

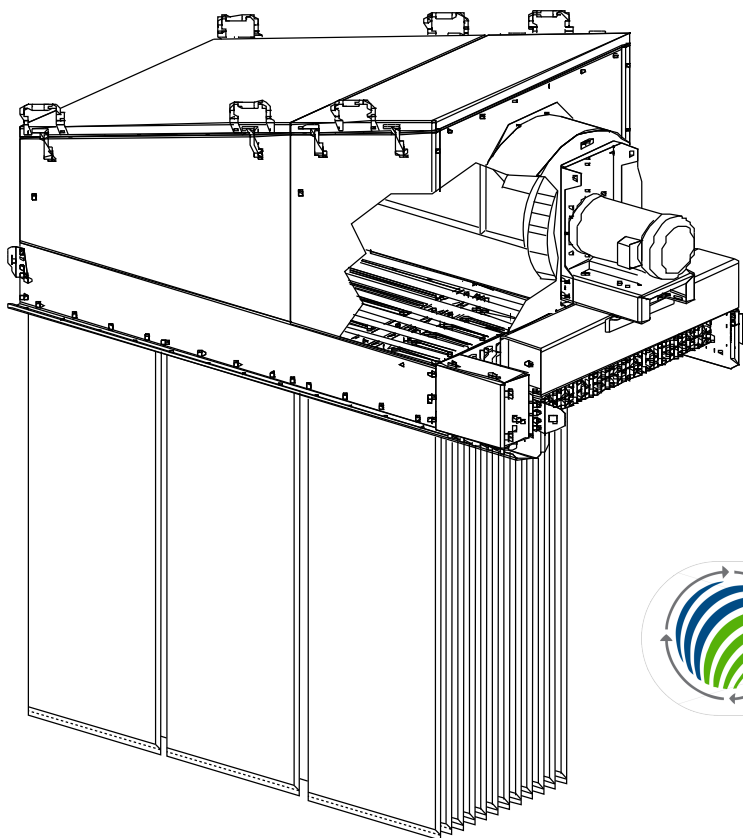


Dalamatic® Insertable

DLMV 4/7, 7/7, 8/7, 14/7, 21/7, 6/10, 10/10, 12/10, 20/10, 30/10,
9/15, 15/15, 18/15, 30/15, 45/15, 60/15

Installation and Operation Manual

Installation, Operation, and Service Information



This manual is property of the owner. Leave with the collector when set-up and start-up are complete. Donaldson Company reserves the right to change design and specifications without prior notice.

Illustrations are for reference only as actual product may vary.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

WARNING

Process owners/operators have important responsibilities relating to combustible hazards. Process owners/operators must determine whether their process creates combustible dust, fume, or mist. If combustible dust, fume, or mist is generated, process owners/operators should at a minimum:

- Comply with all applicable codes and standards. Among other considerations, current NFPA standards require owners/operators whose processes involve potentially combustible materials to have a current Hazard Analysis, which can serve as the foundation for their process hazard mitigation strategies.
- Prevent all ignition sources from entering any dust collection equipment.
- Design, select, and implement fire and explosion mitigation, suppression, and isolation strategies that are appropriate for the risks associated with their application.
- Develop and implement maintenance work practices to maintain a safe operating environment, ensuring that combustible dust, fume, or mist does not accumulate within the plant.

Donaldson recommends process owners/operators consult with experts to insure each of these responsibilities are met.

As a manufacturer and supplier of Industrial Filtration Products, Donaldson can assist process owners/operators in the selection of filtration technologies. However, process owners/operators retain all responsibility for the suitability of fire and explosion hazard mitigation, suppression, and isolation strategies. Donaldson assumes no responsibility or liability for the suitability of any fire and/or explosion mitigation strategy, or any items incorporated into a collector as part of an owner/operators hazard mitigation strategy.

Improper operation of a dust control system may contribute to conditions in the work area or facility that could result in severe personal injury and product or property damage. Check that all collection equipment is properly selected and sized for the intended use.

DO NOT operate this equipment until you have read and understand the instruction warnings in the Installation and Operations Manual. For a replacement manual, contact Donaldson Torit.

This manual contains specific precautionary statements relative to worker safety. Read thoroughly and comply as directed. Discuss the use and application of this equipment with a Donaldson Torit representative. Instruct all personnel on safe use and maintenance procedures.

Data Sheet

Model Number _____	Serial Number _____
Ship Date _____	Installation Date _____
Customer Name _____	
Address _____ _____	
Filter Type _____	
Accessories _____	
Other _____	

Contents

Description	1	Maintenance Information.....	15
Purpose and Intended Use	1	Operational Checklist	15
Operation.....	3	Diaphragm Replacement	16
Inspection on Arrival.....	4	Filter Removal and Installation.....	16
Installation Codes and Procedures	4	Compressed Air Components.....	18
Installation.....	4	Optional Equipment.....	19
Foundations or Support Framing	5	Magnehelic® Gauge	19
Collector Location	5	Photohelic® Gauge	20
Site Selection	5	Delta P Control.....	22
Rigging Instructions.....	5	Delta P Plus Control	23
Hoisting Information	5	DS Controller Installation.....	24
Typical Installation.....	6	Antistatic Option.....	27
Standard Equipment.....	7	Troubleshooting.....	28
Collector Installation.....	7		
Compressed Air Installation	7		
Electrical Wiring	8		
Solid-State Timer Installation.....	9		
Filter Bag Installation.....	11		
Helix Tube Filter Installation	13		
Preliminary Start-Up Check	14		

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 **DANGER**

DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

 **WARNING**

WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

 **CAUTION**

CAUTION, used with the safety alert symbol, indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to personal injury that may result in damage to equipment.

Description

The Dalamatric Model DLMV Insertable dust collectors are continuous-duty collectors with bag-style filters designed to handle known quantities of dust. Primarily installed in storage vessels or silos, they provide continuous filtration and maintain high collection efficiency at constant system resistance. Variations are available for pneumatic conveying operations where high dust concentrations of raw materials and particulate products are found. Continuous duty means no downtime. The filters are pulse-cleaned one at a time without turning the collector off. Standard sizes range from 43 to 645 sq ft of filter area and feature either a Delta P or Delta P Plus controller to control the filter cleaning operation.

Purpose and Intended Use



Misuse or modification may result in severe personal injury and/or property damage.

Do not misuse or modify.

There are four configurations of the DLMV.

- Type B is for indoor applications where filtered air can simply be released back into the ambient air.
- Type H is for indoor applications where filtered air must be ducted outdoors or to another location or where a remote fan will be used to draw air through the collector.
- Type W adds a weather cowl to the Type H configuration and is for outdoor applications where filters must be protected from the weather and a fan is not required.
- Type F is for indoor and outdoor applications where a fan is required to draw air through the filter bags. The fan is included in this configuration.

Dalamatric Insertables can be integrated with process machinery requiring dust control such as fluid bed reactors, mixers, blenders, mills, and crushers. Some typical applications include powder paint booths and automatic bag-slitting machines. The DLMV is commonly used in the chemical, mineral, food, plastic, metal compounds, and pharmaceutical industries. With custom modifications, the DLMV is suitable for high-temperature applications.

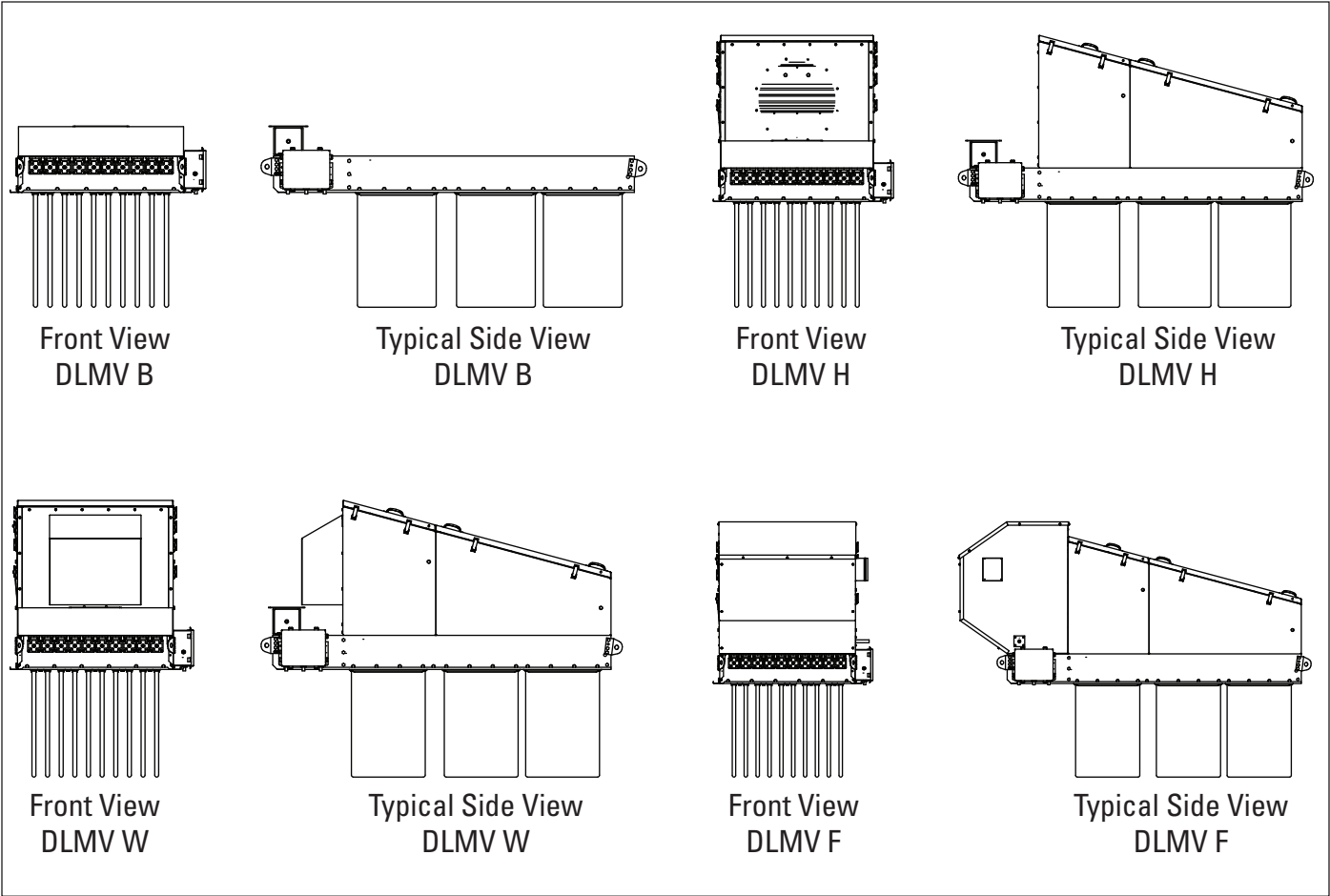


Combustible materials such as buffing lint, paper, wood, metal dusts, weld fume, or flammable coolants or solvents represent potential fire and/or explosion hazards. Use special care when selecting, installing, and operating all dust, fume, or mist collection equipment when such combustible materials may be present in order to protect workers and property from serious injury or damage due to a fire and/or explosion.

Consult and comply with all National and Local Codes related to fire and/or explosion properties of combustible materials when determining the location and operation of all dust, fume, or mist collection equipment.

Standard Donaldson Torit equipment is not equipped with fire extinguishing or explosion protection systems.

Rating and Specification Information



All Collectors:

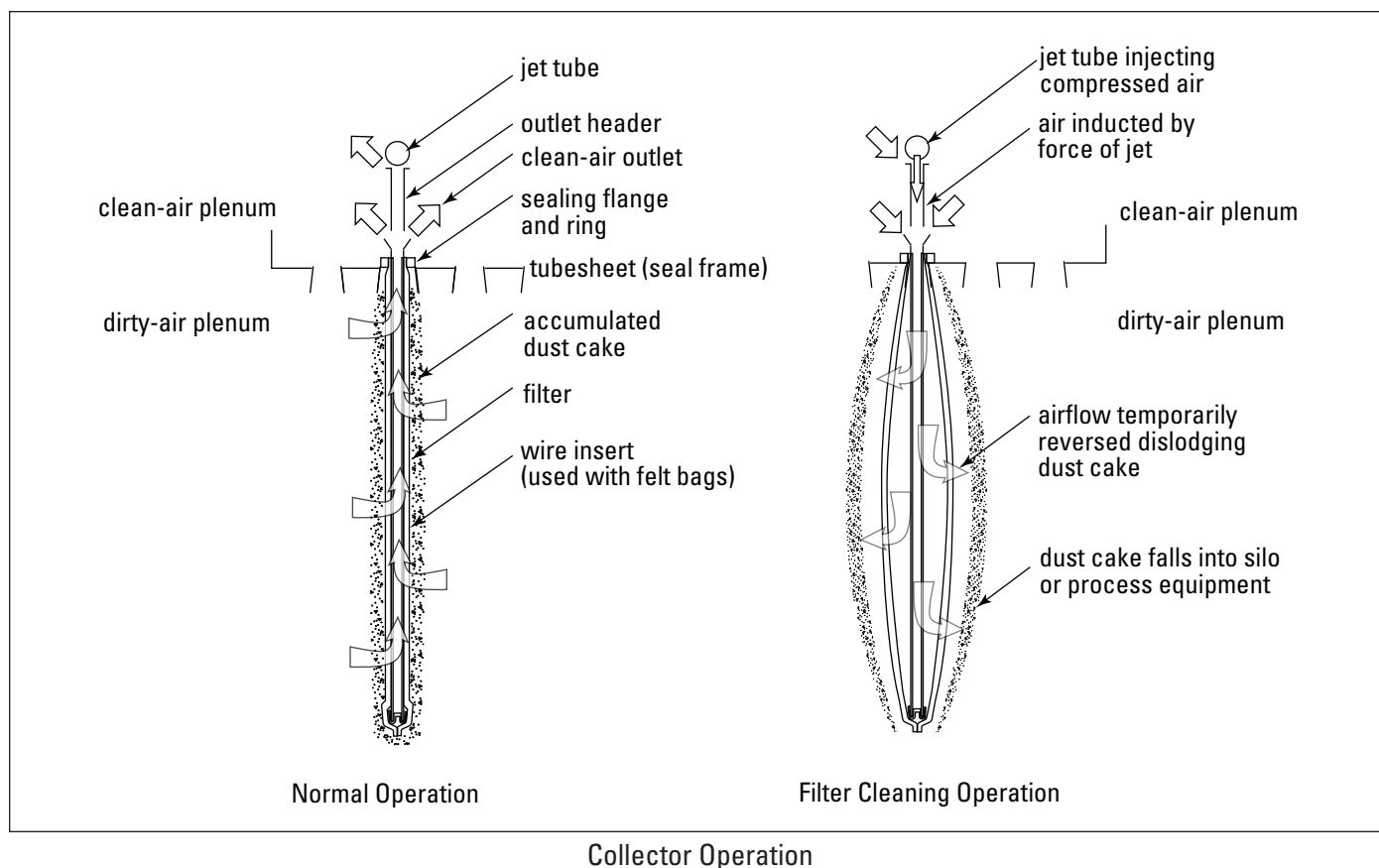
Compressed air supply, psig 90-100
Housing rating, inches water gauge +/-20
Control power 120-Volt 50/60 Hz

*If unit was supplied with a Record Drawing, the specifications on the drawing will supersede the standard specifications above.

Operation

During normal operation, dust-laden air is drawn to the filters. The velocity is reduced and natural pre-separation, caused by the effects of gravity, takes place. Fine particles collect on the outside surface of the filter and clean, filtered air passes to the center of the filter and discharges through the clean-air outlet.

Filter cleaning is completed using pulse-jet technology. A jet tube positioned over each filter distributes a pulse of compressed air through the filter. As the compressed air enters the filter, airflow is temporarily reversed dislodging the dust cake formed on the outside of the filter. The dust cake falls back into the silo or process equipment.



Inspection on Arrival

1. Inspect collector upon delivery.
2. Report any damage to the delivery carrier.
3. Request a written inspection report from the Claims Inspector to substantiate any damage claim.
4. File claims with the delivery carrier.
5. Compare collector received with description of product ordered.
6. Report incomplete shipments to the delivery carrier and your Donaldson Torit representative.
7. Remove crates and shipping straps. Remove loose components and accessory packages before lifting collector from truck.
8. Check for hardware that may have loosened during shipping.
9. Use caution removing temporary covers.

Installation Codes and Procedures

CAUTION

Codes may regulate recirculating filtered air in your facility.

Consult with the appropriate authorities having jurisdiction to ensure compliance with all national and local codes regarding recirculating filtered air.

Safe and efficient operation of the collector depends on proper installation.

Authorities with jurisdiction should be consulted before installing to verify local codes and installation procedures. In the absence of such codes, install collector according to the National Electric Code, NFPA No. 70-latest edition and NFPA 91 (NFPA 654 if combustible dust is present).

A qualified installation and service agent must complete installation and service of this equipment.

All shipping materials, including shipping covers, must be removed from the collector prior to or during collector installation.

NOTICE

Failure to remove shipping materials from the collector will compromise collector performance.

Inspect collector to ensure all hardware is properly installed and tight prior to operating collector.

Installation

WARNING

Use proper equipment and adopt all safety precautions needed for servicing equipment.

Electrical service or maintenance work must be performed by a qualified electrician and comply with all applicable national and local codes.

Turn power off and lock out electrical power sources before performing service or maintenance work.

Do not install in classified hazardous atmospheres without an enclosure rated for the application.

Turn compressed air supply OFF, bleed and lock out lines before performing service or maintenance work.

CAUTION

Site selection must account for wind, seismic zone, and other

load conditions when selecting the location for collectors.

Codes may regulate acceptable locations for installing dust collectors. Consult with the appropriate authorities having jurisdiction to ensure compliance with all national and local codes regarding dust collector installation.

Collectors must be anchored in a manner consistent with local code requirements. Anchors must be sufficient to support dead, live, seismic, and other anticipated loads.

Consult a qualified engineer for final selection of anchorage.

NOTICE

Do not set compressed-air pressure above 100-psig as component damage can occur.

All compressed air components must be sized to meet the system requirements of 90-100-psig supply pressure.

The compressed-air supply must be oil and moisture free. Contamination in the compressed air used to clean filters will result in poor cleaning, cleaning valve failure, or poor collector performance.

Purge compressed air lines to remove debris before connecting to the collector's compressed air manifold.

The collector is suitable for either indoor or outdoor installations. Reference the Rating and Specification Information.

If collector is to be located outdoors, an appropriate exhaust and remote electrical controls may be necessary.

Foundations or Support Framing

Prepare the foundation or support framing in the selected location. Foundation or support framing must comply with local code requirements and may require engineering.

Foundation and support framing must be capable of supporting dead, live, wind, seismic and other applicable loads. Consult a qualified engineer for final selection of foundation or support framing.

Collector Location

WARNING

Donaldson Torit equipment is not designed to support site installed ducts, interconnecting piping, or electrical services. All ducts, piping, or electrical services must be adequately supported to prevent severe personal injury and/or property damage.

When hazardous conditions or materials are present, consult with local authorities for the proper location of the collector.

CAUTION

Dust collection equipment may reach peak sound pressure levels above 80 dB (A). Noise levels should be considered when selecting collector location.

Locate the collector to ensure easy access to electrical and compressed air connections, to simplify solids collection container handling and routine maintenance, and to ensure the straightest inlet and outlet ducts.

Site Selection

This collector can be located on a foundation or structural framing.

Provide clearance from heat sources and avoid any interference with utilities when selecting the location.

The collector can be located in the top of storage silos and bins, or integrated into hoods for material handling equipment such as belt conveyors and bucket elevators or process equipment such as blenders and crushers.

Rigging Instructions

Suggested Tools & Equipment

Clevis Pins and Clamps	Lifting Slings
Crane or Forklift	Pipe Sealant
Drift Pins	Pipe Wrenches
Drill and Drill Bits	Screwdrivers
End Wrenches	Socket Wrenches
Adjustable Wrench	Spreader Bars
Torque Wrench (inch/lbs, 9/16-in Socket)	

Hoisting Information

WARNING

Failure to lift the collector correctly can result in severe personal injury and/or property damage.

Use appropriate lifting equipment and adopt all safety precautions needed for moving and handling the equipment.

A crane or forklift is recommended for unloading, assembly, and installation of the collector.

Location must be clear of all obstructions, such as utility lines or roof overhang.

Use all lifting points provided.

Use clevis connectors, not hooks, on lifting slings.

Use spreader bars to prevent damage to collector's casing.

Check the Specification Control drawing for weight and dimensions of the collector and components to ensure adequate crane capacity.

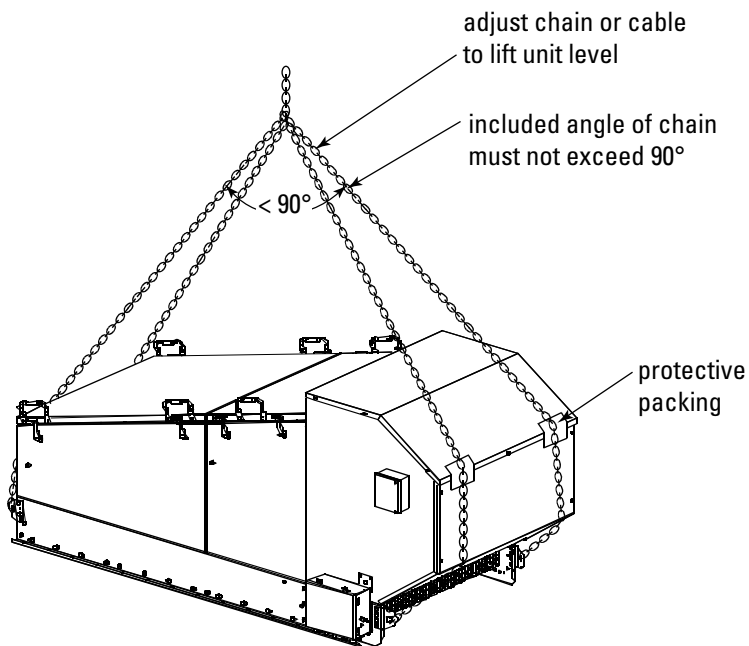
Allow only qualified crane or forklift operators to lift the equipment.

Refer to applicable OSHA regulations and local codes when using cranes, forklifts, and other lifting equipment.

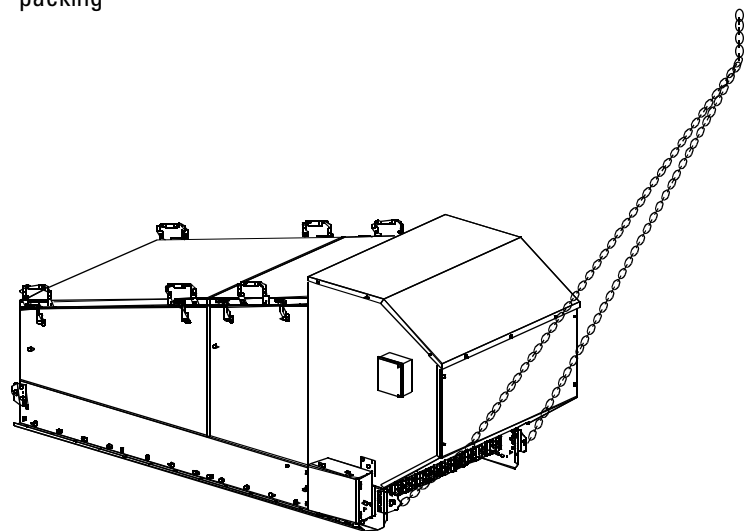
Lift collector and accessories separately and assemble after collector is in place.

Use drift pins to align holes in section flanges during assembly.

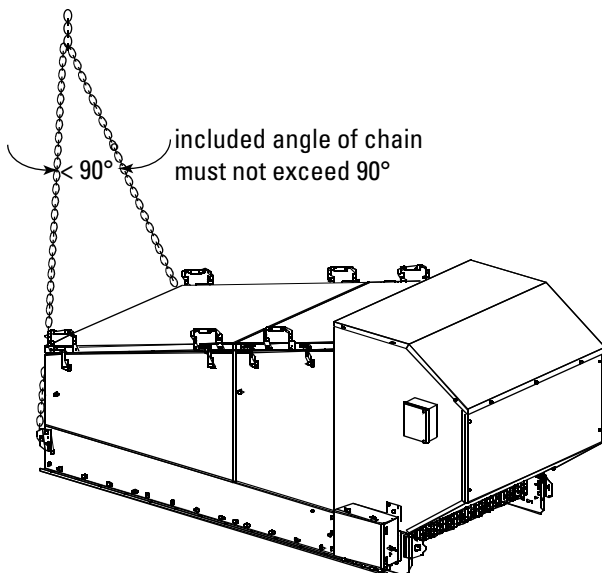
Typical Installation



Four-Point Lift for Vertical Installation



Two-Point Lift for Horizontal Installation, Manifold Up



Two-Point Lift for Horizontal Installation, Manifold Down

Note: Horizontal installations are normally placed manifold up for service and maintenance access. However, if headroom is restricted, they may be placed manifold down.

Typical Installation

Standard Equipment

Dalamatic Insertable dust collectors are delivered partially assembled. Collector installation, filter installation, compressed air, and electrical connections are completed at the job site.

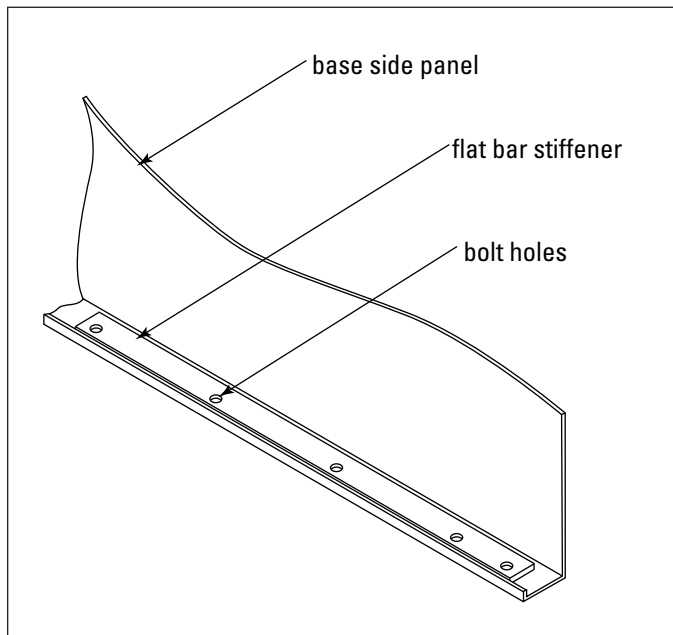
Collector Installation

Note: Compare the position and spacing of the bolt pattern on the collector's mounting flange to the bolt pattern on the mounting surface.

1. Open the header cover and remove the components shipped loose inside.
2. Apply two strips of 1/4-in diameter rope-type sealant or caulk to the mounting surface: one toward the inside of the bolt pattern and one toward the outside of the bolt pattern.
3. Lift collector into position over mounting surface and lower slowly.
4. Use drift pins to align holes.

Note: Install flat bar stiffeners, if equipped. See Optional Flat Bar Stiffener Installation.

5. Secure with bolts, washers, and hex nuts supplied. Tighten to form an airtight seal.



Optional Flat Bar Stiffener Installation

Compressed Air Installation

WARNING

Turn compressed air supply OFF, bleed and lock out lines before performing service or maintenance work.

A safety exhaust valve should be used to isolate the compressed air supply. The safety exhaust valve should completely exhaust pressure in the collector manifolds when closed, should be capable of being interlocked with fire or explosion mitigation equipment and should include provisions to allow closed-position locking.

NOTICE

Do not set compressed-air pressure above 100-psig as component damage can occur.

All compressed air components must be sized to meet the system requirements of 90-100-psig supply pressure.

Compressed air pressure must be set to the pressure listed in the Compressed Air Requirements table to ensure proper operation.

The compressed-air supply must be oil and moisture free. Contamination in the compressed air used to clean filters will result in poor cleaning, cleaning valve failure, or poor collector performance.

Purge compressed-air lines to remove debris before connecting to the collector's compressed-air manifold.

1. Remove the plastic pipe plug from the collector's air manifold and connect the compressed-air supply lines. Use thread-sealing tape or pipe sealant on all compressed-air connections.
2. Install a customer-supplied shut-off valve, bleed-type regulator with gauge, filter, and automatic condensate valve in the compressed-air supply line.
3. Set compressed-air supply pressure to a level suitable for the filters (90-psig). The pulse-cleaning controls are factory set to clean one or more filters every 10-seconds during a cleaning cycle.

Electrical Wiring



WARNING

Electrical installation, service, or maintenance work must

be performed by a qualified electrician and comply with all applicable national and local codes.

Turn power off and lock out electrical power sources before performing service or maintenance work.

Do not install in classified hazardous atmospheres without an enclosure rated for the application.

All electrical wiring and connections, including electrical grounding, should be made in accordance with the National Electric Code (NFPA No. 70-latest edition).

Check local ordinances for additional requirements that apply.

The appropriate wiring schematic and electrical rating must be used. See collector's rating plate for required voltage.

An electric disconnect switch having adequate amp capacity shall be installed in accordance with Part IX, Article 430 of the National Electrical Code (NFPA No. 70-latest edition). Check collector's rating plate for voltage and amperage ratings.

Refer to the wiring diagram for the number of wires required for main power wiring and remote wiring.

Compressed Air Requirements

Model	Compressed Air Pressure*	Pulse Duration, millisecond	Pipe Diameter, inches***
DLMV 4/7, 6/10 and 9/15	65-psig	200	1/2
DLMV 7/7, 10/10 and 15/15	65-psig	200	1/2
DLMV 8/7, 12/10 and 18/15	90-psig	200	1/2
DLMV 14/7 and 20/10,	90-psig	200	1/2
at 12-second intervals*			
DLMV 21/7 and 30/10	75-psig	60	1/2
DLMV 30/15	65-psig	110	1/2
DLMV 45/15	75-psig	110	1/2
DLMV 60/15	90-psig	110	1/2

* Normal operating pressure

** Recommended initial setting

*** Up to 100 ft

Solid-State Timer Installation

WARNING

Electrical installation, service or maintenance work during

installation must be performed by a qualified electrician and comply with all applicable national and local codes.

Turn power off and lock out electrical power sources before performing installation, service, or maintenance work.

Do not install in classified hazardous atmospheres without an enclosure rated for the application.

The solid-state timer is used to control the filter cleaning system. Available options include 3, 6, 10, 20, or 32-pin solenoid valve controls.

1. Using the wiring diagram supplied, wire the starter, solid-state timer and solenoid valves. Use appropriate wire gauge for rated amp load as specified by local codes.
2. Plug the program lug into the pin that corresponds with the number of solenoid valves controlled.
3. With power supply ON, check the operation of the timer and valves. The valves should open and close sequentially at factory set 10-second intervals.
4. If a gauge or similar device is used to control the solid-state timer, the jumper on the pressure switch portion of the timer should be removed. The solenoid valves will then pulse only when the differential pressure reaches the high-pressure setpoint. The valves will continue to pulse until the low-pressure setpoint is reached.

NOTICE

The solid-state timer voltage must match the voltage of the rating of the timer provided (typically 120VAC).

Do not mount the solid-state timer directly to the collector as mechanical vibration can damage the timer.

Solenoid Connection

The collector is equipped with electric solenoid valves (typically 120V) that controls the pulse-cleaning valves, which in turn clean the filters.

Solenoid enclosures are mounted near or on the collector's compressed-air manifold.

Wire the solenoids to the solid-state timer following the wiring diagram supplied with the collector. Filter life and cleaning operation will be affected if not wired correctly.

Timer and Solenoid Specifications

Power to the solid-state timer is supplied to Terminals L1 and L2, which are intended to operate in parallel with the fan starter's low-voltage coil. On fan start-up, power is supplied to the timer and the preset OFF time is initiated. At the end of the OFF time, the timer energizes the corresponding solenoid valve to provide the ON time cleaning pulse for one diaphragm valve and then steps to the next until all filters have been cleaned.

To pulse when the fan is OFF, install a toggle switch as shown on the Solid-State Timer Wiring Diagram. When the toggle switch is ON, the timer receives power and energizes the solenoid valves' pulse-cleaning operation even though the fan is turned OFF.

Input
105-135V/50-60Hz/1Ph

Output Solenoids
The load is carried and turned ON and OFF by the 200 watt maximum-load-per-output solid-state switch.

Pulse ON Time
Factory set at 100-milliseconds, or 1/10-second.

NOTICE

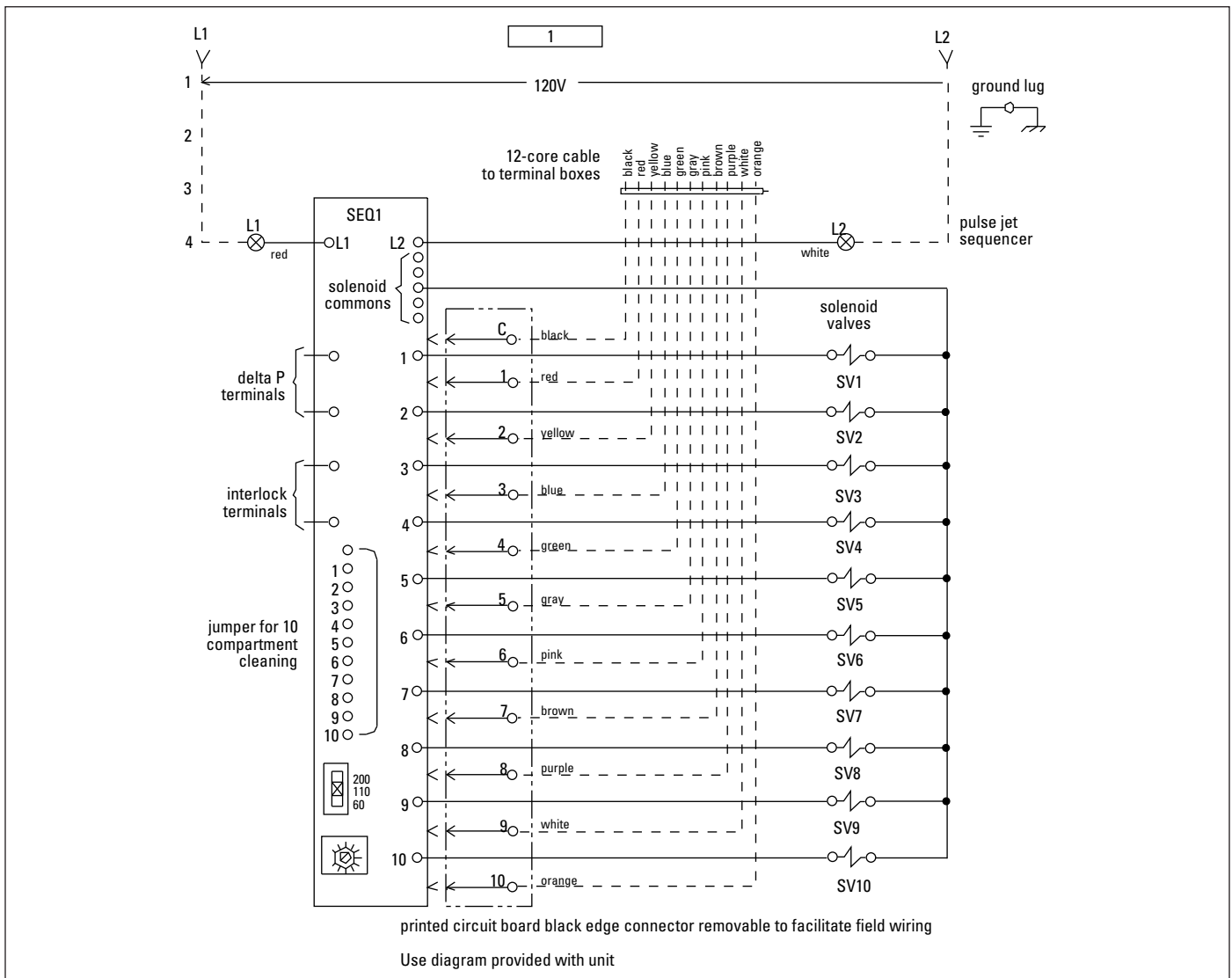
Do not adjust pulse ON time unless the proper test equipment is available. Too much or too little ON time can cause shortened filter life.

Pulse OFF Time
Factory set at 10-seconds, adjustable from 1.5-sec minimum to maximum 30-seconds.

Operating Temperature Range
-20° F to 130° F

Transient Voltage Protection
50 kW transient volts for 20-millisecond duration once every 20 seconds, 1% duty cycle.

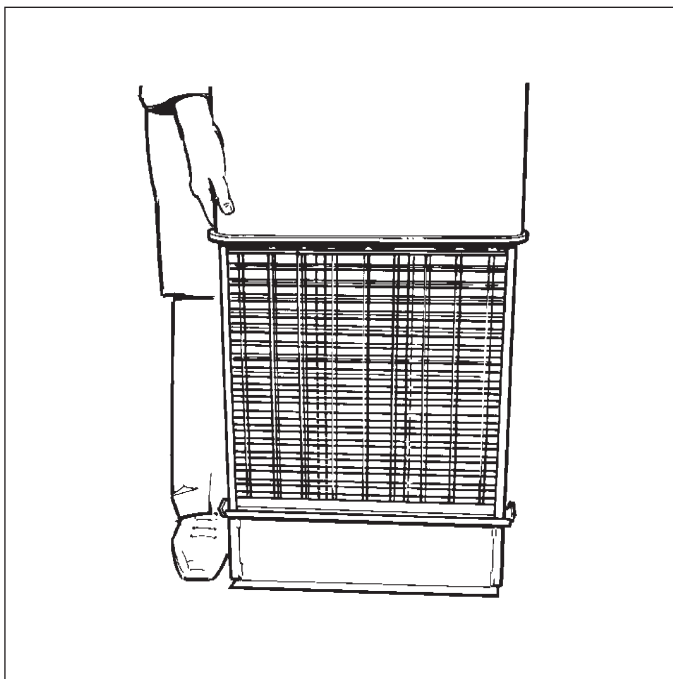
Solenoid Valves
115-Volt at 19.7 watts each



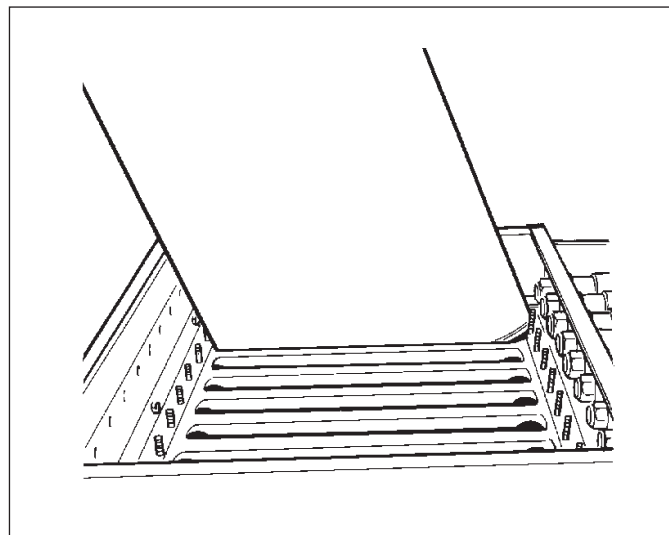
Solid-State Timer Typical Wiring Diagram

Filter Bag Installation

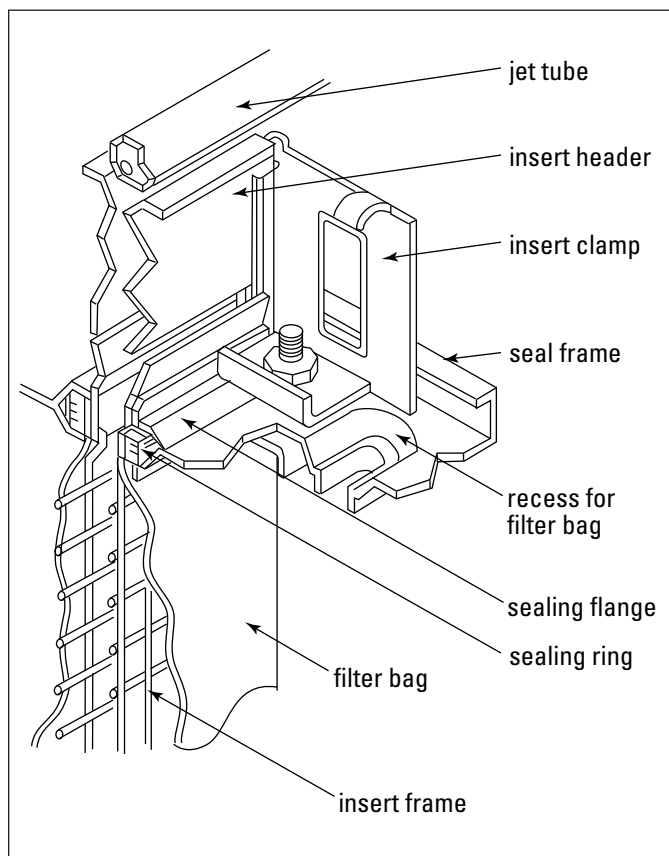
1. Remove header cover, if equipped.
 2. Remove jet tubes and set aside. Cover the openings to the diaphragm valves.
 3. Slide the filter bag over the wire support frame shown in Filter Bag Assembly. Slide bag carefully until top of bag is tight against the support frame flange.
 4. Starting at one side of the collector, place a filter bag assembly in a seal frame slot as shown in Filter Bag Installation.
 5. Install a second filter bag assembly adjacent to the prior filter bag assembly.
 6. Position clamps and tighten using a deep well socket and extension. Do not overtighten. Maximum recommended torque is 20 ft/lb. See Clamps and Inserts.
- Note: If filter bag assemblies are mounted horizontally, tighten bottom clamp first.
7. Repeat steps 3-6 to install all bags.
 8. Replace jet tubes with the open end pressed firmly into its locator and the orifices directed toward the filter bag assemblies. See Jet Tube Installation.



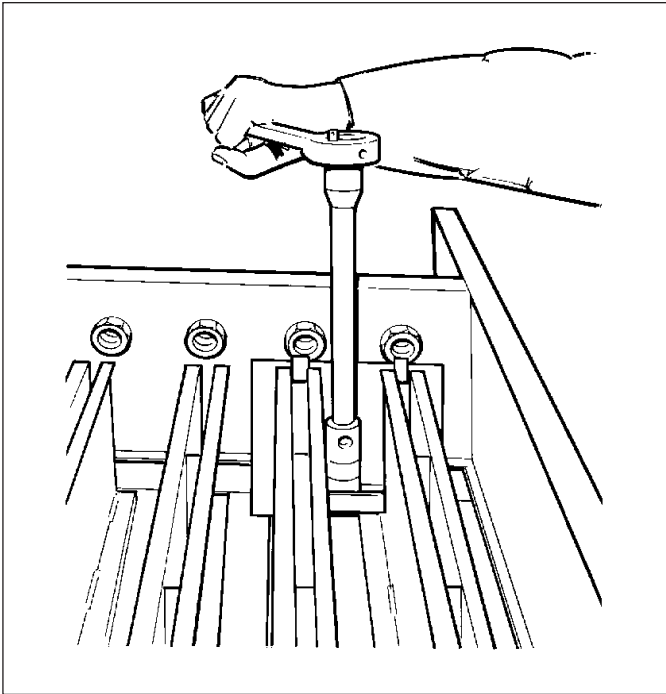
Filter Bag Assembly



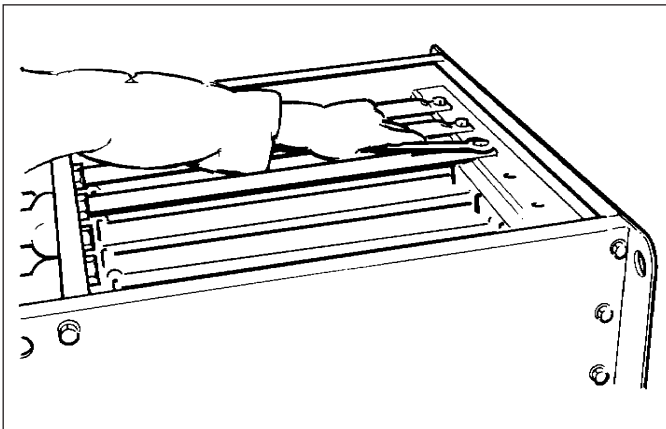
Filter Bag Installation



Filter Bag Detail



Clamps and Inserts



Jet Tube Installation

Helix Tube Filter Installation

1. Remove header cover, if equipped.
2. Remove jet tubes and set aside. Cover the openings to the diaphragm valves.
3. Remove the hex nuts securing the insert clamps. Remove the clamps and set aside.
4. Starting on one side of the collector, place a helix tube filter in a seal frame slot as shown in Helix Tube Filter Installation.

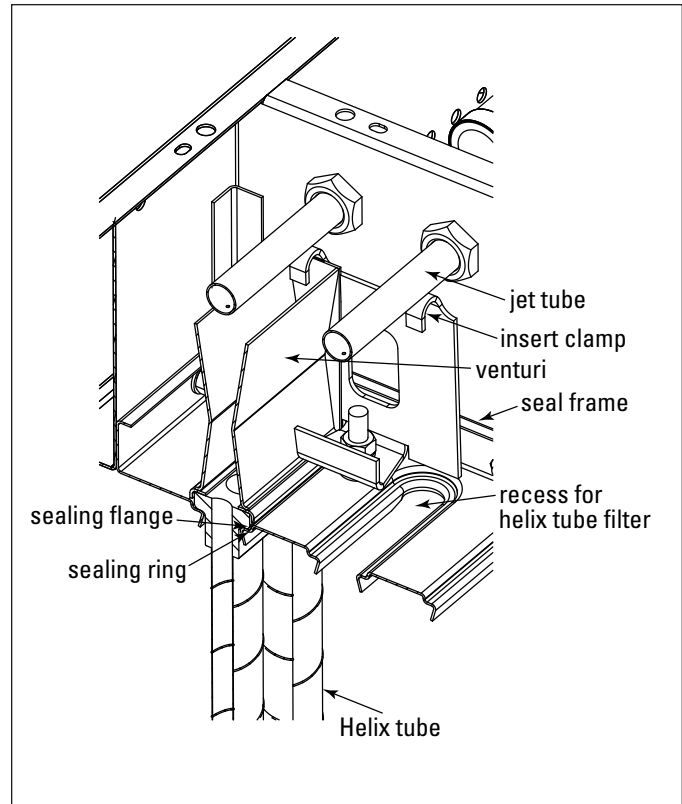
NOTICE

Be careful to not scrape the filters when slipping them through the seal frame.

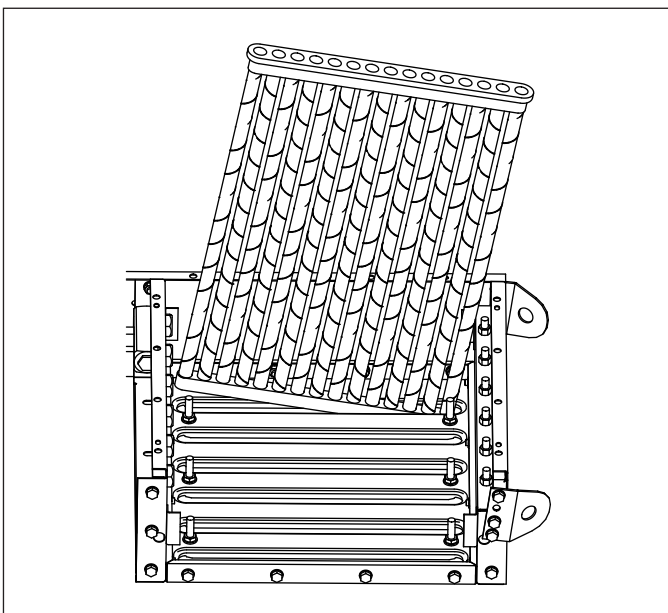
5. Install a second helix tube filter adjacent to the prior helix tube filter.
6. Install a venturi on both adjacent helix tube filters and place a clamp over one end of both venturis. Install a nut and tighten using a deep well socket and extension. See Clamps and Inserts. Do not overtighten. Maximum recommended torque is 20 ft/lb.

Note: If helix tubes are mounted horizontally, tighten bottom clamp first.

7. Repeat to install all helix tubes.
8. Replace jet tubes with the open end pressed firmly into its locator and the orifices directed toward the helix tube filter. See Jet Tube Installation.



Helix Tube Filter Detail



Helix Tube Filter Installation

Preliminary Start-Up Check

Instruct all personnel on safe use and maintenance procedures.



WARNING

Electrical work during installation, service or maintenance must be performed by a qualified electrician and comply with all applicable national and local codes.

Turn power off and lock out electrical power sources before performing service or maintenance work.

Turn compressed air supply OFF, bleed and lock out lines before performing service or maintenance work.

Check that the collector is clear and free of all debris before starting.

Do not install in classified hazardous atmospheres without an enclosure rated for the application.

Optional fans over 600 lbs must be independently supported.

1. Check all electrical connections for tightness and contact.
2. Check for proper rotation as noted on the fan and/or hopper discharge device housing.

To reverse rotation, single-phase power supply:
Follow manufacturer's instructions on the motor's nameplate.

To reverse rotation, three-phase power supply:
Switch any two leads on the motor junction box.



WARNING

Do not interchange a power lead with the ground wire. Severe personal injury and/or property damage may result.

3. All access panels should be sealed and secure.
4. Check that the dust container is properly sealed and clamped.
5. Check that fan exhaust damper is set to the fully-closed position.
6. Check and remove all loose items in or near the inlet and outlet of the collector.

7. Check that all remote controls and solenoid enclosures (if applicable) are properly wired and all service switches are in the OFF position.
8. Check that all optional accessories are installed properly and secured.
9. Turn power ON at source.
10. Turn the compressed-air supply ON. Set compressed-air supply pressure to a level suitable for the filters (90-psig).
11. Turn fan motor ON.



WARNING

Do not look into fan outlet to determine rotation. View the fan rotation through the back of the motor.

Check that the exhaust plenum is free of tools or debris before checking blower/fan rotation.

Stand clear of exhaust to avoid personal injury.

12. Adjust airflow with the exhaust damper.

NOTICE

Excess airflow can shorten filter life, cause electrical system failure and fan motor failure.

13. Turn powered hopper discharge devices ON.

Start-Up

1. Turn compressed-air supply ON.
2. Turn the equipment being served ON.
3. Turn timing controls ON.
4. Turn main fan ON, if equipped.

Shut Down

Follow this shutdown procedure to clear residual deposits from the filter bags, filter body, and equipment served:

1. Turn main fan OFF, leaving compressed air supply ON to allow off-line filter cleaning.
Note: Contact your Donaldson representative for shutdown instructions for explosion vented collectors.
2. Wait 10 to 15 minutes and turn timing controls and compressor OFF.

Maintenance Information

Instruct all personnel on safe use and maintenance procedures.

WARNING

Use proper equipment and adopt all safety precautions needed for servicing equipment.

Use appropriate access equipment. The standard collector is not equipped with access platforms unless noted on specification drawings.

Electrical service or maintenance work must be performed by a qualified electrician and comply with all applicable national and local codes.

Turn power off and lock out electrical power sources before performing service or maintenance work.

Do not install in classified hazardous atmospheres without an enclosure rated for the application.

Turn compressed air supply OFF, bleed and lock out lines before performing service or maintenance work.

NOTICE

Do not set compressed-air pressure above 100-psig as component damage can occur.

All compressed air components must be sized to meet the system requirements of 90-100 psig supply pressure.

The compressed-air supply must be oil and moisture free. Contamination in the compressed air used to clean filters will result in poor cleaning, cleaning valve failure, or poor collector performance.

Purge compressed air lines to remove debris before connecting to the collector's compressed air manifold.

Operational Checklist

1. Monitor the physical condition of the collector and repair or replace any damaged components.

Routine inspections will minimize downtime and maintain optimum system performance. This is particularly important on continuous-duty applications.

2. Periodically check the compressed air components and replace compressed air filters.

Drain moisture following the manufacturer's instructions. With the compressed air supply ON, check the cleaning valves, solenoid valves, and tubing for leaks. Replace as necessary.

3. Monitor pressure drop across filters.

Abnormal changes in pressure drop may indicate a change in operating conditions and possibly a fault to be corrected. For example, prolonged lack of compressed air will cause an excess build-up of dust on the filters resulting in increased pressure drop. Cleaning off-line with no airflow usually restores the filters to normal pressure drop.

4. Monitor exhaust.

Check Monthly

1. Proper solenoid and diaphragm valve operation.
2. If equipped, check door seals for condition and contact. Replace or adjust as necessary.
3. If equipped, check that the clean-air plenum is free of dust accumulation. If dust is present, check the surrounding filter for damage or loose seals.

Check Annually

Moisture Separator

Isolate the compressed-air supply and remove and clean the filter.

Compressed-Air Manifold

Isolate the compressed air supply, remove the drain plug and air inlet connections and clean thoroughly.

Filters

Remove one or two filters and inspect for general condition. Replace if necessary.

Jet Tubes

Check that jet tubes are clean and the orifices are clear.

Diaphragm Replacement

1. Remove nylon tubing by pushing inward on the fitting collar and withdraw the tubing.
2. Remove the hex-head set screws and washers securing the valve bonnet.
3. Check that the bleed-hole pin is not blocked.
4. Place the diaphragm over the bleed hole pin with the nylon sealing washer inside the valve throat.
5. Position spring, if equipped, inside the bonnet recess.
6. Replace valve bonnet with the spring over the diaphragm disk shoulder and bonnet over the bleed hole pin. Secure using the hex-head set screws and washers removed in Step 2.
7. Reconnect nylon tubing and secure.

Filter Removal and Installation



WARNING

Use proper safety and protective equipment when removing contaminants and filters.

Dirty filters may be heavier than they appear.

Use care when removing filters to avoid personal injury and/or property damage.

Turn power off and lock out electrical power sources before performing service or maintenance work.

Turn compressed air supply OFF, bleed and lock out lines before performing service or maintenance work.



CAUTION

Do not operate with missing or damaged filters.

Filter Bag Removal

1. Activate the pulse cleaning for 10 to 15 minutes to remove excess dust from the filter bags.
2. Remove header cover, if equipped.
3. Remove jet tubes and set aside. Cover the openings to the diaphragm valves.
4. Remove the hex nuts securing the wire insert clamps. Remove the clamps and withdraw the insert and filter bag. Inspect insert for excess corrosion, broken mesh, or other damage and replace as necessary.

Filter Bag Installation

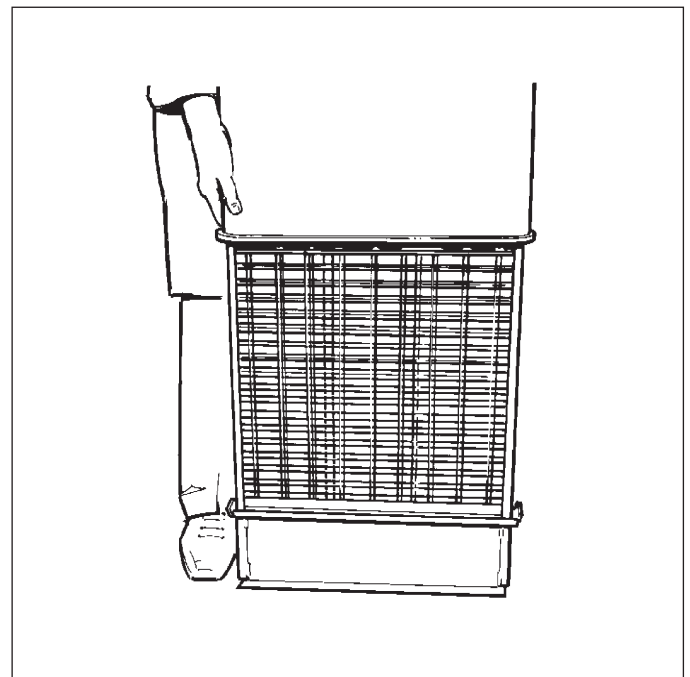
1. Slide the filter bag over the wire support frame shown in Filter Bag Assembly. Slide bag carefully until top of bag is tight against the support frame flange.
2. Starting at one side of the collector, place a filter bag assembly in a seal frame slot as shown in Filter Bag Installation.
3. Install a second filter bag assembly adjacent to the prior filter bag assembly.
4. Position clamps and tighten using a deep well socket and extension. Do not overtighten. Maximum recommended torque is 20 ft/lb. See Clamps and Inserts.

Note: If filter bag assemblies are mounted horizontally, tighten bottom clamp first.

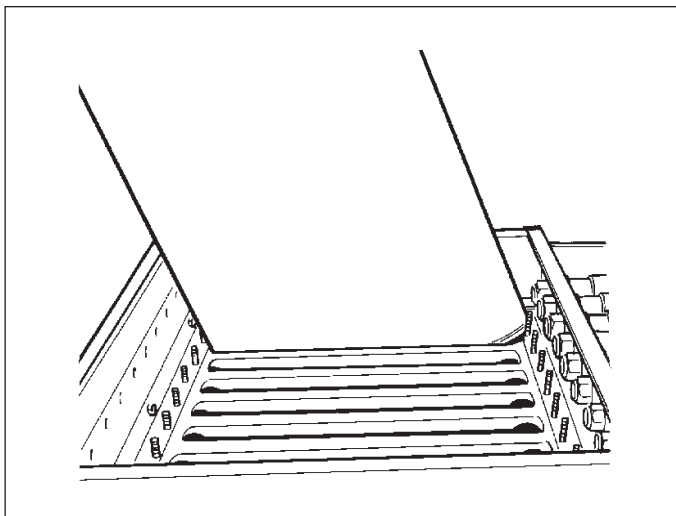
5. Repeat steps 1-4 to install all bags.
6. Replace jet tubes with the open end pressed firmly into its locator and the orifices directed toward the filter bag assemblies. See Jet Tube Installation.

NOTICE

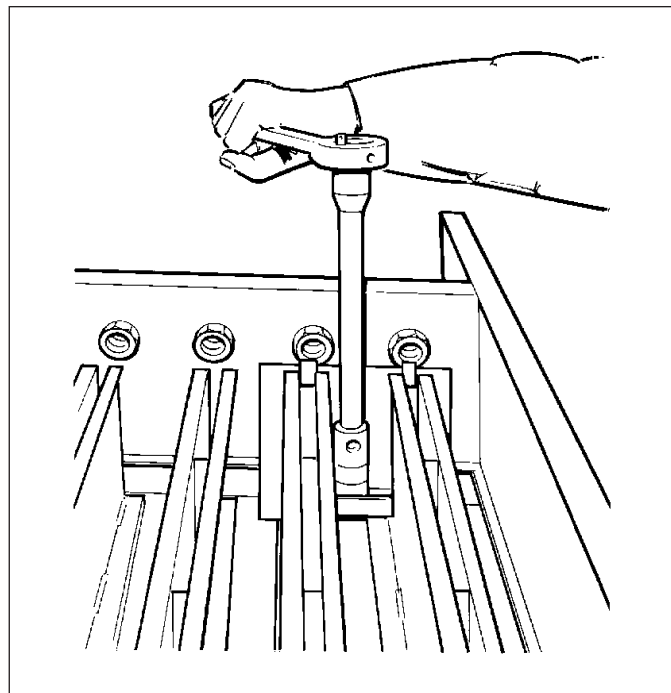
Check and clear any plugged orifices in the jet tubes prior to placing them back in the collector.



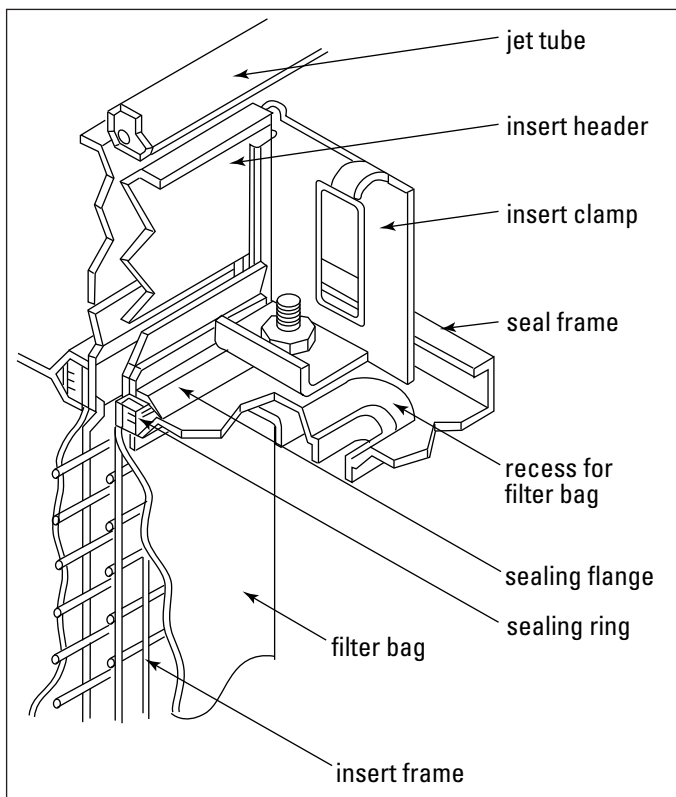
Filter Bag Assembly



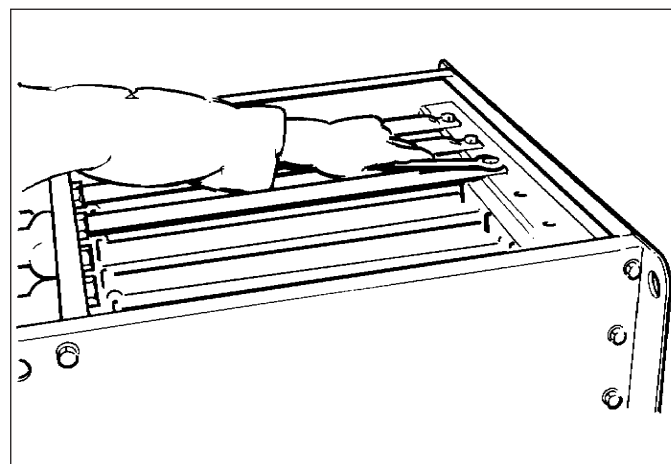
Filter Bag Installation



Clamps and Inserts



Filter Bag Detail



Jet Tube Installation

Helix Tube Filter Removal

1. Activate the pulse cleaning for 10 to 15 minutes to remove excess dust from the helix tube filters.
2. Turn compressed air supply off and bleed the lines.
3. Remove header cover, if equipped.
4. Remove jet tubes and set aside. Cover the openings to the diaphragm valves.
5. Remove the hex nuts securing the insert clamps. Remove the clamps and set aside.
6. Remove venturi's and helix tubes. Set venturi's aside as they will be reused.

Helix Tube Filter Installation

1. Starting on one side of the collector, place a helix tube filter in a seal frame slot as shown in Helix Tube Filter Installation.

NOTICE

Be careful to not scrape the filters when slipping them through the seal frame.

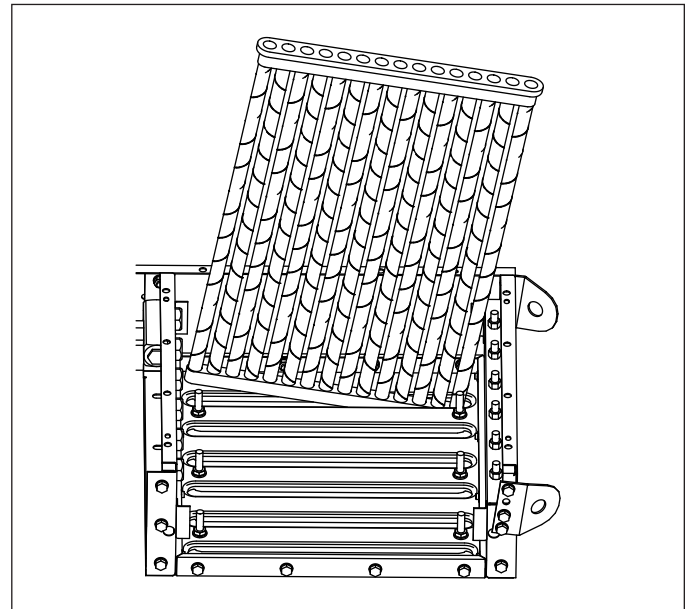
2. Install a second helix tube filter adjacent to the prior helix tube filter.
3. Install a venturi on both adjacent helix tube filters and place a clamp over one end of both venturis. Install a nut and tighten using a deep well socket and extension. See Clamps and Inserts. Do not overtighten. Maximum recommended torque is 20 ft/lb.

Note: If helix tubes are mounted horizontally, tighten bottom clamp first.

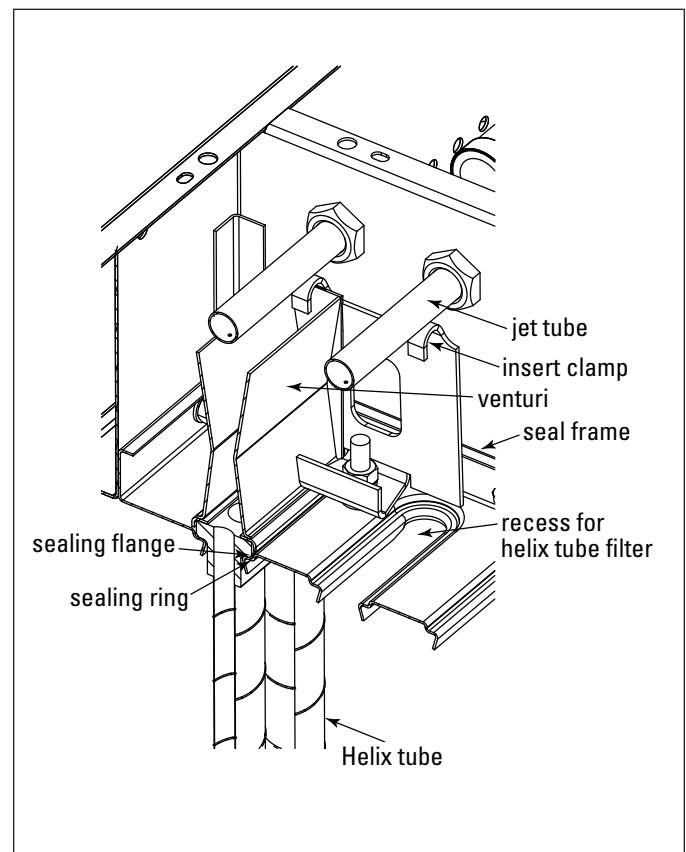
4. Repeat to install all helix tubes.
5. Replace jet tubes with the open end pressed firmly into its locator and the orifices directed toward the helix tube filter. See Jet Tube Installation.

Compressed Air Components

1. Periodically check the compressed air components and replace compressed-air filters.
2. Drain moisture following the manufacturer's instructions.
3. With the compressed-air supply ON, check the cleaning valves, solenoid valves, and tubing for leaks. Replace as necessary.



Helix Tube Filter Installation



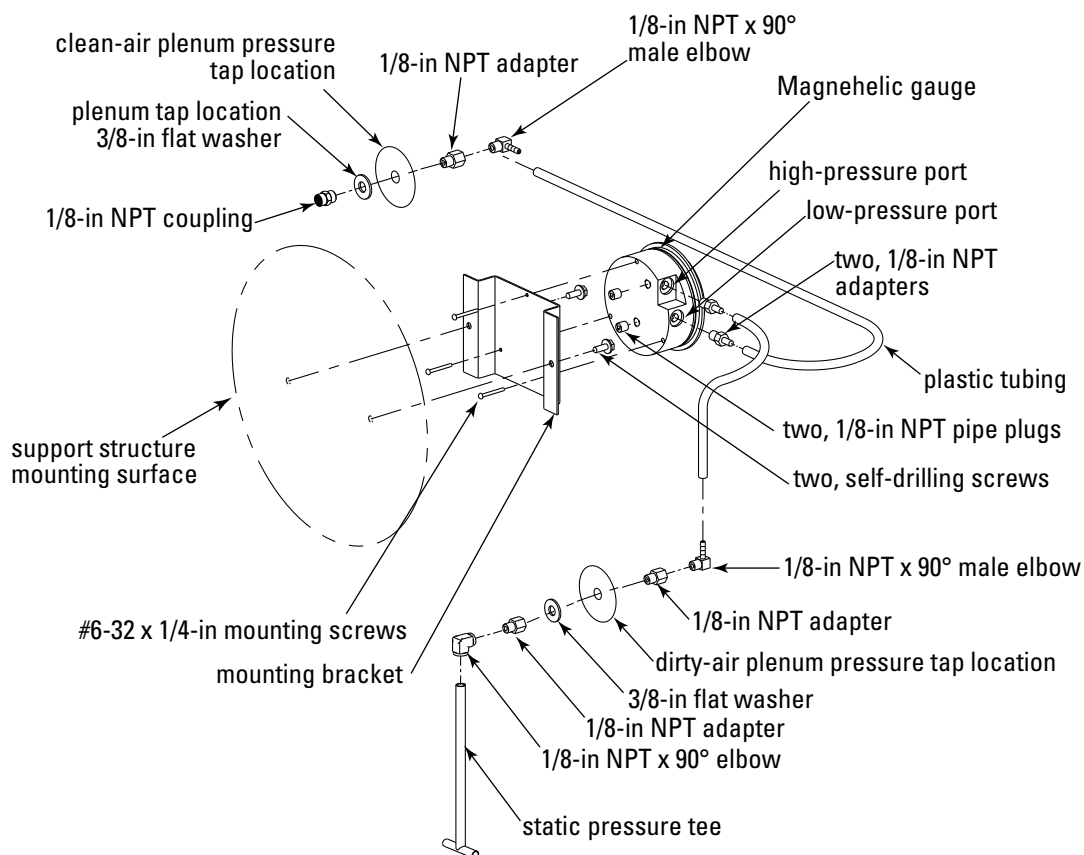
Helix Tube Filter Detail

Optional Equipment

Magnehelic® Gauge

The Magnehelic is a differential pressure gauge used to measure the pressure difference between the clean-air and dirty-air plenums and provides a visual display of filter change requirements. The high-pressure tap is located in the dirty-air plenum and the low-pressure tap is located in the clean-air plenum.

1. Choose a convenient, accessible location on or near the collector for mounting that provides the best visual advantage.
2. Plug the pressure ports on the back of the gauge using two, 1/8-in NPT pipe plugs supplied. Install two, 1/8-in NPT male adapters supplied with the gauge into the high- and low-pressure ports on the side of the gauges.
3. Attach the mounting bracket using three, #6-32 x 1/4-in screws supplied.
4. Mount the gauge and bracket assembly to the supporting structure using two, self-drilling screws.
5. Thirty-five feet of plastic tubing is supplied and must be cut in two sections. Connect one section of tubing from the gauge's high-pressure port to the pressure fitting located in the dirty-air plenum. Connect remaining tubing from the gauge's low-pressure port to the fitting in the clean-air plenum. Additional tubing can be ordered from your representative.
6. Zero and maintain the gauge as directed in the manufacturer's Operating and Maintenance Instructions provided.



Magnehelic Gauge Installation

Photohelic® Gauge

⚠ WARNING

Electrical installation, service, or maintenance work must be performed by a qualified electrician and comply with all applicable national and local codes.

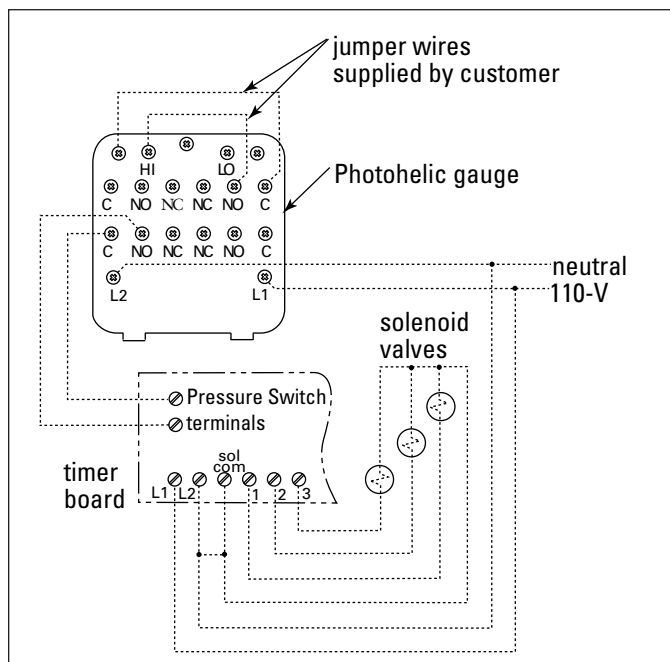
Turn power off and lock out electrical power sources before performing service or maintenance work.

Do not install in classified hazardous atmospheres without an enclosure rated for the application.

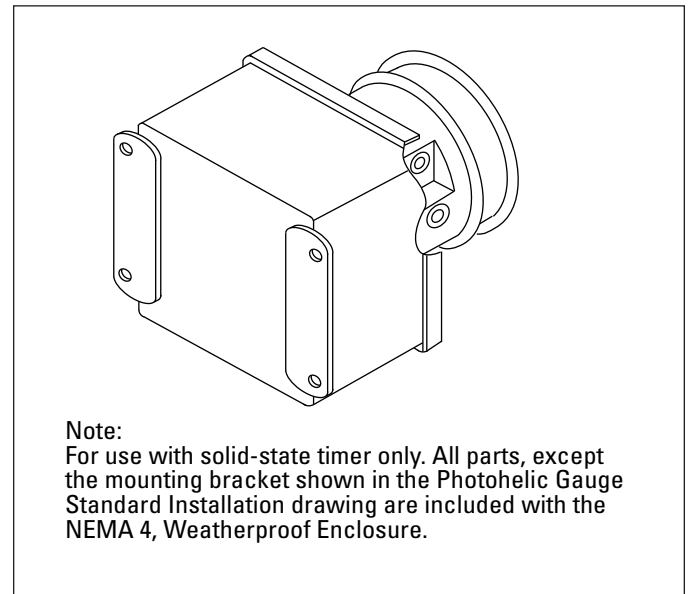
The Photohelic combines the functions of a differential pressure gauge and a pressure-based switch. The gauge function measures the pressure difference between the clean-air and dirty-air plenums and provides a visual display of filter condition. The high-pressure tap is located in the dirty-air plenum and a low-pressure tap is located in the clean-air plenum. The pressure-based switch function provides high-pressure ON and low-pressure OFF control of the filter cleaning system.

1. Choose a convenient, accessible location on or near the collector for mounting that provides the best visual advantage.

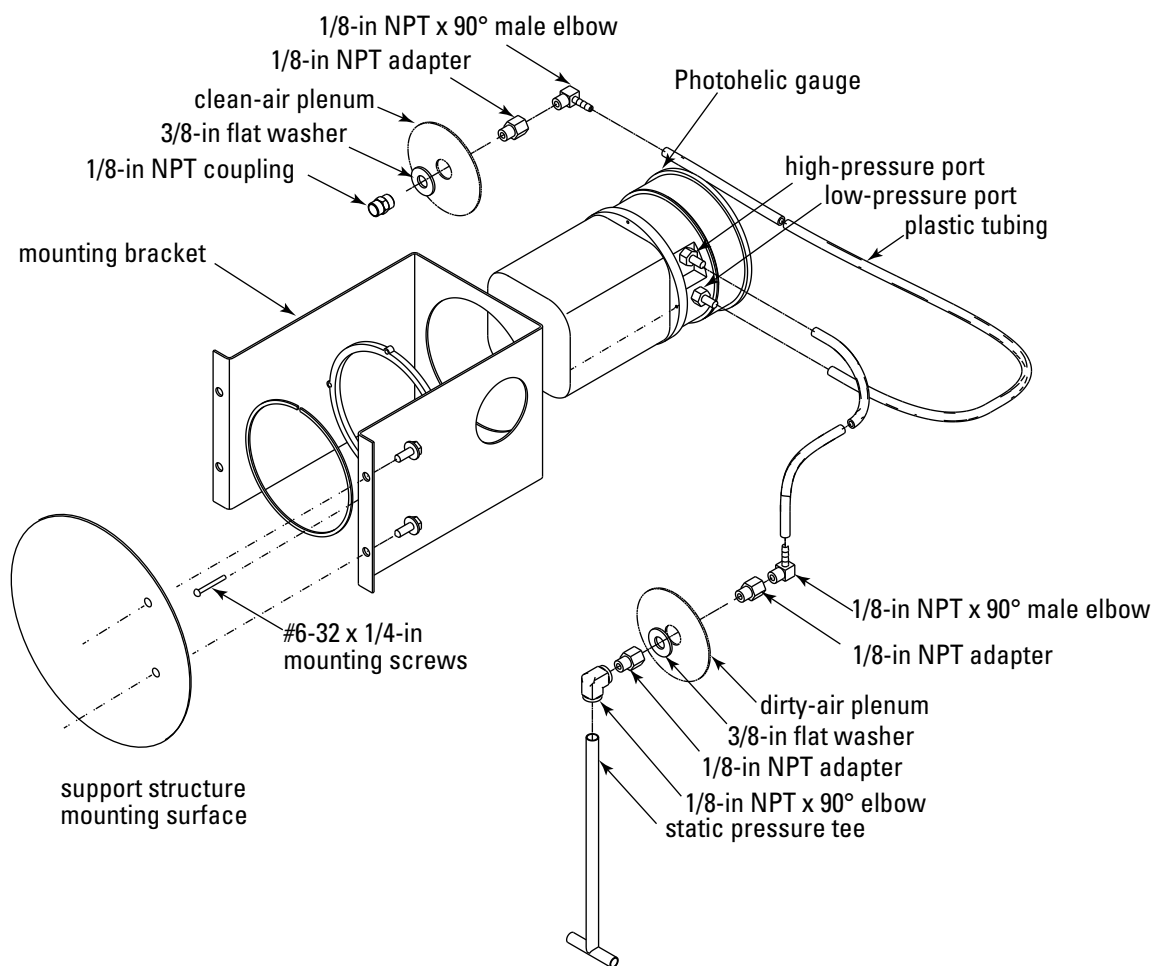
2. Mount the gauge to the remote panel or door using the mounting ring, retaining ring, and four #6-32 x 1 1/4-in screws. Do not tighten screws. Connect two, 1/8-in NPT x 1/4-in OD male adapters to the gauge's high- and low-pressure ports. Tighten screws.
3. On the back of the gauge, remove four #6-32 x 5/16-in screws and plastic enclosure. Set aside. Add two jumper wires supplied by customer. Remove the jumper from the pressure switch located on the timer board, if equipped. Using the 3/4-in conduit opening, wire the gauge as shown. Reassemble and fasten enclosure securely.
4. Thirty-five feet of plastic tubing is supplied and must be cut in two sections. Connect one section of tubing from the gauge's high-pressure port to the pressure fitting located in the dirty-air plenum. Connect remaining tubing from the gauge's low-pressure port to the fitting in the clean-air plenum. Additional tubing can be ordered from your representative.
5. Zero and maintain the gauge as directed in the manufacturer's Operating and Maintenance Instructions provided.
6. To install the Photohelic Gauge mounted in a NEMA 4, Weatherproof Enclosure, follow Steps 4 and 5.



Photohelic Gauge Wiring Diagram



Photohelic Gauge in Optional NEMA 4 Weatherproof Enclosure



Photohelic Gauge, Remote Panel or Door Installation

Delta P Control

For complete information, see the most current version of the Delta P Installation, Operation, and Maintenance manual.

Description

The Delta P Controller monitors the differential pressure between the clean-air and dirty-air plenums, providing a visual display of the filter condition. When combined with a pulse timer, it manages the pressure drop by turning the cleaning mechanism On and Off at the chosen limits. There are three (3) set points: High Pressure On, Low Pressure Off, and Alarm. The first two, High Pressure On and Low Pressure Off, control the filter cleaning system. The third, Alarm, provides a relay output to activate an external alarm supplied by others.

Operation

Normal

The Delta P Controller monitors the pressure in the clean-air and dirty-air air plenums while the collector is running. The blower draws air through the filters, creating a pressure drop. The Delta P Controller measures the pressure drop and provides a visual display in inches water gauge or metric (SI) collectors of daPa.

Filter Cleaning

When the pressure drop across the filters reaches the High Pressure On setpoint, the controller closes an output relay allowing a timer to trigger the cleaning valves sequentially. When the controller senses that the pressure drop has decreased to the Low Pressure Off setpoint, the relay opens and the cleaning cycle stops. This sequence continues as long as the collector is in use, maintaining the pressure drop within a narrow range.

Alarm

The Alarm setpoint is set to a higher setting than the High Pressure On setpoint used to start the filter cleaning cycle. It indicates situations when the cleaning system cannot reduce the pressure drop due to cleaning system failure, lack of compressed air, or the end of the filter's useful life. There is a time delay prior to setting the Alarm to prevent nuisance trips. The Delta P Controller also provides an input connection for a remote alarm reset.



Delta P Control Display

Delta P Plus Control

For complete information, see the most current version of the Delta P Plus Installation, Operation, and Maintenance manual.

Description

The Delta P Plus Controller monitors the differential pressure between the clean-air and dirty-air plenums, providing a visual display of the filter condition. When combined with a pulse timer, it manages the pressure drop by turning the cleaning mechanism On and Off at the chosen limits. There are three (3) set points: High Pressure On, Low Pressure Off, and Alarm. The first two, High Pressure On and Low Pressure Off, control the filter cleaning system. The third, Alarm, provides a relay output to activate an external alarm supplied by others.

The user can program the Delta P Plus Controller to pulse while the collector is running, to maintain a relatively constant pressure drop across the filters, pulse only after the collector is shut down (after-shift cleaning), or a combination of both, cleaning while running as well as end of the shift.

Operation

Normal

The Delta P Plus Controller monitors the pressure on both sides of the tubesheet while the collector is running. As air flows through the filters, the resistance of the media and collected dust creates a pressure difference or "drop" between the dirty and clean air plenums. The Delta P Plus Controller measures the pressure drop and provides a visual display in inches water gauge or metric (SI) collectors of daPa.

Filter Cleaning

The Delta P Plus Controller offers three filter cleaning options.

1. **Differential Pressure Cleaning (DFF)** - When the pressure drop across the filters reaches the Controller's High Pressure On setpoint, the Controller closes an output relay allowing a sequential timer to trigger the cleaning valves. When the Controller senses that the pressure drop has decreased to the Low Pressure Off setpoint, the relay opens and the cleaning cycle stops. This sequence continues as long as the collector is in use, maintaining the pressure drop within a narrow range.

2. **Downtime Cleaning (DTC)** - The Delta P Plus Controller monitors the collection system. When the pressure drop exceeds the Low Pressure Off set point and then approaches zero again, the Delta P Plus Controller runs a delay timer to allow the blower to come to a stop and then engages the cleaning mechanism for a preselected time.
3. **Combined Differential and Downtime Cleaning (ALL)** - The Delta P Plus Controller combines the two functions described above; maintaining the pressure drop in a narrow band and downtime cleaning the filters when the collector is shut down. The downtime cleaning function can be toggled On or Off from the keyboard.

Alarm

The Alarm setpoint is set to a higher setting than the High Pressure On used to start the filter cleaning cycle. It indicates situations when the cleaning system cannot reduce the pressure drop due to cleaning system failure, lack of compressed air, or the end of the filter's useful life. There is a time delay prior to setting the Alarm to prevent nuisance trips. The Delta P Plus Controller also provides an input connection for a remote Alarm reset.



Delta P Plus Control Display

DS Controller Installation

⚠ WARNING

Electrical installation, service, or maintenance work must

be performed by a qualified electrician and comply with all applicable national and local codes.

Turn power off and lock out electrical power sources before performing service or maintenance work.

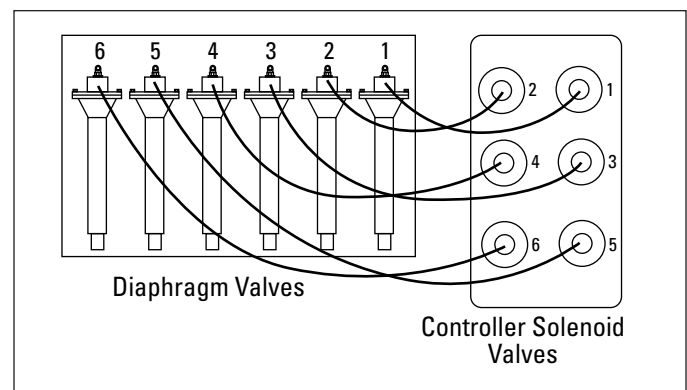
Do not install in classified hazardous atmospheres without an enclosure rated for the application.

The DS Controller is an optional electronic timer used to control the filter cleaning system.

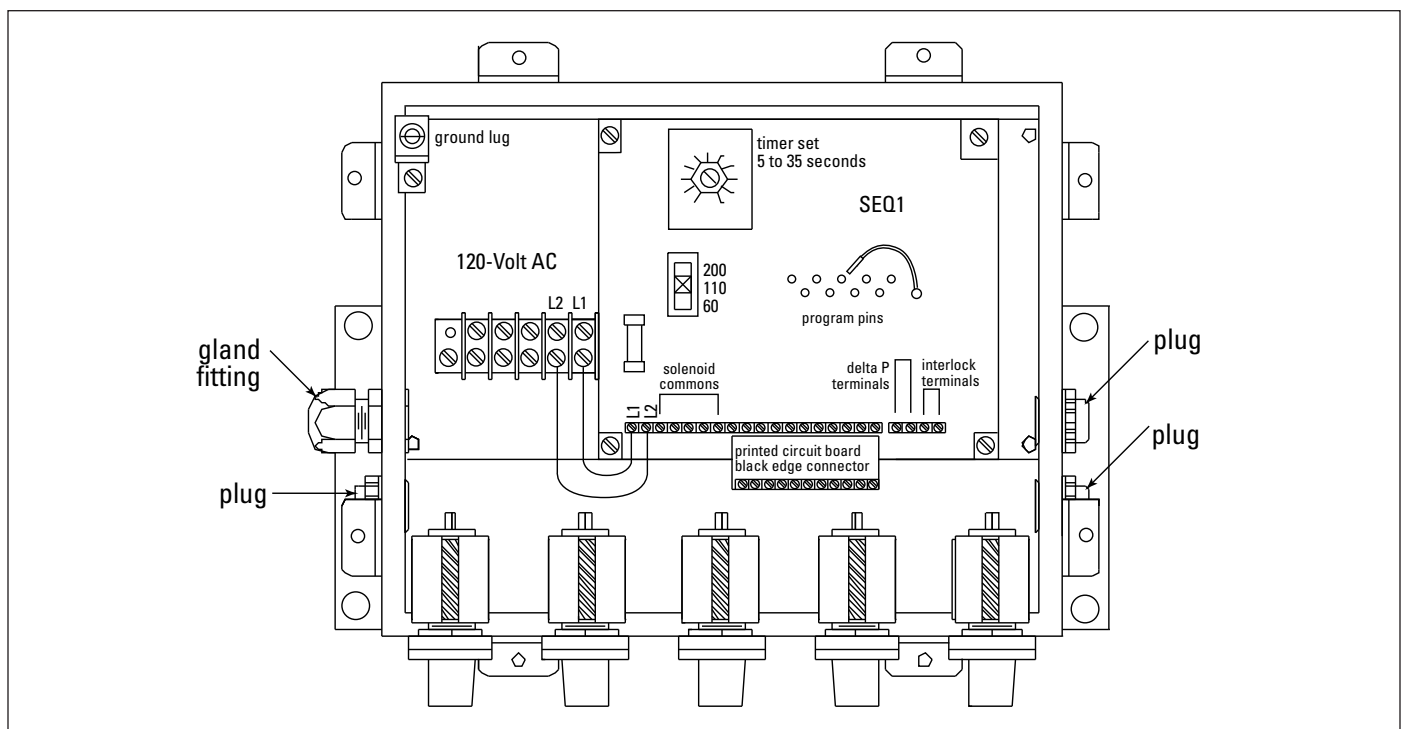
1. Loosely mount the collector to the preferred side of the collector using the top two bolts and nuts only.
2. Prepare tubing to connect the solenoid valves to the diaphragm valves by cutting to the required length.
3. The solenoid and diaphragm valves are equipped with push fittings. Push the cut end of the tubing

into the diaphragm valve fitting, pass the other end through the corresponding hole on the side of the collector and push it into the correct solenoid fitting. See Solenoid and Diaphragm Valve Connection. To disassemble, push inward on the collar of the push fitting and withdraw the tubing.

4. Secure controller to collector using the remaining bolts and lock washers. Tighten all connections.



Solenoid and Diaphragm Valve Connections



DS Controller

DS Controller Set-Up and Connection

1. Loosen the enclosure cover clamps and remove the cover. Connect line power to the terminal strip as marked. For line-neutral systems, connect line to L1 and neutral to L2. See DS Controller Wiring Diagram.
2. Plug the program lug into the pin that corresponds with the number of solenoid valves controlled.
3. Set the pulse-duration slide switch to 60, 110, or 200 milliseconds. See Compressed Air Requirements.
4. Adjust the pulse-interval time between 5 and 35-seconds. The recommended initial setting is 10-12-seconds. Turn clockwise to increase the interval, counterclockwise to decrease interval time.
5. Connect the optional Delta P Control to the proper terminals, if equipped.
6. Connect a normally-closed contact to the terminals marked INT to start and stop pulse cleaning in conjunction with blower operation. See DS Controller Optional Settings.

DS Controller Specifications

Power is supplied to the controller and the LP1 and LP2 LED's illuminate continuously indicating power to the system. A preset 20-second OFF time is initiated and the timer energizes each solenoid valve sequentially. The LP3 LED flashes with each output pulse to a valve. The cleaning cycle continues until power to the controller is turned OFF or until one of the controller options is activated.

Voltage Input

110-Volt, two wire, 50-60 Hz, line-line or line-neutral

Power Requirements

36 VA

Temperature Range

14° F to 140° F

Pulse ON Time

See Compressed-Air Requirements.

Solenoid Valves

115-Volt

Compressed-Air

See Compressed-Air Requirements.

DS Controller Optional Settings

Note: The optional settings interact if both are used simultaneously. If the Delta P circuit is calling for cleaning, closing the INT contact stops the pulse sequence. If the Delta P circuit is not calling for cleaning, it does not matter if the INT contact is open or closed, the pulse sequence will not start.

Delta P

The DS Controller has a Delta P option for use with a separate differential control such as the Delta P Control or Photohelic gauge. Pressure taps mounted in the clean- and dirty-air plenums and the remote-mounted gauge provide the differential pressure readings. Use the normally-closed contacts on the Delta P Control or Photohelic gauge.

When governed by a differential pressure switch, LED LP2 is permanently lit. When the differential pressure reaches the high setpoint, LED LP1 lights and if the signal continues for 20-seconds, the cleaning cycle starts and pulse cleaning continues as indicated by LED LP3 flashing with each pulse, until the low setpoint is reached and the last solenoid connected pulses.

The cycle restarts with the first valve in the sequence when the differential pressure again reaches the high setpoint.

Intermittent Operation

The intermittent option allows interlocking with other system components such as the blower. Wiring the INT terminals through a normally closed auxiliary contact on the blower motor starter energizes the printed circuit board, but only runs when the system is operating. With the intermittent option in use, LED's LP1, LP2, and LP4 are illuminated. The auxiliary contact opens on blower start-up and LED LP4 turns OFF and the pulse cleaning cycle starts, which is indicated by the LP3 LED flashing with each pulse. When the auxiliary contact closes, LED LP4 lights and the pulse cleaning cycle stops. When the auxiliary contact closes again, the pulsing system starts the cleaning cycle starting with the next valve in sequence.

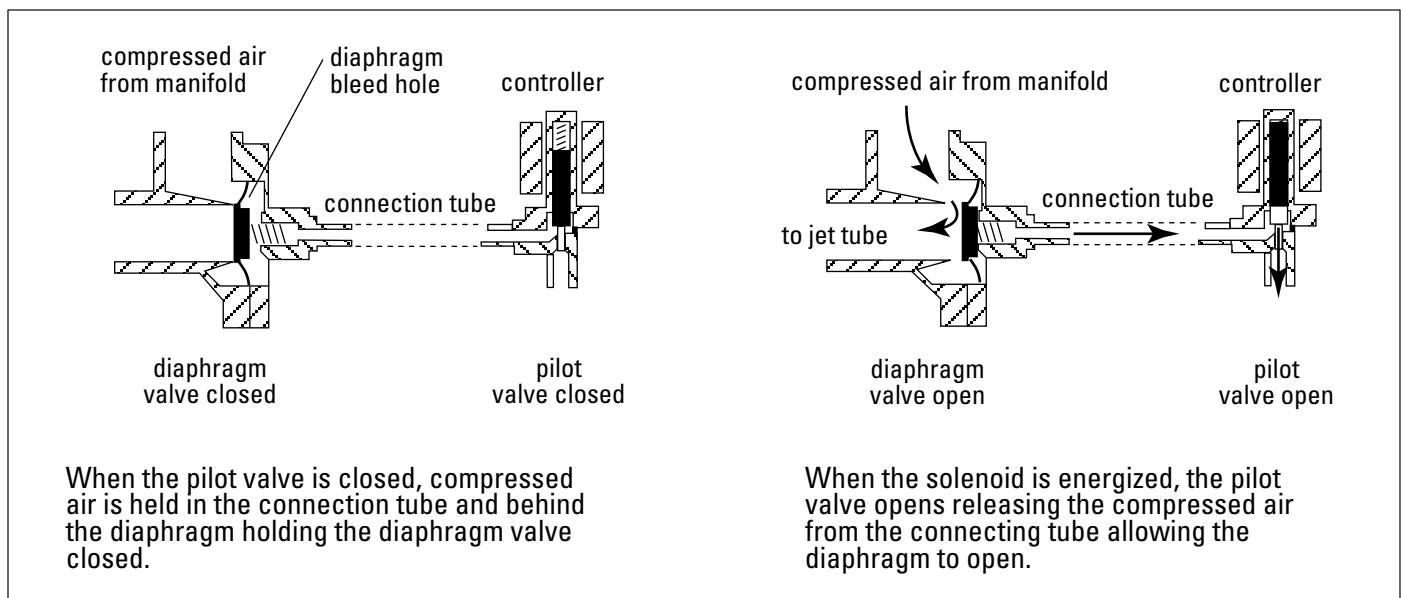
Troubleshooting

Fuses: Verify that the proper voltage is available at the correct terminals. Check the condition and contact of the fuse located on the printed circuit board. If LED LP2 is lit and the board does not function, check that operation is not interrupted by one of the control options.

Output Triac: Triacs are solid-state switches used to control the solenoid valves. If they fail, they normally fail in the closed position. The solenoid connected to the failed triac will remain open and bleed air. If left uncorrected, the solenoid coil may overheat and fail as well.

Overload Protection

Protect feeder circuits with suitable fuses and contactors with integral overload protection. A fused isolator with a 1.6-amp fuse with the proper voltage rating should be installed between the controller and the incoming power supply. Use a high-rupture capacity, HRC, cartridge-type fuse.

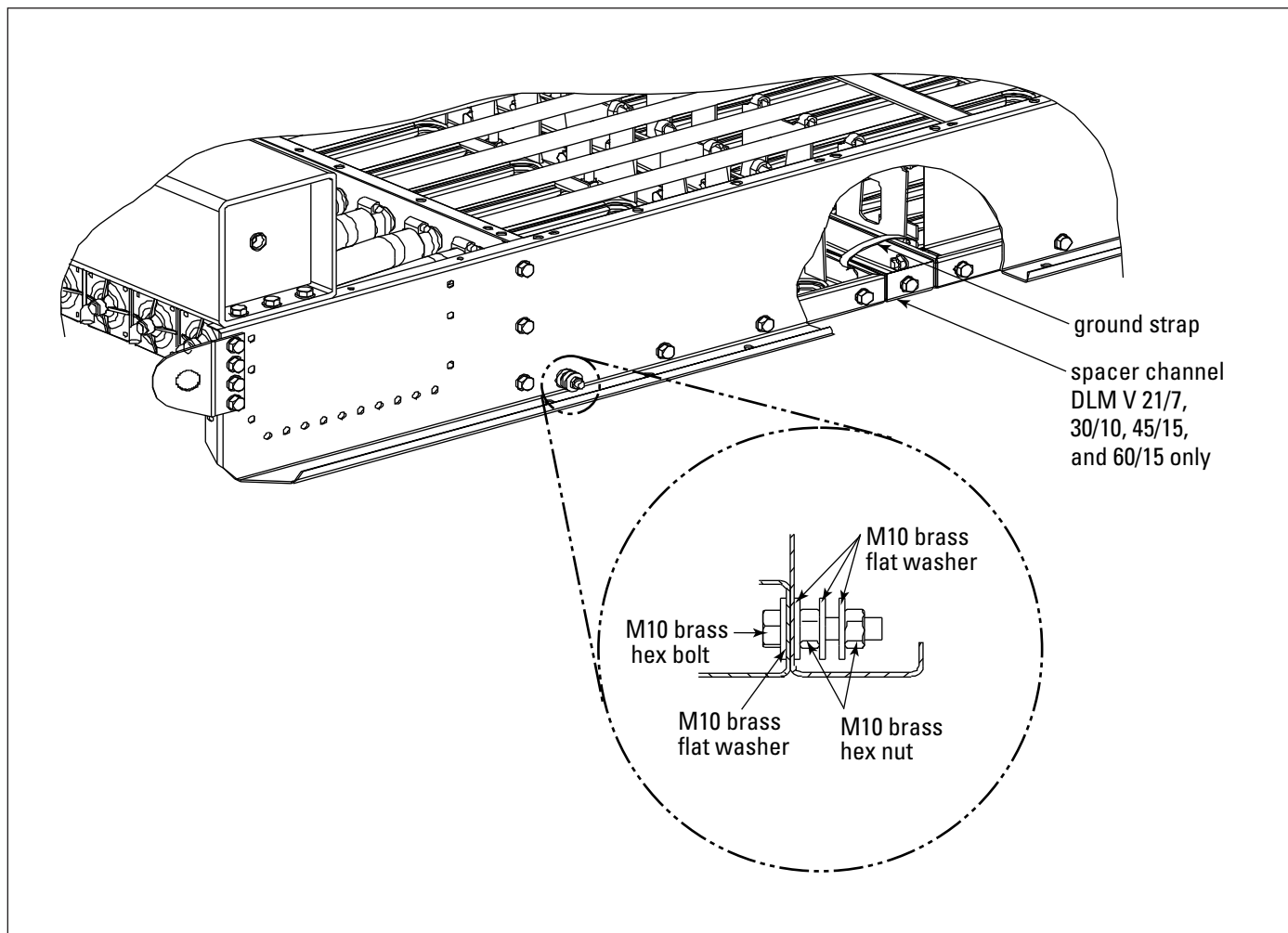


Solenoid and Diaphragm Valve Operation

Antistatic Option

Collectors using antistatic filters must be properly bonded and grounded.

1. Remove and replace the standard hardware with the brass hardware as shown.
2. Loop grounding strap from seal frame to seal frame and fasten using existing hardware as shown.
3. Connect a suitable ground wire to the grounding lug located on the side of the collector housing.



Bonding and Antistatic Ground Connection

Troubleshooting

Problem	Probable Cause	Remedy
Fan blower and motor do not start	Improper motor wire size	Rewire using the correct wire gauge as specified by national and local codes.
	Not wired correctly	Check and correct motor wiring for supply voltage. See motor manufacturer's wiring diagram. Follow wiring diagram and the National Electric Code.
	Collector not wired for available voltage	Correct wiring for proper supply voltage.
	Input circuit down	Check power supply to motor circuit on all leads.
	Electrical supply circuit down	Check power supply circuit for proper voltage. Check for fuse or circuit breaker fault. Replace as necessary.
	Damaged motor	Replace damaged motor.
Fan blower and motor start, but do not stay running	Incorrect motor starter installed	Check for proper motor starter and replace if necessary.
	Access doors are open or not closed tight	Close and tighten access doors. See Filter Installation.
	Electrical circuit overload	Check that the power supply circuit has sufficient power to run all equipment.
Clean-air outlet discharging dust	Filters not installed correctly	See Filter Installation.
	Filter damage, dents in the end caps, gasket damage, or holes in media	Replace filters as necessary. Use only genuine Donaldson replacement parts. See Filter Installation.
	Access cover(s) loose	Tighten access doors securely. See Filter Installation.
Insufficient airflow	Fan rotation backwards	Proper fan rotation is clockwise from the top of the collector. The fan can be viewed through the back of the motor. See Preliminary Start-Up Check.
	Access doors open or not closed tight	Check that all access doors are in place and secured.
	Fan exhaust area restricted	Check fan exhaust area for obstructions. Remove material or debris. Adjust damper flow control.
	Filters need replacement	Remove and replace using genuine Donaldson replacement filters. See Filter Removal and Installation.
	Filters plugged	Check that the dust storage silo or bin is not full or that the equipment served is operating. Turn fan OFF and allow the controller to perform several complete cleaning cycles. Replace damaged or torn filters.

Troubleshooting

Problem	Probable Cause	Remedy
Insufficient airflow continued	Lack of compressed air	See Rating and Specification Information for compressed air supply requirements.
	Pulse cleaning not energized	Use a voltmeter to check the solenoid valves in the control panel. Check pneumatic lines for kinks or obstructions.
	Pulse valves leaking compressed air	Lock out all electrical power to the collector and bleed the compressed air supply. Check for debris, valve wear, pneumatic tubing fault, or diaphragm failure by removing the diaphragm cover on the pulse valves. Check for solenoid leaks or damage. If pulse valves or solenoid valves and tubing are damaged, replace.
	Faulty interlock	Check and replace if necessary.
	Excess moisture in the compressed air supply	Check that the compressed air supply is oil and moisture free.
	No pulse to diaphragm valves	Check the vent opening on the solenoid valve for pulse. If all valves are affected, check that the LED LP1 on the controller is ON. If not illuminated, check power supply and printed circuit board fuse. If illuminated, check that the interrupt function is not enabled. If interrupt function is not enabled and still no pulse, replace the printed circuit board. If isolated solenoid or diaphragm valve is affected, check LED LP3 on the controller that flashes corresponding to the malfunctioning valve. If illuminated, replace solenoid valve. Replace printed circuit board if LED is not illuminated.
	Solid-State timer failure	Using a voltmeter, check supply voltage to the timer board. Check and replace the fuse on the timer board if necessary. If the fuse is good and input power is present but output voltage to the solenoid is not, replace the timer board. See Solid-State Timer Installation.
	Solid-State timer out of adjustment	See Solid-State Timer and Solid-State Timer Wiring Diagram.
No display on the Delta P Controller	No power to the controller	Use a voltmeter to check for supply voltage.
	Fuse blown	Check the fuse in the control panel. See wiring diagram inside the control panel. Replace if necessary.

Problem	Probable Cause	Remedy
Display on Delta P Controller does not read zero when at rest	Out of calibration	Recalibrate as described in Delta P Maintenance Manual.
	With collector discharging outside, differential pressure is present from indoor to outdoor	Recalibrate with the pressure tubing attached as described in the Delta P Maintenance Manual.
Delta P Controller ON, but cleaning system does not start	Pressure tubing disconnected, ruptured, or plugged	Check tubing for kinks, breaks, contamination, or loose connections.
	Not wired to the timing board correctly	Connect the pressure switch on the timer board to Terminals 7 and 8 on TB3.
	Faulty relay	Using a multimeter, test relay for proper closure. Replace if necessary.
Pulse cleaning never stops	Pressure switch not wired to the timer board correctly	Connect the pressure switch on the timer board to Terminals 7 and 8 on TB3.
	Pressure switch terminals on the timer board jumpered	Remove jumper wire on Solid-State Timer board before wiring to the Delta P Control.
	High Pressure On or Low Pressure Off setpoint not adjusted for system conditions	Adjust setpoints to current conditions.
	Pressure tubing disconnected, ruptured, plugged, or kinked	Check tubing for kinks, breaks, contamination, or loose connections.
Alarm light is ON	Alarm setpoint too low	Adjust to a higher value.
	Excess pressure drop	Check cleaning system and compressed air supply. Replace filters if filters do not clean down.
	Pressure tubing disconnected, ruptured, plugged, or kinked	Check tubing for kinks, breaks, contamination, or loose connections.
Delta P arrow keys do not work	Improper operation	Press and hold one of the three setpoint keys to use arrow keys.
	Programming keys disabled	Remove the Program Disable jumper from Terminals 3 and 4 on TB2.

Troubleshooting

Problem	Probable Cause	Remedy
Cleaning light is ON, but cleaning system not functioning	Improper wiring	Check wiring between the Delta P Control and the timer board, and between the timer board and solenoid valve coils.
	Defective solenoids	Check all solenoid coils for proper operation.
	Timer board not powered	Check power ON light on timer board's LED display. If not illuminated, check the supply voltage to the timer board. Check the fuse on the timer board. Replace if necessary.
	Timer board defective	If LED is illuminated, observe the output display. Install a temporary jumper across the pressure switch terminals. Output levels should flash in sequence. Check output using a multimeter set to 150-Volt AC range. Measure from SOL COM to a solenoid output. The needle will deflect when LED flashes for that output if voltage is present. If LED's do not flash, or if no voltage is present at output terminals during flash, replace the board.

The Donaldson Torit Warranty

Donaldson warrants to the original purchaser that the major structural components of the goods will be free from defects in materials and workmanship for ten (10) years from the date of shipment, if properly installed, maintained and operated under normal conditions. Donaldson warrants all other Donaldson built components and accessories including Donaldson Airlocks, TBI Fans, TRB Fans, Fume Collector products and Donaldson built Afterfilters for twelve (12) months from date of shipment. Donaldson warrants Donaldson built filter elements to be free from defects in materials and workmanship for eighteen (18) months from date of shipment. Donaldson does not warrant against damages due to corrosion, abrasion, normal wear and tear, product modification, or product misapplication. Donaldson also makes no warranty whatsoever as to any goods manufactured or supplied by others including electric motors, fans and control components. After Donaldson has been given adequate opportunity to remedy any defects in material or workmanship, Donaldson retains the sole option to accept return of the goods, with freight paid by the purchaser, and to refund the purchase price for the goods after confirming the goods are returned undamaged and in usable condition. Such a refund will be in the full extent of Donaldson's liability. Donaldson shall not be liable for any other costs, expenses or damages whether direct, indirect, special, incidental, consequential or otherwise. The terms of this warranty may be modified only by a special warranty document signed by a Director, General Manager or Vice President of Donaldson. To ensure proper operational performance of the equipment, use only genuine Donaldson replacement parts. THERE EXIST NO OTHER REPRESENTATIONS, WARRANTIES OR GUARANTEES EXCEPT AS STATED IN THIS PARAGRAPH AND ALL OTHER WARRANTIES INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, WHETHER EXPRESS OR IMPLIED ARE HEREBY EXPRESSLY EXCLUDED AND DISCLAIMED.



Parts and Service

