

RX- AS CALIBRATION CHAMBER FOR ASS S



This is a short chamber that is used when performing calibration of the GASSYS3 Gas Analysis module. The large chamber and rod are replaced with a shorter chamber and rod. Using the included stopper on the inlet of the GASSYS3, calibration gases may then be injected into the calibration chamber using the AFT17 + GASREG + GASCAL/GASCAL2. After calibration, the larger chamber is used.

The stopper includes a standard female Luer lock connector to interface to other equipment as well.



RX-GAS3 connected to MP36

ASCAL CALIBRATION GAS



COMPRESSED GAS, N.O.S.
(4% CO₂, 16% O₂,
BAL. N₂)

ASRE REGULATOR



GASCAL and GASCAL2

Composition: GASCAL: 4% Carbon Dioxide, 16% Oxygen, balance Nitrogen

GASCAL2: 8% Carbon Dioxide, 21% Oxygen, balance Nitrogen

Cylinder Type:

ED

Valve Connection:

CGA-973 works with GASREG regulator

Accuracy:

±0.03% absolute

Stability Guaranteed:

3 years

Cylinder Pressure:

2200 psig

Gas Volume:

560 liters

Cylinder Recycling:

Cylinder Recycling Program available. Contact support@biopac.com to receive instructions for returning a cylinder; delivery paid by sender and recycling covered by manufacturer.

GASREG

Use the non-corrosive, two stage regulator with flow control with the GASCAL Calibration Gas Cylinder.

This regulator is used to inject calibration gases into the GASSYS2/GASSYS3 or AFT15 chambers to create the secondary calibration points for a proper gas calibration of O₂ and CO₂ sensors.

- The initial case (for the primary calibration points) is the chamber flooded with ambient air (20.95% Oxygen, 0.04% Carbon Dioxide and balance Nitrogen).
- The secondary case (for the secondary calibration points) is using the GASCAL with GASREG to inject a calibrated gas mixture into the chamber.
- The chamber will be flooded with this mixture from GASCAL or GASCAL2.

GASCAL is a tank containing 4% carbon dioxide, 16% oxygen and balance (80%) nitrogen.

GASCAL2 is a tank containing 8% carbon dioxide, 21% oxygen and balance (71%) nitrogen.

Use 3.2 mm ID tubing to run from GASREG output to the chamber and seal the 3.2 mm ID tube to the input port of the chamber, during calibration.

Wait for the chamber to be flooded, typically about 1-2 minutes.

Put regulator at 10 psi and open up the flow valve.

After flooding, then largely close the flow valve, but keep some small flow during the calibration of secondary point, to maintain positive pressure in the chamber.

The chamber needs to be flooded prior to attempting to calibrate for secondary points.

After secondary calibration, shut down the tank by closing the main valve.

See also: [AFT16 Regulator Barb Interface Kit](#) for interfacing the GASCAL+GASREG combination to an AFT15 mixing chamber to calibrate the O₂100C or CO₂100C amplifier modules.

[AFT17 Regulator Barb Interface](#) to inject calibration gases into the RX-GAS3 Calibration Chamber to calibrate the GASSYS3 Gas Analysis System.

MEDIUM-FLOW PNEUMOTACH TRANSDUCER

- SS11LB and SS11LA for MP3X and MP45 System
- TSD117A & TSD117A-MRI for MP160/150 System
- RX117A-MRI Replacement Airflow Head
- See also: **AFT series** of accessories for airflow and gas analysis

The SS11LB handheld airflow transducer is intended for human use and can be used to perform a variety of tests relating to airflow and lung volume. The transducer is factory-calibrated to measure airflows ranging from -10 to +10 liters/second within +/-5%. The transducer has a removable head (RX117A-MRI) for sterilization and replacement.



The SS11LB transducer incorporates the following improvements over the earlier-model SS11LA:

- No calibration syringe is required.
- Airflow measurement is much less susceptible to changes in transducer orientation.
- New tiered airflow head design allows for direct connection to multiple standard pulmonary ID/OD hoses and components without the need for couplers.
- Flow correction that was previously only included in lessons (via syringe) is now in Lessons and BSL *PRO* analog preset.

Use standard disposable mouthpieces with disposable bacterial filters, or use an autoclavable mouthpiece, depending on budget and/or lab preference. Direct connection to AFT36 35 mm Filtered mouthpiece. The SS11LB can also be used with the AFT22 Non-Rebreathing T-valve for low dead space requirements, and to monitor expiration and inspiration signals separately.

NOTE: SS11LB is compatible with BSL 4.1.1 and above or *AcqKnowledge* 4.4.2 and above. For earlier BSL and *AcqKnowledge* software versions, use SS11LA. (See page 2.)

FLOWCAL Optional SS11LB Calibration/Validation Kit



To perform an optional SS11LB user calibration, use the FLOWCAL Kit.

This kit consists of a calibrated 3-Liter calibration syringe (AFT27) plus coupler (AFT11D) that connects the syringe to the SS11LB. Download the free graph template file and FLOWCAL procedure from the [BIOPAC FLOWCAL](#) page.

Users wishing to perform an accurate validation should also have equipment that can measure humidity, temperature, and pressure of the lab environment.

The SS11LB is factory-calibrated for use when directly connected to a mouthpiece. If the flow transducer is connected to a hose, facemask, or other tubing it should be recalibrated with those attachments by using the syringe and this kit.

SS11LA Medium Flow Pneumotach Transducer

Older model SS11LA with RX117 is available for systems running BSL 4.1.0 and below or AcqKnowledge 4.4.1 and below (software upgrade recommended), and is the shipping airflow transducer model for Chinese, Italian, and Russian BSL 3.7 Systems. Use AFT1 Filter + AFT2 mouthpiece with SS11LA flow head RX117. See page 5 for SS11LA connection and calibration instructions.

TSD117A Medium Flow Pneumotach Transducer

The TSD117A is intended for human use and can be used to perform a variety of tests relating to air flow, lung volume and expired gas analysis. The new tiered flow head allows for direct connection to multiple standard pulmonary ID/OD hoses and components without the need for couplers. The flow head is removable, for easy cleaning and sterilization or replacement (RX117A-MRI). The TSD117A interfaces with the DA100C general-purpose transducer amplifier.

Replaces older model TSD117/RX117.

TSD117A-MRI Medium Flow Pneumotach Transducer

The TSD117A-MRI is designed for use in the MRI environment and interfaces with the MECMRI-DA to the DA100C general-purpose transducer amplifier. Includes RX117A-MRI removable flow head.

Replaces older model TSD117-MRI/RX117-MRI.

The TSD117A-MRI terminates in a DSUB9 and requires MECMRI-DA for proper operation.

MRI Use: MR Conditional to 3T

Note: Conductive parts of transducer are electrically and thermally isolated from subject. The TSD117-MRI is used outside the bore in the MRI Chamber Room and AFT7-L tubing is connected to reach the subject using AFT35-MRI non-rebreathing T-valve.

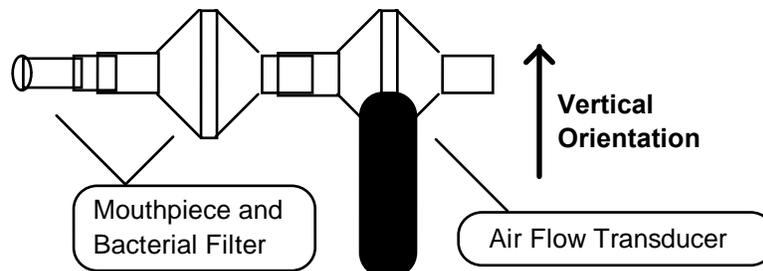
Components: Polyvinyl Chloride (PVC) Plastic, Polycarbonate Clear Plastic, Acrylonitrile Butadiene Styrene (ABS) Thermo-molded, Plastic, Polymer thick film device (rigid substrate, printed semi-conductor), Copper clad fiberglass lamination (PCB material), Stainless steel screen (type 316L), Stainless steel machine screws/nuts, tinned copper wire, Silicone elastomer, PVDF (Kynar®) heat shrink tubing

Please note the following for all airflow transducers:

- The bacterial filter and mouthpiece are disposable and are one per person items. Use a new disposable filter and mouthpiece each time a different person is to be breathing through the airflow transducer.
- For more effective calibration, use a bacterial filter between the calibration syringe and the airflow transducer.

Normal Measurement Connections

- SS11LA/SS11LB plugs directly into the MP3X or MP45 unit
- TSD117A plugs directly into the DA100C amplifier module
- TSD117A-MRI plugs into MECMRI-DA cable to DA100C amplifier module



For the most accurate lung volume recording, be sure to use a noseclip to prevent airflow through the nose. Also, be sure not to remove the airflow transducer assembly from the mouth during the recording. All air leaving or entering the lungs must pass through the airflow transducer during the lung volume measurement.

Use the following measurement procedure for determining lung volume:

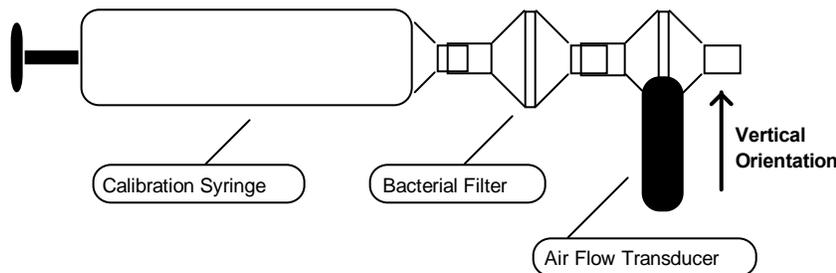
1. Breathe normally for 3 cycles (start on inspire)
2. Inspire as deeply as possible
3. Return to normal breathing for 3 cycles
4. Expire as deeply as possible
5. Return to normal breathing (end on expire)

Data Processing

When integrating the collected data to determine lung volume, it's important to integrate from the starting point of the first inspire, to the end point of the last expire. Before integration, the mean of the selected (airflow) data must be determined and then subtracted from the record. This process insures that the integral will have the same starting and ending point.

Calibration For Medium-Flow Pneumotachs

1. Syringe Calibration



After the calibration process, please remove the calibration syringe and attach a new bacterial filter and mouthpiece to the airflow transducer.

It's very important that each individual use his/her own mouthpiece and bacterial filter.

Place the narrow end of the bacterial filter and mouthpiece assembly into either side of the airflow transducer. Airflow data can now be recorded. For best results, hold the airflow transducer vertically.

2. Mathematical Calibration (TSD117A and TSD117-MRI)

The transducer can be roughly calibrated without using the calibration syringe. Using the transducer's nominal output of 60 μV per liter/sec (normalized to 1 volt excitation), the following calibration factors can be entered in the software Scaling window.

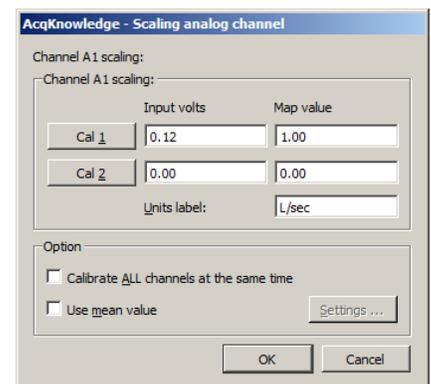
Scaling Factors for Rough Calibration of the airflow transducer

The following equation illustrates why 0.12 volts maps to 1.00 liter/sec:

$$\text{Calibration Constant} \times \text{Amp Gain} \times \text{Amp Excitation} = \text{Scale Factor}$$

Thus

$$60 \mu\text{V}/[\text{liter}/\text{sec}] \times 1000 \times 2 \text{ Volts} = 0.12 \text{ V} / [\text{liter}/\text{sec}]$$



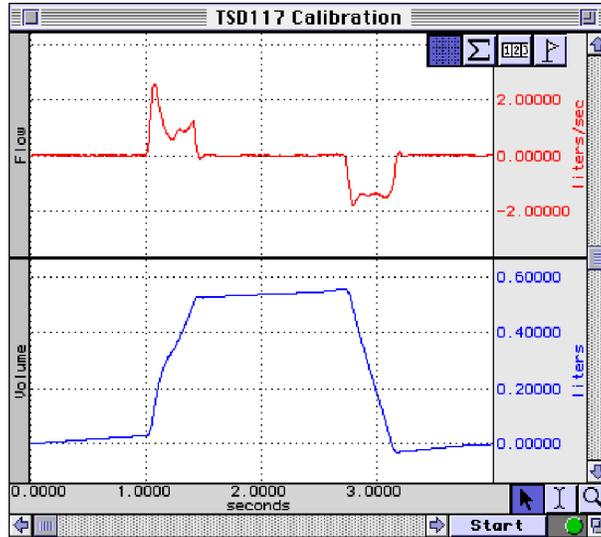
Data can now be collected directly. Prior to analyzing the data, remember that there will always be some offset recorded in the case of zero flow.

Note: With the TSD117A and MP160/150 system, it's possible to largely trim this offset out, using the ZERO potentiometer on the DA100C amplifier, but some residual will always remain.

To remove residual offset after the flow data has been collected, select a portion of the baseline (zero flow reading) and calculate the mean value using the popup measurements. Subtract this mean value from the raw data to obtain a mean corrected flow signal.

Now, the integral of the mean can be calculated as shown in this graph →

In this case, a 600 ml-calibration syringe was used to check the rough calibration of the airflow transducer. The rough calibration indicates a syringe volume of about 550 ml, so this method may only be expected to be accurate within ±10% of the real reading.



Flow Measurement and Volume Calculation

To achieve a more exact calibration, start with the above scaling factors and then boost or drop them slightly as indicated by the rough calibration. In this case, if the map value correlating to 0.12 volts were boosted about 10% to 1.10 (from 1.0 liters/sec), the resulting calibration would be fairly accurate.

See also: DA100C Calibration options.

>>> All Instructions also apply to the older airflow transducer — model SS11L with non-removable head <<<

SS11LA To MP3X Connection

1. Make sure the BIOPAC MP3X unit is turned OFF.
Note: Turn the MP3X power off even if the software is running.
2. The airflow transducer (SS11LA) can be plugged into any input channel on the MP3X.
3. After the transducer is plugged in securely, turn the MP3X power ON.
4. Launch the BSL or AcqKnowledge software.

IMPORTANT: After launching the software, allow at least 5 minutes for the SS11LA/LB Airflow Transducer to properly warm up.

Note: SS11LA to MP connection instructions also apply to 2-channel MP45 hardware.

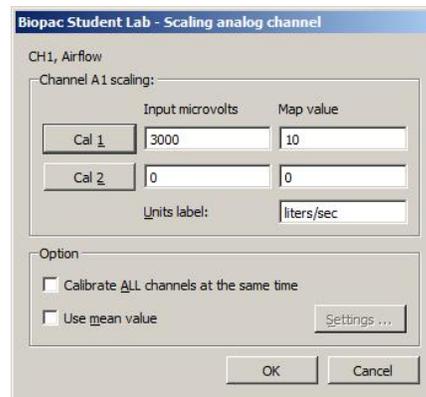


SS11LA to MP3X connection

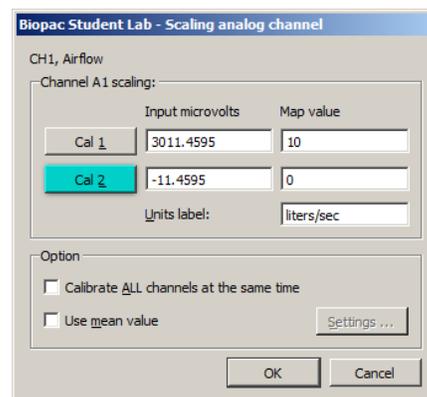
Rough Calibration (MP3X)

1. Choose the MP3X menu and select **Set Up Data Acquisition > Channels**.
2. Select the **Analog** channel that the SS11LA transducer is plugged into and activate it by checking the **Acquire**, **Plot** and **Values** boxes.
3. Click the **Preset** pop-up menu  and select **Airflow (SS11LA)** from the Preset list.
4. Click the **Setup** button in upper right of Channels screen.
5. Click the **Scaling** button at bottom of Setup screen. Note the default **Cal1 Input value** is 3000 microvolts, and the **Cal1 Map value** is 10, as shown in upper right example.
6. Click **Cal2**: Note the adjusted **Input value**. (Leave the **Map value** at 0.)
7. Add the adjusted **Cal2 Input value** to the **Cal1 Input value**, as shown in lower right example.
8. Click **OK**.

The SS11LA can be roughly calibrated without using the AFT6 calibration syringe by choosing the SS11LA preset and re-scaling to account for amplifier excitation. Use the "Rough Calibration" steps shown on the left to apply this calibration method.



SS11LA Default Scaling



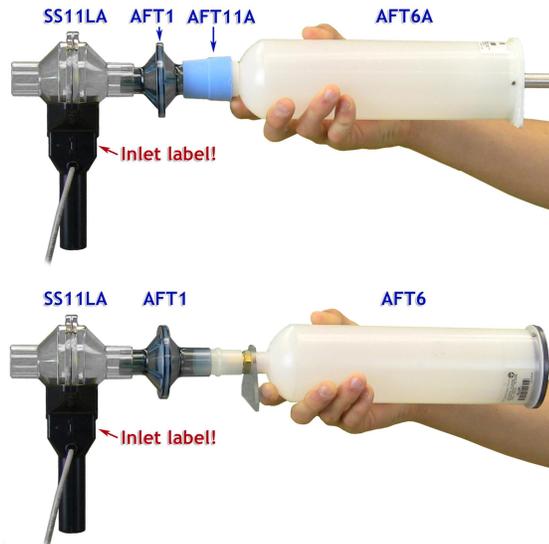
SS11LA Adjusted Scaling

Using the Calibration Syringe

1. Place a filter onto the end of the calibration syringe.
2. **Insert** the Calibration Syringe/Filter Assembly into the airflow transducer.

IMPORTANT!
 Always insert on the side labeled **Inlet**.

The filter is necessary for calibration because it forces the air to move smoothly through the transducer. This assembly can be left connected for future use. The filter only needs to be replaced if the paper inside the filter tears.



Calibration Syringe into airflow transducer

Insert syringe assembly so that the transducer cable exits on the left, as shown above.

- **If** using an older SS11L transducer with non-removable head, insert syringe assembly into the larger diameter port.

IMPORTANT: If the lab sterilizes the airflow heads after each use, make sure a clean head is installed now.

The Airflow Transducer is sensitive to gravity so it needs to be held upright throughout the calibration and recording.



Proper handling of the Calibration Syringe Assembly

Never hold onto the airflow transducer handle when using the Calibration Syringe or the syringe tip may break.

3. **Pump** the plunger several times before the recording. **Always** pull and push the plunger all the way until it stops when using the syringe. This assures that the full volume of air (0.6 liter) flows in and out of the airflow transducer.

Recording with the Airflow Transducer

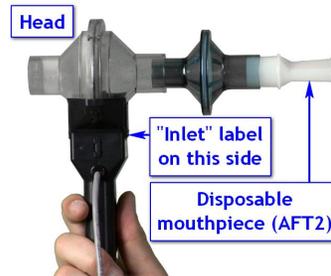
- 1) **Attach** the appropriate filter and mouthpiece on the side labeled **Inlet**.

WARNING

The bacterial filter and mouthpiece are disposable and are **one per person** items. Please use a new disposable filter and mouthpiece each time a different person is to be breathing through the airflow transducer.

- 2) Breathe through the airflow transducer, following the proper procedure defined to the right.

If using SS11LA transducer and not sterilizing the head after each use, insert a filter and mouthpiece into the airflow transducer on the side labeled "Inlet".



SS11LA with unsterilized head

If using SS11LA transducer and sterilizing the head after each use, insert a disposable mouthpiece (BIOPAC AFT2) or a sterilizable mouthpiece (BIOPAC AFT8) into the airflow transducer on the side labeled "Inlet".



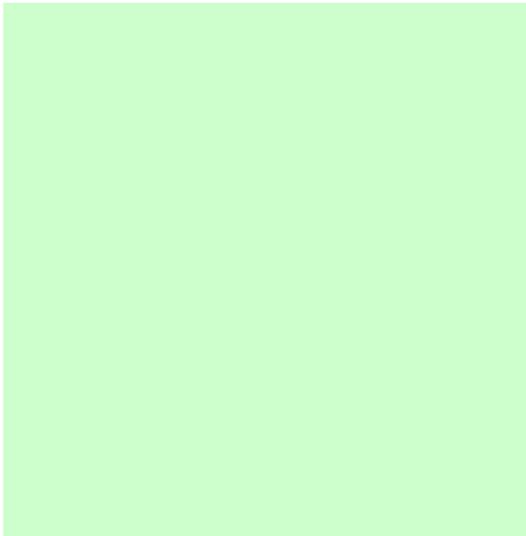
SS11LA with sterilized head

Hints for obtaining optimal data:

- a) Keep the Airflow Transducer upright at all times.



- b) Always insert on and breathe through the side of the SS11LA airflow transducer labeled "Inlet".
- c) Always use a nose clip when breathing through the airflow transducer and secure a tight seal with the mouth so that air can only escape through the airflow transducer.
- d) Always begin breathing normally through the airflow transducer prior to the beginning of the recording and continue past the end of the recording.



- e) If starting the recording on an inhale, try to end on an exhale, and vice-versa. This is not absolutely critical, but will increase the accuracy of Airflow to Volume calculations.
- f) The Subject must try to expand the thoracic cavity to its largest volume during maximal inspiratory efforts. (The Subject should wear loose clothing so clothing does not inhibit chest expansion.)
- g) During recording of FEV, the Subject should attempt to exhale as quickly as possible into the mouthpiece.
- h) During recording of MVV, the Subject should attempt to exhale and inhale as quickly and deeply as possible. Breathing rates should be faster than 60 breaths/minute or greater than 1 breath/second for the best results. The breathing needs to be maintained for 12-15 seconds.

RX117A-MRI Replacement Airflow Head



The RX117A-MRI is a sterilizable airflow head for the TSD117A, TSD117A-MRI, and SS11LA pneumotach transducers. The material used in the flow head is polycarbonate and the screen is Stainless Steel. To reduce the cost of disposable items, use the RX117A-MRI with the AFT8 sterilizable mouthpiece. (22 mm ID/30 mm OD). Multiple RX117A-MRI heads help eliminate equipment downtime during cleaning procedures.

Recommended sterilization: cold sterilization (i.e., Cidex® OPA) or autoclave. If autoclaved, RX117A-MRI Airflow Heads should be cleaned at the lowest autoclave temperature setting. The life cycle will be about 10-20 cycles, depending upon temperature used.

MRI Use: MR Conditional to 3T

Condition: The RX117-MRI head is used with the TSD117A-MRI transducer outside the bore of the MRI Chamber Room and AFT7-L tubing is connected to the subject.

Handheld Pneumotach and Flow Head Specifications

TRANSDUCER:	TSD117A	TSD117A-MRI	SS11LB/SS11LA
Interface:	DA100C	MECMRI-DA to DA100C	MP36/35/45
Cable Length:	3 m shielded	8 m, shielded	3 m, shielded
Flow Rate:	±10 liters/sec (highest linearity (±5 liters/sec)		
Nominal Output:	60 µV/[liters/sec] (normalized to 1 V excitation)		
¼+25 TPI mounting nut:	Standard camera mount		
Handle Dimensions:	127 mm (length) x 23 mm (thick) x 35 mm (wide)		
Handle Construction:	Black ABS		
RX117A-MRI SPECS:			
Flow Head Construction:	Clear Acrylic		
Flow Bore (Ports):	Inner Diameter: 22 mm, Tiered Outer Diameter: 29 mm, 31 mm, 35 mm		
Flow Head Dimensions:	82.5 mm (diameter) x 101.5 mm (length)		
Flow Head Weight:	80 g		
Handle Weight:	85 g		
Dead Space:	93 ml		

See also: Student Accessory Pack BSL-ACCPACK and BSLACCPACK-11B

AFT SERIES AIRFLOW & AS ANAL SIS ACCESSORIES

Includes the following airflow accessories:

Bacterial Filters	Mouthpieces	Calibration	Airflow Tubing	Facemasks & Accessories	Noseclip
AFT1 AFT4 AFT36	AFT2 ATF8 AFT9 RX-AFT35-MOUTH	AFT6A AFT27 AFT16 AFT17	AFT7 AFT7L AFT12	AFT10 AFT10S AFT25 RX-AFT25-SMALL RX-AFT25-MEDIUM RX-AFT25-LARGE RX-AFT25-CAP	AFT3
Gas Sampling Kits	AFT T-valves	Head Support	Gas Tubing	Mixing Chamber	Couplers
AFT20 AFT31-MRI	AFT21 AFT22 AFT23 AFT35-MRI	AFT24	AFT30	AFT15	AFT11A AFT11B AFT11C AFT11D AFT11E AFT11F AFT11H AFT11I



DISPOSABLE BACTERIAL FILTERS

MRI Use: MR Safe

AFT1/4/36 Bacterial Filter Components: Polycarbonate Clear Plastic

AFT1 Disposable Bacterial Filter

Available in Packs of 10 or 250

Designed to remove airborne bacteria. Pore Size: Virus Filtration Efficiency (VFE): 3.1 micron; Bacterial Filtration Efficiency (BFE): 2.8 micron. Use between any SS11L, SS11LA, SS11LB, or TSD117, or TSD117A and the AFT2. 22 mm ID/OD.

AFT4 Disposable Bacterial Filter

Designed to remove airborne bacteria; for use with the TSD107B, or other 35 mm breathing circuits, connects between the AFT7 and the AFT9. (35 mm ID/35 mm OD)

AFT36 Disposable Pulmonary Function Filter and Mouthpiece *Available in packs of 10 or 200*

This disposable bacteriological filter with integrated mouthpiece is recommended for use with the SS11LB or TSD117A airflow transducer, and attaches directly to the outside of the airflow head. Independent laboratory tests have verified 99.99% bacterial and viral filtration efficiency. This surpasses published ATS recommendations for flow resistance in pulmonary function instrumentation, which suggest resistance should be below 1.5 cm H₂O/L/sec at flow rates of 14 L/sec. Port: 35 mm OD. **NOTE:** The AFT36 is not compatible with earlier-style SS11L or SS11LA or TSD117 airflow transducers. (Use AFT1 + AFT2 instead.)



MOUTHPIECES

MRI Use: MR Safe

AFT Mouthpiece Components: Polyethylene EVA Copolymer, Thermoplastic Rubber, Polycarbonate Plastic

AFT2 Disposable Mouthpiece *Available in Packs of 10 or 250*
22 mm OD; connects to the older model SS11LA or TSD117 via the AFT1.

AFT8 Autoclavable Mouthpiece *Available in Packs of 1 or 10*
30 mm ID; interfaces with the SS11LA, SS11LB, or TSD117A and reduces the cost of disposable parts.

- RX117A-MRI Replacement Sterilizable Airflow Head: 22 mm ID/30 mm OD; autoclavable transducer head for the TSD117A; can be used with the AFT8 to reduce the cost of disposable items.

AFT9 Reusable Mouthpiece *Available in Packs of 1 or 10*
35 mm ID; designed to connect to the TSD107B or other 35 mm breathing circuits with the AFT7 via the AFT4. (Also connects to the AFT21 Non-rebreathing T Valve.)

NOSECLIP

MRI Use: MR Safe

AFT Noseclip Components: Thermoplastic Rubber, Polyvinyl Chloride (PVC) Plastic, Polyurethane Foam Plastic

AFT3 Disposable Noseclip *Available in Packs of 10 or 250*
Gently squeezes the nostrils shut while using the SS11LA or TSD117A Airflow Transducer.

CALIBRATION

AFT6A Calibration Syringe
0.6 liter calibration syringe. **See also:** AFT27 3.0 liter Calibration Syringe

AFT27 Calibration Syringe (3.0 liter)



The AFT27 is a 3.0 Liter Calibration Syringe for the SS11LB, SS11LA or TSD117A Airflow Transducer. The AFT27 Calibration Syringe is certified to have a 3-liter volume that meets or exceeds an accuracy $\pm 0.5\%$ of the total displacement volume. The increased size and accuracy of this

3.0 liter calibration syringe provide a wider calibration range than the AFT6A for advanced studies. A coupler is included and can be reordered as AFT11D (SS11LB) or AFT11I (SS11LA) if it is inadvertently discarded when an airflow accessory is removed. This adjustable aluminum calibration syringe is shipped with the volume locked to 3.0 L and BIOPAC templates and software settings are set for 3 L. The locking collar and graduated rod allow users to select other calibration volumes, from 0.5 Liters to 3.0 Liters. The aluminum syringe has a universal connector and works with BIOPAC's AFT11D flexible coupler (35 mm OD, 35 mm OD).

NOTE: The AFT27 3.0 Liter Calibration Syringe replaces the AFT26 2.0 Liter Calibration Syringe, which was discontinued in September of 2017.

AFT16 Regulator Barb Interface Kit

Use the Regulator Barb Interface Kit to interface the GASCAL+GASREG calibration gas combination to an AFT15 mixing chamber to calibrate the CO2100C carbon dioxide measurement and O2100C oxygen measurement amplifier modules.

Kit includes 2 meters of tubing that connect to the GASREG and mixing chamber along with two stoppers to seal the inlet and outlet ports of the mixing chamber.

**AFT17 Regulator Barb Interface for GASSYS3**

Use this Regulator Barb Interface with Luer lock to connect a regulator (such as GASREG) and GASCAL or GASCAL2 calibration gas to inject calibration gases into the RX-GAS3 Calibration Chamber to calibrate the GASSYS3 Gas Analysis System.

TUBIN FOR AIRFLOW

MRI Use: MR Safe

AFT7/7L/12 Tubing Components: Polyethylene EVA Copolymer

AFT7 Smooth Bore Tubing

1 m length, 35 mm ID; connects to the TSD107B, AFT4, or other 35 mm breathing circuits. *See also:* AFT part guide for additional applications. Sterilization: Cidex® / Cidex OPA® recommended

AFT7L Smooth Bore Tubing

3 m length, 35 mm ID; connects to the TSD107B, AFT4, or other 35 mm breathing circuits. *See also:* AFT part guide for additional applications. Sterilization: Cidex® / Cidex OPA® recommended

AFT12 Tubing (22 mm)

Smooth bore tubing for use in 22 mm breathing circuits. (1.8 meter length, 22 mm ID)

FACEMAS S FACEMAS ACCESSORIES**AFT10 Disposable Adult Facemask**

These mouthpieces connect to 22 mm breathing circuits. Connects directly to the AFT1, AFT22 non-rebreathing T-valve, SS11LA/TSD117 airflow transducer (via AFT11B coupler) or SS11LB/TSD117A airflow transducer (via AFT11H coupler). Includes hook-ring to secure AFT10S adjustable head strap. (22 mm ID/25 mm OD)

MRI Use: MR Safe

AFT10 Facemask Components: Thermoplastic Elastomer, Polyvinyl Chloride (PVC) Plastic

AFT10S Adjustable Head Strap

This fully adjustable latex head strap holds the AFT10 disposable facemask securely to the subject's head. Use one or more straps to securely fasten the mask.

MRI Use: MR Safe

AFT10S Head Strap Components: Latex Rubber

AFT25 Facemask with Valve

This adult facemask with integral non-rebreathing T valve is a high performance, very low dead space, low airflow resistance mask and valve; suitable for high airflow applications (e.g. exercise physiology). The AFT25 incorporates two gas sampling ports (female Luer) for interfacing with the AFT20 Gas Sampling Kit. All ports are 35 mm OD, 28 mm ID

MRI Use: MR Safe

AFT25 Facemask Components: Mask: Thermoplastic Elastomer, Valve:



Acetal Plastic, Acrylic Plastic, Aluminum (nickel plated silver,) Elastomer, Nylon, Thermoplastic Polyester, Polycarbonate Plastic, Silicone Rubber, Stainless Steel, Polysulfone Plastic

Headgear: Fabric with Velcro® straps

AFT25 Accessories—Masks and Cap

Airflow mask and cap accessories for the AFT25 adult facemask:

Masks do not include T-valve. Available in small, medium, or large. To use, remove the valve and adapter from the original AFT25 mask and then attach them to the T-valve on the new mask via the valve adapter that is part of the AFT25 mask.

Mask Part Numbers: **RX-AFT25-SMALL, RX-AFT25-MEDIUM, RX-AFT25-LARGE**

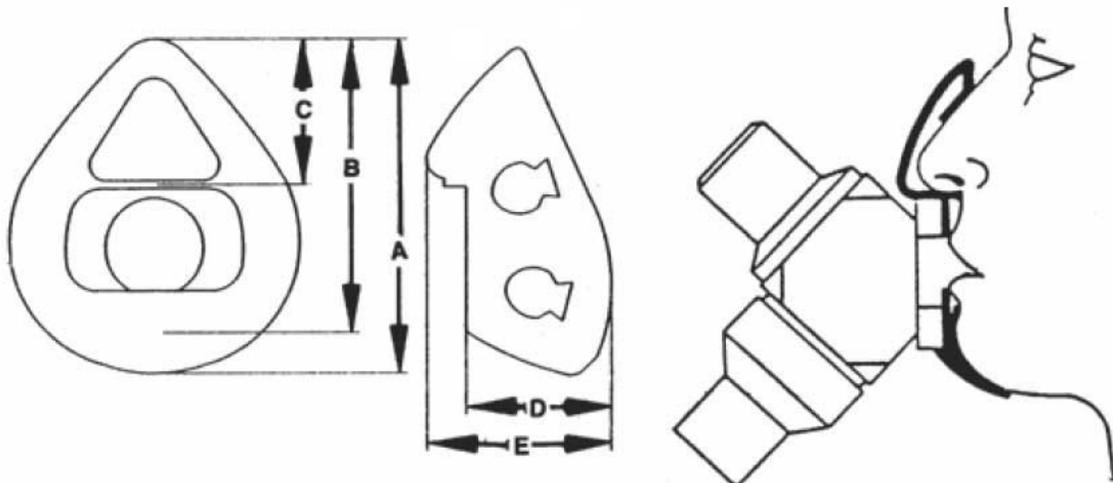
Cap does not include mask or T-valve. Cap includes cap, straps and clips for the AFT25 mask. Design ensures the mask has a secure fit to the subject's face and head, overcoming the problem of slipping during active or long-term setups, as with exercise physiology or sleep studies. Cap fits all three mask sizes.

Cap Part Number: **RX-AFT25-CAP**

Need a complete facemask with integral non-rebreathing T-valve? See our AFT25 high performance, very low dead space, low airflow resistance mask and valve; suitable for high airflow applications (e.g., exercise physiology).

MRI Use: MR Safe (see AFT25 Specifications on previous page for components)

MOUTH BREATHING MASK FACE PIECE DIMENSIONS



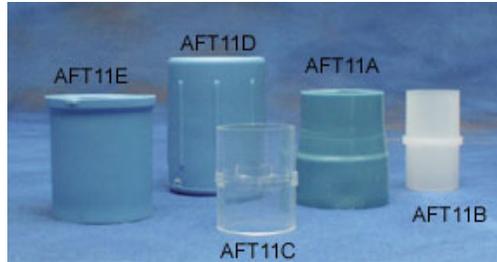
Part #	Size	A Inch (mm)	B Inch (mm)	C Inch (mm)	D Inch (mm)	E Inch (mm)
RX-AFT25-LARGE	Adult Large	5.3 (134.6)	4.8 (122.7)	2.4 (61.2)	2.0 (50.8)	3.0 (74.9)
RXAFT25-MEDIUM	Adult Medium	4.9 (125.2)	4.5 (113.0)	2.2 (54.6)	2.0 (50.8)	2.7 (67.3)
RX-AFT25-SMALL	Adult Small	4.6 (117.6)	4.2 (117.6)	1.9 (47.5)	2.0 (50.8)	2.6 (66.6)

GUIDELINES FOR MASK FIT: Adult Large Large Adult
 Adult Medium Large Adolescent to Medium Adult
 Adult Small 9 Years to Small Adult

COUPLERS

MRI Use: MR Safe

AFT11 Series Coupler Components: Thermoplastic Rubber, Polyvinyl Chloride (PVC) Plastic, Polycarbonate Clear Plastic, Acrylonitrile Butadiene Styrene (ABS) Thermo-molded, Plastic



AFT11A Flexible

AFT11B Rigid

AFT11C Rigid

AFT11D Flexible

AFT11E Flexible

AFT11F Rigid

AFT11H Flexible

AFT11I Flexible (for AFT27)

These couplers are very useful for connecting up a variety of airflow port IDs and ODs to transducers, tubing and calibration syringes. Pick an AFT11 Series coupler that matches the port sizes to be interfaced.

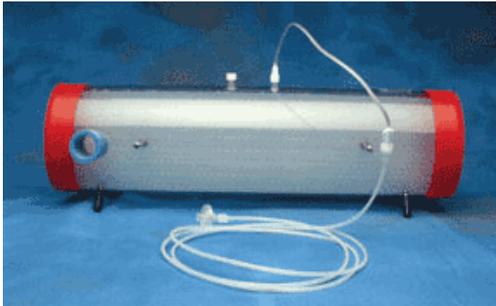
AFT11 Series Coupler Guide

Item 1	Item	Coupler
15 mm OD	22 mm ID	AFT11B
20 mm OD	22 mm ID	AFT11B
22 mm ID	15 mm OD	AFT11B
	20 mm OD	AFT11B
	22 mm ID	AFT11B
	22 mm OD	AFT11I
22 mm OD	22 mm ID	AFT11C
	22 mm OD	AFT11C
	25 mm ID	AFT11C
22-25 mm OD	22 mm OD	AFT11E
	25 mm ID	AFT11E

Item 1	Item	Coupler
25 mm ID	25 mm ID	AFT11C
25-30 mm OD	25-30 mm OD	AFT11A
	28-35 mm ID	AFT11A
28-35 mm ID	25-30 mm OD	AFT11A
	35 mm ID	AFT11A
34-37 mm ID	41-47 mm ID	AFT11F
35 mm ID	28-35 mm ID	AFT11A
	38 mm ID	AFT11E
35-38 mm ID	22-25 mm OD	AFT11E
35-38 mm OD	35-38 mm OD	AFT11D
35 mm OD	28.6 mm OD	AFT11H

Coupler	Size	Interface
AFT11A	25 mm OD/35 mm ID	AFT6A to AFT1
AFT11B	15 mm OD/22 mm ID	AFT10 to SS11LA
AFT11D	35 mm OD/35 mm ID	AFT27 to SS11LB
AFT11E	22 mm OD/35 mm ID	AFT7 to AFT22/25
AFT11F	35 mm OD/45 mm OD	SS52L to GASSYS2
AFT11H	35 mm OD/28.6 mm ID	AFT10 to SS11LB
AFT11I	22 mm OD/22 mm ID	AFT27 replacement coupler for SS11LA

AFT1 MIXIN CHAMBERS



AFT15A/B mixing chambers incorporate dual baffles and flexible connection ports capable of interfacing with 35 mm or 22 mm breathing circuits.

Two female Luer connection ports are provided between the baffles for the simultaneous monitoring of O₂ and CO₂ concentrations.

AFT15A shown with AFT20 (not included)

AFT15A — 5 Liter

Use for demanding expired gas analysis measurements (e.g. VO₂ or RER measurements).

Dimensions: 13 cm (dia) x 47 cm (long) Coupling Ports: 35 mm OD, 25 mm ID

AFT15B — 8 Liter

Use for very high volume and rate expired gas analysis measurements (e.g. VO₂ or RER measurements).

Dimensions: 13 cm (dia) x 73 cm (long) Coupling Ports: 35 mm OD, 25 mm ID

MRI Use: MR Conditional to 3T

Condition: Mixing Chambers AFT15 (5 liter) and AFT15B (8 liter) can be placed in chamber room, where gas sampling lines to CO2100C and O2100C are directed through chamber to control room waveguide parts.

AFT15/15B Mixing Chamber Components: Aluminum; Stainless Steel; Nylon plastic; Vinyl; Polypropylene; Low-density polyethylene; Butyrate.

AS SAMPLIN INTERFACE ITS

AFT20

Use to interface the CO2100C and the O2100C modules with the TSD107B or TSD117A Airflow Transducer breathing circuits.

Includes: 1.8 meters of 1.5 mm inner diameter semi-flexible polyethylene tubing with M/F Luer connector; 30 cm Nafion[®] water vapor permeable tubing with M/F Luer connector; 5 micron filter with M/F Luer connector; M/F Luer to female Luer “Y” connector.



The AFT20 connects the CO2100C or O2100C directly to the sampling port of a mixing chamber. The AFT20 also permits sampling connections to the Non-rebreathing “T” Valves (AFT21 or AFT22).

MRI Use: MR Safe

AFT20 Gas Sampling Kit Components: Tubing: 1.8 m of 1.5 mm diameter polyethylene tubing with M/F Luer; Tubing: 30 cm Nafion[®] water vapor permeable tubing with M/F Luer connector; Y-connector: Acrylonitrile butadiene styrene (ABS) polycarbonate

AFT31-MRI



(L) AFT31-MRI components – (R) connected to AFT35-MRI mouthpiece

This 3.175 mm ID tubing is 10 meters long with male and female Luer locks for direct connection with the AFT35-MRI T-valve gas sampling port, CO2100C module, and/or O2100C module. To use both CO2100C and O2100C modules simultaneously, a “Y” connector gas sampling interface adapter is included, along with two Nafion® Drying Tubes and two 17 mm 45 micron Hydrophobic Filters to prevent moisture buildup.

Notes:

- The 3.175 mm polyethylene plastic tubing can be cleaned with isopropyl alcohol. Isopropyl alcohol is not recommended for sterilization.
- Hydrophobic filters and Nafion® Drying Tubes are used to keep gas samples clean and dry as they enter the sensing chambers of oxygen and carbon dioxide modules. Nafion® tubing should be replaced when tubing becomes discolored, and filters should be replaced monthly.
 - Replacement Drying Tubes and Hydrophobic Filters are available in packs of 10. When reordering, request RX-AFT20-NAFION and RX-AFT20-FILTER.
- Humidity effects of tubing, filters, and module setup are discussed in the [O2100C-CO2100C](#) spec sheet for Gas Concentration Measurement Modules.

MRI Use: MR Safe

AFT31-MRI Gas Sampling Kit Components: Polyethylene, Polyvinyl Chloride Plastic, Polycarbonate Clear Plastic, Nafion® water vapor permeable tubing, hydrophobic filter

ID/OD: 3.175 mm (1/8") / 6.35 mm (1/4")	Type: Crack-Resistant Polyethylene Tubing
Maximum Pressure: 358 psi @ 21° C	Material: Linear Low Density Polyethylene
Operating Temperature Range: -73° to +79° C	Wall Thickness: 1.588 mm (1/16")
“Y” connector: 1 x male to 2 x female	Bend Radius: 51 mm (2")
Length: 10 m	Durometer: 95A (Firm)

AFT T-VALVES

AFT21 Non-Rebreathing “T” Valve: Female, 35 mm

High performance, very low dead space, low airflow resistance valve, suitable for high airflow applications (e.g. exercise physiology). The non-rebreathing “T” valve incorporates a Female Luer connector gas sampling port for interfacing with the AFT20. All ports are 35 mm OD, 30 mm ID.

Includes: 35 mm OD coupler

Requires: AFT4, AFT7, and AFT9 for proper operation.



AFT (top left) **AFT 1** (top right)
AFT (bottom)

AFT22 Non-Rebreathing “T” Valve: Male, 22 mm

Very low dead space valve, suitable for low to medium airflow applications. The non-rebreathing “T” valve incorporates a Male Luer connector gas sampling port for interfacing with the AFT20. Coupler ports are 22 mm OD fittings. Common port incorporates a 15 mm ID connection. Dead space 20 cc. Resistance: 0.29 cmH₂O at 5 liter per minute flow, 0.65 cmH₂O at 10 liter per minute. Single subject disposable item – **do not autoclave**. Includes: 22 mm OD coupler

Requires: AFT1 and AFT2 for proper operation.

Includes: 22 mm OD coupler *Requires:* AFT1 and AFT2 for proper operation.

MRI Use: MR Safe

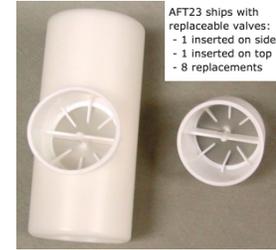
AFT21/22 T-Valve Components: Acrylic Plastic, Elastosomer, Polycarbonate Clear Plastic

AFT23 Non-Rebreathing T-Valve, 35 mm

The AFT23 is a disposable paper mouthpiece featuring a one-way valve for pulmonary function measurements (expiratory only). It provides low air resistance, adds cross-contamination protection, and is strong and durable. It ships with eight extra valves. Mouthpiece OD: 35 mm. Fits AFT1 + AFT2 pulmonary function filter & mouthpiece set.

MRI Use: MR Safe

AFT23 T-Valve Components: Acrylic Plastic, Elastomer, Paper



AFT35-MRI

The AFT35-MRI is a low profile mouthpiece and non-rebreathing T-valve assembly specifically designed to fit inside an fMRI head coil.

NOTE: Although fit is fine with 32 channel head coils, a shortening (cut via snips) of the flexible snorkel mouthpiece may be required to encourage a better fit for 20 and 64 channel head coils.

Use the AFT35-MRI to perform the following airflow and lung volume tests:

- End Tidal CO₂
- VO₂ max
- Breath-by-breath Air Flow
- Breath-by-breath Volume
- Metabolic Studies



The assembly includes a female Luer lock connection for direct connection to AFT31-MRI gas sampling tubing for CO₂ and O₂ gas analysis. The Luer port has a removable male Luer sealing cap for when gas sampling is not used. The AFT35-MRI also interfaces with AFT7/7-L tubing, via the AFT11A coupler, for operation with the TSD117A-MRI ±300 L/min airflow transducer. Extra mouthpiece included.

For the AFT31-MRI, 3.175 mm ID tubing at 10 meters, the gas sensing delay will be approximately 47.1 seconds, assuming 100 ml/min total gas sampling flow rate. This delay includes 0.6 seconds additional, due to gas module internal sampling and 30 cm NAFION tubing.

Low clearance – only 25 mm between subject and coil

Dimensions: 25 mm breathing port height (excluding mouthpiece) x 35 mm outlet port diameter x 83 mm wide x 115 mm long

Deadspace: 88 ml

Sterilization: Cidex[®] / Cidex OPA[®] recommended

RX-AFT35-MOUTH

The RX-AFT35-MOUTH is a low profile liquid silicone mouthpiece replacement for the AFT35-MRI non-rebreathing T-valve assembly.

MRI Use: MR Safe



AFT35-MRI Sample Setups

Perform a variety of tests. Place transducer outside the bore in the MRI Chamber Room and run tubing to connect to the subject and breathing accessories; place amp in Control Room.

- **End Tidal CO₂:** CO2100C amp + AFT31-MRI tubing + AFT35-MRI airflow interface
- **Airflow & Lung Volume:** DA100C amp + MECMRI-DA cable/filter set + TSD117A-MRI transducer + AFT1 filter + AFT7L tubing + AFT11A coupler + AFT35-MRI

- **Airflow & Lung Volume with End Tidal CO₂:** DA100C + MECMRI-DA + TSD117A-MRI + AFT1 filter + AFT7L tubing + AFT11A + AFT35-MRI + AFT31-MRI + CO2100C
- **Metabolic:** DA100C + MECMRI-DA + TSD117A-MRI + AFT1 filter + 2 x AFT11A + 2 x AFT7L + AFT35-MRI + AFT31-MRI + AFT15A/B + CO2100C and/or O2100C

MRI Use: MR Safe

AFT35-MRI Components: Polyvinyl Chloride (PVC) plastic, Polyethylene EVA Copolymer, Thermoplastic Rubber, Polycarbonate Plastic, Acrylic Plastic, Elastosomer, Paper, Latex Rubber, Polyurethane Foam Plastic, Acrylonitrile Butadiene Styrene (ABS) Thermo-molded

AFT24 Head Support



The AFT24 head support is used when breathing directly into the AFT21 non-rebreathing T valve for exercise physiology measurements. The AFT21 is secured directly in front of the subject and minimizes the strain associated with the weight of valves and tubing.

TUBIN FOR AS SAMPLIN

AFT30 Series Tubing and M/F Luer Locks

Use this semi-flexible 1.5 mm tubing with male and female Luer locks to interface with the RX110 self-inflating pressure pad, TSD114 response/hand force pump bulb, or gas sampling ports on AFT15 mixing chambers, CO2100C module, or O2100C module. *See AFT31-MRI for gas sampling in the MRI.*



Assuming a gas sampling module (CO2100C/O2100C) flow rate of 100 ml/min, the following approximate delays will be introduced as a function of tubing length:

AFT30: 1.8 m length, 1.5 mm ID – 2.5 seconds*

AFT30-L: 4 m length, 1.5 mm ID – 4.8 seconds*

AFT30-XL: 10 m length, 1.5 mm ID – 11.1 seconds*

*These delays include 0.6 seconds additional – due to gas sampling module internal tubing and 30 cm NAFION tubing.

MRI Use: MR Safe

AFT30 Series Gas Sampling Kit Components: 1.5 mm diameter polyethylene tubing with M/F Luer

Part Summary for Typical Airflow / Gas Analysis Applications Pulmonary Function

Part	Hi Flo <i>Exercising human</i>	Me .Flo <i>Resting human</i>	Lo Flo <i>Child, Pig, Dog</i>	Ver Lo Flo <i>Small Animals</i>
AFT2 Mouthpiece		X		
AFT3 Noseclip	X	X		
AFT6A Calibration Syringe	X	X	X	
AFT7/7L Tubing	X (2)			
AFT9 Mouthpiece	X			
AFT21 T Valve	X			
AFT24 Head Support	X (optional)			
AFT36 Mouthpiece	X			
AC137 In-line Transformer				
DA100C Amplifier	X (2)	X	X	X
TSD107B Pneumotach (High)	X (2)			X

TSD117A Pneumotach (Med.)		X		
TSD127 Pneumotach (Low)			X	
TSD137 A-E Pneumotachs (Very Low)				X (by size)

Part Options: AFT25 = AFT21 + AFT9 + AFT3 + optional AFT24
 AFT2 + AFT3 = AFT0 + AFT11B

Exercise Physiology

Part	Mice Respirators		Breath-Breath		
	High Flow Exercising human	Med. Flow Resting human	High Flow Exercising human	Med. Flow Resting human	Low Flow Dog
AFT6A Calibration Syringe	X	X	X	X	X
AFT7 Tubing	X (2)		X		
AFT10 Facemask		X		X	
AFT10S Head Strap		X		X	
AFT11 Series Couplers		X (3)*		X	X (2)**
AFT12 Tubing		X (2)		X	
AFT15A Mixing Chamber	X	X			
AFT20 Interface Kit	X (2)	X (2)	X (2)	X	X (2)
AFT22 T Valve		X		X	X
AFT25 Facemask w/Valve	X		X		
DA100C Amplifier	X	X	X	X	X
CO2100C CO ₂ Module	X	X	X	X	X
O2100C O ₂ Module	X	X	X	X	X
TSD107B Pneumotach (High)	X		X		
TSD117A Pneumotach (Med.)		X		X	
TSD127 Pneumotach (Low)					X

Part Options: AFT25 = AFT21 + AFT9 + AFT3 + optional AFT24 * use 2 AFT11B and 1 AFT11C
 AFT10 + AFT10S = AFT2 + AFT3 + AFT11C ** use 1 AFT11B and 1 AFT11C

See also: AFT coupler guide for additional applications.

AFT Series Cleaning & Disinfection

All AFT components, with the exception of filters, will hold up to liquid and gas sterilization as specified in this document.

The following disinfectants are recommended for LIQUID “COLD” sterilization of BIOPAC transducers:

- **Cidex[®] / Cidex[®] OPA** Disinfectant Solution, Johnson & Johnson
- **Perform[®]** Powder Disinfectant Concentrate, Schülke & Mayr
- **Terralin[®]**, Liquid Disinfectant Concentrate, Schülke & Mayr

➡ Always follow the manufacturer’s directions.

Recommended gas based method:

- Low temperature, **Ethylene Oxide (EtO)** gas sterilization