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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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 accompanying 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.

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.

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 possibility 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.
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.
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P/N 100000

4
TOOLS AND ACCESSORIES REQUIRED FOR CALIBRATION AND DISASSEMBLY/REASSEMBLY

Special SECHRIST tools and accessories are required to calibrate, 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

Figure #2. Caliper and micrometer

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
Precision Caliper (see figure 2)
Precision Depth Micrometer (see figure 2)
Lubricant for O-rings: Krytox 240 AC (DuPont)

EQUIPMENT REQUIRED FOR TEST SYSTEM:
O₂ high pressure hose
Air high pressure hose
Oxygen regulator (2 stage adjustable)
Air regulator (2 stage adjustable)
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 I 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 O₂ analyzer probe into sampling reservoir.

NOTE: O₂ analyzer must be calibrated and accurate to ±1%.
Test System SECHRIST Air-Oxygen Mixer

Model 3500, 3500HL

Oxygen Supply

Air Supply

adjustable regulator
0-60 p.s.i.g.

Gauge

adjustable regulator
0-60 p.s.i.g.

Gauge

Flowmeter

Reservoir

O₂ Analyzer

FIGURE 3
1.5 The sampling rate should be:
   7 LPM for Low Flow
   15 LPM for Hi/Low Flow.

2.0 Proportioning Module.
2.1 Set O₂ pressure and air pressure to 50 p.s.i.
2.2 Compare O₂ 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 FIO₂ varies more than ±4% between the
   Mixer and O₂ 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 FIO₂s at very low flows.
   These bleed rates are predetermined by the
   factory and cannot be reset in the field.

3.0 Pressure Balancing Module.
3.1 With same test system set up as above, select an
   FIO₂ of .60 and observe the O₂ analyzer
   reading.
3.2 Vary the inlet pressures to the Mixer to 40 p.s.i.
   O₂ and 60 p.s.i. air and then to 60 p.s.i. O₂ and
   40 p.s.i. air. If FIO₂ varies more than ±1% from
   initial O₂ analyzer reading, calibration or
   service may be necessary (see Troubleshooting
   Guide).

4.0 Alarm Module.
4.1 Set air and O₂ 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 O₂ 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 O₂ inlet supply;
   when alarm sounds, O₂ 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

FIO₂ RANGE: .21 + .01 to 1.0 - .01
ACCURACY*: ±3%

MAXIMUM FLOW:
Model 3500 (Low Flow): 40 LPM @ .60 FIO₂ setting with 50 p.s.i. (@ 1.5 SCFM minimum flow) inlet pressures
Model 3500HL (Hi/Lo Flow): 100 LPM @ .60 FIO₂ setting with 50 p.s.i. (@ 1.5 SCFM minimum flow) inlet pressures

NOMINAL SUPPLY PRESSURES**
Model 3500 (Low Flow): 50 p.s.i. ±10 p.s.i. (@ 1.5 SCFM minimum flow).
Model 3500HL (Hi/Lo Flow): 100 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 FIO₂ 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.
<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>POSSIBLE CAUSE</th>
<th>CORRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROPORTIONING MODULE</td>
<td>O₂ analyzer out of calibration (most common problem)</td>
<td>recalibrate O₂ analyzer</td>
</tr>
<tr>
<td>FIO₂ not accurate</td>
<td>Improper purity of supply gases</td>
<td>Check quality of supply gases</td>
</tr>
<tr>
<td></td>
<td>Wrong gas supplied to inlet</td>
<td>Assure outlets and hoses are correct</td>
</tr>
<tr>
<td></td>
<td>Front or rear seats worn</td>
<td>Clean or replace seats</td>
</tr>
<tr>
<td></td>
<td>Calibration of proportioning valve incorrect</td>
<td>See Calibration Section</td>
</tr>
<tr>
<td></td>
<td>Pressure Balancing Module malfunctioning</td>
<td>See Calibration for Pressure Balancing Module</td>
</tr>
<tr>
<td>Knob is hard to turn</td>
<td>Faceplate has shifted causing knob to rub</td>
<td>Reposition faceplate</td>
</tr>
<tr>
<td></td>
<td>Knob has been bumped bending adjustment shaft</td>
<td>Replace adjustment shaft and recalibrate</td>
</tr>
<tr>
<td>PRESSURE BALANCING MODULE</td>
<td>Air or O₂ inlet filter dirty causing &gt;20 p.s.i. difference</td>
<td>Replace filter</td>
</tr>
<tr>
<td>FIO₂ Change &gt; 1% when testing</td>
<td>Regulator needle(s) out of calibration</td>
<td>Calibrate</td>
</tr>
<tr>
<td></td>
<td>O-ring(s) on regulator seat damaged causing leak</td>
<td>Replace O-rings and recalibrate</td>
</tr>
<tr>
<td></td>
<td>Contamination from supply gases</td>
<td>Clean and recalibrate</td>
</tr>
<tr>
<td>ALARM MODULE</td>
<td>Dirty inlet filter(s)</td>
<td>Replace filter(s)</td>
</tr>
<tr>
<td>Continuous alarm with both inlet pressures equal</td>
<td>Bypass check ball leaking</td>
<td>Need to clean check ball and seat (see Disassembly of Alarm Module)</td>
</tr>
<tr>
<td></td>
<td>Alarm Module adjustments out of calibration</td>
<td>See Calibration Section</td>
</tr>
<tr>
<td>Alarm not sounding with loss of one pressure</td>
<td>Defective reed</td>
<td>Replace reed</td>
</tr>
<tr>
<td></td>
<td>Alarm Module adjustments out of calibration</td>
<td>See Calibration Section</td>
</tr>
<tr>
<td></td>
<td>Alarm poppets stuck</td>
<td>Clean, lubricate and recalibrate</td>
</tr>
</tbody>
</table>
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) — P/N 3513

(4)

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) — P/N 3513

(4)

The SECHRIST Mixer is calibrated and tested in conditions similar to the environment for which the Mixer was designed. Medical Breathing O₂ and Medical Breathing Air sources will be required to calibrate the system. A calibrated oxygen analyzer is necessary (be sure O₂ 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

<table>
<thead>
<tr>
<th>DIAPHRAGM THICKNESS</th>
<th>MICROMETER READING</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3500 LOW FLOW</td>
</tr>
<tr>
<td>.810</td>
<td>.3975</td>
</tr>
<tr>
<td>.809</td>
<td>.3970</td>
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<td>.808</td>
<td>.3965</td>
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<td>.791</td>
<td>.3880</td>
</tr>
<tr>
<td>.790</td>
<td>.3875</td>
</tr>
</tbody>
</table>

Table 1
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).

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](image)

**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 O₂ supplies to respective inlet adapters.
2.8 Connect proportioning output to calibrated O₂ analyzer (see diagram for Test System Set-up figure 3).

NOTE: O₂ analyzer must be calibrated and the accuracy of the readout scale must be within ±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 O₂ analyzer.
Model 3500HL (Hi/Lo Flow): Select a flow of 15 LPM to the O₂ analyzer.
2.10 Turn adjustment shaft (P/N 3533) by hand until O₂ 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 O₂ 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 O₂ analyzer agrees with knob reading of .90 ± 1% (see figure 12).

![Figure #12. Adjusting rear seat on Proportioning Module](image)

2.14 Turn knob to the .21 position (making sure knob hits the stop pin), then up to .30 position on mixer. O₂ analyzer should read 30±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:

<table>
<thead>
<tr>
<th>ABOVE P/N</th>
<th>USE P/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>3521</td>
<td>3513</td>
</tr>
<tr>
<td>3531</td>
<td>3531-7</td>
</tr>
<tr>
<td>3532</td>
<td>3532-3</td>
</tr>
<tr>
<td>3542</td>
<td>3542-4</td>
</tr>
</tbody>
</table>

PROPORTIONING MODULE
Model 3500 (Low Flow)

FIGURE 9
\( \nabla \) IF MIXER S/N IS 1670 OR BELOW
THE FOLLOWING PART NUMBERS
MUST BE USED:

<table>
<thead>
<tr>
<th>ABOVE P/N</th>
<th>USE P/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>3521</td>
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<td>3613-1</td>
</tr>
<tr>
<td>3615</td>
<td>3615-1</td>
</tr>
</tbody>
</table>

PROPORTIONING MODULE
MODEL 3500HL (Hi/Lo Flow)
FIGURE 10
30±1% is obtained on the O₂ 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 O₂ 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 O₂ 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, FIO₂ 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 O₂ analyzer reading is slightly above 90% (around 91%). When jam nut is tightened, O₂ 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 valve (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 valve (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 O₂ valve "ON", regulating to 60 p.s.i., leave air "OFF"; alarm should sound. Turn O₂ 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 O₂ calibration adjuster (P/N 3622), turn O₂ and air to "ON", regulating to 50 p.s.i.

NOTE: THE O₂ CALIBRATION ADJUSTMENT IS LOCATED UNDER THE AIR INLET; THE AIR CALIBRATION ADJUSTMENT IS LOCATED UNDER THE O₂ 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 O₂ 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 O₂ 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 O₂ adjuster (under air inlet) clockwise until alarm stops; then turn counterclockwise just until alarm sounds.

3.12 Reduce O₂ pressure to 0 and relieve pressure within hose from Mixer to regulator.

3.13 After venting, no pressure should build in gauge on O₂ regulator.
NOTE: If pressure starts to build on the O₂ gauge, the duck bill valve (P/N 3525) in the O₂ inlet is leaking and causing a back flow of air into O₂ inlet; clean or replace as needed (see disassembly of gas inlet valves in Routine Maintenance Section - see figure 21).

3.14 Open O₂ 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 O₂ calibration adjuster until the alarm stops sounding. Repeat the calibration procedure from step 3.7 until alarm sounds when O₂ pressure is between 24 and 28 p.s.i. and stops sounding before 40 p.s.i., when O₂ pressure is increased.

3.15 Tighten jam nut over O₂ 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 O₂ in instructions, remembering that the air adjuster is located under O₂ 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
(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) — P/N 3513 (4)

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) — P/N 3513 (4)

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).

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).

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).

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) counterclockwise 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/Lo 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.
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 IMMERS 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)

<table>
<thead>
<tr>
<th>PART NAME</th>
<th>PART NUMBER</th>
<th>QUANTITY</th>
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EXPLODED VIEW—WALL MOUNT
Model 3500HL (Hi/Lo Flow)

FIGURE 17