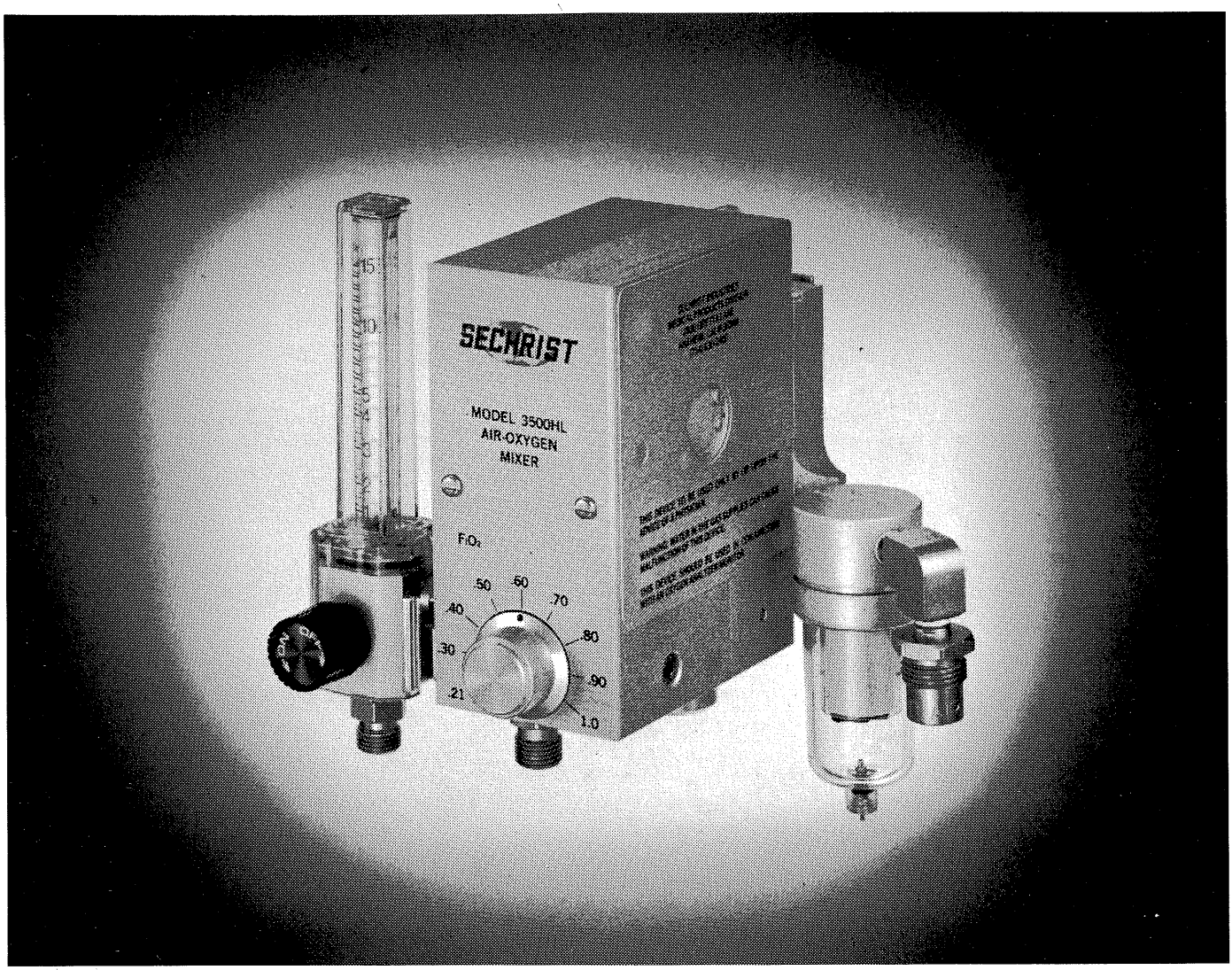
CALIBRATION AND SERVICE INSTRUCTIONS

SECHRIST AIR-OXYGEN MIXER



MODEL 3500: Low Flow Air-Oxygen Mixer
MODEL 3500HL: Hi/Lo Air-Oxygen Mixer

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WARRANTY

SECHRIST INDUSTRIES, INC. warrants this product to meet the published specifications and to be free from defects in material and workmanship under normal use for a period of one (1) year from the date of purchase. THE FOREGOING IS IN LIEU OF ANY OTHER WARRANTY, EXPRESS, IMPLIED OR STATUTORY, INCLUDING WITHOUT LIMITATION ANY WARRANTY OF MERCHANTABILITY. The sole liability of SECHRIST under this warranty is limited to replacing, repairing, or issuing credit at the discretion of SECHRIST for the products, equipment or parts which fail to meet the published specifications or which become defective during the warranty period and which are upon examination by SECHRIST found not to meet the published specifications or to be defective in material or workmanship. SECHRIST will not be liable under this warranty unless the following provisions are strictly complied with: (a) SECHRIST is promptly notified, in writing, upon discovery of the failure of said product or equipment to meet the published specifications or of defects in material or workmanship, (b) the defective product, equipment or part thereof is returned to SECHRIST, transportation charges prepaid by the buyer, (c) the defective part is received by SECHRIST for examination no later than one (1) month following the expiration of the warranty period and provided (d) that examination by SECHRIST of said product, equipment or part shall disclose to SECHRIST'S satisfaction that such defect has not been caused by improper usage, accident, neglect, alteration, abuse, improper installation or unauthorized repair. Products, equipment or parts replaced under this warranty are warranted only through the terms of the original warranty. SECHRIST neither assumes nor authorizes any other person or entity to assume for it any other warranty, obligation or liability in connection with its products or equipment whatsoever, and this warranty can only be changed in writing by a duly authorized representative of SECHRIST. SECHRIST makes no representations or warranties whatsoever as to the fitness or usefulness of the products or equipment manufactured by it for any medical treatment, physical condition or other purpose whatsoever. In no event shall SECHRIST be liable for personal injury, property damage or any special or consequential damage to any buyer, user or any other person whomsoever, including, but not limited to, loss of profits, loss of use of the product or equipment, or for damages of any other kind whatsoever based on a claim for breach of warranty other than a refund of the purchase price of any defective product or equipment. Any authorization for repair or alteration by buyer must be in writing from SECHRIST to prevent the voiding of this warranty. In the event SECHRIST or its representatives render any technical advice or service of any kind to buyer or anyone else in connection with the equipment or products covered by this warranty, the buyer hereby releases SECHRIST from all liability of any kind whatsoever as a result thereof; and the warranty as hereinbefore set forth shall not be enlarged or affected by said action by SECHRIST.

USER RESPONSIBILITY

CAUTION

Federal law restricts this device to sale by or on the order of a physician.

The SECHRIST Air-Oxygen Mixer is a restricted medical device. The SECHRIST Mixer will perform in conformance with the specifications and description contained in this Calibration and Service Manual and other accompanying labeling when assembled, operated, maintained and repaired in accordance with the instructions contained in this manual and other acccompanying documentation. Do not attempt to operate this Mixer before reading and thoroughly understanding these instructions. The Mixer must be checked periodically as specified in this manual (see Routine Maintenance Section). A defective device should not be used. Should repair become necessary, this Calibration and Service Manual is available to qualified hospital technicians. If the hospital does not have the capability to calibrate, service and repair this equipment, please contact the authorized SECHRIST distributor who effected delivery of this device. If a suitable response is not received within a reasonable time, communicate directly with our Home Office in Anaheim, California. This product should be repaired only in accordance with written instructions from SECHRIST, and should not be modified in any way, except with prior written approval from SECHRIST.

WARNING

Whenever a patient is attached to respiratory care equipment, constant attendance is required by qualified personnel. The use of an alarm or monitoring system does not give absolute assurance of warning for every form of malfunction that may occur with the system. In addition, some problems may require immediate attention.

SUMMARY OF WARNINGS AND CAUTIONS

The SECHRIST Air-Oxygen Mixer is a restricted medical device intended for use only by qualified personnel under the direction of a qualified physician.

Personnel operating this equipment are responsible for reading and thoroughly understanding all product documentation provided. Statements throughout the product documentation provided have special significance as follows:

KEY TO WARNINGS, CAUTIONS AND NOTES:

WARNING

Means there is a possibility of personal injury to the operator or patient.

CAUTION

Indicates there is a possbility of damage to the Mixer or other equipment attached to it.

NOTE: Notes are used to call attention to statements pertaining to more efficient or convenient operation or service of the equipment.

SUMMARY OF ALL WARNINGS AND CAUTIONS CONTAINED IN THIS DOCUMENT:

WARNING

Whenever a patient is attached to respiratory care equipment, constant attendance is required by qualified personnel. The use of an alarm or monitoring system does not give absolute assurance of warning for every form of malfunction that may occur with the system. In addition, some problems may require immediate attention.

WARNING

This precision gas mixing device is intended for use with Medical Breathing Air and Medical Breathing Oxygen only. Do not modify inlets to accommodate other breathing gases, especially anesthetic gases.

CAUTION

Federal law restricts this device to sale by or on the order of a physician.

CAUTION

Grasp nipple at base next to the proportioning valve block — not on the end or the nipple may be damaged.

CAUTION

If resistance is met before stop pin at 1.0 position is reached, do not force the knob. Re-adjust rear seat slightly — just enough to allow free range of movement to stop pin position. Recheck the calibration as described above.

CAUTION

Alarm bleed set screw (P / N 3568) is calibrated at factory and should not require calibration.

CAUTION

Do not tape or hold finger over alarm outlet port. Permanent damage to reed can be caused by prolonged occlusion of reed outflow.

CAUTION

DAMAGE MAY OCCUR TO BOTH FRONT SEAT AND REAR SEAT, WHEN REAR SEAT IS BEING INSTALLED, IF NEEDLE IS NOT STRAIGHT UP AND CENTERED.

CAUTION

DO NOT ATTEMPT TO DIG BALL OUT OF HOLE; DAMAGE WILL OCCUR.

CAUTION

DO NOT IMMERSE THE MIXER. DO NOT GAS OR STEAM STERILIZE; DAMAGE MAY RESULT.

INTRODUCTION

The SECHRIST Air-Oxygen Mixer has been designed for durability and serviceability. If the criteria for the gas supply are met and the supply is satisfactorily clean and dry, the SECHRIST Mixer should provide years of use with relatively little care and service. However, should it become necessary, these instructions are provided to serve as a guide for qualified technicians to service and repair the SECHRIST Mixer.

This manual is designed to take the technician through a step-by-step process to:

- Test for proper operations
- Troubleshoot any malfunctions
- Calibrate the Mixer if necessary
- Disassemble and reassemble the Mixer
- Keep the Mixer operating at its optimum efficiency of design.

This manual provides information in a general to specific manner. Section I describes all tools and test equipment required to calibrate and service SECHRIST Air-Oxygen Mixer products. Section II details the testing procedures necessary to determine optimum working conditions of the SECHRIST Mixer. If service is necessary, based on the outcome of the testing, a Troubleshooting Guide is given in Section II to determine which component module of the Mixer is involved and what procedures are recommended.

The procedures necessary for service are given next in the Calibration Section (III) and the Disassembly and Reassembly Section (IV). These sections are broken down into the three component modules of the Mixer. These three modules serve unique purposes. The Proportioning Module does the actual gas mixing and proportions the outflow. The Pressure Balancing Module takes the incoming gas pressures, with a potential differential of 20 p.s.i., and reduces the differential to 3 cm. of water pressure, thereby nullifying the differences and equalizing the incoming pressures. The Alarm Module sounds a continuous reed alarm if the incoming gas pressures differ more than 25 p.s.i. When the alarm is activated, the gas with the highest pressure will be delivered by the Mixer until supply gas pressures are reestablished.

Photographs and diagrams are given to provide a visual display of the instructions. Exploded diagrams of individual modules will provide a structured way of following the step-by-step instructions for disassembly and reassembly.

NOTE: The greatest enemy of all gas mixing devices is contamination from the supply gases, especially the Medical Breathing Air supply. Required service can be significantly reduced by assuring the quality of the supply gases and performing routine filter maintenance.

WARNING

This precision gas mixing device is intended for use with Medical Breathing Air and Medical Breathing Oxygen only. Do not modify inlets to accommodate other breathing gases, especially anesthetic gases.

Maintenance / Repair Qualifications

The Maintenance, Repair, and Testing procedures covered in this manual are to be performed by individuals qualified in the servicing and maintenance of medical life support equipment. ONLY procedures covered in this manual are to be performed in the field. Procedures requiring more extensive electronic/pneumatic trouble-shooting, and/or electronic component replacement must be performed by Sechrist Industries, Inc.

TABLE OF CONTENTS

TOOLS AND ACCESSORIES REQUIRED FOR CALIBRATION AND DISASSEMBLY/REASSEMBLY

Special SECHRIST tools and accessories are required to calibate, disassemble and reassemble the SECHRIST Air-Oxygen Mixer.

SPECIAL CALIBRATION AND ASSEMBLY TOOLS (see figure 1):

SECHRIST Tool Kit (P/N 3651)
AT. 1: 1/8" spanner wrench (P/N 3654)
AT. 2: 3/8" spanner wrench (P/N 3653)
AT. 3: 5/8" spanner wrench (P/N 3652)
AT. 4: Bypass plate (P/N 3655)
Brass Plug 10-32 (P/N 3635)
Brass 10-32 x 1/16 fitting (P/N IV-310)
Roll Pins (8) (P/N 3537)
Screws (2) 6-32 (P/N 3559)
O-rings -008 (P/N 3534)

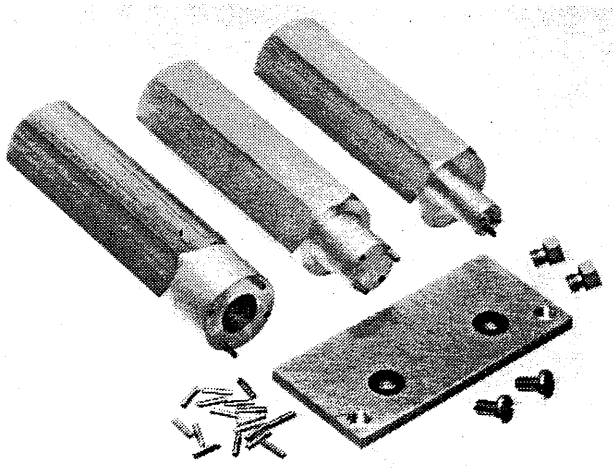


Figure #1. Assembly tools

GENERAL CALIBRATION AND ASSEMBLY TOOLS:

1/16" allen wrench
5/64" allen wrench
7/64" allen wrench
9/64" allen wrench
3/16" allen wrench
1/4 " allen wrench
3/32" allen wrench
Medium blade screwdriver
7/16" open end wrench
1/2 " open end wrench
3/4 " open end wrench
1/4 " nut driver
Internal tru-arc pliers
Needle nose pliers
Soft mallet

Precision Caliper (see figure 2)
Precision Depth Micrometer (see figure 2)

Lubricant for O-rings: Krytox 240 AC (Dupont)

EQUIPMENT REQUIRED FOR TEST SYSTEM:

O_2 high pressure hose
Air high pressure hose
Oxygen regulator (2 stage adjustable)
Air regulator (2 stage adjustable)

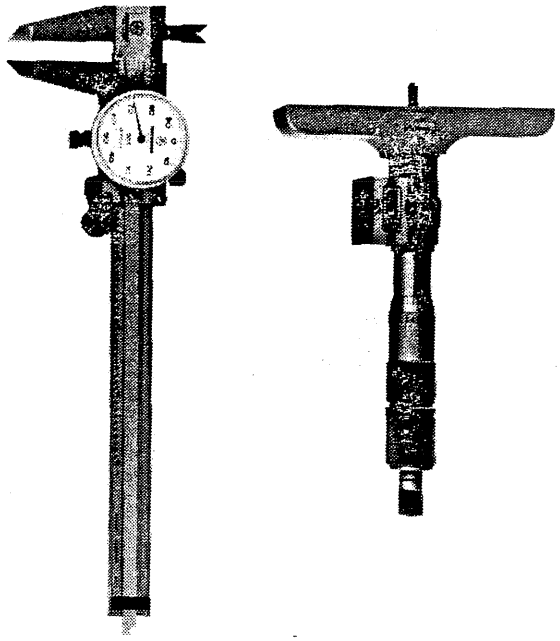


Figure #2. Caliper and micrometer

Flowmeter (0 -15 LPM)
Oxygen analyzer (calibrated to ±1% accuracy, readout accurate to 1% increments)
Sampling reservoir (bottle or tube)
Pressure gauge (0-60 p.s.i.)

ROUTINE MAINTENANCE REQUIREMENT:

SECHRIST Overhaul Kit (P/N 3658)
(See APPENDIX 1 for Overhaul Kit parts and part numbers).

Before attempting to calibrate or repair a SECHRIST Mixer, a qualified hospital technician should be familiar with the design and function of the device (see UNDERSTANDING THE AIR-OXYGEN MIXER in the SECHRIST Operational Instructions).

The following instructions utilize a numbering system which is to be followed in sequence. All parts are numbered and can be reviewed on the exploded parts diagrams contained herein.

TEST PROCEDURE

In order to determine the optimal function of the SECHRIST Mixer and the potential need for calibration, service or repair, complete the following test procedures.

1.0 Initial Test System Set Up (see figure 3).
- 1.1 Connect the Mixer to clean and dry Medical Breathing Oxygen and Medical Breathing Air supplies which are independently adjustable from 0 to 60 p.s.i.
- 1.2 Connect a flowmeter to the outlet of the Mixer.
- 1.3 Direct the flow from the flowmeter to a sampling reservoir (i.e. bottle or tube), making sure that no room air is being entrained to dilute the mixture.
- 1.4 Insert 0_2 analyzer probe into sampling reservoir.

NOTE: O_2 analyzer must be calibrated and accurate to ±1%.

Test System SECHRIST Air-Oxygen Mixer

Model 3500, 3500HL

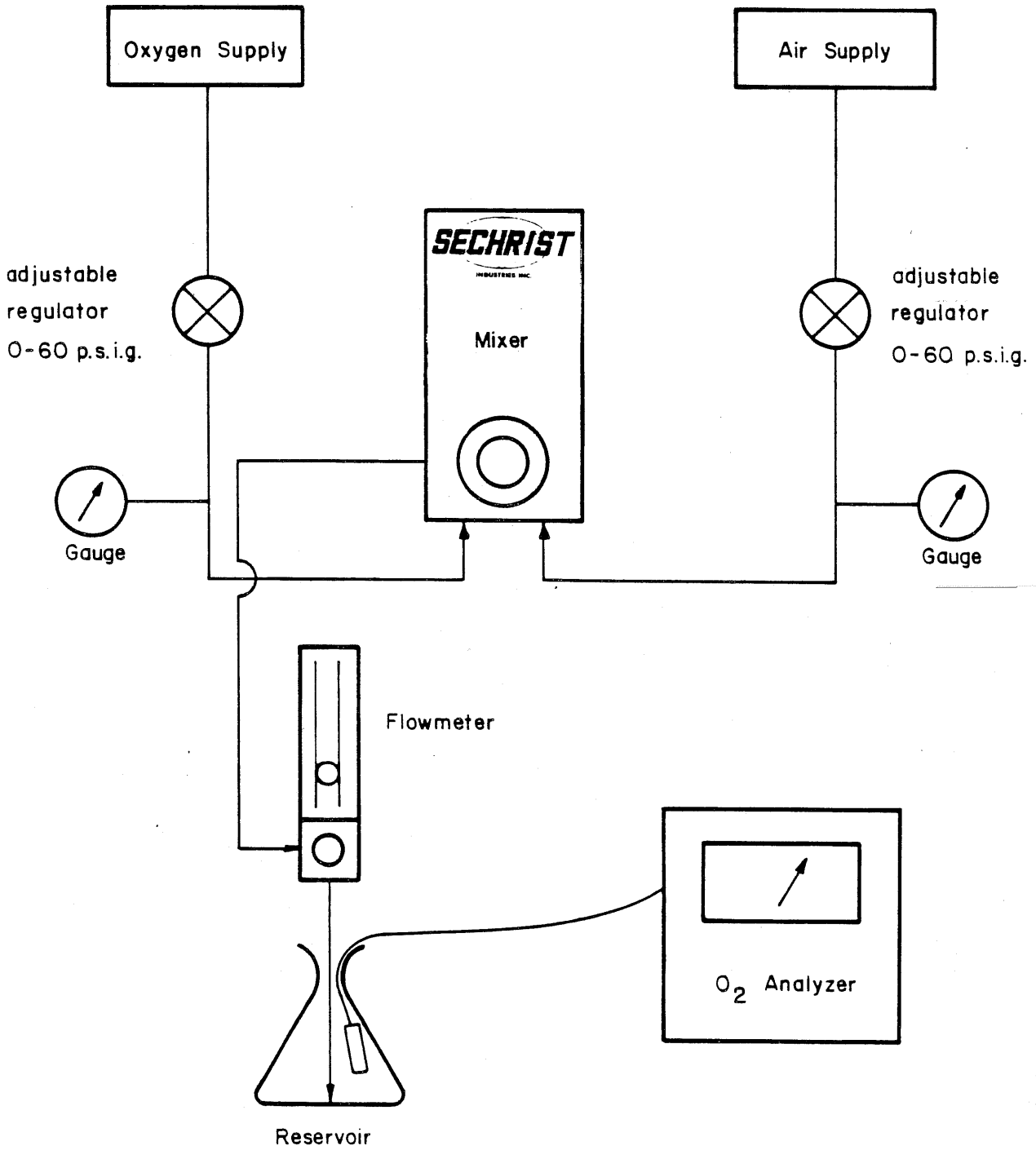


FIGURE 3

1.5 The sampling rate should be:
7LPM for Low Flow
15 LPM for Hi/Low Flow.

2.0 Proportioning Module.

2.1 Set O_2 pressure and air pressure to 50 p.s.i.

2.2 Compare O_2 analyzer readings to Mixer settings of .21, .40, .60, .80 and 1.0.

2.3 The Mixer has a specified accuracy of ±3% If the FIO_2 varies more than ±4% between the Mixer and O_2 analyzer reading, calibration or service may be necessary (see Troubleshooting Guide).

2.4 There is a constant bleed of mixed gas from the bottom of the Proportioning Module. This bleed is approximately 3 1/2 LPM for Low Flow and 8 1/2 LPM for Hi/Lo Flow. This is needed to maintain accurate FIO_2s at very low flows. These bleed rates are predetermined by the factory and can not be reset in the field.

3.0 Pressure Balancing Module.

3.1 With same test system set up as above, select an FIO_2 of .60 and observe the O_2 analyzer reading.

3.2 Vary the inlet pressures to the Mixer to 40 p.s.i. O_2 and 60 p.s.i. air and then to 60 p.s.i. O_2 and 40 p.s.i. air. If FIO_2 varies more than ±1% from initial O_2 analyzer reading, calibration or service may be necessary (see Troubleshooting Guide).

4.0 Alarm Module.

4.1 Set air and O_2 supplies to 50 p.s.i.; alarm should be silent.

4.2 Slowly reduce air inlet supply; the alarm should sound between 24 and 28 p.s.i. and O_2 analyzer should read 100%. Increase air inlet supply, slowly, to 50 p.s.i.; alarm should reset at or before 40 p.s.i.

4.3 Repeat step 4.2 varying the O_2 inlet supply; when alarm sounds, O_2 analyzer reading should be 21%.

4.4 If alarm does not function as per above specifications, calibration or service may be necessary (see Troubleshooting Guide).

5.0 Air Inlet Filtration System (most frequent service required).

5.1 To test the pressure drop through the water/trap filter or the internal air inlet filter, a test port has been provided on the rear of the Mixer above the air inlet.

5.2 With 1/4" nut driver, remove plug from test port and install a Brass 10-32 x 1/16 fitting (P/N IV-310) (see Tool Kit)

5.3 Connect a high pressure gauge (0 to 60 p.s.i.) to 10-32 fitting.

5.4 With flow set at 7 LPM for Low Flow (15 LPM for Hi/Lo Flow), set mixer knob to .21. Observe pressure indicated at test port.

5.5 If the difference between the pressure at the test port and the inlet pressure is greater than 10 p.s.i., replace either or both air inlet filters (see Routine Maintenance section).

SPECIFICATIONS

FIO_2 RANGE:	.21 + .01 to 1.0 − .01
ACCURACY*:	±3%
MAXIMUM FLOW:	
Model 3500 (Low Flow):	40 LPM @ .60 FIO_2 setting with 50 p.s.i. (@ 1.5 SCFM minimum flow) inlet pressures
Model 3500HL (Hi/Lo Flow):	100 LPM @ .60 FIO_2 setting with 50 p.s.i. (@ 1.5 SCFM minimum flow) inlet pressures
NOMINAL SUPPLY PRESSURES**	50 p.s.i. ±10 p.s.i. (@ 1.5 SCFM minimum flow).
BLEED FLOW:	
Model 3500 (Low Flow):	3.0 to 4.0 LPM @ 7 LPM Flow
Model 3500HL (Hi/Lo Flow):	7.5 to 9.5 LPM @ 15 LPM Flow
DIMENSIONS:	
Model 3500 (Low Flow):	HEIGHT: 6" WIDTH: 6" DEPTH: 6"
Model 3500HL (Hi/Lo Flow):	HEIGHT: 6" WIDTH: 6" (Pole Mount) 6 1/2" (Wall Mount) DEPTH: 6" (Pole Mount) 5 1/2" (Wall Mount)
WEIGHT:	6 lbs.

*NOTE: The Mixer will maintain the delivered FIO_2 within ±1% of the selected value with fluctuations of the supply pressures. The additional 2% error is caused by the readability of the set point and scale error.

**NOTE: The outlet pressure of the Mixer will always be slightly lower than the lower of the two inlet pressures. Some respiratory care equipment attached to the Mixer may require closer tolerances; consult the manufacturer's instructions.

TROUBLESHOOTING GUIDE		
PROBLEM	**POSSIBLE CAUSE**	**CORRECTION**
PROPORTIONING MODULE		
FIO_2 not accurate	O_2 analyzer out of calibration (most common problem)	recalibrate O_2 analyzer
	Improper purity of supply gases	Check quality of supply gases
	Wrong gas supplied to inlet	Assure outlets and hoses are correct
	Front or rear seats worn	Clean or replace seats
	Calibration of proportioning valve incorrect	See Calibration Section
	Pressure Balancing Module malfunctioning	See Calibration for Pressure Balancing Module
Knob is hard to turn	Faceplate has shifted causing knob to rub	Reposition faceplate
	Knob has been bumped bending adjustment shaft	Replace adjustment shaft and recalibrate
PRESSURE BALANCING MODULE		
FIO_2 Change > 1% when testing	Air or O_2 inlet filter dirty causing >20 p.s.i. difference	Replace filter
	Regulator needle(s) out of calibration	Calibrate
	O-ring(s) on regulator seat damaged causing leak	Replace O-rings and recalibrate
	Contamination from supply gases	Clean and recalibrate
ALARM MODULE		
Continuous alarm with both inlet pressures equal	Dirty inlet filter(s)	Replace filter(s)
	Bypass check ball leaking	Need to clean check ball and seat (see Disassembly of Alarm Module)
	Alarm Module adjustments out of calibration	See Calibration Section
Alarm not sounding with loss of one pressure	Defective reed	Replace reed
	Alarm Module adjustments out of calibration	See Calibration Section
	Alarm poppets stuck	Clean, lubricate and recalibrate

CALIBRATION

NOTICE: MODEL 3500 Mixers with serial numbers lower than 1671 use the following part numbers in the Proportioning Module:

Proportioning valve block	— P/N 3531-7
Front seat	— P/N 3532-3
Rear seat	— P/N 3542-4
Front and rear seat O-ring(s) (4)	— P/N 3513

NOTICE: MODEL 3500HL Mixers with serial numbers lower than 1671 use the following part numbers in the Proportioning Module:

Proportioning valve block	— P/N 3531-7
Front seat	— P/N 3613-1
Rear seat	— P/N 3615-1
Front and rear seat O-ring(s) (4)	— P/N 3513

The SECHRIST Mixer is calibrated and tested in conditions similar to the environment for which the Mixer was designed.

Medical Breathing O_2 and Medical Breathing Air sources will be required to calibrate the system. A calibrated oxygen analyzer is necessary (be sure O_2 analyzer is calibrated and that the accuracy of the readout is in 1% increments); and a flowmeter is used to sample the gas mixture being delivered to the oxygen analyzer.

To calibrate the SECHRIST Mixer, the system must be broken down into 3 modules: the Proportioning Module, the Pressure Balancing Module and the Alarm Module (see Disassembly and Reassembly Section).

NOTE: The order of calibration given must be followed (i.e. the Pressure Balancing Module must be calibrated before the Proportioning Module can be connected and calibrated; and the Pressure Balancing Module and Proportioning Module must be calibrated together before the Alarm Module can be installed and calibrated).

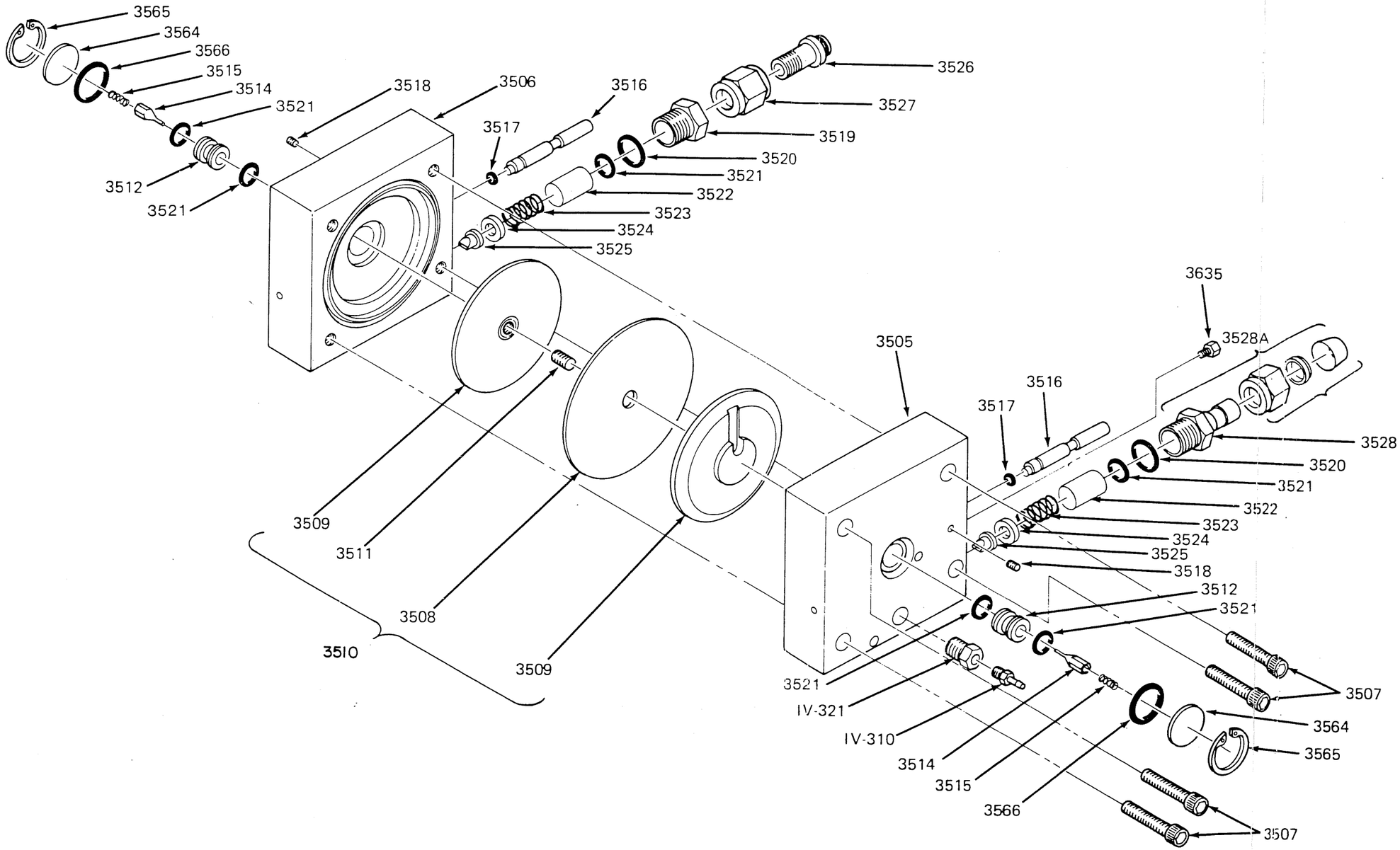
1.0 Pressure Balancing Module (see figures 4 and 5).

1.1 To calibrate Pressure Balancing Module, all accessory parts (i.e. pole mount, wall mount, ventilator, flowmeter) and Proportioning and Alarm Modules must be removed.

REGULATOR NEEDLE SETTING TABLE

DIAPHRAGM THICKNESS	MICROMETER READING	
	3500 LOW FLOW	3500HL HI/LO FLOW
.810	.3975	.3850
.809	.3970	.3845
.808	.3965	.3840
.807	.3960	.3835
.806	.3955	.3830
.805	.3950	.3825
.804	.3945	.3820
.803	.3940	.3815
.802	.3935	.3810
.801	.3930	.3805
.800	.3925	.3800
.799	.3920	.3795
.798	.3915	.3790
.797	.3910	.3785
.796	.3905	.3780
.795	.3900	.3775
.794	.3895	.3770
.793	.3890	.3765
.792	.3885	.3760
.791	.3880	.3755
.790	.3875	.3750

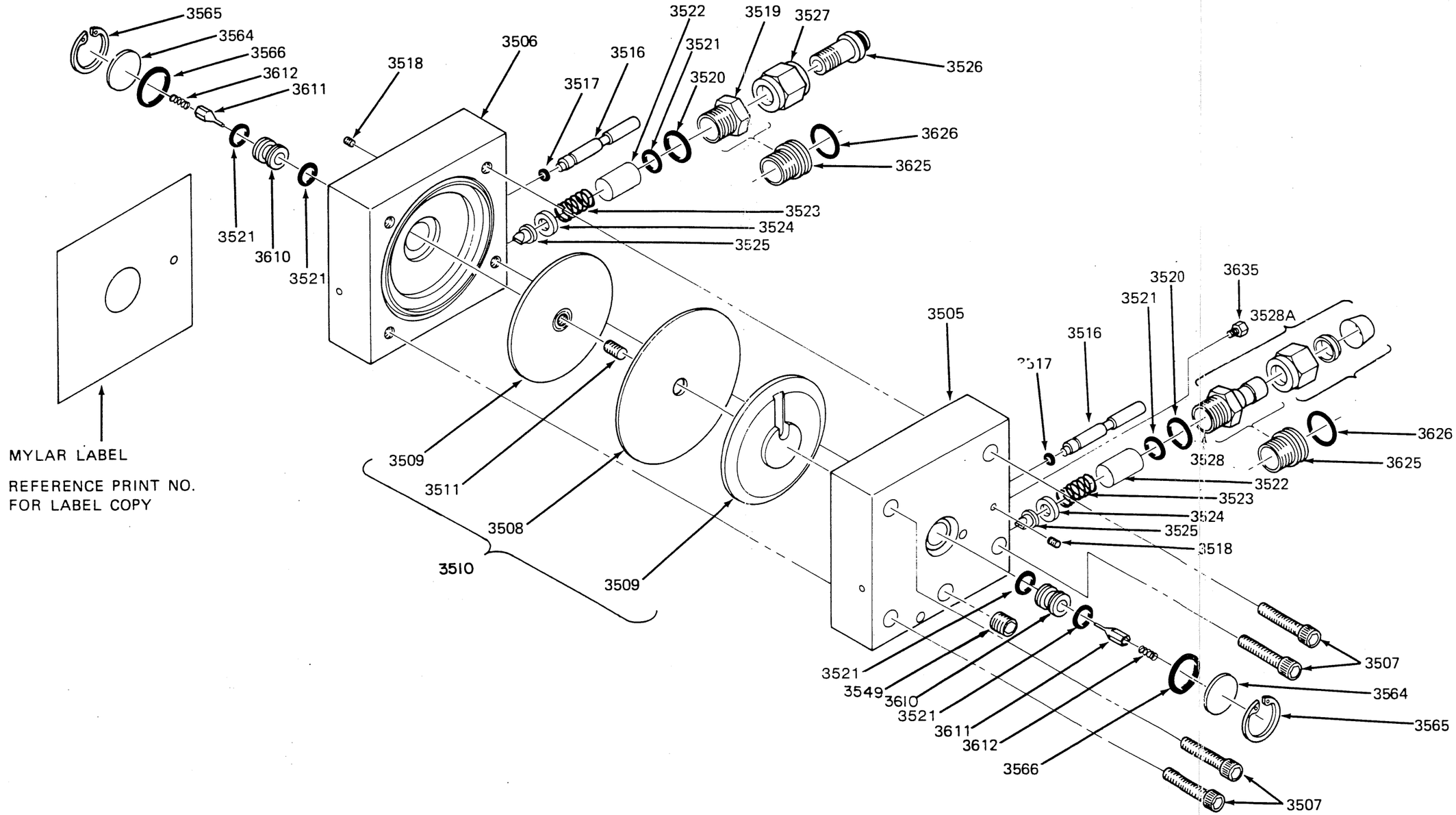
Table 1



PRESSURE BALANCING MODULE

Model 3500 (Low Flow)

FIGURE 4



PRESSURE BALANCING MODULE
Model 3500HL (Hi/Lo Flow)

FIGURE 5

1.2 Using 3/16" allen wrench, remove 4 screws (P/N 3507) from the air block (P/N 3505) and divide the Pressure Balancing Module into 3 sections: air block (P/N 3505), oxygen block (P/N 3506) and diaphragm assembly (P/N 3510).(see figure 6).

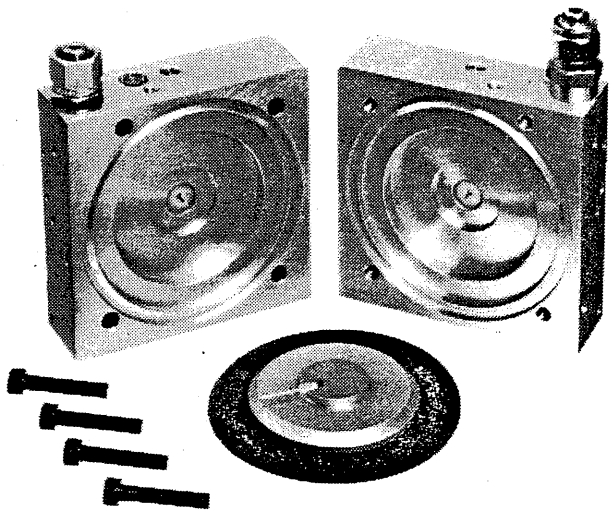


Figure #6. 3 sections of Pressure Balancing Module

NOTE: Air block and oxygen block are identical for calibration purposes.

1.3 Using a precision caliper (see Tool List), measure the thickness of the diaphragm assembly (the distance between the 2 diaphragm support plates) (see figure 7). The distance should be about 0.800 ± 0.010.

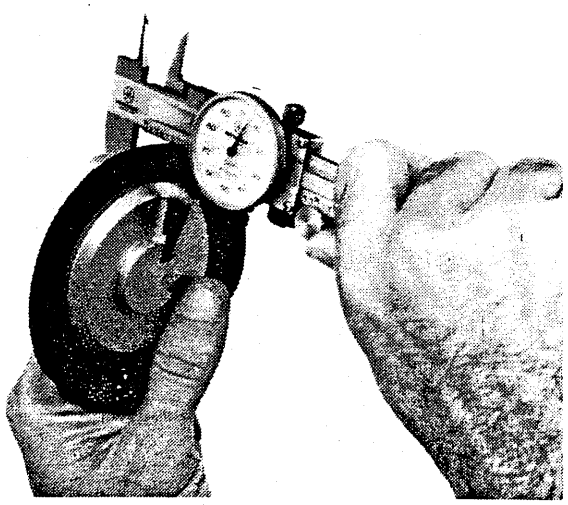


Figure #7. Holding caliper

1.4 Locate the measured diaphragm assembly thickness in the Regulator Needle Setting Table (see Table 1) and read across to find the corresponding depth micrometer setting for the appropriate Mixer model.

1.5 Set the depth micrometer (see Tool List) to the setting indicated in the table; rest the micrometer across the block cavity (see figure 8).

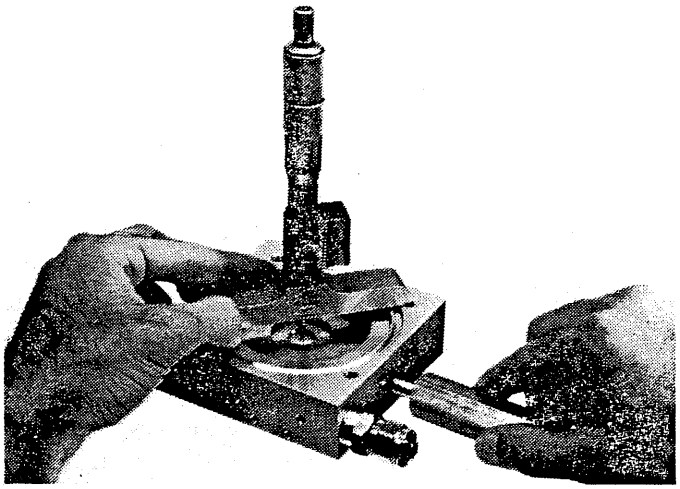


Figure #8. Micrometer across block

1.6 Using either a 1/16" or a 5/64" allen wrench, loosen set screw (P/N 3518). Using Assembly Tool (AT.) 1, insert into the eccentric adjuster (P/N 3516) and begin turning clockwise (see figure 8).

1.7 The regulator seat (P/N 3512 Low Flow, P/N 3610 Hi/Lo Flow) and the regulator needle (P/N 3514 Low Flow, P/N 3611 Hi/Lo Flow) will move up and down.

NOTE: CALIBRATION MUST BE DONE ON THE DOWNSTROKE OF THE REGULATOR SEAT AND NEEDLE.

1.8 As the spanner wrench is being turned (always clockwise), the needle and seat will arrive at top dead center and start back down. As it starts back down, start sliding the depth micrometer back and forth across the needle; do not bend the needle.

1.9 Slowly turning the spanner wrench in very small increments, listen for the tapping noise of the depth micrometer contacting the needle as it slides over it.

1.10 At some point in the downstroke of the needle, the depth micrometer will no longer come in contact with the needle. As soon as the tapping noise ceases, the regulator needle is in the proper position.

1.11 Using either a 1/16" or a 5/64" allen wrench, tighten set screw (P/N 3518) to secure calibration.

1.12 Calibrate both blocks in this manner and reassemble Pressure Balancing Module by replacing diaphragm assembly and securing the 2 block halves with 4 screws (P/N 3507), hand tightening only.

NOTE: Position the 2 halves so that they are flush (make sure that the 2 halves of the module face, where the Proportioning Module mounts, are flush).

1.13 Tighten 4 screws (P/N 3507) in a cross pattern to evenly distribute pressure.

1.14 Pressure Balancing Module is now calibrated.

NOTE: At the end of all calibration procedures, a test of the Pressure Balancing Module must be performed to confirm the calibration.

2.0 Proportioning Module (see figures 9 and 10).

2.1 Using a 9/64" allen wrench, attach Proportioning Module to Pressure Balancing Module with 4 screws (P/N 3550).

NOTE: Be sure O-rings are in place between the Proportioning Module and the Pressure Balancing Module.

2.2 Install faceplate (P/N 3605) with 2 screws (P/N 3559).

2.3 Install Assembly Tool 4 (see Tool List) to occlude high pressure inlet ports to Alarm Module from Pressure Balancing Module.

2.4 Using needle nose pliers, remove bypass nipple (P/N 3547) (see figure 11).

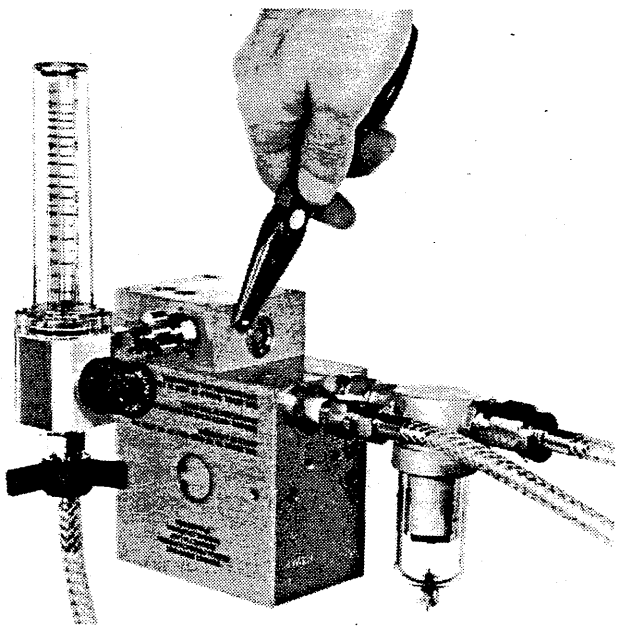


Figure #11. Showing needle nose pliers removing nipple

CAUTION

Grasp nipple at base next to the proportioning valve bock — not on the end or the nipple may be damaged.

2.5 Using 1/4" nut driver, install brass plug (P/N 3635) (see Tool List) into bypass nipple port.

2.6 Install a flowmeter.

NOTE: For Model 3500 (Low Flow), install SECHRIST flowmeter. For Model 3500HL (Hi/Lo Flow), install a flowmeter (0 to 15 LPM) to 50 p.s.i. outlet of Proportioning Module.

2.7 Connect Medical Breathing Air and Medical O_2 supplies to respective inlet adapters.

2.8 Connect proportioning output to calibrated O_2 analyzer (see diagram for Test System Set-up figure 3).

NOTE: O_2 analyzer must be calibrated and the accuracy of the readout scale must be within $\pm 1\%$. All analyzer readings specified throughout the calibration procedures are expressed as true fractional oxygen concentrations.

2.9 Model 3500 (Low Flow): Select a flow of 7 LPM to the O_2 analyzer.
Model 3500HL (Hi/Lo Flow): Select a flow of 15 LPM to the O_2 analyzer.

2.10 Turn adjustment shaft (P/N 3533) by hand until O_2 analyzer reads 30%.

2.11 Attach the Mixer knob (P/N 3538) to the adjustment shaft (P/N 3533). Align the black indicator on knob with .30 position on faceplate. Using hex wrench, tighten set screw just enough to attach knob; do not fully tighten set screw at this time.

2.12 Turn knob to .90 position; check O_2 analyzer reading.

2.13 Using AT. 3, loosen jam nut (P/N 3543). Using AT. 2, adjust rear seat (P/N 3542 Low Flow, P/N 3615 Hi/Lo Flow) until O_2 analyzer agrees with knob reading of .90 $\pm$ 1% (see figure 12).

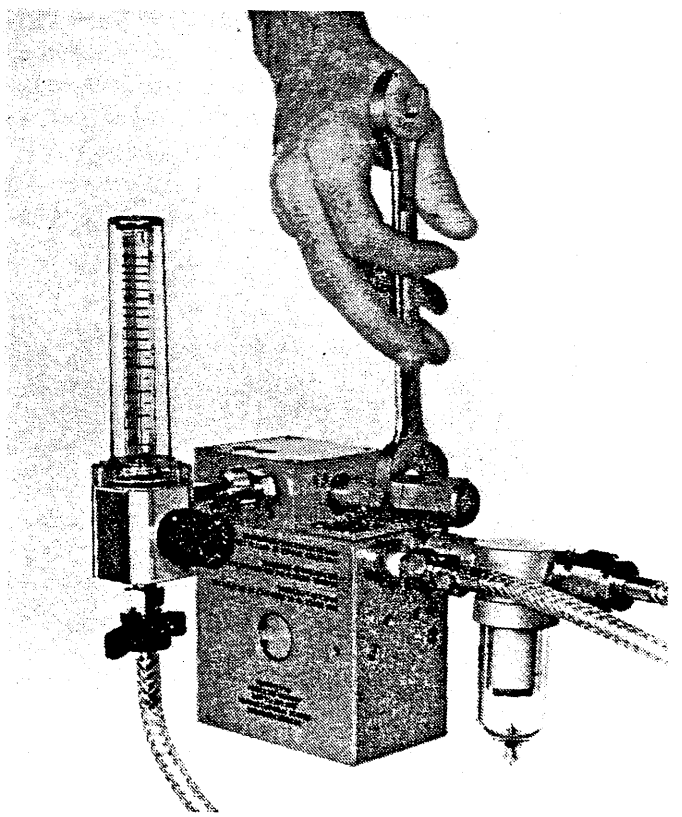
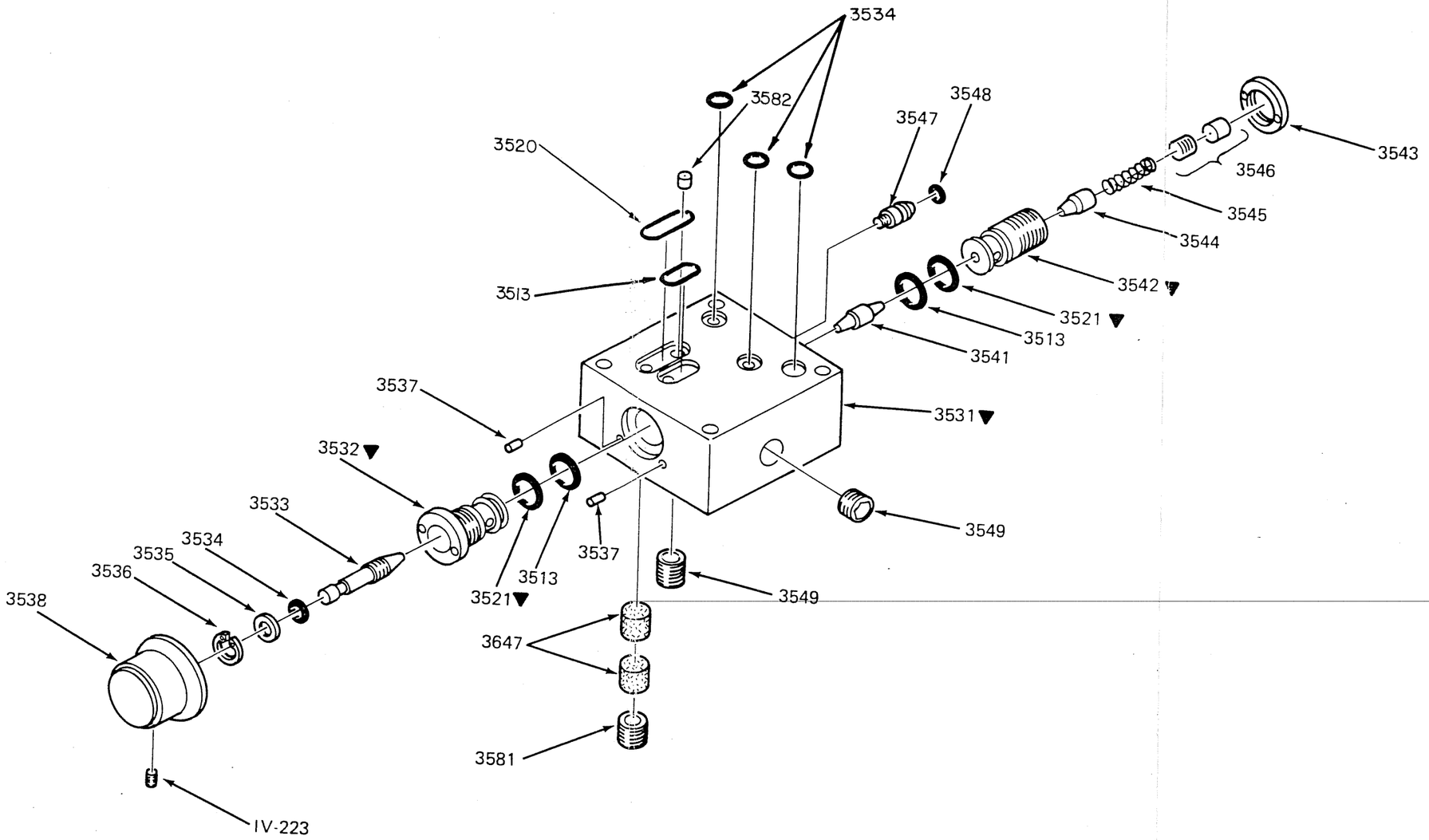


Figure #12. Adjusting rear seat on Proportioning Module

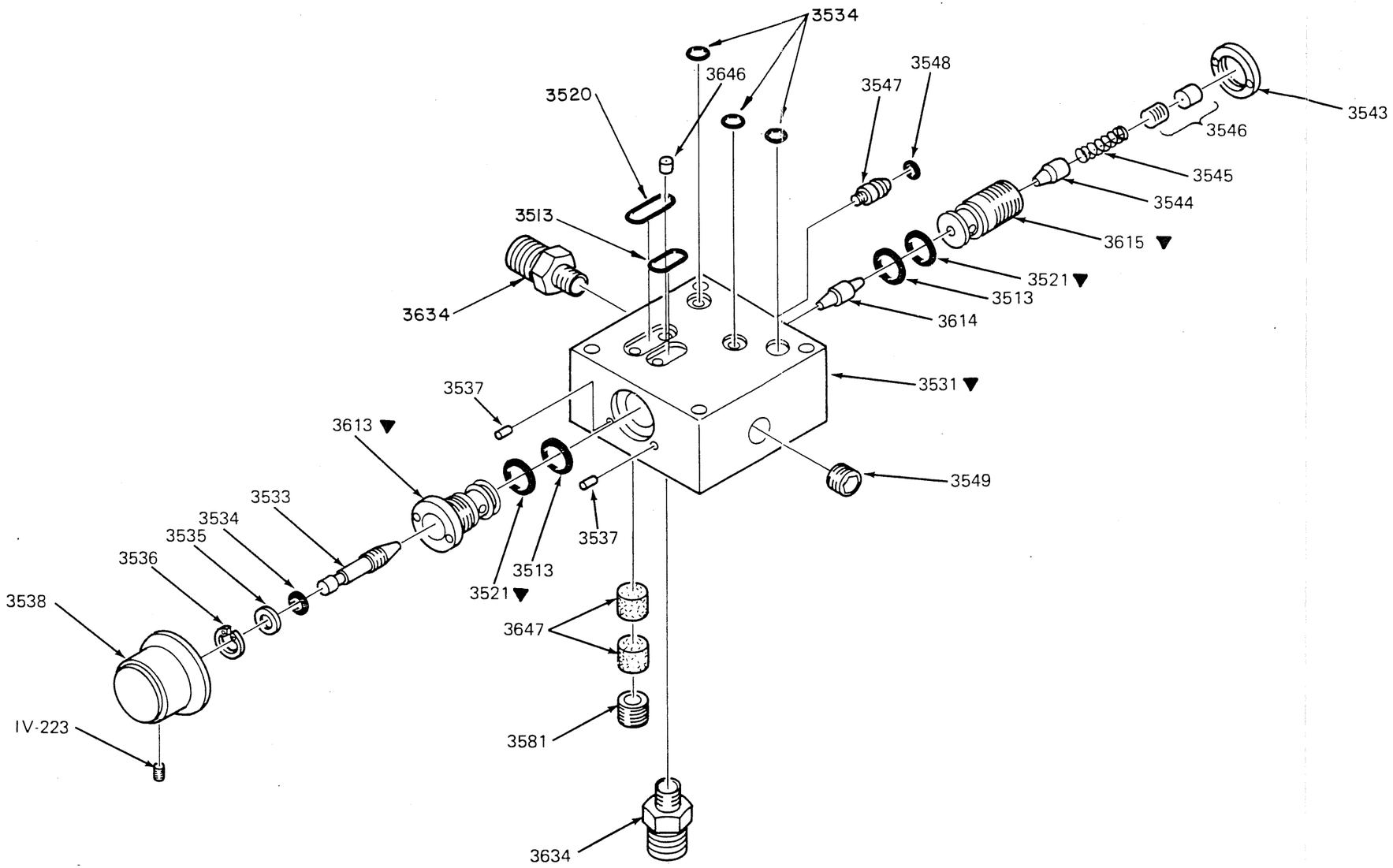
2.14 Turn knob to the .21 position (making sure knob hits the stop pin), then up to .30 position on mixer; O_2 analyzer should read $30 \pm 1\%$. If necessary, rotate the knob until a reading of



▼ IF MIXER S/N IS 1670 OR BELOW THE FOLLOWING PART NUMBERS MUST BE USED :

ABOVE P/N	USE P/N
3521	3513
3531	3531-7
3532	3532-3
3542	3542-4

PROPORTIONING MODULE
Model 3500 (Low Flow)
FIGURE 9



▼ IF MIXER S/N IS 1670 OR BELOW THE FOLLOWING PART NUMBERS MUST BE USED :

ABOVE P/N	USE P/N
3521	3513
3531	3531-7
3613	3613-1
3615	3615-1

PROPORTIONING MODULE

MODEL 3500HL (Hi/Lo Flow)

FIGURE 10

30±1% is obtained on the O_2 analyzer, and reposition the knob to align the knob indicator with the .30 position on the faceplate.

2.15 Turn the knob to the .90 position; adjust the rear seat until the O_2 analyzer reads 90±1%.

2.16 Repeat steps 2.14 and 2.15 until proper readings are recorded.

2.17 Turn knob to 1.0 position; make sure O_2 analyzer reads at least 98% (and no higher than 99.5%) and knob is hitting stop pin.

CAUTION

If resistance is met before stop pin at 1.0 position is reached, do not force the knob. Re-adjust rear seat slightly - just enough to allow free range of movement to stop pin position. Recheck the calibration as described above.

2.18 Using AT. 3, tighten the jam nut (P/N 3543) to secure the calibration of the rear seat.

NOTE: When tightening the jam nut, FIO_2 may drop due to movement of rear seat. This can be compensated for by setting the Mixer knob at .90 position and adjusting the rear seat until the O_2 analyzer reading is slightly above 90% (around 91%). When jam nut is tightened, O_2 analyzer should come down to 90%.

2.19 Verify that the full range of positions can be obtained within a ±3% variation.

2.20 When calibrations are completed, using an allen wrench, tighten knob set screw(s) (P/N IV-223).

2.21 Turn gas supplies "OFF", remove bypass plate (AT. 4), install bypass nipple (P/N 3547).

2.22 Calibration of Proportioning Module is now complete.

3.0 Alarm Module (see figures 13 and 14).

3.1 Slide the Alarm Module onto the bypass nipple (P/N 3547) and secure the Alarm Module to the Pressure Balancing Module with 2 screws) (P/N 3624).

NOTE: Be sure O-rings are in place between modules.

3.2 With Mixer still attached to gas supply lines, calibration of Alarm Module can now be performed.

3.3 Test procedure for acceptable alarm bleed response: turn O_2 valve "ON", regulating to 60 p.s.i., leave air "OFF"; alarm should sound. Turn O_2 down to 30 p.s.i.; alarm should sound. If alarm sounds throughout 30 p.s.i. to 60 p.s.i. range, the alarm bleed is fully functioning.

CAUTION

Alarm bleed set screw (P/N 3568) is calibrated at factory and should not require calibration.

3.4 If alarm is not functioning properly, check reed (P/N 3560) before performing alarm bleed calibration. The reed pedal may be damaged or contaminated.

3.5 If alarm bleed does need calibration, using tru-arc pliers, remove tru-arc ring (P/N 3570); remove reed cap (P/N 3561), with reed (P/N 3560) and reed retaining ring (P/N 3562); do not disassemble reed cap assembly.

3.6 If alarm does not sound at lower range of 30 p.s.i., flow to reed must be increased by adjusting alarm bleed set screw (P/N 3568) clockwise. If alarm does not sound at the upper range of 60 p.s.i., or hesitates when finger is passed over reed cap hole quickly, flow to reed must be decreased by adjusting the alarm bleed set screw counterclockwise. After adjustments, reed cap must be placed in its seat and held by hand to verify alarm function. When full range of alarm has been tested and obtained, install tru-arc ring over reed cap, making sure O-ring (P/N 3569) is in place to seal reed cap assembly.

CAUTION

Do not tape or hold finger over alarm outlet port. Permanent damage to reed can be caused by prolonged occlusion of reed outflow.

3.7 To calibrate the bypass alarm O_2 calibration adjuster (P/N 3622), turn O_2 and air to "ON", regulating to 50 p.s.i.

NOTE: THE O_2 CALIBRATION ADJUSTMENT IS LOCATED UNDER THE AIR INLET; THE AIR CALIBRATION ADJUSTMENT IS LOCATED UNDER THE O_2 INLET.

3.8 Alarm should be silent.

3.9 Using gas supply regulators, set air supply to 50 p.s.i. and slowly reduce the O_2 supply. The alarm should sound between 24 p.s.i. and 28 p.s.i.

3.10 If no alarm sounds, loosen the jam nut (P/N 3623), turn the O_2 adjuster (located under air inlet) (P/N 3622) counterclockwise slowly until alarm sounds.

3.11 If alarm is sounding when gas supply is turned on, turn the O_2 adjuster (under air inlet) clockwise until alarm stops; then turn counterclockwise just until alarm sounds.

3.12 Reduce O_2 pressure to 0 and relieve pressure within hose from Mixer to regulator.

3.13 After venting, no pressure should build in gauge on O_2 regulator.

NOTE: If pressure starts to build on the O_2 gauge, the duck bill valve (P/N 3525) in the O_2 inlet is leaking and causing a back flow of air into O_2 inlet; clean or replace as needed (see disassembly of gas inlet valves in Routine Maintenance Section - see figure 21).

3.14 Open O_2 pressure to 50 p.s.i.; alarm should stop sounding at or before 40 p.s.i.

NOTE: If the alarm continues to sound above 40 p.s.i., rotate the O_2 calibration adjuster until the alarm stops sounding. Repeat the calibration procedure from step 3.7 until alarm sounds when O_2 pressure is between 24 and 28 p.s.i. and stops sounding before 40 p.s.i., when O_2 pressure is increased.

3.15 Tighten jam nut over O_2 calibration adjuster to secure calibration.

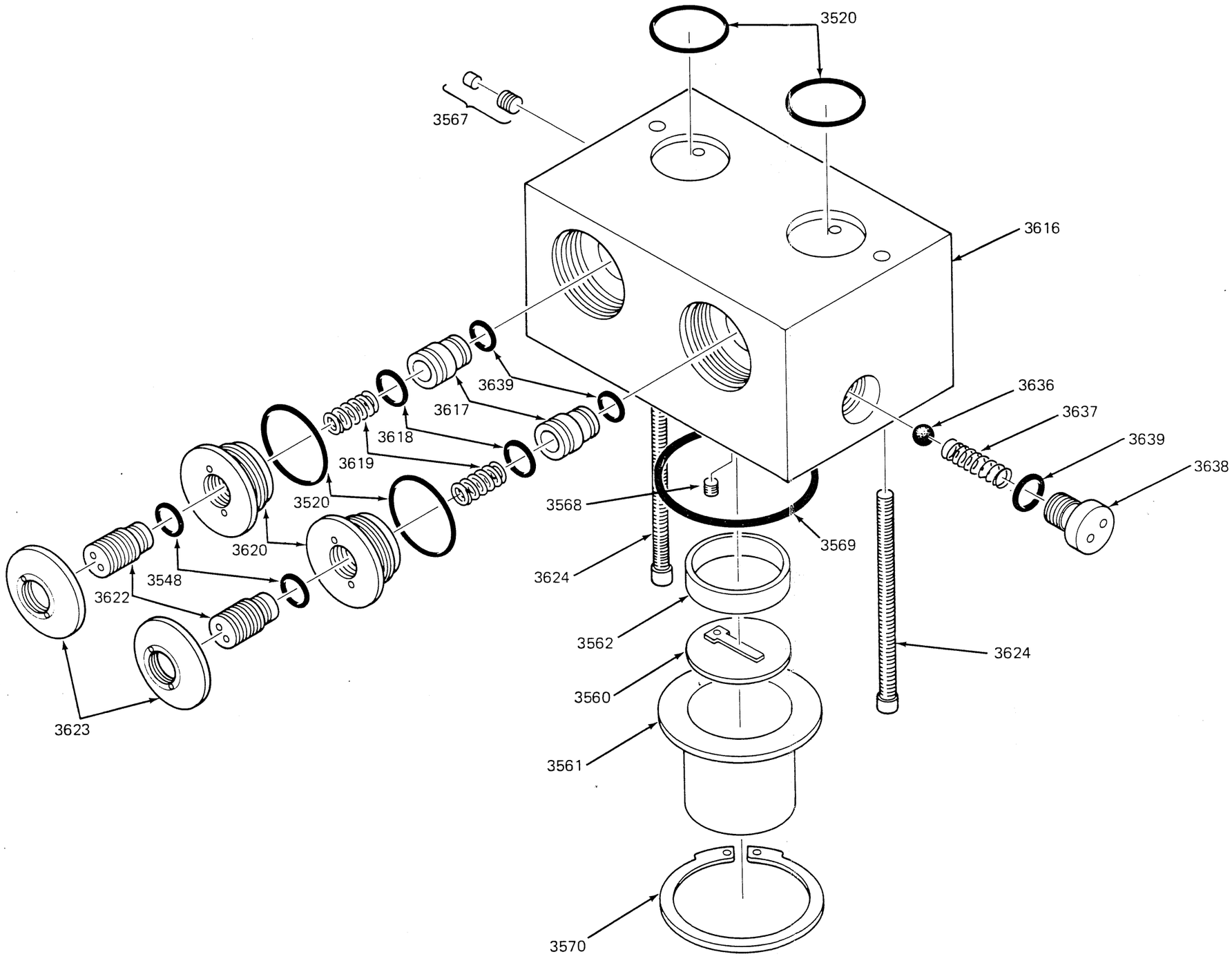
3.16 To calibrate the bypass alarm air calibration adjuster, complete steps 3.5 through 3.7, replacing air for O_2 in instructions, remembering that the air adjuster is located under O_2 inlet.

4.0 Testing for Mixer function.

4.1 After all calibration procedures are completed, perform the Pressure Balancing Module test procedure (see Test Procedure Section for Pressure Balancing Module).

4.2 The SECHRIST Mixer is now calibrated and ready for use.

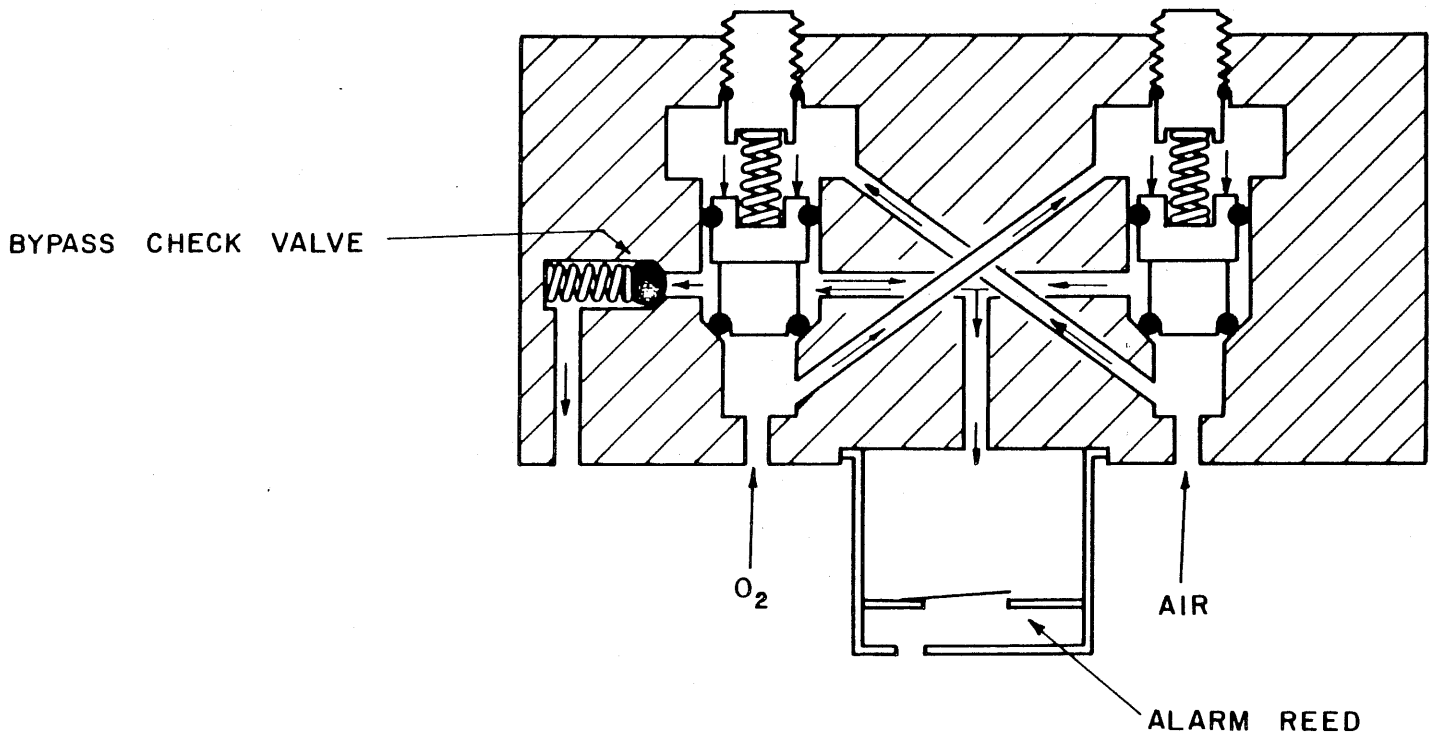
4.3 To reassemble to ventilator, pole mount or wall mount, see Disassembly and Reassembly Section.



ALARM MODULE

Model 3500, 3500HL

FIGURE 13



ALARM MODULE
(Gas Flow Schematic)
Model 3500, 3500HL

FIGURE 14

DISASSEMBLY AND REASSEMBLY

NOTICE:

MODEL 3500 Mixers with serial numbers lower than 1671 use the following part numbers in the Proportioning Module:

Proportioning valve block	— P/N 3531-7
Front seat	— P/N 3532-3
Rear seat	— P/N 3542-4
Front and rear seat O-ring(s) (4)	— P/N 3513

NOTICE:

MODEL 3500HL Mixers with serial numbers lower than 1671 use the following part numbers in the Proportioning Module:

Proportioning valve block	— P/N 3531-7
Front seat	— P/N 3613-1
Rear seat	— P/N 3615-1
Front and rear seat O-ring(s) (4)	— P/N 3513

General Disassembly Procedures

Before servicing, be sure all exterior connections (i.e. electrical plug, gas lines) are disconnected.

1.0 Removal of Mixer from ventilator (Low Flow Mixer) (see figures 15, 16 and 17).

1.1 Using 3/32" allen wrench, remove ventilator backplate by removing 1 hex screw from each corner of the backplate.

1.2 Disconnect ribbon cable from top of processor board.

1.3 Using a 7/16" open end wrench, remove 2 bolts (which secure Mixer to ventilator) located on right side of ventilator case (keep spacers which are located between ventilator and Mixer for reassembly).

1.4 Disconnect 1/16" I.D. tube from ventilator regulator.

2.0 Removal of nipple, tube and flowmeter (Low Flow Mixer).

2.1 Using 1/4" wrench, unscrew the barbed fitting and tube.

2.2 Using 9/64" allen wrench, remove 2 screws (P/N 3579) from flowmeter block. Pull flowmeter away from Mixer.

2.3 Save O-ring (P/N 3578) located between flowmeter block and Mixer for reassembly.

3.0 Removal of pole mount or wall mount bracket assemblies (Hi/Lo Flow Mixer).

3.1 Pole mount: using 3/16" allen wrench, remove 2 screws (P/N 3607) to disconnect pole mount from Mixer.

3.2 Wall mount: using blade screwdriver, remove 4 screws (P/N 3629) from male suction mount (P/N 3628) (see figure 18).

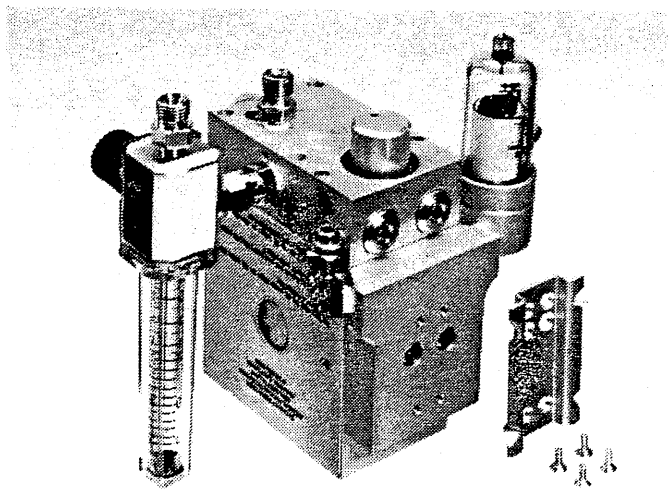


Figure #18. Wall mount coming away from Mixer

3.3 Using 3/16" allen wrench, remove 2 screws (P/N 3630).

3.4 Slide male suction mount back and off of O-rings.

4.0 Disassembly into 3 major modules: Proportioning Module, Pressure Balancing Module and Alarm Module.

4.1 To remove Alarm Module (P/N 3604), using 7/64" allen wrench, remove 2 screws (P/N 3624) (see figure 19).

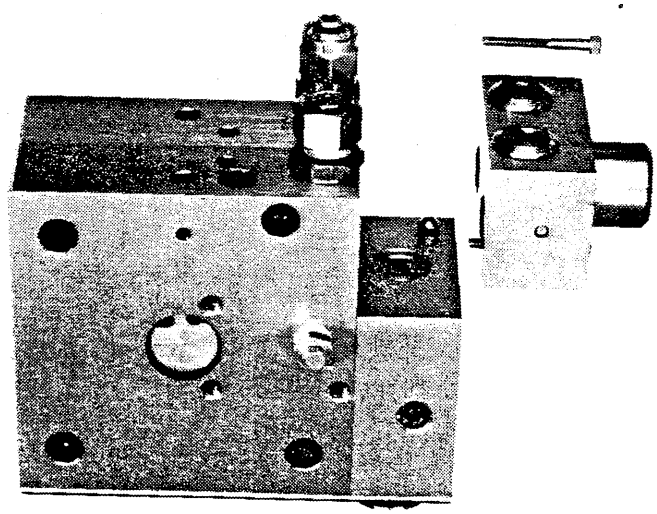


Figure #19. Alarm Module being taken off Mixer

4.2 Slide Alarm Module straight back to clear bypass nipple (P/N 3547) and lift off of the Mixer.

4.3 Remove 2 screws (P/N 3559) from faceplate and remove faceplate from Mixer (see figure 20).

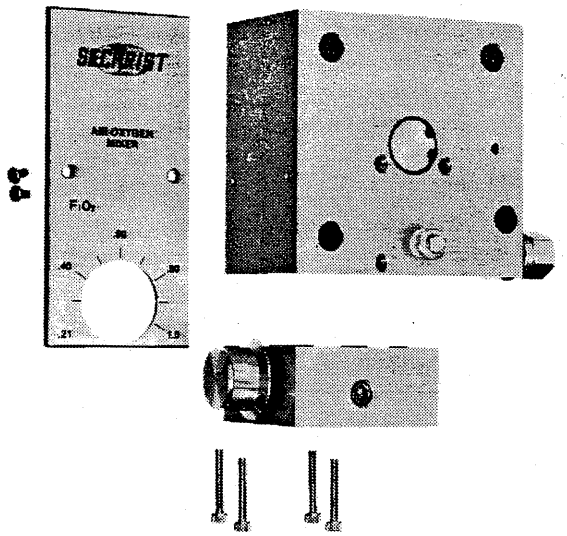


Figure #20. Faceplate and Proportioning Module removal

4.4 Using 9/64" allen wrench, remove 4 screws (P/N 3550) from the Proportioning Module (P/N 3502) and separate the Proportioning Module from the Pressure Balancing Module, making sure not to displace O-rings (see figure 20).

Proportioning Module (see figures 9 and 10).

1.0 Disassembly.

1.1 Using either 1/16" or 5/64" allen wrench, release knob (P/N 3538) by removing set screw(s) (P/N IV-223); pull off knob.

1.2 Use AT. 2 to insert into front seat (P/N 3532 Low Flow, P/N 3613 Hi/Lo Flow). Use 1/2" open end wrench to turn spanner wrench and remove front seat.

1.3 With front seat removed, double tapered needle (P/N 3541 Low Flow, P/N 3614 Hi/Lo Flow) will fall out.

1.4 Turn module over to rear seat (P/N 3542 Low Flow, P/N 3615 Hi/Lo Flow).

1.5 Insert AT. 3 into rear seat locking nut (P/N 3543). Loosen using 3/4" open end wrench.

1.6 With locking nut loosened, insert AT. 2 into rear seat. Unscrew and remove rear seat.

1.7 Front seat, rear seat and proportioning block can now be serviced.

2.0 Reassembly of Proportioning Module.

2.1 Before reassembling Proportioning Module: inspect all O-rings, replace each O-ring that is cut, flat or worn and apply a light coating of Krytox to the front and rear seat O-rings.

2.2 Using AT. 2, install front seat (P/N 3532 Low Flow, P/N 3613 Hi/Lo Flow) into front seat port (the front of the proportioning block is identified by the presence of two stop pins), making sure not to tear O-ring (Do not install knob at this time).

2.3 Turn adjustment shaft (P/N 3533) counter-clockwise until resistance is felt.

2.4 Place Proportioning Module front seat down.

NOTE: Module must be level, which may be accomplished by either placing module into a vise or positioning on two level blocks.

2.5 Drop double tapered needle (P/N 3541 Low Flow, P/N 3614 Hi/Lo Flow) into rear seat port and make sure needle is standing up straight in the center of the valve bore.

> **CAUTION**
>
> DAMAGE MAY OCCUR TO BOTH FRONT SEAT AND REAR SEAT, WHEN REAR SEAT IS BEING INSTALLED, IF NEEDLE IS NOT STRAIGHT UP AND CENTERED.

2.6 Install rear seat (P/N 3542 Low Flow, P/N 3615 Hi/Low Flow) into rear seat port, working it carefully so that needle stays centered. Using AT. 2 (hand tighten only), screw the rear seat down (about 6 turns) past the first resistance until contact is made with the needle. In this position, back off 1/2 turn.

2.7 Calibrate the Proportioning Module (See Calibration Section for Proportioning Module).

Pressure Balancing Module (see figures 4 and 5)

1.0 Disassembly of Pressure Balancing Module.

1.1 For disassembly of Pressure Balancing Module, Proportioning Module, Alarm Module and faceplate must be removed.

1.2 Using 3/16" allen wrench, remove 4 screws (P/N 3507) from the air block (P/N 3505).

1.3 Module comes apart into 3 sections: air block, oxygen block and diaphragm assembly.

NOTE: Disassembly, reassembly and calibration of the air block and oxygen block are identical.

1.4 Using tru-arc pliers, remove tru-arc ring (P/N 3565).

1.5 Cover disc (P/N 3564) will pop up, and spring (P/N 3515 Low Flow, P/N 3612 Hi/Lo Flow) and regulator needle (P/N 3514 Low Flow, P/N 3611 Hi/Lo Flow) can be removed.

1.6 Using 5/64" allen wrench, loosen set screw (P/N 3518) from side of block.

NOTE: It is not necessary to completely remove the screw from the block.

1.7 Using AT. 1, remove eccentric adjuster (P/N 3516).

1.8 Regulator seat (P/N 3512 Low Flow, P/N 3610 Hi/Lo Flow) can now be removed from either end.

1.9 Seats and seat bore can now be serviced.

NOTE: Air and oxygen inlet adapters, which are connected to the Pressure Balancing Module, are diagrammed and discussed in the Routine Maintenance Section.

2.0 Reassembly of Pressure Balancing Module.

2.1 Before reassembling the Pressure Balancing Module: inspect all O-rings, replace each O-ring that is cut, flat or worn and apply a light coating of Krytox to O-rings of regulator seat (P/N 3512 Low Flow, P/N 3610 Hi/Lo Flow).

2.2 Place regulator seat (P/N 3512 Low Flow, P/N 3610 Hi/Lo Flow) in regulator seat port, centering it in the block bore, with small opening of regulator seat towards the inside of the block.

2.3 Install eccentric adjuster (P/N 3516), making sure it is flush with block. If eccentric adjuster is not flush, rotate with AT. 1 until it drops into place and is flush.

NOTE: Do not tighten set screw at this time.

2.4 Install regulator needle (P/N 3514 Low Flow, P/N 3611 Hi/Lo Flow), spring (P/N 3515 Low Flow, P/N 3612 Hi/Lo Flow), cover disc (P/N 3564) and tru-arc ring (P/N 3565). Make sure O-ring (P/N 3566) is in position in machine groove.

2.5 Calibrate regulator needle in air block and oxygen block (See Calibration Section for Pressure Balancing Module).

2.6 Center diaphragm assembly (P/N 3510) into center of oxygen block (P/N 3506), with oxygen block flat.

2.7 Install calibrated air block over diaphragm assembly.

2.8 Install 4 screws (P/N 3507) to module (hand tighten).

2.9 Using soft mallet, position the 2 blocks so that they are flush (make sure that the 2 halves of the module, where the Proportioning Module mounts, are flush).

2.10 Tighten 4 screws (P/N 3507) in a cross pattern to evenly distribute pressure.

Alarm Module (see figure 13)

1.0 Disassembly of Alarm Module.

1.1 Using tru-arc pliers, remove tru-arc ring (P/N 3570).

1.2 Remove reed cap (P/N 3561) with reed (P/N 3560) and reed retaining ring (P/N 3562); do not disassemble reed cap.

1.3 Using AT. 2, loosen outside jam nut (P/N 3623). And using AT. 1, remove adjusters (P/N 3622).

NOTE: The two adjusters are identical.

1.4 Using AT. 2, remove adjustment cap cover (P/N 3620).

1.5 Remove spring (P/N 3619).

1.6 Carefully remove poppet (P/N 3617).

NOTE: Carefully wedge poppet out of bore using small allen wrench.

1.7 Poppet and block may now be serviced.

1.8 Using AT. 1, remove check valve retainer (P/N 3638).

1.9 Remove spring (P/N 3637) from check valve retainer bore (will freely release).

1.10 Remove ball (P/N 3636) from check valve retainer bore by forcing high pressure air through one of the poppet bores.

CAUTION

DO NOT ATTEMPT TO DIG BALL OUT OF HOLE; DAMAGE WILL OCCUR.

2.0 Reassembly of Alarm Module.

2.1 Before reassembling the Alarm Module: inspect all O-rings, replace each O-ring that is cut, flat or worn and apply a light coating of Krytox to all O-rings.

2.2 Install ball (P/N 3636) in check valve retainer bore.

2.3 Drop spring (P/N 3637) in check valve retainer bore.

2.4 Using AT. 1, install check valve retainer (P/N 3638).

2.5 Insert poppets (P/N 3617), small end first, into the poppet bores.

2.6 Install spring (P/N 3619) into center of poppet.

2.7 Using AT. 2, replace adjustment cap cover (P/N 3620).

2.8 Using AT. 1, install adjuster (P/N 3622), turning until resistance is felt (about 3 turns). From this position, back off 1/2 turn.

2.9 Using AT. 2, tighten jam nut (P/N 3623) over adjuster (P/N 3622) (hand tighten only).

2.10 Calibrate module at this time (See Calibration Section for Alarm Module).

General Reassembly Procedures

1.0 Reassembly of Mixer.

1.1 With all modules serviced and calibrated, reassembly can be completed in the reverse order of the disassembly procedure.

2.0 Reassembly of tube, nipple and flowmeter to Mixer. (Low Flow Mixer).

2.1 Connection of the tube, nipple and flowmeter to Mixer can now be completed in the reverse order of the disassembly procedure.

3.0 Reassembly of Mixer to ventilator (Low Flow Mixer).

3.1 Mixer can be connected to ventilator in the reverse order of the disassembly procedure.

4.0 Reassembly of pole mount and wall mount (Hi/Lo Flow Mixer).

4.1 Pole mount and wall mount can be connected in the reverse order of the disassembly procedure.

ROUTINE MAINTENANCE

Routine maintenance of the Mixer is limited to periodic checking and changing of the inlet filters and general cleaning. Please see Test Procedure and Troubleshooting Guide Section to determine replacement need.

1.0 Inlet filters.

1.1 Periodically replace air water trap/inlet filter as needed (see figure 21).

1.2 Replace the internal sintered stainless steel filters as needed (see figure 21).

NOTE: It is recommended that the internal filters be removed one at a time to be sure that the inlet assemblies are not interchanged.

1.3 Routine maintenance procedures for 3500HL Pole Mount and 3500 Low Flow Mixer are identical.

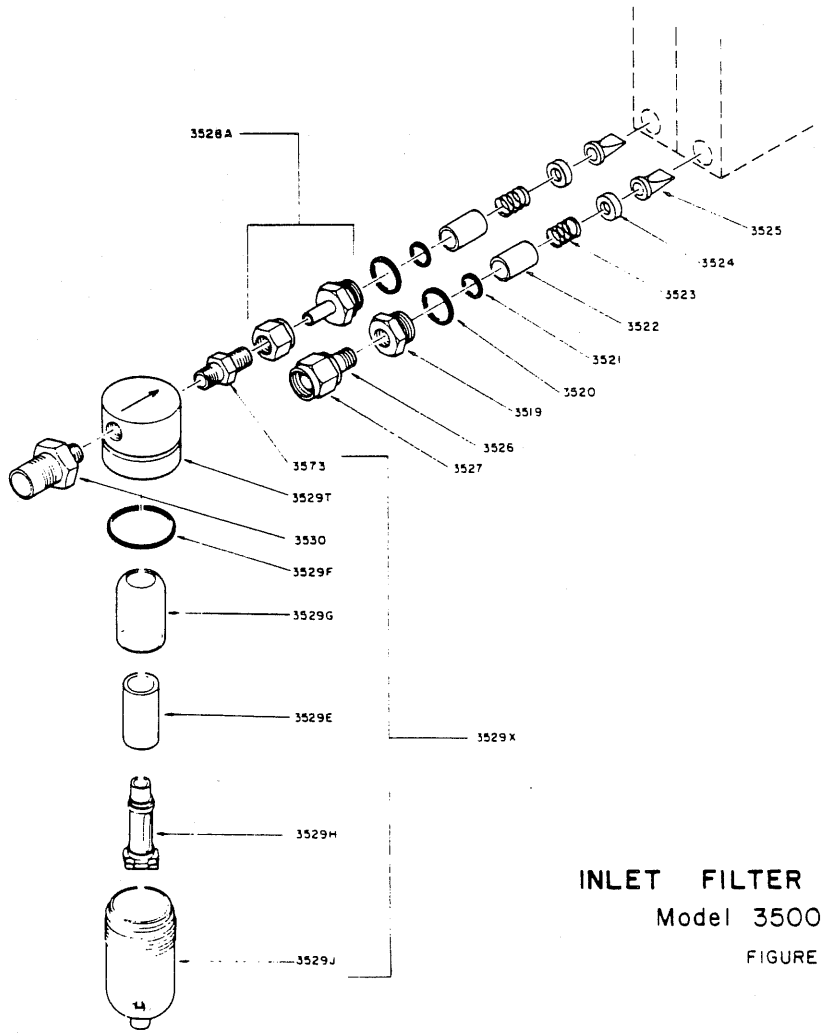
1.4 To service filters on 3500HL Wall Mount, wall mount adapter must be removed (see Disassembly/Reassembly Section).

2.0 Cleaning.

2.1 Exterior surfaces of the Mixer can be cleaned with a mild soap solution or wiped with a liquid disinfectant solution. Do not use cleaning agents that contain abrasives.

CAUTION

DO NOT IMMERSE THE MIXER. DO NOT GAS OR STEAM STERILIZE; DAMAGE MAY RESULT.

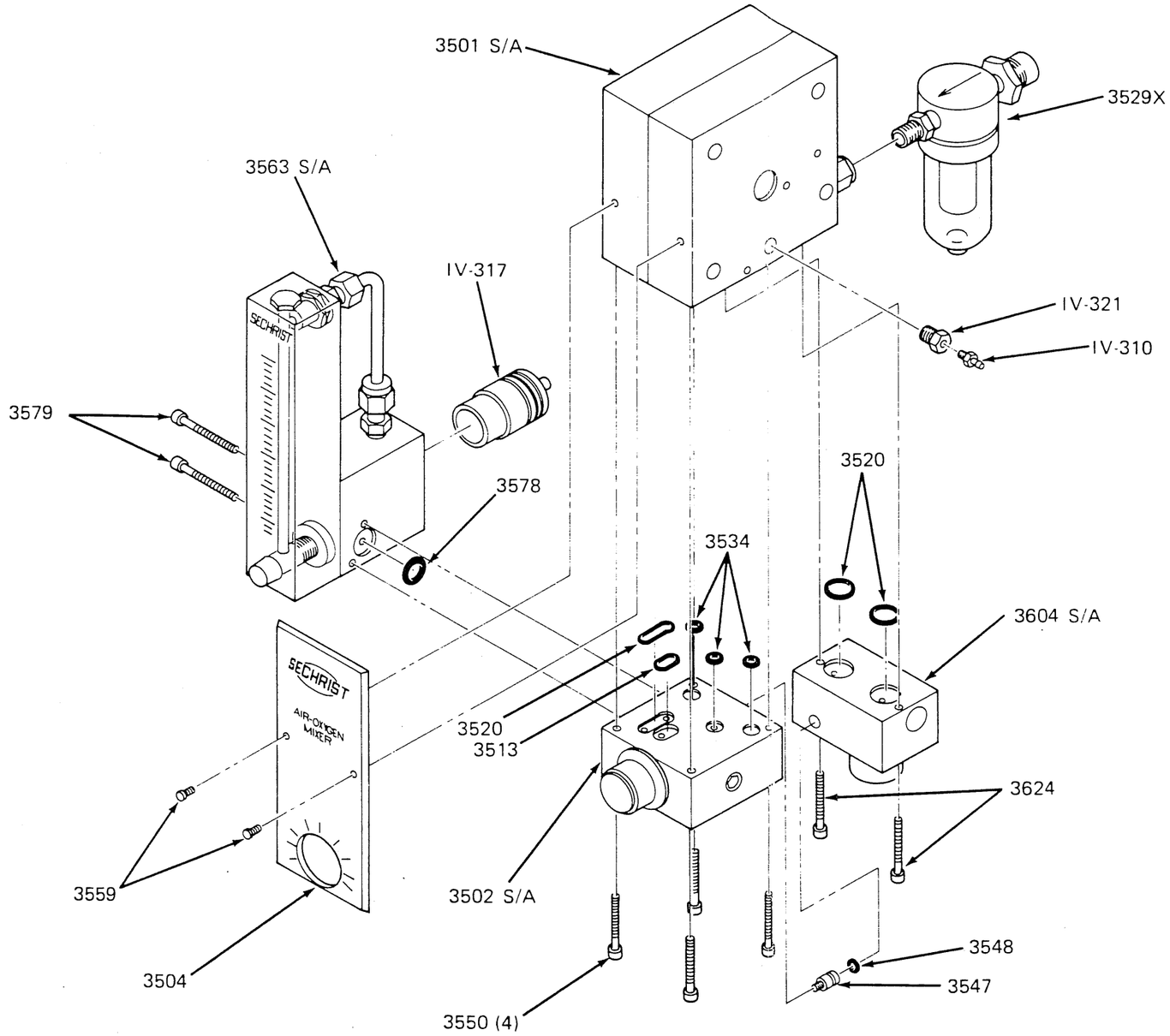


INLET FILTER REPLACEMENT
Model 3500, 3500HL
FIGURE 21

APPENDIX 1

Mixer Overhaul Kit (P/N 3658)

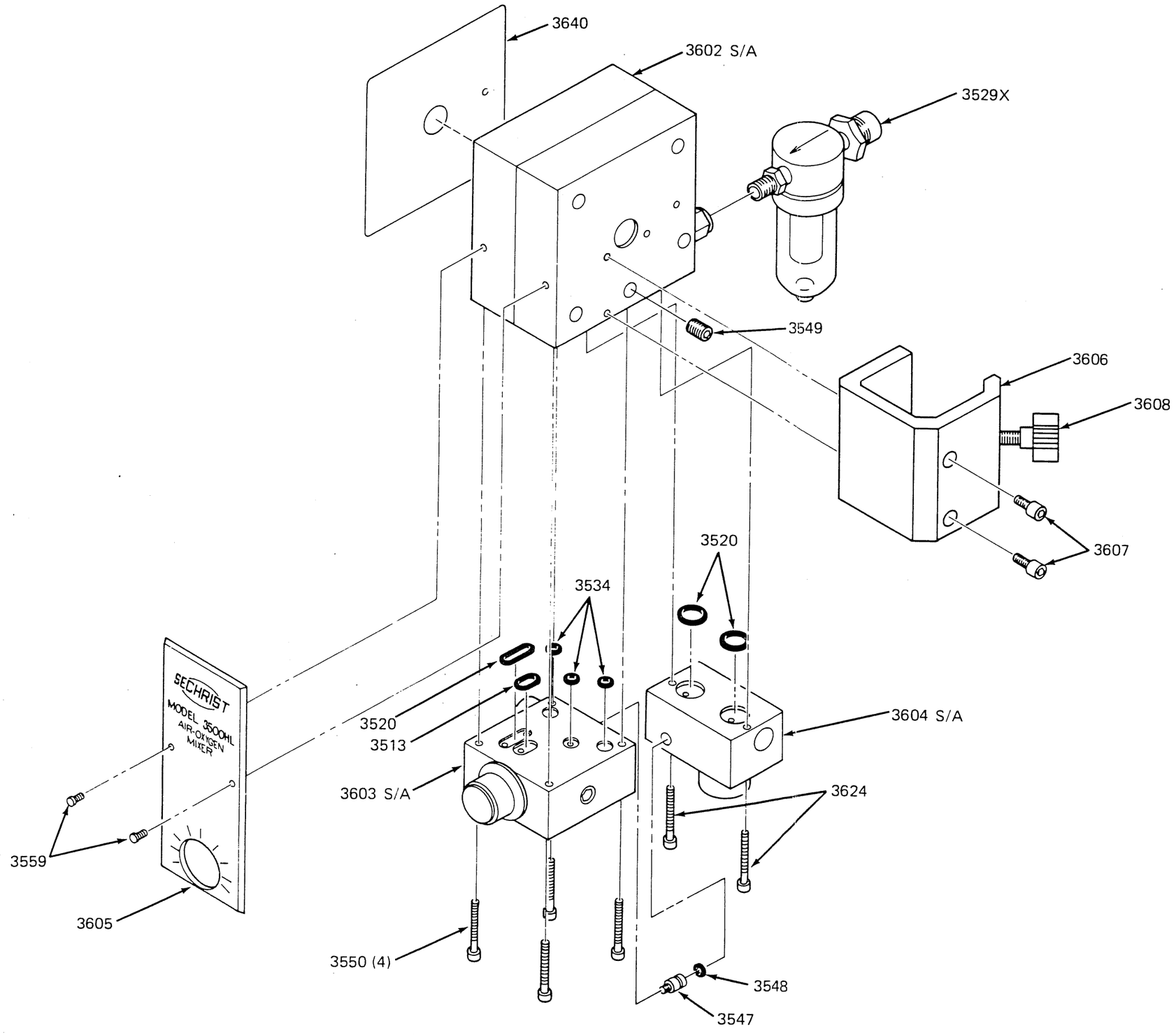
PART NAME	PART NUMBER	QUANTITY
PROPORTIONING MODULE:		
O-ring	3548	1
O-ring	3513	5
O-ring	3521	2
O-ring	3534	4
O-ring	3520	1
Washer	3535	1
Adjustment Shaft	3533	1
PRESSURE BALANCING MODULE:		
O-ring	3521	4
O-ring	3517	2
O-ring	3566	2
O-ring (wall mount)	3626	2
O-ring (inlet)	3520	2
Spring (Low Flow)	3515	2
Spring (Hi/Low Flow)	3612	2
Diaphragm Assembly	3510	1
Check Valves	3525	2
ALARM MODULE:		
O-ring	3639	3
O-ring	3548	2
O-ring	3618	2
O-ring (reed)	3569	1
O-ring	3520	4
Alarm Reed	3560	1
Spring	3619	2
Spring	3637	1
Check Ball	3636	1
FILTRATION SYSTEM:		
Water Trap Filter	3529E	1
Air and O_2 Inlet Filter	3522K	2
FLOWMETER BLOCK:		
O-ring	3578	1



EXPLODED VIEW

Model 3500 (Low Flow)

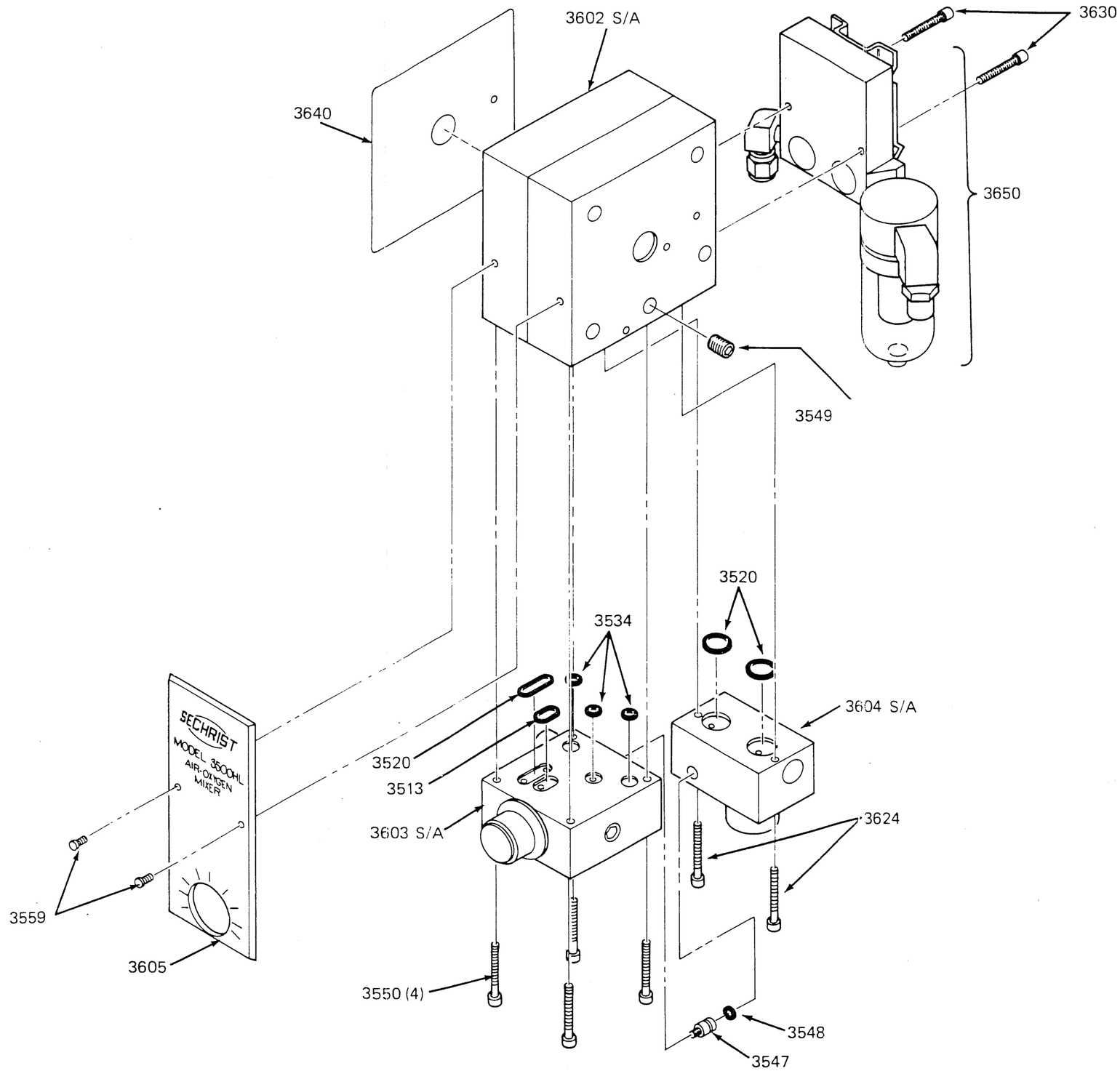
FIGURE 15



EXPLODED VIEW – POLE MOUNT

Model 3500HL (Hi/Lo Flow)

FIGURE 16



EXPLODED VIEW — WALL MOUNT

Model 3500HL (Hi/Lo Flow)

FIGURE 17