
INSTRUCTIONS FOR SERIES 150 TWO TUBE GAS BLENDER

THIS BOOKLET CONTAINS PROPRIETARY INFORMATION OF
ADVANCED SPECIALTY GAS EQUIPMENT CORP. AND IS PROVIDED
TO THE PURCHASER SOLELY FOR USE IN CONJUNCTION WITH
SERIES 150 TWO TUBE GAS BLENDERS.

IMPORTANT

These instructions are for experienced operators who know the general principles and safety precautions to be observed in handling specialty gases and operating gas regulation equipment. If you are not certain you fully understand the safety precautions for handling gases, we urge you to obtain and read the Material Safety Data Sheet (MSDS) for each gas being used.

Do not permit untrained persons to install, operate, or maintain this gas blender. Do not attempt to install or operate this blender until you have read and fully understand these instructions. If you do not fully understand these instructions, contact your Advanced Specialty Gas Equipment Distributor.

Be sure this information reaches the operator. Your supplier has extra copies.



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SAFETY PRECAUTIONS

Protect yourself and others. Read and understand the following instructions before attempting to use these gas blenders. Failure to understand and follow these instructions could result in serious personal injury and/or damage to equipment.

- Know and understand the physical and chemical properties of the gas being used.
- Observe general precautions for the use of gases.
- Observe safety precautions for the gas being used.
- Read and follow precautions on cylinder labels.
- Never use these gas blenders with gases not compatible with the materials of construction. The use of gases not compatible with the materials of construction may cause damage to equipment or injury to personnel.
- If flammable gases are used with these blenders, do not locate the blenders near open flames or any other source of ignition.
- If toxic or flammable gases are used with these blenders, emergency equipment applicable to the gases in use should be available in the operating area.
- Many gases can cause asphyxiation by displacing oxygen in the atmosphere. Make certain the area where gas blenders are operated is well ventilated. Provide a device to warn personnel of oxygen depletion in the work area.
- Do not release toxic or flammable gases in the vicinity of personnel. Use this equipment only in well ventilated areas. Vent gases to the outside atmosphere, and in an area away from personnel. Be sure that venting and disposal methods are in accordance with Federal, State and local requirements. Locate and construct vent lines to prevent condensation or gas accumulation. Be sure the vent outlet cannot be obstructed by rain, snow, ice, insects, birds, etc. Do not interconnect vent lines; if more than one vent is needed, use separate lines.
- Relief devices should be installed and properly vented in all gas handling systems to protect against overpressurization.
- Never use oil or grease on these gas blenders. Oil and grease are easily ignited and may combine violently with some gases under pressure.
- Never connect a flowmeter to a supply source having a pressure greater than the maximum rated pressure of the gas blender. Refer to Product Specifications (page 9) for maximum inlet pressures.

DESCRIPTION

The Series 150 Two Tube Gas Blenders provide a simplified method of metering and blending two different gases into a homogeneous, two-component mixture. The blender consists of two Series 150 Flowmeter Tubes, each with separate inlet fittings and metering valves, which control the flow rate of each gas. The ratio of the flow rates of the two gases determines the ratio of the gas mixture.

The two gases flow upward through the metering tubes, then down through the mixing tube (located between the two metering tubes) and exiting at the bottom.

The Two Tube Gas Blenders are available with inlet/outlet end blocks and adaptors made from aluminum or Type 316 Stainless Steel. Both types are available with either standard needle-type metering valves or high accuracy, non-rotating stem (NRS) metering valves.

Each tube comes standard with two floats (glass and stainless steel) which expand the range of the blender. The linear scale (10–150 mm) allows each tube to be used with a variety of gases via a calibration chart. Tube selection depends on the gas being metered and the range of flow rates required. See Tube Selection Table (pages 12–13).

OPTIONAL EQUIPMENT

Baseplate with Leveling Screws and Spirit Level (FM4702) permits bench use.

Inlet Filter – a two-micron in-line filter available in aluminum (FM4741) or Type 316 Stainless Steel (FM4746).

Floats – Factory installed floats of sapphire (S1000), tantalum (T1000) and carboloy (C1000) are available. (Note: the glass float may be replaced by sapphire; the stainless steel float may be replaced by either carboloy or tantalum)

INSTALLATION

WARNING: Before attempting to install and operate these blenders, read and fully understand the safety precautions on page 3 in this booklet. Failure to follow the safety precautions may result in serious personal injury and/or damage to equipment.

1. Inspect the blender for physical damage or contamination.
Blenders are shipped completely assembled and tested and should not require tightening or adjustment before installation.
2. Blenders must be mounted within 6 degrees of true vertical with the inlet connections to the blender at the bottom. If blender is mounted on a base plate, adjust feet so that blender is level. Be sure that piping is adequately supported to prevent undue strain on the blender.
3. Built-in metering valves provide flow control through the gas blender. These control valves are designed for fine control. Although the valves will provide bubble-tight shut-off, excessive tightening may damage the valve seat and limit its effectiveness as a fine control valve. If tight shut-off is required, it is recommended that a separate shut-off valves be installed before the blender.

OPERATION

WARNING: DO NOT exceed pressure and temperature specifications during operation. Injury or death to personnel and/or damage to equipment may result. DO NOT operate the blender under any circumstances if it leaking or otherwise malfunctioning. Glass metering tubes may break and injure operating personnel. A customer supplied safety shield constructed of ½ inch acrylic plastic should be used when operating pressures exceed 50 psig.

1. The blender is ready for operation after it has been installed in the flow system and connections have been tested for leaks with nitrogen or air and either a soap solution, such as Snoop[®] or a gas leak detector. Do not exceed 200 psig during the leak test procedure. Vent all pressure from the system and repair any leaks before proceeding.
2. Establish the desired mixture ratio of the gases to be blended and the total flow rate of the mixture.
3. Determine the flow rate of each of the component gases.

Example: Mixture – Oxygen/Helium

Total Mixture Flow Rate Desired – 50 slpm

Ratio Desired – 90% oxygen, 10% helium

90 per cent of 50 slpm = 45 slpm oxygen flow rate

10 per cent of 50 slpm = 5 slpm helium flow rate

From the Tube Selection Table (pages 12–13): Tube number 6 with a carboloy or tantalum float will meet the required flow rate for oxygen (45 slpm) and tube number 4 with a standard stainless steel float will meet the required flow rate for helium (5 slpm).

Note: The blender should have been purchased with these tubes and floats.

4. Close both metering valves by turning each hand knob clockwise.
5. Select the appropriate calibration chart(s) for each tube by matching the metered gas, float material and tube number of the unit in service with the information provided at the top of the chart. From the calibration chart, determine the scale reading for each required flow rate.
6. Gradually introduce the gas into the blender to prevent a pressure surge or thermal shock to the blender. Do not exceed 200 psig during operation. Adjust the valves to obtain the desired flow rate (marked by the center of the ball float) through each tube.

SHUTDOWN OR REMOVAL FROM SERVICE

1. Shut off the both gas supplies to the blender. The gas supplies should always be shut off when the system is not in use.

WARNING: Hazardous gases must be discharged into a safety vent. Be sure to use a venting procedure that is environmentally acceptable and complies with Federal, State and local requirements.

2. Vent the system to atmospheric pressure. If the blender was used with a hazardous gas, purge the flowmeter and entire system with clean dry nitrogen gas. Continue purging until the hazardous gas level in the system is below the TLV for the gas.

DISASSEMBLY

1. Remove the front and back plates.
2. Loosen the appropriate seal spindle located at the top of the blender by turning it counterclockwise with a 5/32 in. hex wrench. Remove the tube from the blender housing.
3. The tube, float and float stops may be cleaned as a unit or may be disassembled for cleaning. Using a small hook, remove either of the Teflon[®] float stops from the metering tube and remove the float. Be careful not to chip the ends of the tube.
4. Remove the packing seats and packing inserts.
5. Remove the seal spindle, if necessary, by rotating it clockwise. Do not remove the seal spindle unless the O-Ring which seals the spindle requires replacement. The O-Ring may be used as long as it is not torn or distorted.
6. Remove the metering valve assembly by turning the valve body counterclockwise. Remove and clean the valve seat, stem and packing.

NOTE: If the blender is equipped filters, it may be necessary to change the elements periodically. Unscrew the filter assembly and replace the element and the O-Ring seal.

REASSEMBLY

1. Use the reverse of steps 1 through 6 of the disassembly procedure to reassemble the blender. Note the following during reassembly:
 - Prior to installing the needle control valve assembly make certain that the valve stem is turned completely counterclockwise to prevent damage to the valve seat.
 - When replacing the packing gaskets in the blender body, be sure the packing grommets are approximately $\frac{1}{16}$ in. above the top of the packing gasket. Also, be certain the tube seats firmly on the packing gaskets and does not overlap onto the end block.
 - The seal spindle serves to radially compress the tube packing gasket and exert a uniform pressure on the metering tube to prevent any possibility of leakage. Do not overtighten the seal spindle. Damage to the equipment may result.
2. After the blender has been reassembled, it is important that it be leak tested with nitrogen or air and either a soap solution, such as Snoop[®] or a gas leak detector. Do not exceed 200 psig during the leak test procedure. Vent all pressure from the system and repair any leaks before proceeding.

CALIBRATION

Series 150 Gas Blender Tubes are calibrated using Air at normal temperature (70°F) and pressure (14.7 psia) to an accuracy of $\pm 5\%$ of full scale from 10% to 100% of range. Calibrations for gases other than Air are mathematically derived from the Air calibration. Calibration charts for Air and Nitrogen are shipped with each blender or replacement tube. Calibration charts for many other gases are available at no additional charge. The accuracy of this calibration is $\pm 5\%$ of full scale (each tube).

MAINTENANCE AND REPAIRS

Periodically inspect the tubes and floats, and clean if necessary. Dirt or foreign materials adhering to the float or the inside of the tube may cause inaccuracy and sticking of the float. Borosilicate glass metering tubes and related parts may be cleaned ultrasonically or with a solvent that does not attack glass.

Repairs beyond those contained in this instruction booklet must be made by Advanced Specialty Gas Equipment Corp. who have the special tools, test equipment and trained personnel required to make a safe repair. Contact your Advanced Specialty Gas Equipment Distributor to arrange for repair.

Warranty Repairs are only available through Advanced Specialty Gas Equipment Corp., and will be performed at no charge for parts and labor. For information on warranty, see the last page of this instruction booklet.

Non-Warranty Repairs are available through your distributor. Upon receipt at the factory, the blender will be inspected and you will be contacted by your distributor with a repair cost estimate. No item will be repaired until approval is received. There will be an evaluation charge assessed for equipment not repaired.

SPECIFICATIONS

Maximum Operating Pressure and Temperature	200 psig at 250°F
Minimum Operating Temperature	32°F
Accuracy	±5% of full scale (standard) from 10% to 100% of range (each tube). Optional ±1% of full scale calibration is available.
Repeatability	Within 0.5% of full scale (each tube)
Tube Graduations	Millimeters (0–150)
Scale Length	150 millimeters
Available Ranges	See Tube Selection Table
Table Inlet and Outlet Connections	½ in. NPT female (2 inlets, 1 outlet)
Weight (approx.)	2 lbs.

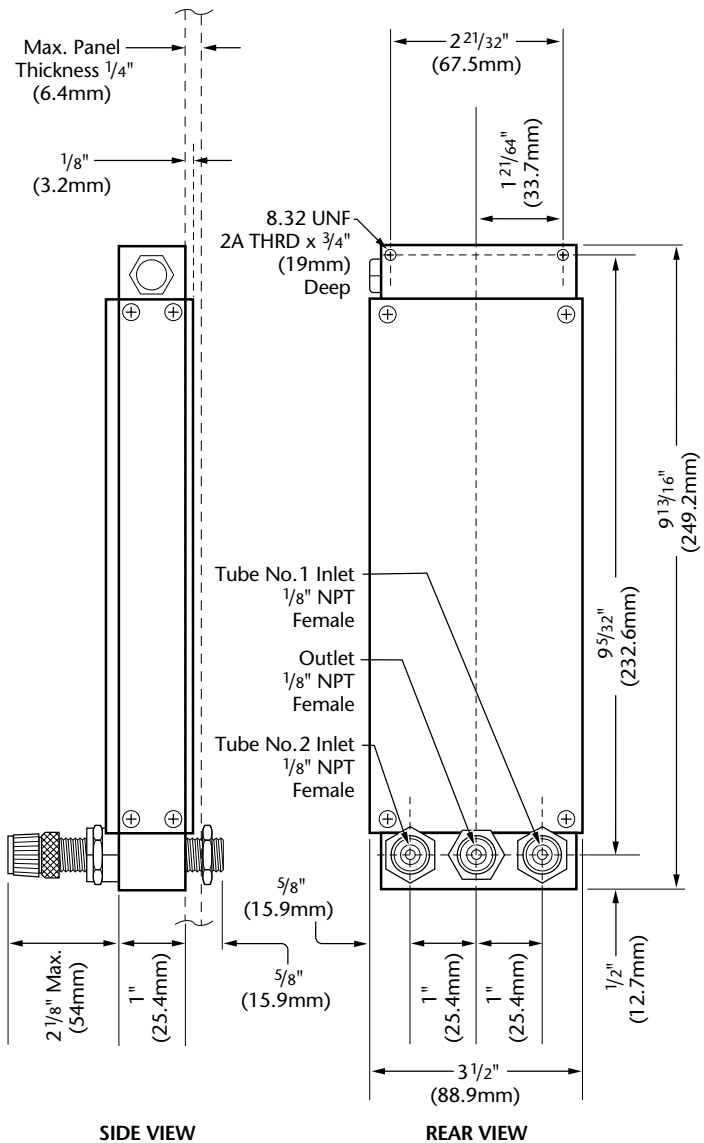
MATERIALS OF CONSTRUCTION

Tubes	Borosilicate Glass with float stops of Teflon®
Mixing Tube	Type 316 Stainless Steel
Floats	Borosilicate Glass and Type 316 Stainless Steel are standard; other materials are available as an option. (See Tube Selection Table and Optional Equipment)
End Blocks	See Table 1
Inlet/Outlet Adaptors	See Table 1
Side Plates	Aluminum
Back Plate	White Plastic
Front Plate	Clear Plastic
Seals and Packing	Viton® (other material available on special order)
Valve(s):	
Model FM4621	Chrome-Plated Brass
All Others:	Type 316 Stainless Steel

Table 1

Part No.	Configuration	End Blocks Material	Inlet/Outlet Adaptor Material
FM4620-(*)	With Standard Metering Valve	Aluminum	Aluminum
FM4621-(*)	With High Accuracy (NRS) Metering Valve	Aluminum	Aluminum
FM4630-(*)	With Standard Metering Valve	Type 316 SS	Type 316 SS
FM4631-(*)	With High Accuracy (NRS) Metering Valve	Type 316 SS	Type 316 SS

* Indicates the tube numbers in the order in which they are installed in the blender from left to right. Example: FM4621-23 for tube numbers 2 and 3. See Tube Selection Table on page 12 for ranges available.



Note: Inlet and outlet fittings are threaded and provided with jam nuts for mounting through $\frac{9}{16}$ " (14.3mm) diameter holes.

Figure 1 - Series 150 Two Tube Gas Blender Dimensions

TUBE SELECTION TABLE FOR SERIES 150 TWO TUBE BLENDERS

Flow rates shown are maximum flow rates at 70°F and 14.7 psia.
(Minimum flow rates = 1/10 of maximum)

Tube No.	Float Material*	Air		Argon		Carbon Dioxide		Helium	
		slpm	scfh	slpm	scfh	slpm	scfh	slpm	scfh
1	Glass	0.050	0.106	0.041	0.087	0.059	0.125	0.045	0.095
	Sapphire	0.077	0.163	0.063	0.134	0.088	0.186	0.071	0.150
	316 Stn. Stl.	0.148	0.313	0.122	0.259	0.160	0.339	0.145	0.307
	Carboloy	0.251	0.531	0.208	0.441	0.268	0.568	0.269	0.570
	Tantalum	0.274	0.580	0.227	0.481	0.293	0.621	0.299	0.634
2	Glass	0.088	0.186	0.072	0.153	0.103	0.218	0.083	0.176
	Sapphire	0.136	0.288	0.111	0.235	0.154	0.326	0.130	0.275
	316 Stn. Stl.	0.258	0.546	0.213	0.451	0.278	0.589	0.262	0.555
	Carboloy	0.439	0.929	0.363	0.769	0.446	0.945	0.483	1.02
	Tantalum	0.478	1.01	0.396	0.839	0.481	1.02	0.535	1.13
3	Glass	0.380	0.805	0.318	0.674	0.358	0.759	0.494	1.05
	Sapphire	0.518	1.10	0.433	0.918	0.482	1.02	0.759	1.61
	316 Stn. Stl.	0.832	1.76	0.697	1.48	0.754	1.60	1.41	2.99
	Carboloy	1.24	2.62	1.04	2.20	1.10	2.33	2.29	4.85
	Tantalum	1.33	2.82	1.11	2.35	1.17	2.48	2.47	5.23
4	Glass	2.37	5.02	2.00	4.24	2.06	4.37	5.03	10.7
	Sapphire	3.08	6.52	2.60	5.51	2.68	5.68	6.69	14.2
	316 Stn. Stl.	4.65	9.84	3.92	8.31	4.02	8.52	10.3	21.9
	Carboloy	6.67	14.1	5.64	12.0	5.65	12.0	15.0	31.7
	Tantalum	7.09	15.0	5.99	12.7	5.97	12.7	15.9	33.7
5	Glass	8.68	18.4	7.34	15.6	7.39	15.7	19.3	40.0
	Sapphire	11.2	23.7	9.46	20.1	9.47	20.1	25.3	53.6
	316 Stn. Stl.	16.5	35.0	14.0	29.7	13.9	29.5	38.4	81.4
	Carboloy	23.2	49.1	19.6	41.5	19.4	41.1	55.1	116.8
	Tantalum	24.5	51.9	20.8	44.1	20.5	43.4	58.5	124.0
6	Glass	23.7	50.2	20.1	42.6	19.6	41.5	55.5	117.6
	Sapphire	30.1	63.7	25.5	54.0	25.0	53.0	72.7	154.1
	316 Stn. Stl.	43.7	92.5	37.0	78.4	36.5	77.4	109.4	321.8
	Carboloy	61.1	129.3	51.8	109.8	50.9	107.9	153.2	324.7
	Tantalum	64.6	136.8	54.8	116.1	53.8	114.0	162.0	343.3

Flow capacities for gases not listed may be obtained from your Advanced Specialty Gas Equipment Distributor.

* Series 150 flow tubes are supplied standard with both a glass and stainless steel float.
Other float materials listed are optional.

Hydrogen		Nitrogen		Oxygen		Water	Replacement Tubes and Packing Part No.
slpm	scfh	slpm	scfh	slpm	scfh	sccm	
0.101	0.214	0.051	0.108	0.044	0.093	0.551	FM4331
0.160	0.339	0.080	0.170	0.069	0.146	1.08	
0.323	0.685	0.152	0.322	0.133	0.282	2.56	
0.592	1.25	0.258	0.547	0.228	0.483	5.02	
0.653	1.38	0.282	0.598	0.249	0.528	5.58	
0.185	0.392	0.091	0.193	0.078	0.165	1.01	
0.288	0.610	0.140	0.297	0.121	0.256	1.96	
0.574	1.22	0.266	0.564	0.232	0.492	4.56	
1.04	2.20	0.451	0.956	0.398	0.843	8.80	
1.14	2.42	0.491	1.04	0.434	0.920	9.77	
1.03	2.18	0.389	0.824	0.351	0.744	5.94	FM4333
1.49	3.16	0.529	1.12	0.479	1.02	10.7	
2.53	5.36	0.849	1.80	0.771	1.63	20.9	
3.87	8.20	1.26	2.67	1.15	2.44	33.6	
4.16	8.82	1.35	2.86	1.23	2.61	36.2	
7.99	16.9	2.41	5.11	2.22	4.70	53.3	FM4334
10.5	22.2	3.14	6.65	2.89	6.12	80.2	
15.9	33.7	4.74	10.1	4.36	9.24	134.0	
22.8	48.4	6.81	14.4	6.27	13.3	199.7	
24.3	51.5	7.23	15.3	6.66	14.1	213.2	
29.9	63.4	8.85	18.8	8.16	17.3	202.1	FM4335
38.9	82.4	11.4	24.2	10.5	22.3	299.1	
58.4	123.8	16.8	35.7	15.6	33.0	492.8	
82.9	175.7	23.6	50.0	21.9	46.4	726.4	
87.9	186.3	25.0	53.0	23.2	49.2	773.4	
85.4	181.0	24.2	51.3	22.5	47.7	580.4	FM4336
110.0	233.1	30.6	64.8	28.5	60.4	853.1	
160.3	339.7	44.5	94.3	41.3	87.5	1362.0	
222.0	470.5	62.2	131.8	57.7	122.3	1952.0	
234.5	497.0	65.8	139.4	61.0	129.3	2069.0	

WARRANTY

Advanced Specialty Gas Equipment Corp.,(the Company), warrants to the initial purchaser of each two tube gas blender described herein, that such equipment will be free from defects in material and workmanship which result in breakdown or failure under normal use during a period of 12 months from date of shipment by the Company if used and maintained according to Advanced Specialty Gas Equipment written instructions. This warranty does not cover damage or malfunction due to corrosion. Purchaser is aware that this equipment is designed for specific applications and that using this equipment with the wrong or improperly purged gas or at the wrong pressure may damage or corrode the unit and cause personal injury. Purchaser must confirm that this equipment is compatible with the gas being passed through it. If there is any doubt about compatibility, consult your Advanced Specialty Gas Equipment Corp. distributor.

The Company's liability under this warranty shall be limited to the repair, or at its option, replacement or refund of the purchase price, of such equipment which proves to be defective, provided; however, that this warranty shall only apply if the purchaser (1) gives the Company written notice within ten (10) days after discovery of such defect, (2) immediately on discovery of the claimed defect, discontinues all use of such equipment, and (3) returns such equipment freight prepaid to plant of manufacture.

THERE ARE NO EXPRESS WARRANTIES OTHER THAN THOSE SPECIFIED HEREIN. NO WARRANTIES ADVANCED SPECIALTY GAS EQUIPMENT CORP.(OTHER THAN WARRANTY OF TITLE AS PROVIDED IN THE UNIFORM COMMERCIAL CODE) SHALL BE IMPLIED OR OTHERWISE CREATED UNDER ANY APPLICABLE LAW, INCLUDING BUT NOT LIMITED TO WARRANTY OF MERCHANTABILITY AND WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE. No claim against the Company of any kind, whether as to equipment delivery or for nondelivery of equipment and whether or not based on contract, warranty, negligence, strict liability in tort or otherwise, shall be greater in amount than the purchase price of the equipment in respect of which such claim is made. Without limiting the generality of the foregoing, Advanced Specialty Gas Equipment Corp. shall not be liable for any special, indirect, or consequential damage, such as failure of parts resulting from corrosion.

If it is determined by Advanced Specialty Gas Equipment Corp. that the equipment is to be repaired or replaced under the terms of this warranty, the cost of returning said equipment to the initial purchaser will be paid by the Company. If, however, equipment returned to the Company in connection with a claim under this warranty is found by the Company not to be defective hereunder, then such equipment will be returned to the initial purchaser, shipping charges collect, and additionally, a service charge will be paid by the purchaser to the Company to cover the cost of handling and testing such equipment.

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