the flow outlets on the anti-hypoxic block.
g. Screw the 4 screws SM0430P with a Philips screwdriver.
h. Install the AHD60 into the machine by screwing the M6 bolts on the back of the AHD60 anti hypoxic device. See Figure 21.
i. Screw the nut NI38P by using a 9/16" spanner. See Figure 22.
j. Put the knobs and then screw the grub screws for each knob by using a flat screwdriver.
k. Connect electrical cable from back light to AHD60
l. Connect the tubing to the AHD60 anti hypoxic device.

5.9 Auxiliary Oxygen Outlet

To replace the o-ring OR-5007and Dowty seal RG205, unscrew the connector GCN002 from body A6025422 as shown in Figure 27.

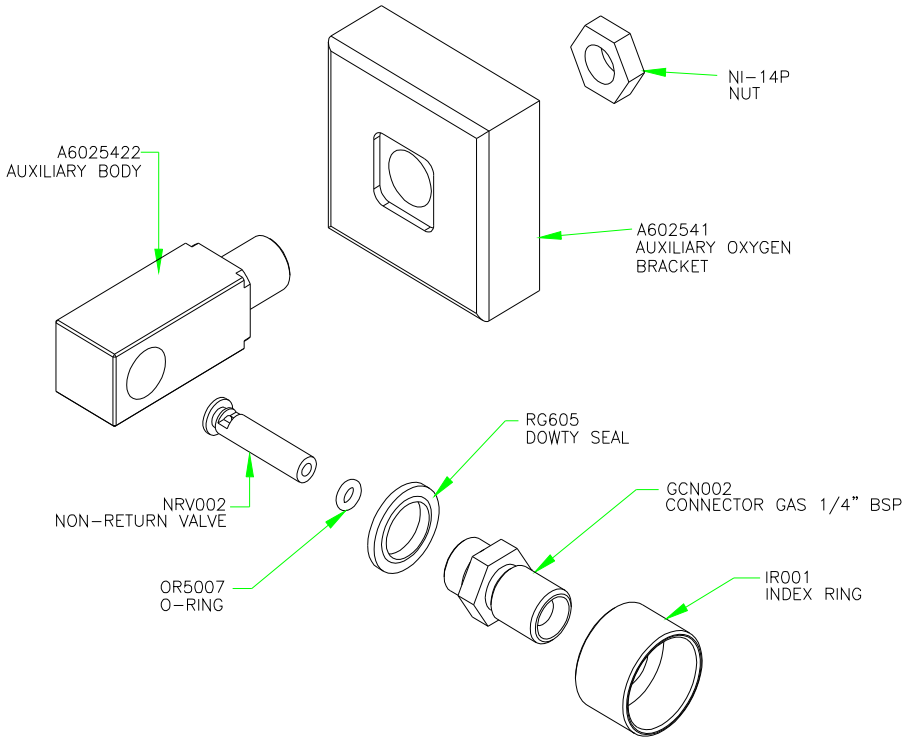


Figure 27: Exploded view of auxiliary oxygen outlet

5.10 Scavenge Block Assembly A7027

5.10.1A3027-99 Service kit

- 1 off OR-5011 O-ring
- 1 off OR-5006 O-ring

5.10.2Tools to be used

- 9/16" spanner.
- Silicone grease Molykote 111.
- Allen key 1.5 mm.
- Flat screwdriver.

5.10.3Preparation to service A7027 manifolds

1. Make sure that the anaesthetic machine is OFF.
2. Remove gas cylinders from the back of the machine.
3. Remove medical gas supply piping lines from the back of the machine.

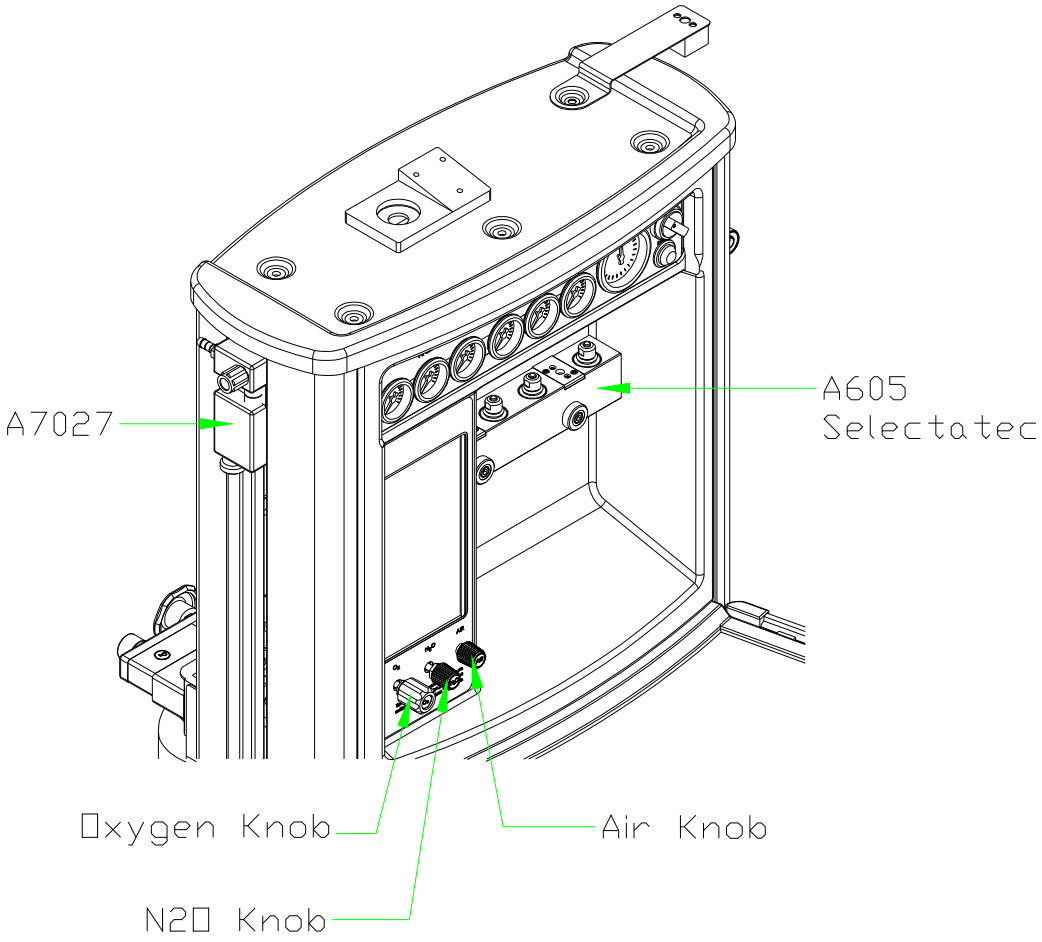


Figure 28: Location of A7027 Scavenger on Anaesthetic machine

5.10.4Service Procedure

To service the scavenger we must follow Figure 29.

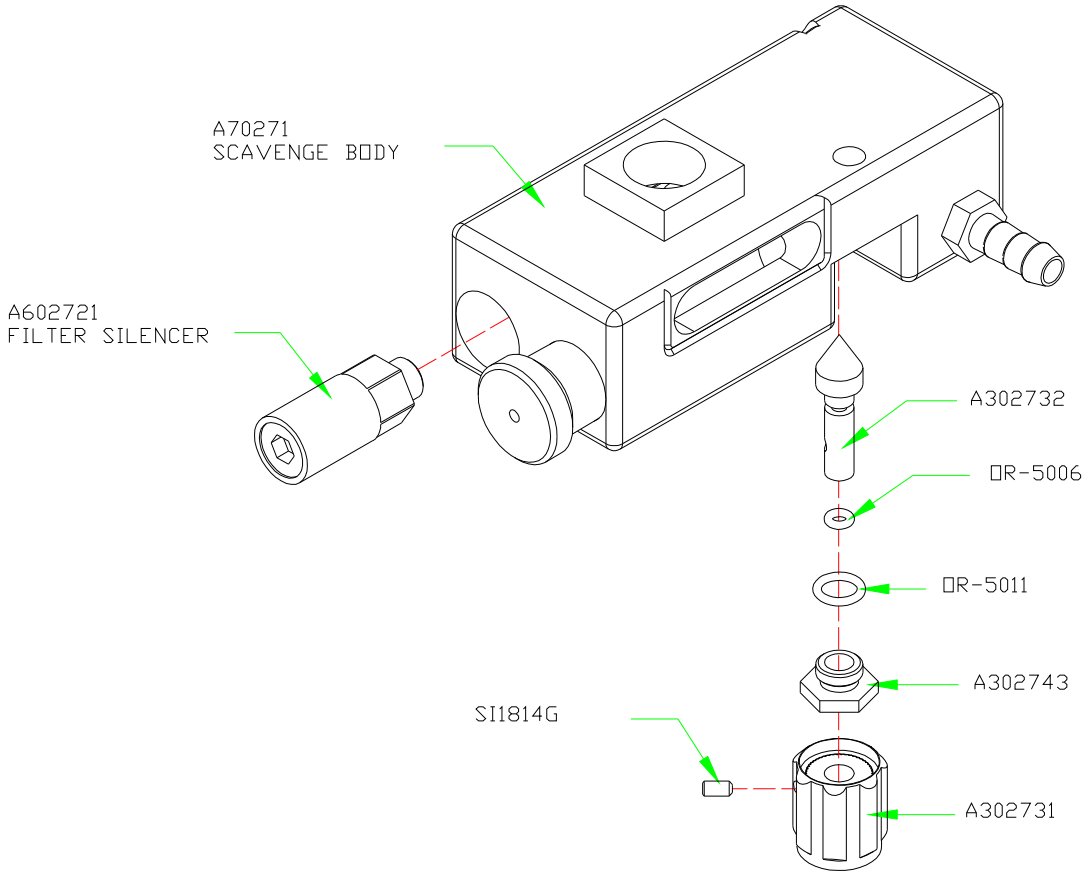


Figure 29: Components to replace in Scavenger A7027

1. **Replacement of o-rings OR-5006 and OR-5011.**
   a. Remove grub screw SI1814G by using a 1.5mm Allen key.
   b. Once the grub screw is out, knob A302731 will comes out.
   c. Remove A302743 needle bush by using a 9/16" spanner
   d. Once the A303743 needle bush is removed, the needle A302732 can be removed.
   e. Replace o-ring OR-5006 and assemble into needle A302732 and smear them it silicone grease Molykote 111.
   f. Reassemble the needle A302732, needle bush A302743 and o-ring OR-5011 with silicone grease Molykote 111 into scavenge body.
   g. Screw them into body by using a 9/16" spanner for it.
   h. Finally reassemble the knob A302731 and grub screw SI1814G by using a 1.5mm Allen key.

5.10.5Test of A7027 scavenger

1. **Preparation:**
   a. Connect the scavenger block to the vacuum line of wall.
   b. When the knob is fully opened the ball must be around the white line mark on the scavenge tube.

5.11 Patient Block A6085

5.11.1A307-99 Service kit

- 1 off OR-5007 O-ring (Must be Viton material)
- 1 off OR-5006 O-ring
- 1 off A3056121 Spring

5.11.2Tools to be used

- ½" spanner.
- 11mm spanner

- Silicone grease Molykote 111.
- Allen key 4 mm.
- Long nose pliers

5.11.3Preparation to service A7085 patient block

1. Make sure that the anaesthetic machine is OFF.
2. Remove gas cylinders from the back of the machine.
3. Remove medical gas supply piping lines from the back of the machine.
4. Remove tubes attached to patient block and remove patient block from workstation.

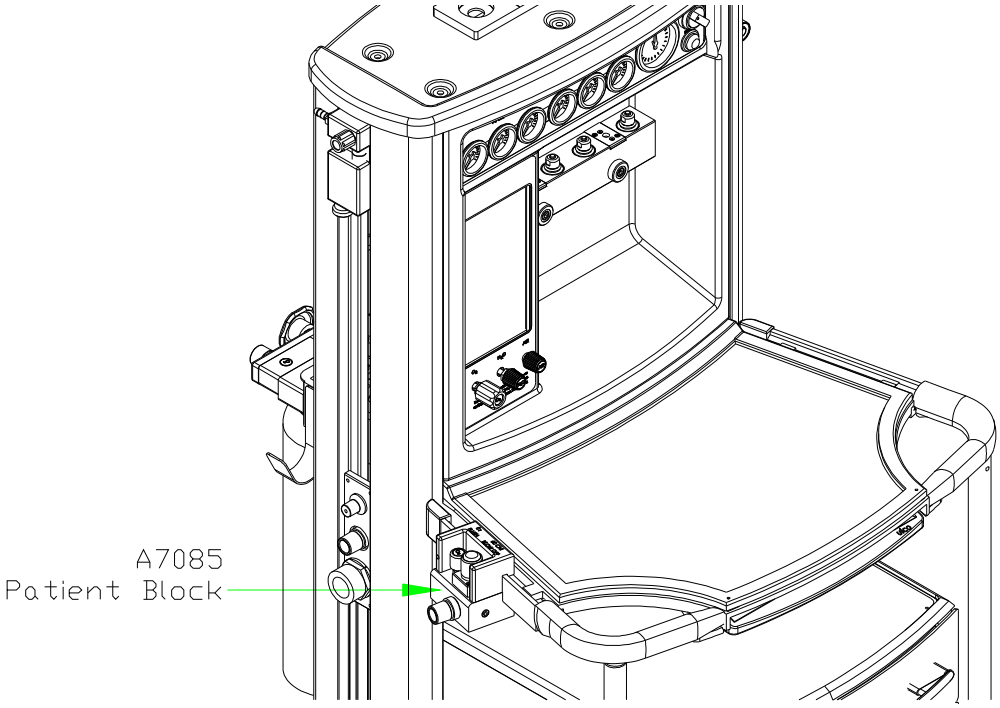


Figure 30: Location of A7085 Patient Block on Anaesthetic machine

5.11.4Service Procedure

To service the patient block follow Figure 31.

1. **Replacement of o-rings OR-5006, OR-5007 and spring A3056121.**
   a. Remove the spring retainer A307135 by using a ½" spanner.
   b. Once the spring retainer is out the spring A3056121 will come out.
   c. To remove spool A307134, pull it gently with a pair of long nose pliers through the hole underneath the patient block.

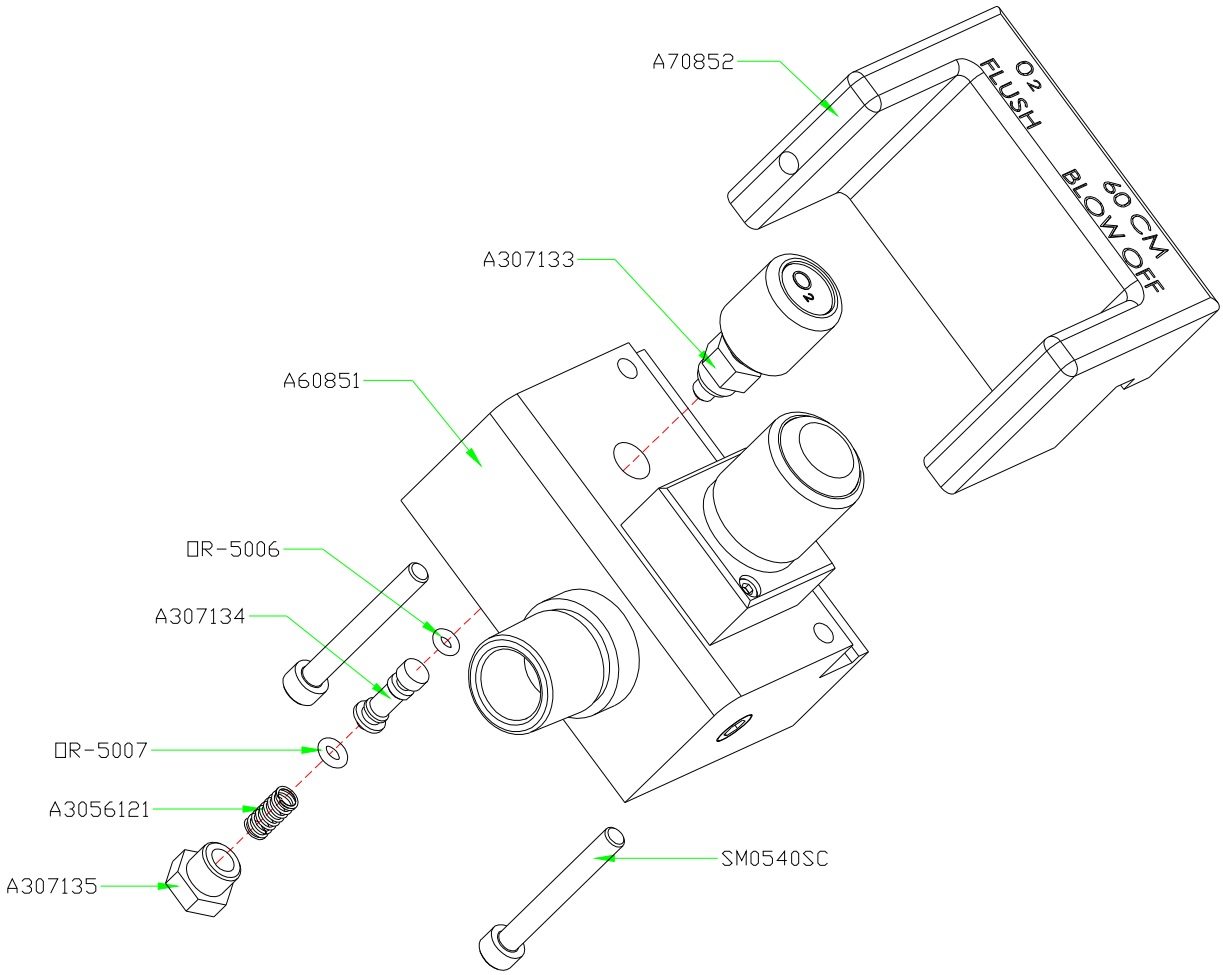


Figure 31: Components to replace in Patient Block A7085

d. After removing the spool A307134, replace o-rings OR-5006 and OR-5007 (viton, a red O-ring) and smear them with silicone grease Molykote 111.
e. Reassemble the spool A307134 and by pushing it back into the patient block.
f. Reassemble the spring A3056121 and spring retainer A307135 by using a ½" spanner.

2. Remove the defeat button housing and clean the pressure relief device components. If necessary, lap the seat of the pressure relief device, procedure TBD.

5.11.5Test of A7085 patient block

1. **Preparation:**
   a. Connect medical gas supply to the machine.
   b. Check that the patient block does not leak with a leak detector spray or soapy water.
   c. Press the oxygen flush button and depress, then check again that it does not leak.

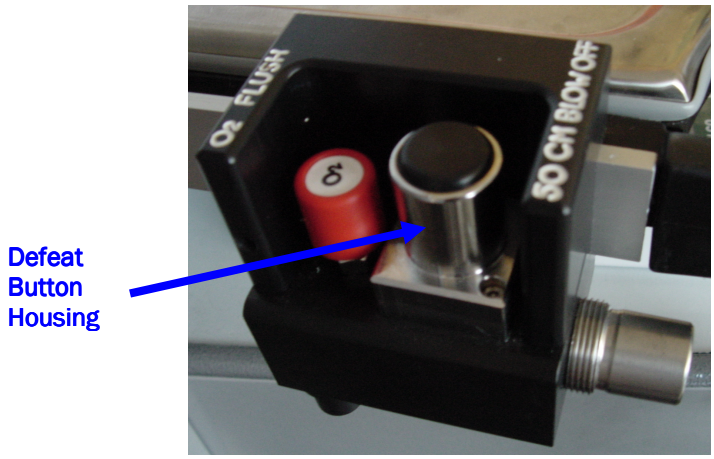


Figure 32: 50 cmH2O Safety Valve on "Patient Block"

Refer to Figure 32

2. Calibration
   a. Place manometer on Fresh Gas Outlet.
   b. Set O_2 to 1 L/min.
   c. Occlude manometer. Safety valve should blow off at 50+ 2cm H_2O.
   d. Remove the "defeat" button housing by unscrewing with a pair of soft-jaw grips
   e. Adjust the valve setting with a large flat blade screw driver (see Figure 33)

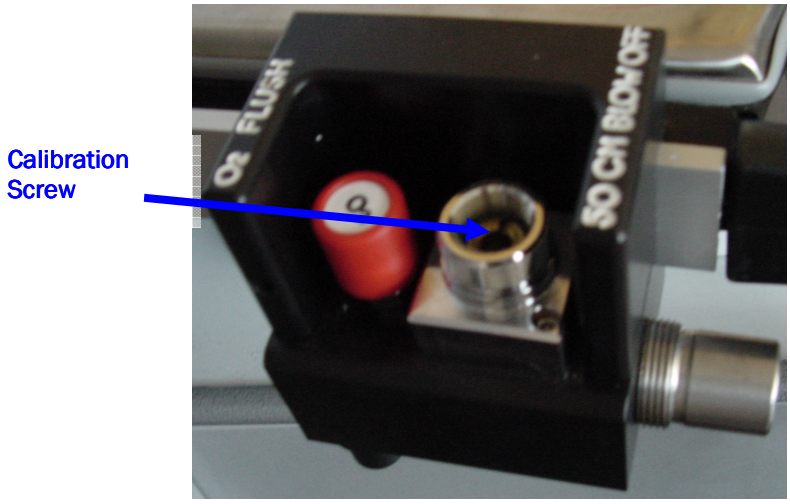


Figure 33: Safety Valve with Defeat Button Housing removed

   f. Set O_2 at 100ml. Should obtain a reading greater than 40cm H_2O.

6 Assembly Drawings

The following assembly drawings are included to enable user and service personnel to identify parts and assemblies for servicing and maintenance requirements.

Included are:

- Scavenging Block
- Sub-assembly fresh gas non-return valve
- Selectatec
- Sub assembly ventilator cut-off valve
- Patient block

6.1 Scavenging Block (A7027)

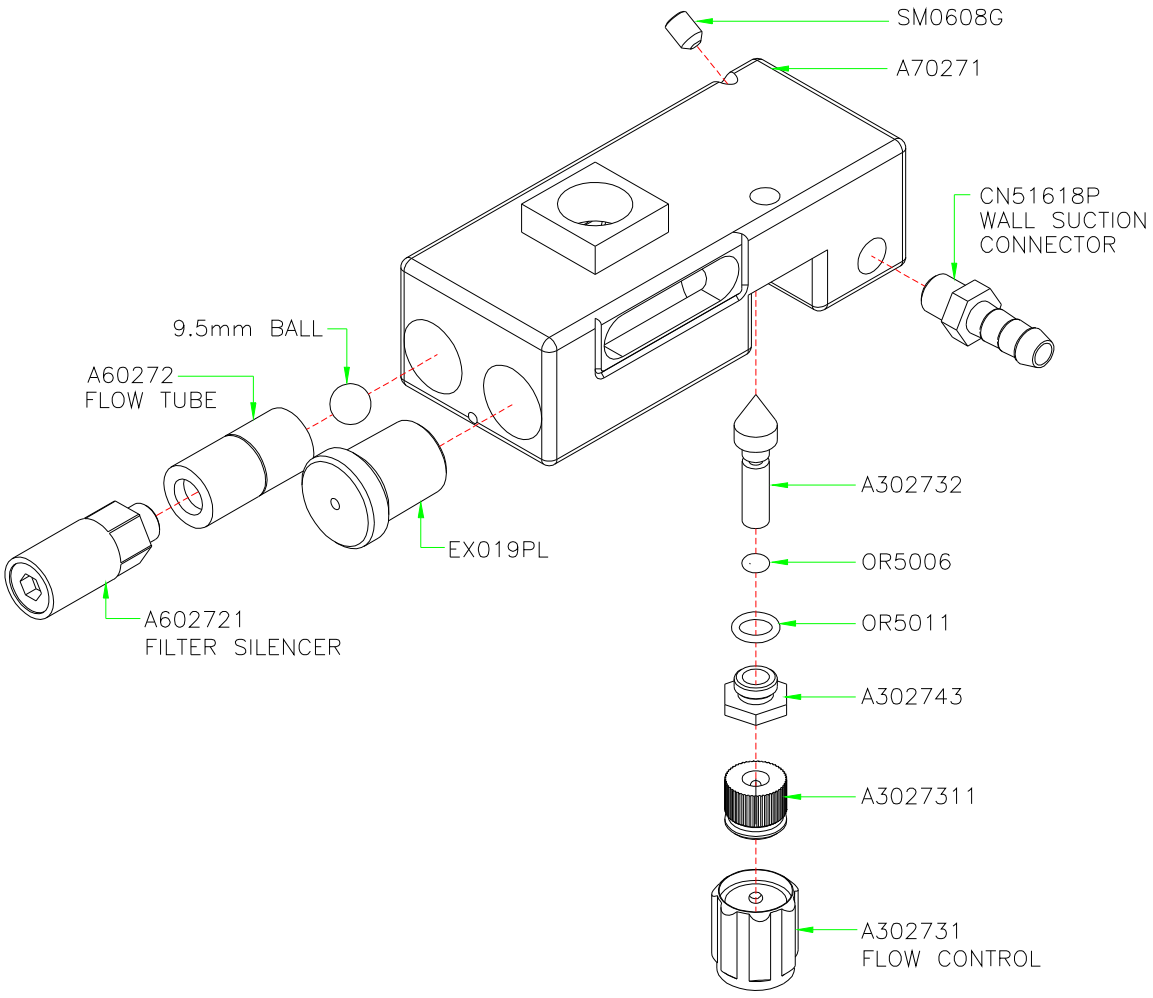


Figure 34: Assembly drawing of scavenge block

A filter silencer is fitted to the flow tube in order to reduce noise and prevent dirt and particle contamination of the Suction system.

The filter/silencer may be replaced when ever it is required by inserting an Allen Key into the base of the filter/silencer, and unscrewing it from the flow tube. Use only the ULCO recommended replacement filter/silencer. No responsibility is accepted for loss of suction if the incorrect filter is used.

6.2 Sub-assembly fresh gas non-return Valve (A6042)

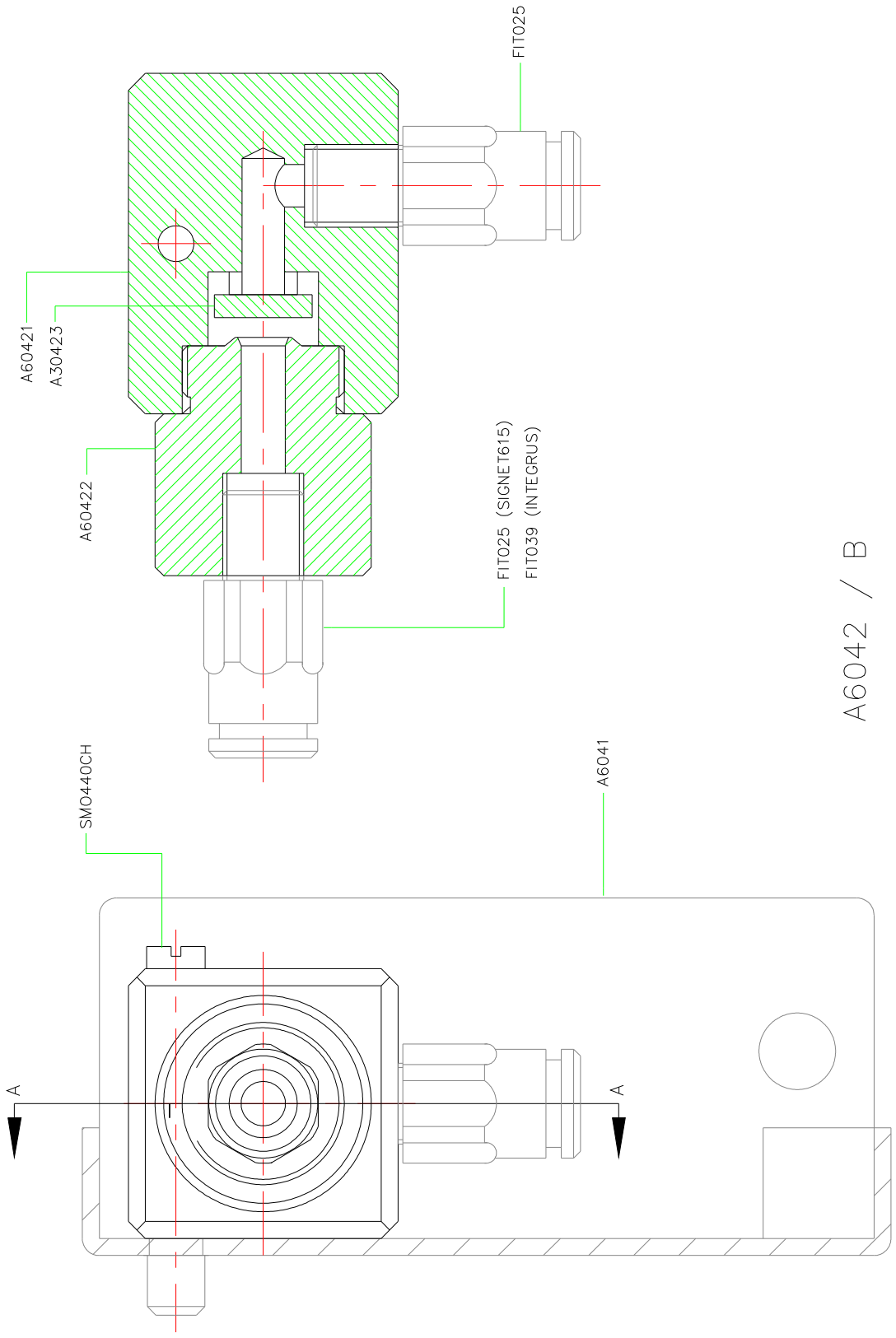


Figure 35: Assembly drawing of fresh gas non-return valve

6.3 Selectatec Assembly (A605)

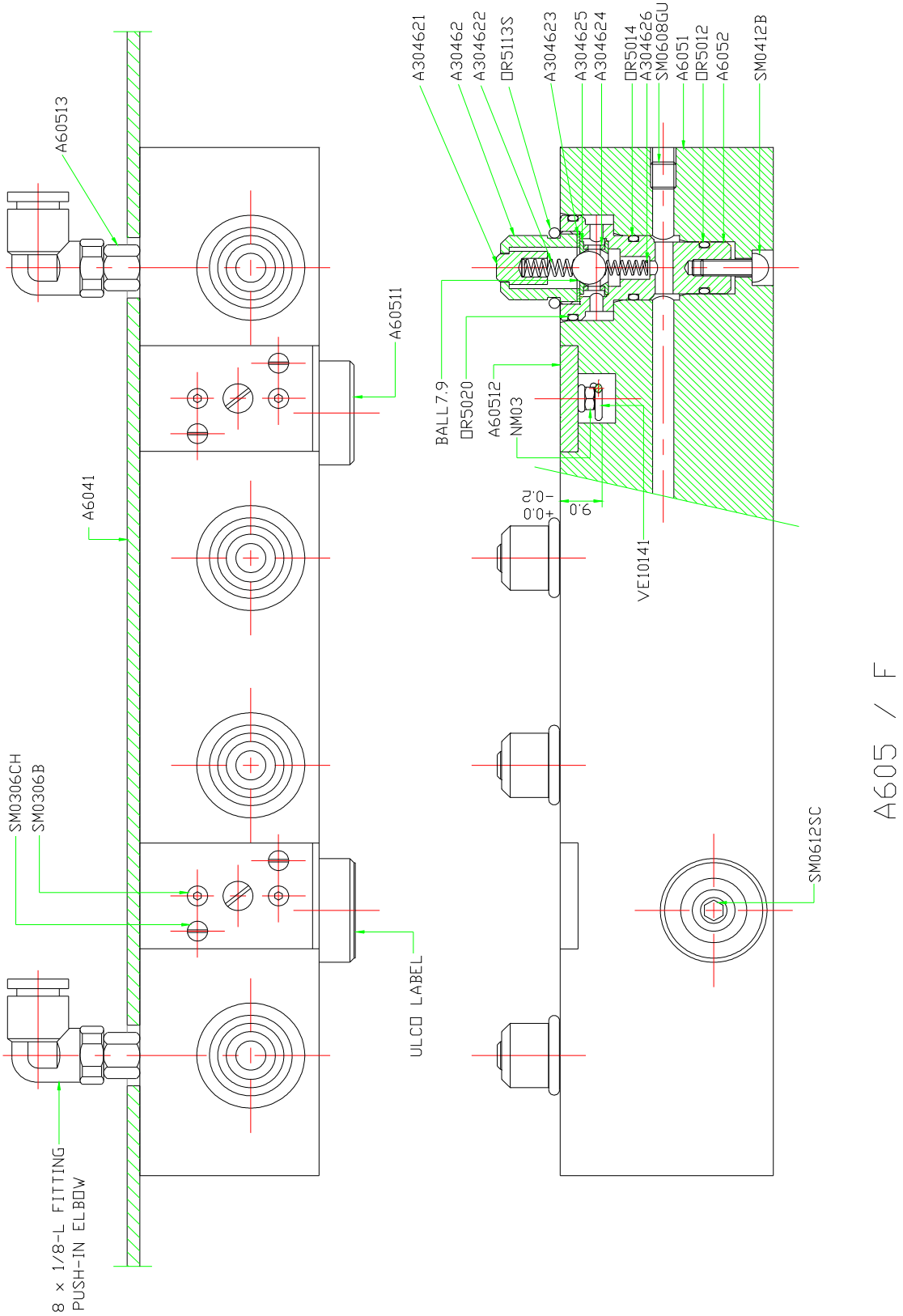


Figure 36: Assembly drawing of selectatec block

6.4 Manifold Block Assembly / Oxy (A6072)

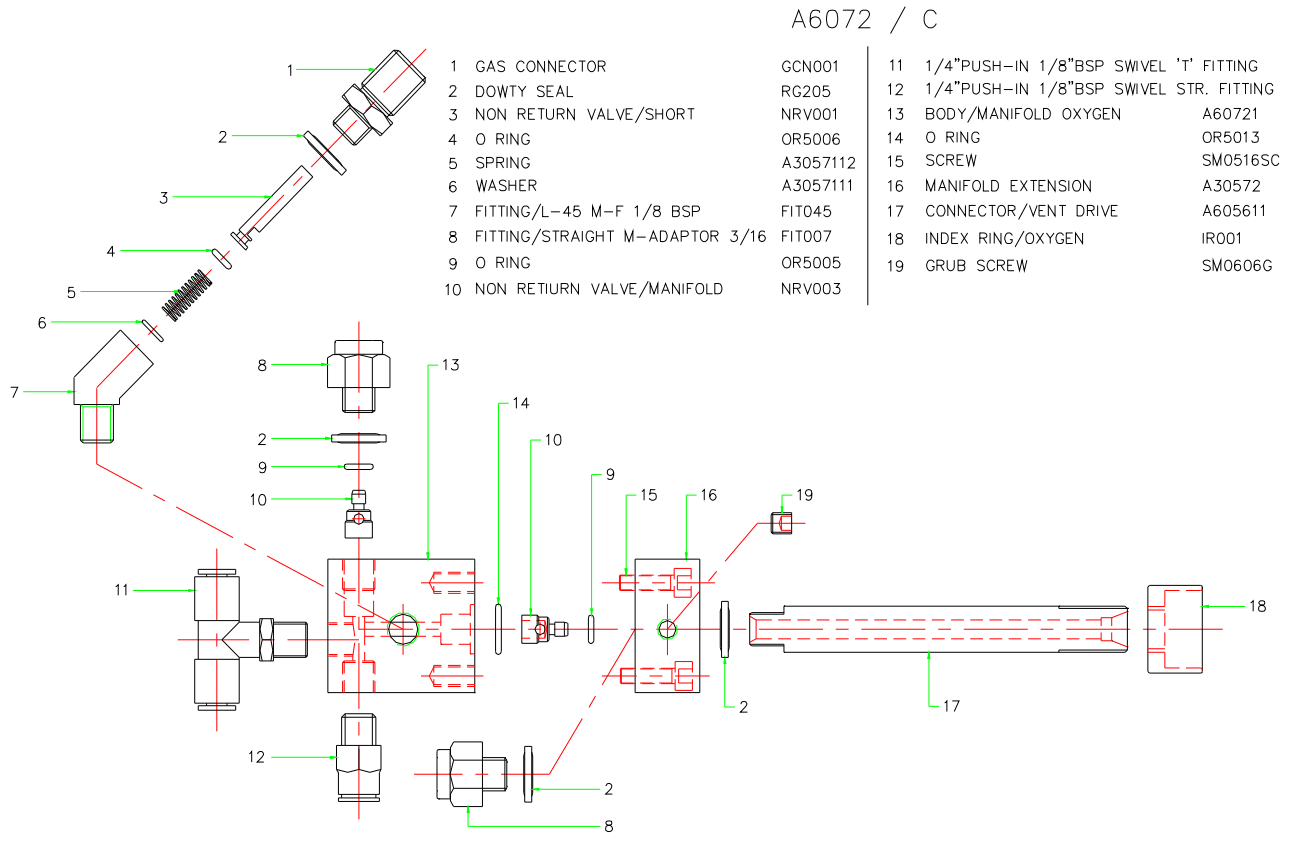


Figure 37: Exploded view of manifold block assembly

6.5 Patient Block (A7085)

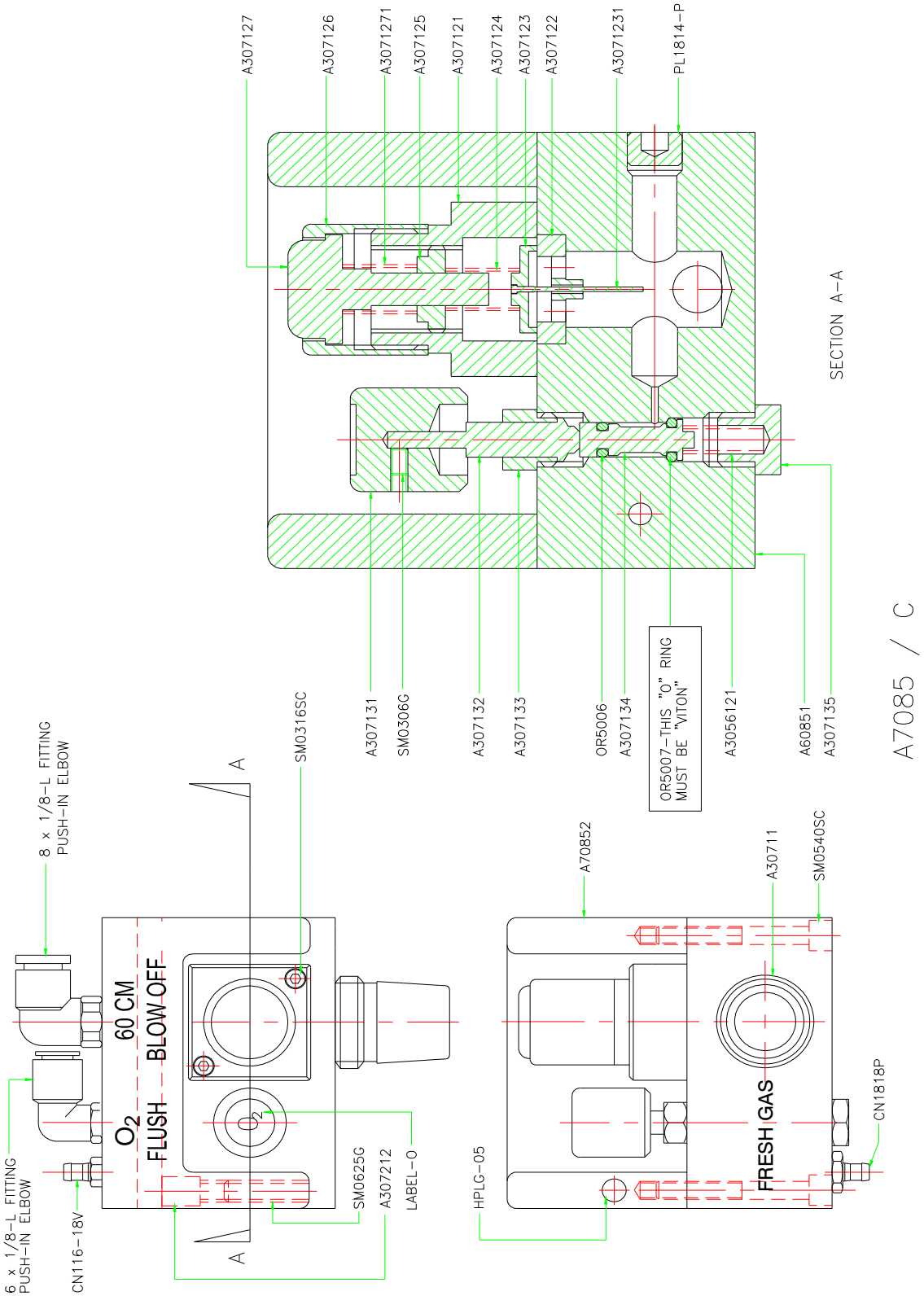


Figure 38: Assembly drawing of patient block

6.6 Overall Schematic of Gas Control System

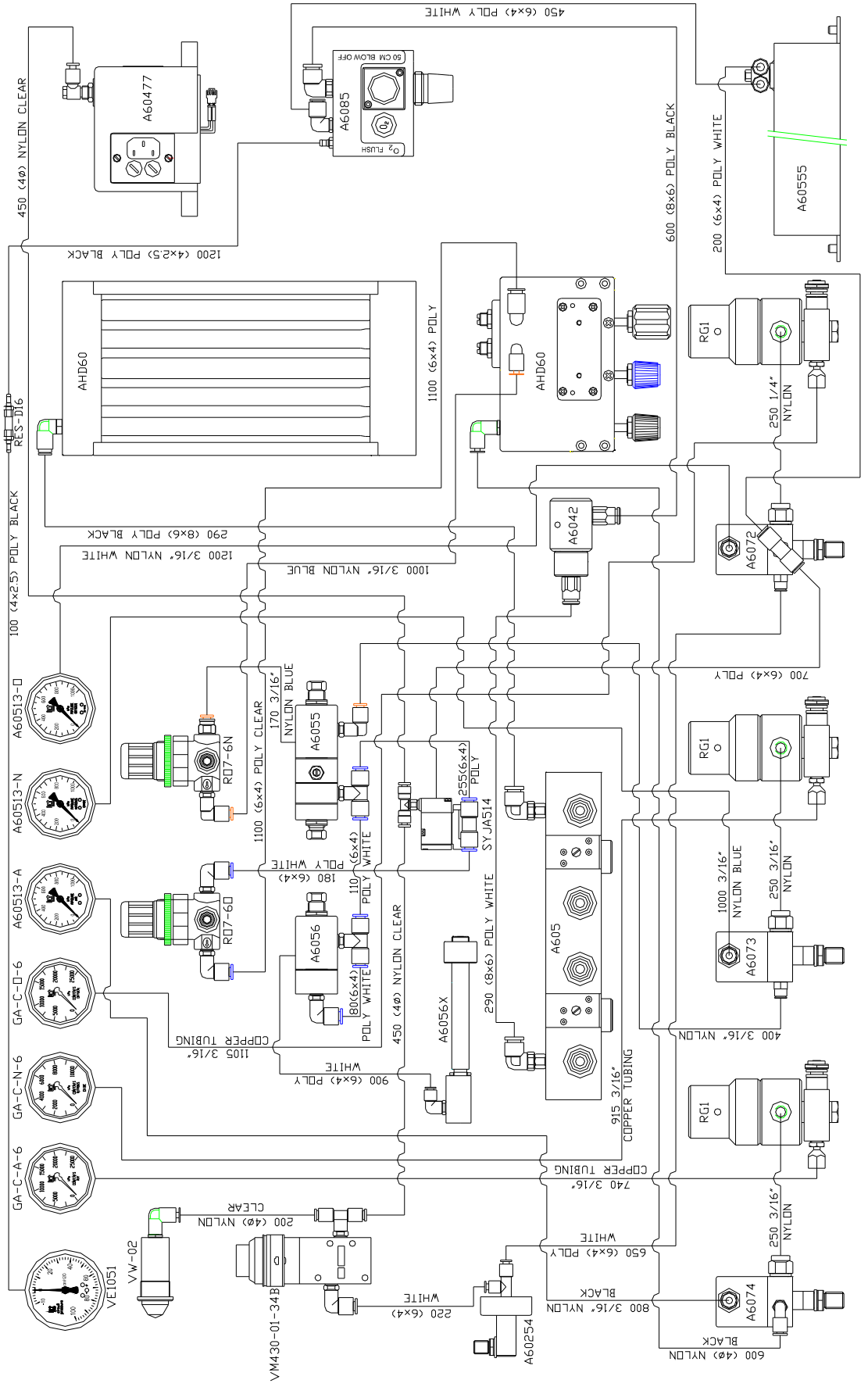


Figure 39: Overall schematic of gas supply system

6.7 Ventilator Interconnection Diagram

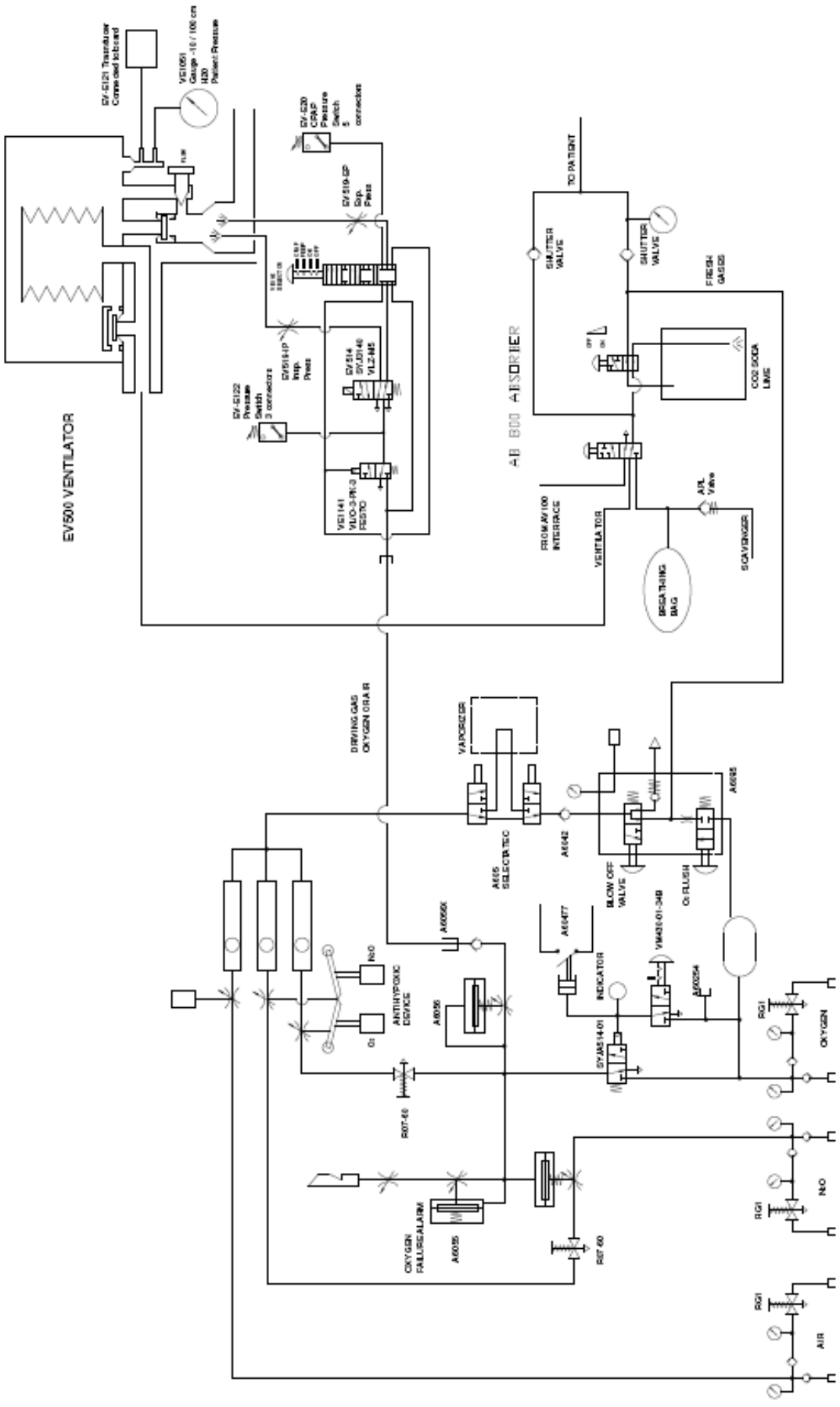


Figure 40: Ventilator interconnections

6.8 Electrical Power Distribution Circuit

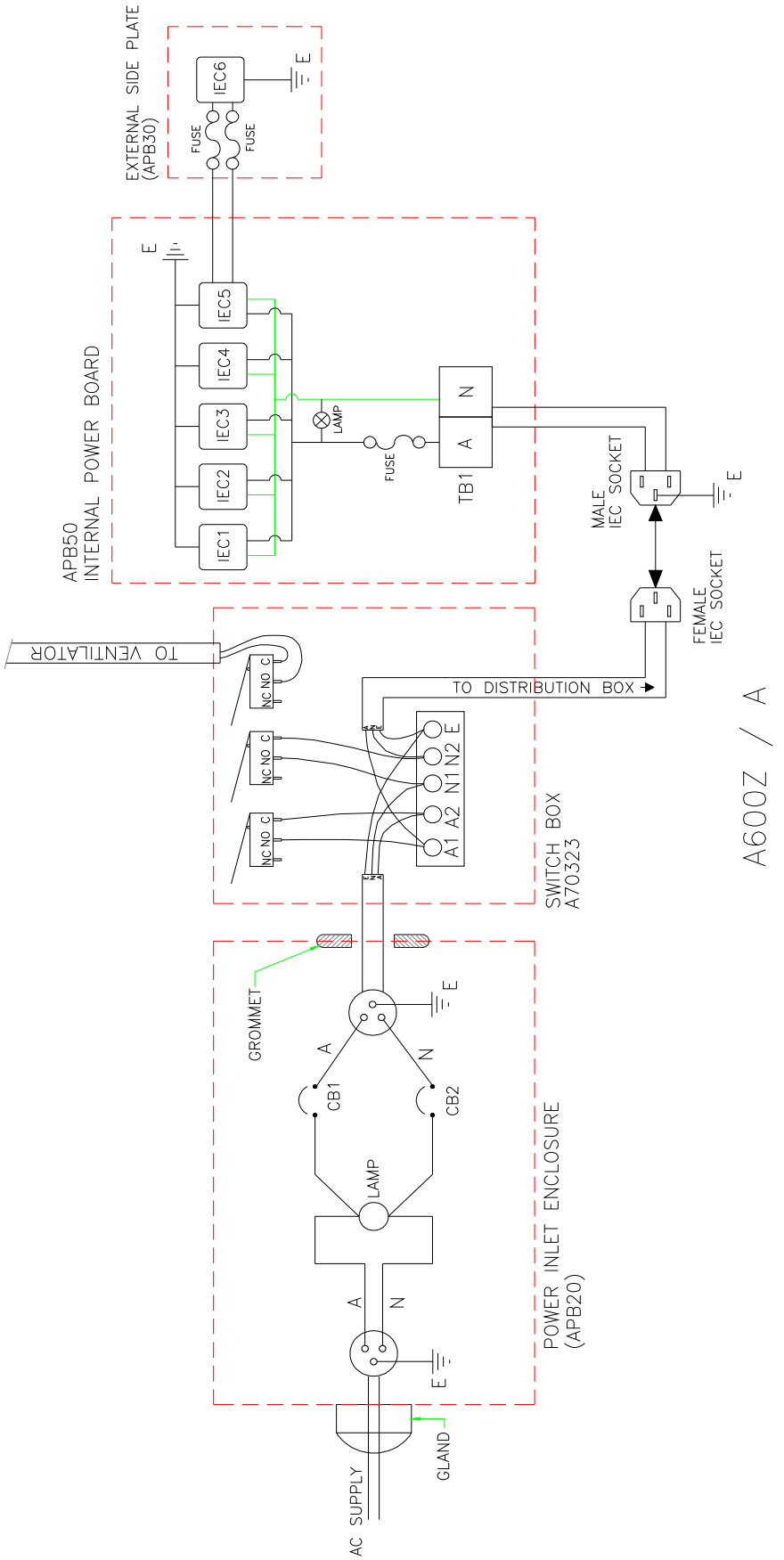


Figure 41: Signet Power Distribution

6.9 Frame Drawings

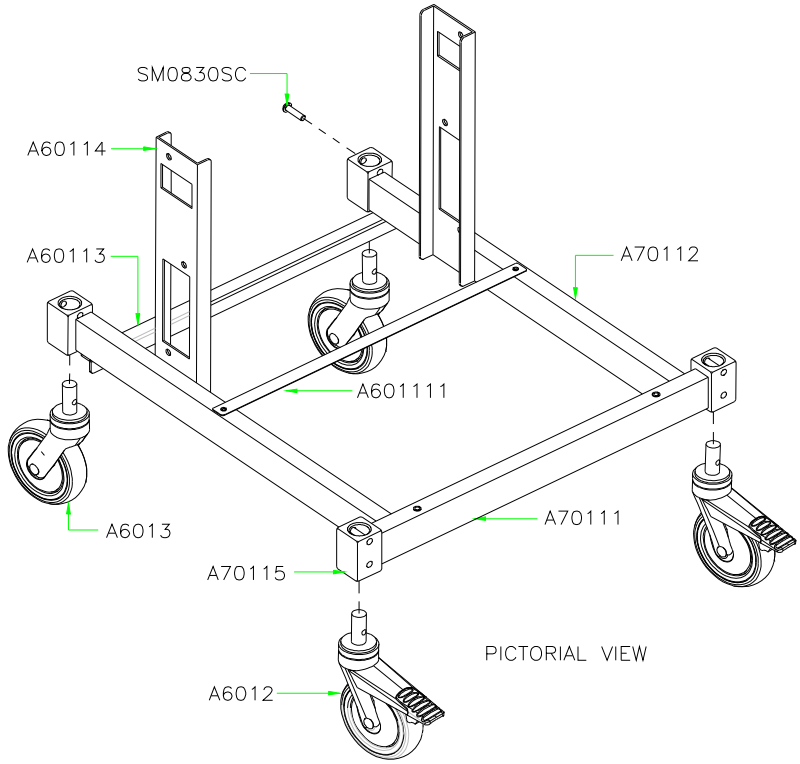


Figure 42: A701 - BASE ASSEMBLY

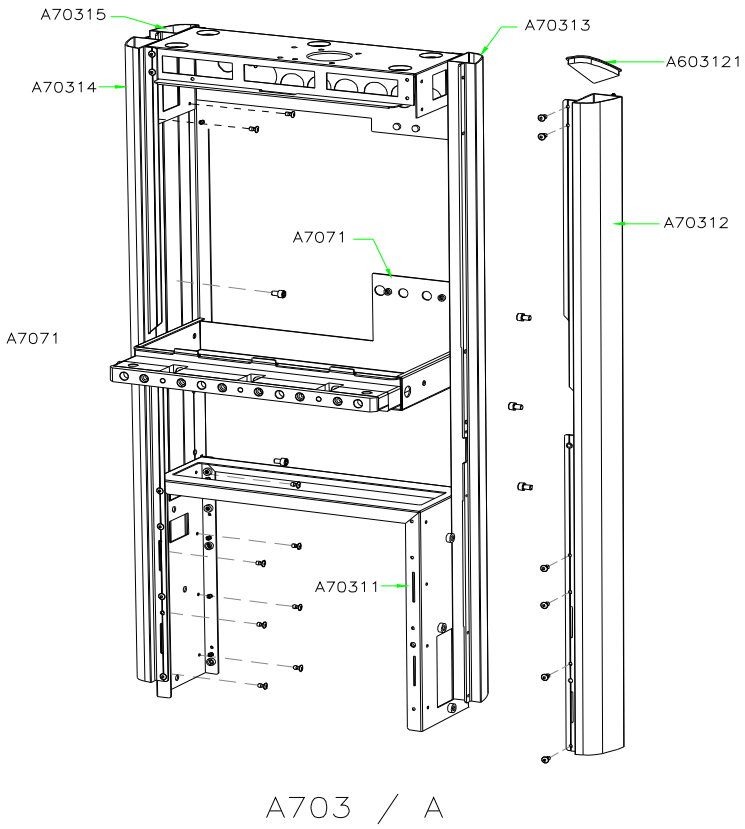


Figure 43: A703 – BODY ASSEMBLY

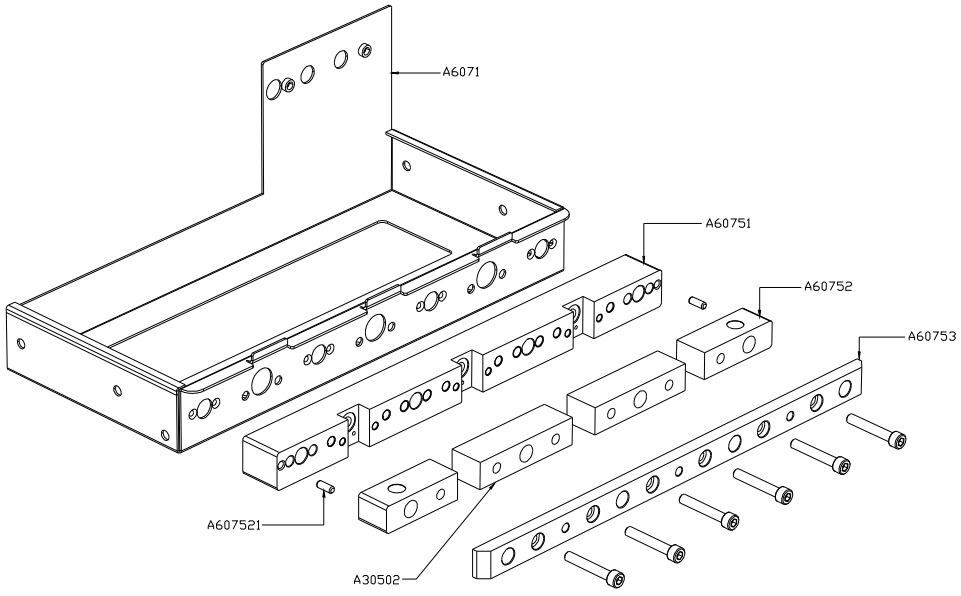


Figure 44: GAS RAIL BOX ASSEMBLY

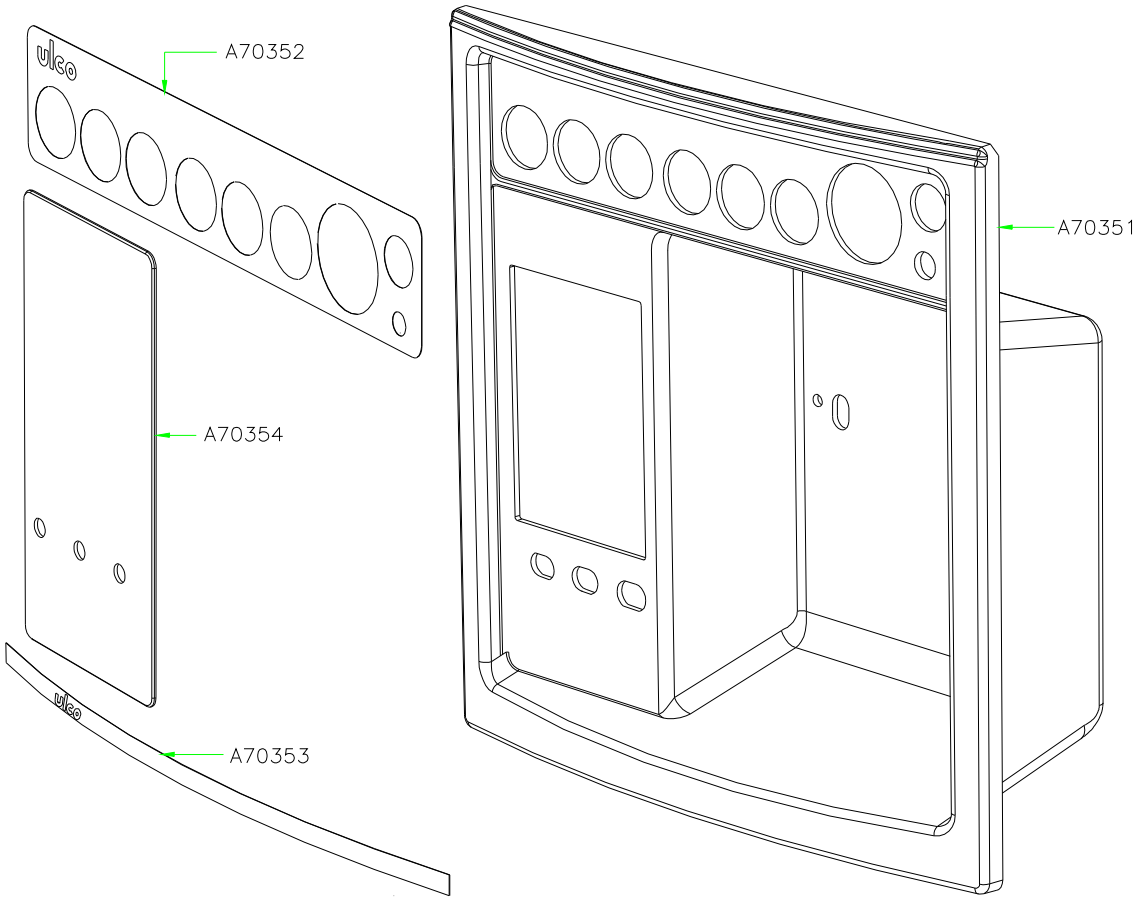


Figure 45: A7035 – COVER / FRONT ASSEMBLY

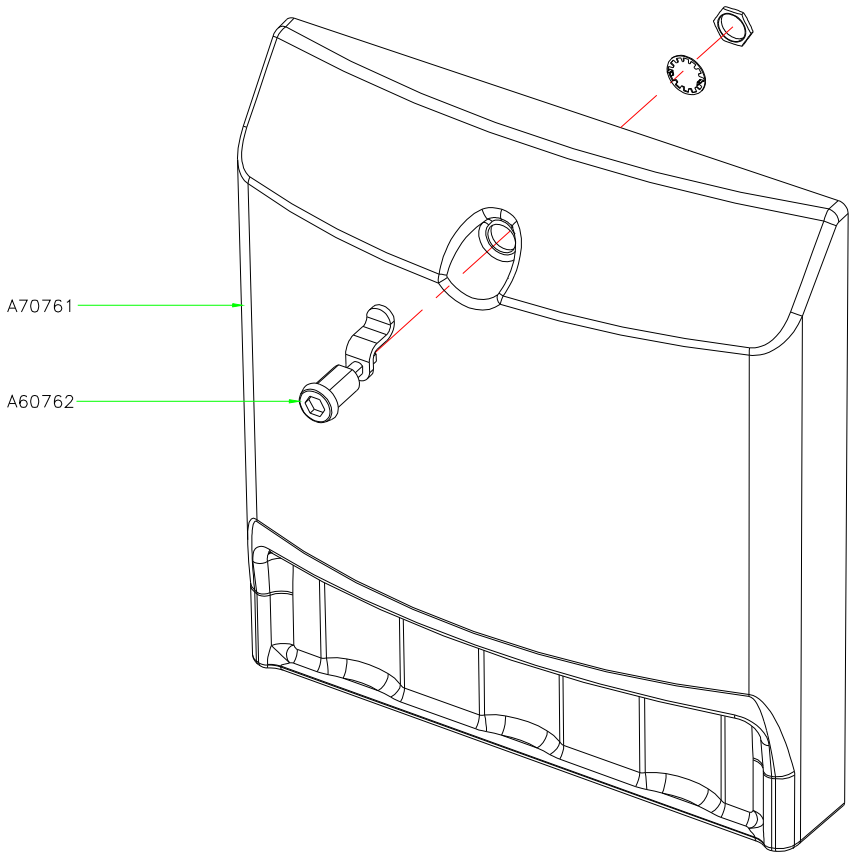


Figure 46: A7076 – COVER / REAR ASSEMBLY

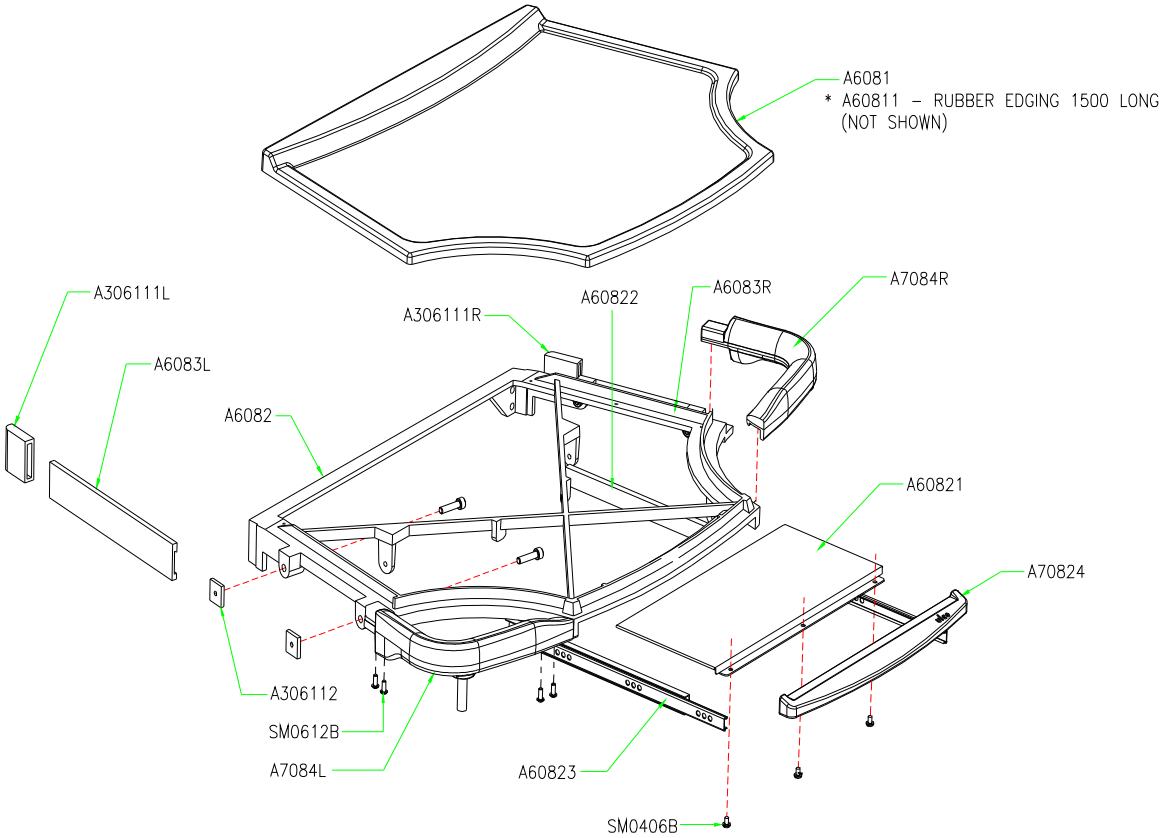


Figure 47: A708 – WORK TABLE ASSEMBLY

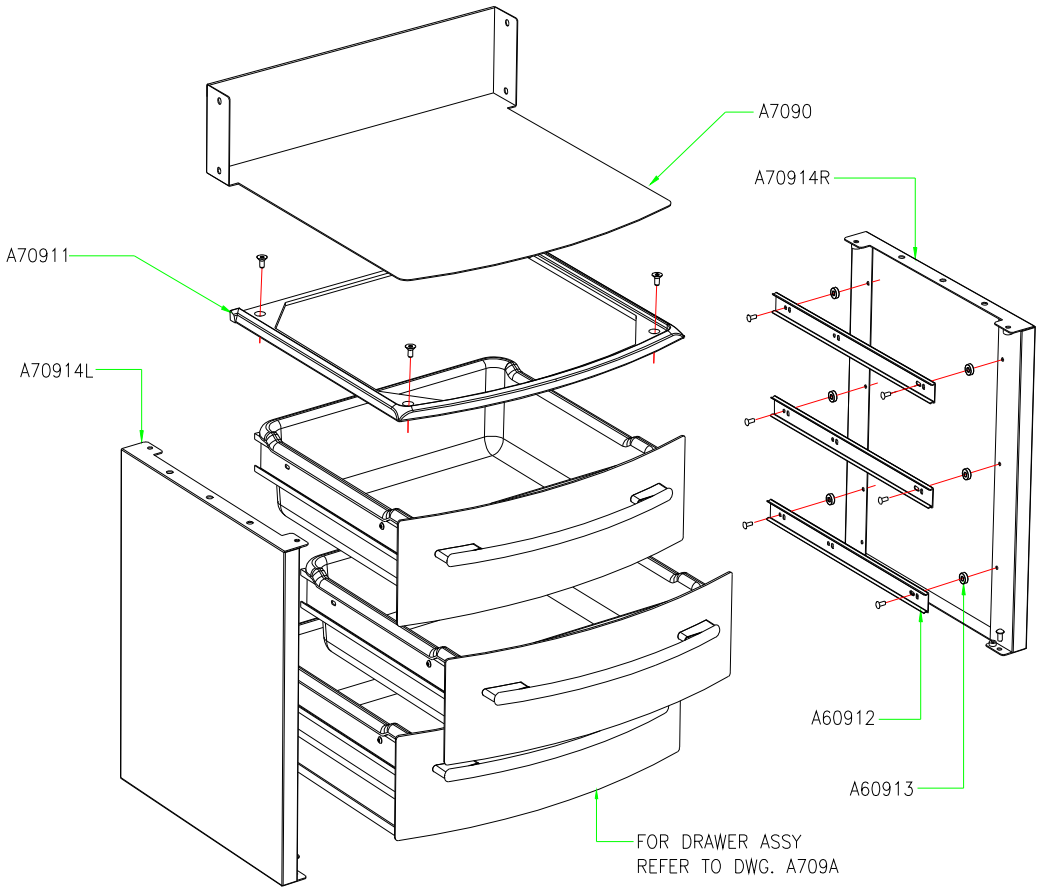


Figure 48: A709 – DRAWER ASSEMBLY / 3-SET