

Drum Scrubber

Installation, Operation, and Maintenance Instructions

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1.0 Introduction

1.1 About this document

This document contains the information necessary to properly receive, assemble, install, operate, and maintain the Drum Scrubber filter system and media. The purchaser, installer, and operator of the filter system **MUST** read and comply with this document in its entirety prior to installation of the equipment and its operation. Failure to comply with the requirements of this manual may void the product warranty.

CAUTION

These instructions are specific to the Drum Scrubber and chemical media. All ancillary tasks including, but not limited to, electrical and mechanical work, equipment handling, and safety procedures, must be performed in accordance with industry accepted practice and all relevant local, state, and federal government codes, laws, and policies.



1.2 Packaging and Shipping, Receiving and Inspection, Handling and Storage

1.2.1 Packaging and shipping: Unless otherwise defined in the purchase order and agreed by MAS the Drum Scrubber and filters are packaged for domestic transit and shipped FOB the MAS factory. The method of shipment will be as specified in the customer's purchase order to MAS.

1.2.2 Receiving and inspection: Obtain a copy of the purchase order and product drawing that was submitted by MAS in association with the order, and a copy of the bill of lading, along with any other shipping papers. Upon receipt of the equipment, or any part thereof, these documents shall be used to ensure that the correct product has been received.

For maximum protection complete the following steps upon receipt of the Drum Scrubber and chemical media:

- Inspect the shipment and all associated documentation. Notify the carrier immediately if there is any visible damage to the packaging or the equipment, or a discrepancy in the shipping papers and, if necessary, file an immediate claim with the carrier against such damage or discrepancy.
- Confirm that the equipment received agrees with the contents of the shipping papers.
- Confirm that the shipping documents agree with the purchase order. Refer to the product drawing submitted for the order as necessary.
- If it is determined that any equipment ordered on the purchase order has not been delivered and is not accounted for in the shipping papers contact MAS Innovations immediately. Reference the MAS control number which will be listed on the shipping papers.

Each shipment may include:

- One or more individually packaged Drum Scrubber
- Polyklean Blue filter pad
- Packaged gas phase chemical media

Note that the Drum Scrubber, Polyklean Blue filter, and gas phase media may ship from different locations and be received at different times.

1.2.3 Handling and storage: Following receipt, inspection, and acceptance of the equipment, and prior to installation, the Drum Scrubber, the particulate filters, and gas phase media shall be handled with great care. The Drum Scrubber ships mounted on a pallet for protection during shipping and handling. It is recommended that it remain on its pallet until it has been moved to its final installation location. Drum Scrubbers may be moved using a fork-lift.

! WARNING: The tank cover top will not support the weight of the unit. Any attempt to lift the Drum Scrubber from the cover may result in serious equipment damage and severe personal injury. Do not walk on the top of the unit or use the top for storage of materials.

The components shall be retained and stored in their protective packaging until immediately prior to installation. Care shall be taken to ensure that the packages are not dropped or subjected to any impact loads.

Prior to installation, the equipment shall be protected from exposure to weather. The equipment shall be stored in a clean, dry, controlled environment. All items shall be stored on pallets so that they are elevated above grade. Particulate filters and gas phase media shall not be stacked more than three (3) cartons high to prevent crushing. Only particulate filters shall be stacked on particulate filters, and gas phase media on gas phase media. The gas phase media ships inside a carton enclosed in transparent protective plastic. Under no circumstances shall the filters be removed from this plastic protection until immediately prior to installation.

Filter products shall not be stored in areas where they may become contaminated by chemicals, either acids or alkali's, in liquid, vapor or gaseous form.



1.3 Product Descriptions

1.3.1 Drum Scrubber: Each Drum Scrubber will be received individually mounted on a shipping pallet and wrapped in plastic for protection during shipping. Contaminated air enters the bottom of the tank and travels up past a particulate filter and through the chemical media before being discharged from the top of the unit. The Drum Scrubber can be supplied in four airflow sizes, 150, 300, 500 and 1000 cubic feet per minute (cfm) and in two models, powered and non-powered. Depending on application, different types of MAS gas-phase, chemical media can be installed (see 1.3.2 for details).



Figure 1
Drum Scrubber 150, with cast aluminum pressure blower

1.3.2 Gas Phase Chemical Media: Gas phase chemical media is shipped in cartons, mesh sacks or sling bags. The carton shown below contains one cubic foot of MAS chemical media in a mesh sack. The weight of cartons will vary between 30 and 50 pounds, depending on the chemical media required.



Figure 2
Typical packaging for media mesh sack
Carton box (14" x 14" x 12" (H x W x D))

Chemical Media	Target Contaminant
EC-101	Volatile Organics (VOCs) Hydrocarbons (HC), NO ₂
EC-102	H ₂ S, SO ₂ , Cl ₂
SP-908	H ₂ S, SO ₂ , NO, Formaldehyde (CH ₂ O)
EC-109	High Capacity for H ₂ S
EC-103	NH ₃ , amines
MB-185	H ₂ S, SO ₂ , VOC, HC, Formaldehyde (CH ₂ O)

Table 1
MAS Chemical Media versus Chemical Contaminants

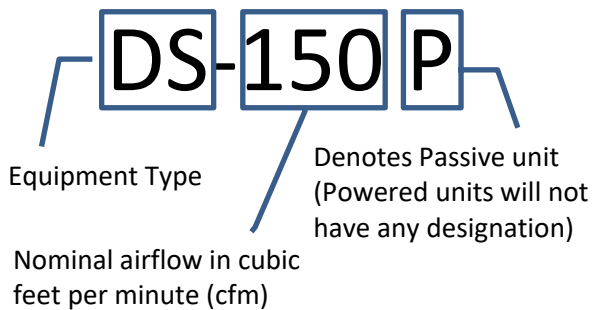


1.3.3 Particulate filters: Particulate pre-filters will typically be Polyklean Blue pads. Depending on the size of the Drum Scrubber ordered the appropriate pad size will be supplied.

Note that other optional or special filter arrangements may be supplied depending on the requirements of the project. Check the purchase order and the MAS submittal drawing(s) for details.

1.4 Product Model Designations

The Drum Scrubber model is designated as follows:



1.5 Product Drawings

Details of standard Drum Scrubber systems are shown on the following MAS drawings:

Equipment	Drawing Number
DS-150	MAS-7150
DS-150P	MAS-8150
DS-300	MAS-7300
DS-300P	MAS-8300
DS-500	MAS-7500
DS-500P	MAS-8500

Table 2
Drum Scrubber Sizes and Drawing Numbers

Copies of the appropriate drawings could have been supplied as part of the MAS submittals in response to the purchase order. Obtain and review the drawing(s) before proceeding with the installation of the filter system.

The Drum Scrubber drawings include the following details:

- Overall filter system dimensions
- Shipping weights
- Operating weights
- Sizes and quantities of the particulate and gas phase filters required
- Details of the gas phase chemical media supplied
- Details of the particulate filters supplied
- System design airflow
- Pressure losses across the filter system at nominal airflow design velocities
- Product details

1.6 Assembly – General Comments

As indicated previously the individual components that will comprise the filter system will ship separately and will be required to be installed on site. The Drum Scrubber is a self-contained product and a minimum amount of assembly is required. Refer to section 3.0, Installation Instructions, of this manual for further detailed instructions. Consult with an experienced installer to obtain an accurate estimate of the time, personnel and equipment resources and tools that will be required to complete the assembly and installation of the filter system. Site assembly will be limited to moving and lifting individual components, screwing components together, and caulking. The Drum Scrubber weights and dimensions can be found on the product drawings.

Completion of the following preparations and provision of the following items will be the responsibility of the installer or others:

- Site preparation
- Connecting hardware for attaching inlet and outlet ducts
- Caulk, as required
- Inlet and outlet ducts, or other sheet metal parts, as required

These items will not be supplied by MAS unless noted specifically in the MAS quotation and in the accepted customer purchase order.



In general, assembly of the filter system will consist of the following:

- Preparation of the installation location
- Transportation of all components to the installation location
- Unpacking the Drum Scrubber
- Installing the Drum Scrubber
- Installing inlet and outlet ducts
- Unpacking gas phase chemical media
- Installing gas phase chemical media
- Unpacking particulate filters
- Installing particulate filters
- Cleaning the site
- Start-up and commissioning of the filter system

1.7 Related System Equipment

Ventilation systems can include other equipment including but not limited to:

- Fan(s), if not supplied as part of the Drum Scrubber
- Dampers
- Analog instrumentation
- Electronic instrumentation and controls

Neither the interface of these items with the filter system supplied by MAS, nor the installation, operation and maintenance of these items is covered in this manual. Whether these items are supplied by MAS or by others, consult the documentation specific to these products for appropriate instructions.

2.0 PRINCIPLES OF OPERATION

An understanding of the design and operating principle of the Drum Scrubber with Gas Phase Chemical Media is useful for effective installation, operation and maintenance. The system is intended to remove corrosive and odorous gaseous contaminants from sewage pumping stations, laboratory vent hoods, and pressure relief valves of chemical storage tanks. Examples of such contaminants may be nuisance odors and smells that may cause domestic and neighborhood discomfort, or harmful gases that may cause damage to health, plant and product in industrial applications. The heart of the system is the MAS Chemical Media. The Drum Scrubber is a small plastic vessel that allows air to move across the chemical media bed in an upward direction. The method of contaminant removal is through a combination of the physical property of adsorption and the chemical process of oxidation. MAS offers a variety of impregnated and un-impregnated dry granular media to handle a wide range of contamination problems. For more information on MAS's gas phase air cleaning products contact your MAS representative.

The Drum Scrubber is one of the various systems designed to support the MAS Chemical media in the air stream and to allow easy installation, operation and maintenance of the system.



3.0 INSTALLATION INSTRUCTIONS

Consult the product drawing(s) submitted on this order before proceeding.

3.1 Space Requirements: A minimum of 24" clear space must be available around the Drum Scrubber to perform routine maintenance. Additionally, it is recommended that 36" clear space be available in at least one direction. Additional space may be required for inlet and outlet ductwork.

3.2 Foundations, supports and anchoring: The foundation and/or supports must be designed to be adequate to support the filter system operating weight, and any seismic, live or other loads (if any), with a sufficient factor of safety as determined to comply with the requirements of all applicable governing codes, standards, and laws. Ensure that the foundation or support surface is level and smooth before proceeding. The filter system is designed for operation in indoor or outdoor locations. The equipment is not specifically designed to resist and operate under unusual dynamic loading situations such as high winds or earthquake conditions. If the equipment is required to function in such circumstances special precautions may be required to ensure that the equipment will remain intact, anchored and functioning. If this situation applies consult with a qualified professional engineer before installing the equipment.



3.4 General Filter System Installation:

3.4.1 Installing the Drum Scrubber: Keeping the Drum Scrubber on its shipping pallet move it to its final installation location. Remove the plastic wrapping that secures the Drum Scrubber to its pallet.

! WARNING: The tank lid will not support the weight of the unit. Any attempt to support the unit from the tank lid may result in serious equipment damage and severe personal injury. Do not walk on the top of the unit or use the top for storage of materials.

3.4.2 Locating, Mounting and Supporting the Drum Scrubber: Locate the Drum Scrubber in its final installation location. The support surface under the base of the frame shall be level, smooth, clean and dry. The location shall not be subject to standing water or flooding. The circumference of the tank base shall be fully supported. Adjust the supports so that the base is level in all directions.

Provision of anchoring hardware, support cradles, or any other supporting component will be the responsibility of the installer or others. These items will not be supplied by MAS unless noted specifically in the MAS quotation and in the accepted customer purchase order.

3.4.3 Connection of inlet and outlet ducts: Inlet and outlet ducts, when required, shall be connected to the inlet and outlet faces of the housing as shown in figure 4.

! WARNING: The housing is not designed to support the weight of inlet and outlet ducts. All ducts shall be supported independently of the housing. Any attempt to support the ducts from the housing may result in serious equipment damage and severe personal injury.

3.4.4 Sealing the inlet and outlet duct connections:

A flexible coupling with stainless steel clamps is provided. All other provisions of the inlet and outlet ducts, the connecting hardware, and the gaskets or caulk will be the responsibility of the installer or others. These items will not be supplied by MAS unless noted specifically in the MAS quotation and in the accepted customer purchase order.

Caulk generously, between the flanges of the connecting ducts and the housing to prevent air leaks. Any caulk used shall be a long life, flexible, non-drying caulking material. The caulk supplier shall ensure that the caulk shall meet the customer specifications for the application in which it is being used.

CAUTION: Many installations prohibit the use of certain caulking materials such as Silicone. The use of materials containing VOCs should also be avoided as they may have a negative effect on the life of the gas phase filters.

3.5 Preparation for filter installation: In order to maximize the life of the gas phase chemical filters and the particulate filters it is recommended that filter installation be the final installation task before start-up and commissioning of the system. In preparation for filter installation it is recommended that the following be completed:

- Completely clean the system to remove all construction debris and dirt, sweep and vacuum to remove visible dirt.
- Finalize and complete all caulking in the system.
- Finalize and complete all painting in the system.

It is recommended that all cleaning materials and paints used in the system be free of solvents. If this is unavoidable it is recommended that sufficient time be allowed for complete drying to occur and for the VOCs to disperse before installing the filters. This process can be accelerated by “blowing down” the system, i.e. operating the fan without the filters to ventilate the system. Before “blowing down” the system check that it is safe to operate the fan without the pressure load of the gas phase chemical filters. Consult the MAS submittal drawing for pressure information.



3.6 Pre-filter Installation: It is highly recommended that a Polyklean Blue filter pad be used to prevent the build up of dust, grease, and water on the gas phase chemical media.

Install the pre-filters as shown in the sequence shown below. For best results MAS recommends the use of the 2" thick Polyklean Blue filter media. Circular Polyklean Blue pads will be cut with a 2" overlap.

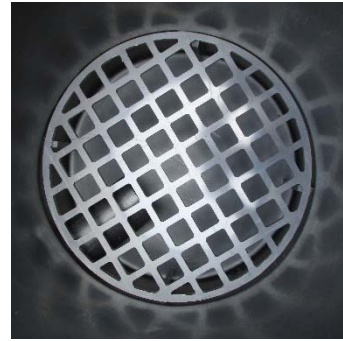
DRUM SCRUBBER MODEL	PARTICULATE FILTER PART NUMBER
DS-150 or DS-150P	358-012-024
DS-300 or DS-300P	358-012-033
DS-500 or DS-500P	358-012-037

Remove the polypropylene perforated screen from the bottom of the tank. Place the Polyklean Blue pad directly onto the HDPE grating at the bottom of the vessel. Ensure there are no gaps between the filter pad and the side wall of the tank.

3.7 Installation of Media in the Drum Scrubber:

There are several varieties of chemical media. Each media is designed to remove a specific contaminant. The arrangement of media in the scrubber is significant. If your system is designed with multiple media beds, media bed #1 is located closest to the inlet or the bottom of the scrubber. Media bed #2 is located closest to the blower or the top of the scrubber. Review the drawing and ensure media is being placed in the correct bed.

! WARNING: Respirator Masks are required to be worn by all personnel during the media installation process.



Step 1: Start with the tank empty and the HDPE grating exposed



Step 2: Place the Polyklean Blue pad on the HDPE grating



Step 3: Place the polypropylene pad on the Polyklean Blue pad



Installing Media by Carton: Loosen latch and remove top hatch. Gradually pour the media in a controlled manner. Avoid causing significant impact loading by gradually metering the media into the scrubber. Media should be filled to approximately six inches below the lip of the tank vessel.

Installing Media by Mesh Sack: Loosen latch and remove top hatch. Place the mesh sack in the bottom of the scrubber ensuring the edge of the media sack touches the side wall. Avoid causing significant impact loading by gradually metering the media into the scrubber. Media should be filled to approximately six inches below the lip of the tank vessel.

3.8 Latches on Tank Cover: Place the cover on the Drum Scrubber tank and latch the cover as shown.



! WARNING: The tank cover top will not support the weight of the unit. Any attempt to lift the Drum Scrubber from the cover may result in serious equipment damage and severe personal injury. Do not walk on the top of the unit or use the top for storage of materials.

3.9 Fans: Sometimes the Drum Scrubber may be supplied with an externally mounted blower. See Table 3 for a list of standard motor details. Please review the MAS drawing for your scrubber's information and details.

Table 3 Standard Motor Characteristics

MODEL	VOLTAGE	HZ	PHASE	HORSE POWER
DS-150	115/230V	60	1	0.3
DS-300	115/230V	60	1	0.5
DS-500	115/230V	60	1	1.0

CAUTION: All electrical work must be carried out in accordance with all appropriate governing electrical codes and standards.

Provide an appropriate power supply as specified in the submittal information.

! WARNING: All electrical work has the potential to cause shock, injury, and even death. Disconnect all power whenever working on the system. Only qualified electrical personnel should work on the system at any time.

CAUTION: Use of the incorrect line voltage may result in irreparable damage to electrical components.

4.0 START-UP INSTRUCTIONS

Immediately on start-up examine the filter system for any apparent air leaks or other anomalies. Air leaks may be detected by noise or by use of a synthetic smoke puffing device at the external joints and seams of the filter system installation. Correct or repair any discrepancies, as necessary. Repeat this examination after 24 hours of operation and again after one week of operation.



5.0 MAINTENANCE

5.1 Polyklean Blue-filter: A Polyklean Blue pad has been included as part of the system. Under normal conditions, the filter can be expected to last for between 10 and 12 months before reaching its final recommended capacity loading (see the MAS drawings for details). However under heavier or lighter particulate loading conditions, this may vary. At an air velocity of 100 feet per minute the 2" deep Polyklean Blue pad can be expected to have an initial pressure drop in the range of less than 0.1" water gauge. MAS recommends that the Polyklean Blue pad be replaced whenever new chemical media is installed.

5.2 Gas Phase Chemical Media Monitoring: A discussion of sophisticated gas phase filter monitoring is beyond the scope of this manual. At its most simple, when the system is used to remove nuisance odors, the time to change out the gas phase chemical media is when the odor begins to be regularly detected on the clean side of the system. In more stringent applications where the system is supplied to protect health and / or high value plant and product, active real time electronic and passive coupon corrosion monitoring systems are available to determine the performance of the system. The remaining life of the media can be determined by taking a sample of media and returning it to MAS for analysis. Consult with your MAS representative regarding active and passive monitoring systems and media sampling for remaining life analysis.

5.3 Removal and Replacement of Particulate and Gas Phase Chemical Media: Removal of filters will be the reverse of the installation process described earlier in this manual. Filter and media replacement will be carried out exactly the same as at initial installation.

5.4 Disposal of used filters: Used chemical filters and particulate filters shall be packaged and disposed of in full accordance with all required and applicable laws and regulations. Consult with local environmental control authorities such as local, state and federal EPA & OSHA authorities for direction. Safety Data Sheets (SDS) are available on all products supplied by MAS. Contact your MAS representative for further information.

5.5 Cover Lid Sealing Gaskets: The proper maintenance of the cover lid sealing gaskets is critical to the performance of the system. Check the gaskets carefully whenever the gas phase chemical filters are replaced. If gaskets are worn, frayed, or damaged in any way they should be replaced. Check the seal between the lid and the tank whenever new MAS chemical media is installed.

5.6 General System Maintenance: Ducts, external Drum Scrubber surfaces, latches, blower and other system infrastructure should be checked at least every 6 months. Internal surfaces shall be examined whenever filters are replaced. Examine all components for the following:

5.6.1 Cleanliness: Sweep and vacuum all standing dust or dirt in the system. If using cleaning solvents, be mindful of the impact of solvents on the performance and life of the gas phase chemical filters and take appropriate precautions to protect the system.

5.6.2 Water: The system should be completely dry at all times. The presence of standing water, condensation or dampness is detrimental to the performance and life of the system. Determine and remove the cause for the presence of water in the system, dry the system and examine all components for the presence of mold and other biological growth. Remove all contamination, clean and sterilize as necessary.

5.6.3 Filter System Integrity: Ensure that the unit contains the appropriate filter elements, both particulate and gas phase, and that these elements are correctly installed. Check for missing or improperly installed components and review the system seals. Check for air leaks at joints and seams and replace gaskets, worn hardware, and seal with caulk as necessary.

5.6.4 Duct and System Integrity: Examine the entire system to ensure that contaminated air cannot leak around the filter system. Check all perimeter seals and repair as necessary.

5.6.5 Corrosion: If metal components are corroded repair the corrosion and provide protective coatings as necessary. Be mindful of the impact of painting on the performance and life of the gas phase chemical filters and take appropriate precautions to protect the system. Determine the source of the corrosion and rectify.



6.0 TROUBLESHOOTING

Potential problems and causes listed are in no order of importance or priority. The causes are only a list of the most common items to check to correct a problem. If you find the cause of a problem, DO NOT assume it is the only cause of that problem. Different problems can have the same cause.

PROBLEM	CAUSE
Odors and Smells	<ol style="list-style-type: none"> 1. Chemical media is spent. 2. Missing or damaged filters. 3. Incorrect media installed.
Airflow (CFM) Too Low	<ol style="list-style-type: none"> 1. Blower wheel turning in wrong direction. 2. Actual system static pressure is higher than expected. 3. Motor speed (rpm) too low. 4. Dampers or valves not adjusted properly. 5. Leaks or obstructions in duct work. 6. Filters dirty. 7. Inlet and/or discharge guards are clogged. 8. Duct elbow too close to blower discharge. 9. Improperly designed duct work. 10. Condensation of moisture blinding the particulate and/or chemical media. 11. Presence of moisture in the filters combined with freezing temperatures can cause the filters to become impassible.
Airflow (CFM) Too High	<ol style="list-style-type: none"> 1. Actual system static pressure is lower than expected. 2. Motor speed (rpm) too high. 3. Filters not in place. 4. Dampers or valves not adjusted properly.
Excessive Vibration	<ol style="list-style-type: none"> 1. Loose mounting bolts, wheel set screws, taper-lock hubs. 2. Worn or corroded blower wheel. 3. Accumulation of foreign material on blower wheel. 4. Bent motor shaft. 5. Worn motor bearings. 6. Motor out of balance. 7. Inadequate structural support. 8. Support structure not sufficiently cross braced. 9. Weak or resonant foundation. 10. Foundation not flat and level.
Motor Overheating	<p>NOTE: A normal motor will operate at 174°F.</p> <ol style="list-style-type: none"> 1. Actual system static pressure is lower than expected. 2. Voltage supplied to motor is too high or too low. 3. Motor speed (rpm) too high or defective motor. 4. Air density higher than expected. 5. Motor wired correctly or loose wiring connections.
Excessive Noise	<ol style="list-style-type: none"> 1. Wheel rubbing inside of housing. 2. Worn or corroded blower wheel. 3. Accumulation of foreign material on blower wheel. 4. Loose mounting bolts, wheel set screws, or taper-lock hubs. 5. Bent motor shaft. 6. Worn motor bearings. 7. Motor out of balance. 8. Motor bearings need lubrication. 9. System resonance or pulsation.
Fan Doesn't Operate	<ol style="list-style-type: none"> 1. Motor wired incorrectly or loose wiring connections. 2. Incorrect voltage supply. 3. Defective fuses or circuit breakers. 4. Power turned off elsewhere. 5. Defective motor.



7.0 SPARE PARTS LIST

It is recommended that the following spare parts be stored at the installation site for routine maintenance purposes. The quantities required will depend on the size of the system. Consult with your MAS representative to determine actual quantities required. Minimum recommended quantities are provided in the table below.

PARTICULATE FILTER PART NUMBER	DESCRIPTION
358-012-024	24" round Polyklean Blue filter for DS-150 or DS-150P
358-012-034	34" round Polyklean Blue filter for DS-300 or DS-300P
358-012-037	37" round Polyklean Blue filter for DS-500 or DS-500P

CHEMICAL MEDIA PART NUMBER IN CARTONS IN MESH SACKS		DESCRIPTION
826-M101	836-M101	EC-101 – Activated Carbon
826-M102	836-M102	EC-102 – Activated Carbon with KOH
826-M908	836-M908	SP-908 – Activated Alumina with KMnO ₄
826-M109	836-M109	EC-109 – High H ₂ S Capacity Catalytic Carbon
826-M103	836-M103	EC-103 – Activated Carbon with H ₃ PO ₄
826-B185	836-B185	MB-185 – 50:50 Blend of EC-101 and SP-908

MODEL	CARTONS REQUIRED	MESH SACKS REQUIRED
DS-150	5	5
DS-150P	5	5
DS-300	10	10
DS-300P	10	10
DS-500	17	17
DS-500P	17	17

8.0 EQUIPMENT OPERATING AND SHIPPING WEIGHTS

MODEL	SHIPPING WEIGHT	OPERATING WEIGHT
DS-150	120 lbs (54 kg)	295 lbs (134 kg)
DS-150P	63 lbs (29 kg)	238 lbs (108 kg)
DS-300	130 lbs (59 kg)	480 lbs (218 kg)
DS-300P	73 lbs (33 kg)	423 lbs (192 kg)
DS-500	160 lbs (73 kg)	755 lbs (342 kg)
DS-500P	95 lbs (43 kg)	690 lbs (312 kg)

- Operating weights based on using chemical media with a density of 35 lbs/ft³. Depending on chemical media selection, media density and operating weight may vary.

