J. H. Fletcher & Co.
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www.jhfletcher.com

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DRY DUST SUPPRESSION SYSTEM
Importance of Dust Suppression System
Drilling cannot occur any faster than the rate at which cuttings are removed from the hole.
The Dust Suppression System must be designed, manufactured and maintained to limit the machine operator’s exposure to harmful dust.
Approval Requirements for Dust Suppression System

MSHA Standard
30 CFR 33.9
30 CFR § 33.9

Certification of dust-collecting systems.

Manufacturers of dust-collecting systems that are designed for integral use on machines with drilling equipment may apply to MSHA to issue a certificate of performance for such systems. To qualify for a certificate of performance, the dust-collecting system shall have met satisfactorily the test requirements of Subpart C under specified operating conditions, such as type of drilling equipment, drilling speed, and power requirements and the construction thereof shall be adequately covered by specifications and drawings officially recorded and filed with MSHA. Individual parts of dust-collecting systems will not be certified for performance. Certificates of performance may be cited to fabricators of combination units as evidence that further inspection and testing of the dust-collecting system will not be required, provided the dust-collecting requirements of the drilling equipment do not exceed the limits of performance for which the system was certified. Since MSHA does not sanction the use of the words "permissible" or "approved" except as applying to completely assembled equipment, dust-collecting systems, which have been certified only as to performance, shall not be advertised or labeled in a manner inferring that such systems themselves are permissible or approved by MSHA. However, a certified system may be advertised as suitable for use on combination units for which certification may be desired if the limits of its performance are cited. Certified dust-collecting systems shall bear labels or tags which shall contain the following: "Performance-tested Dust Collecting System. MSHA File No. P/T______,," and name of manufacturer, identifying numbers of the dust-collector parts, and description of the limitations for which performance is certified. MSHA will assign a P/T file number in the certification letter.
A Dust Suppression System Approval Plate must be installed on the machine.

Provides:
- Approval Number
- Minimum Blower Vacuum
- Relief Valve Setting

Approved for rock drilling in coal mines only when each dust-collecting system is assembled with drill steel (minimum I.D. 1/2 inches), MSHA approved drill head, MSHA approved cyclone tank, MSHA approved filter tank, MSHA approved blower (minimum 1000 rpm), MSHA approved relief valve, MSHA approved 4000 muffler, and not more than 410 inches of MSHA approved collector hose, and not more than 410 inches of MSHA approved exhaust hose.
Tags on Dust Tank
All components must meet Dust Suppression System Approval specifications.
Replacement parts must be ordered from Fletcher or an authorized distributor.
The Blower Vacuum Relief Valve Setting must meet Approval Requirement.
Dresser Industries
Model 2504DVJ blower

setting of 12 inches of mercury. The approval documentation currently states that this blower is operating at 3,000 rpm and 15 inches of mercury with an airflow of 60 CFM. On the same blower curve at 12 inches of mercury the airflow is 68 cfm. The Dresser Industries model 2504DVJ roots blower with a vacuum relief valve setting of 12 inches of mercury will still function properly to meet all the requirements as specified in Part 33 of Title 30 Code of Federal Regulations.

A technical evaluation of this request was conducted using the blower performance curves in our files and comparing the results with the requested vacuum relief valve setting of 12 inches of mercury. The approval documentation currently states that this blower is operating at 3,000 rpm and 15 inches of mercury with an airflow of 60 CFM. On the same blower curve at 12 inches of mercury the airflow is 68 cfm. The Dresser Industries model 2504DVJ roots blower with a vacuum relief valve setting of 12 inches of mercury will still function properly to meet all the requirements as specified in Part 33 of Title 30 Code of Federal Regulations.

The request is granted to allow the J.H. Fletcher and Company to lower the vacuum relief valve setting to 12 inches of mercury when using the model 2504DVJ on their approved dust collection systems.

Sincerely,

[Signature]

Steven J. Luzik
Chief, Approval and Certification Center
System Components
SYSTEM COMPONENTS - DUST HOSE, FITTINGS AND CLAMPS

- No kinks in hoses
- Use only approved hose
- Make sure all clamps are tight
MSHA Approved Dust Hose
SYSTEM COMPONENTS - DUST BOXES AND FILTER ELEMENTS
NOTE: Not all dust boxes can utilize dust bags.

- Basket to be used with dust bags
- Tray to be used without dust bags
SYSTEM COMPONENTS - BLOWERS AND RELIEF VALVES

Oil Fill
SYSTEM COMPONENTS - MUFFLERS

Water drain plug for draining water after flushing muffler
SYSTEM COMPONENTS - COOLING AIR INTAKE FILTER AND MUFFLER

COOLING AIR INTAKE FILTER
(optional)

COOLING AIR INTAKE MUFFLER

Pulls clean air into system. This component is replaceable and should be changed every 6 months.
Inspection
and
Maintenance
INSPECTION AND MAINTENANCE - DRILLHEAD AND CHUCK

- Check Chuck for Cracks and Excessive Wear
- Check for Drill Head Seal Leakage
INSPECTION AND MAINTENANCE - DUST HOSE, FITTINGS AND CLAMPS

- Check for and Fix Any Leaks
- Check for Hose Wear and Replace if Required
- Hose Clamps – Installed and Tight
Skirt on Pre-Cleaner
Operation of the Pre-Collector is controlled by other machine functions. Operation may occur at any time while machine is running.

Before performing any inspection, maintenance or repair on the Pre-Collector unit always remove the power to the machine at the power center, lock and tag out.

Serious injury can occur from failure to remove power, lock and tag out prior to performing inspection, maintenance or repair on the Pre-Collector Unit.
Butterfly Valve Sleeve
Cyclone Cap
PN: 56362

MAKE SURE HOSES ARE CONNECTED CORRECTLY
AIRFLOW DIRECTION ARROWS
INSPECTION AND MAINTENANCE
DUST BOXES AND FILTER ELEMENTS...

Door Latches

• If damaged replace with Fletcher OEM dust tank latch only.
Doors and Door Gaskets

> Doors not warped or bent
> All gaskets installed, in good condition and clean.
> Each chamber must be separated. Check for air leaks and replace gasket if necessary.
Cyclone Separator Units

- Properly installed with clamps in place and tightened
- Check for leaks
- NOTE: If your machine is equipped with a Donaldson dust box, parts are no longer available. If repairs are needed, replace box with a Fletcher dust box.
Filter Elements

Never attempt to clean filter elements.

Remove and properly dispose of dirty element.

Install new approved element when dust collection efficiency decreases to the point that drilling rate is reduced. Make sure element is installed correctly and the wing nut is hand tight making a snug seal. Improperly sealed elements are a key factor to failure.
Dust Filter leakage Test

R.S.A. Preliminary 04/16/09
Window added to dust box cover
Blocked Filter Simulation

- Filter Covered with plastic bag and tape
- Filter placed in dust box and vacuum applied
- Filter was crushed by vacuum
- Tape and plastic removed from end
Filter Taped Up and Crushed
Test 1 with nut just snug

Filter clearly moves about ¼” allowing dust to pass.
(Look at shadow of wing nut)
Test 2 with nut fully tightened

Filter moves again but less than 1/8”
Mostly Blocked Filter Simulation

- Well used filter containing lots of dust
- Filter 90% Covered with tape
- Filter placed in dust box and vacuum applied
- Filter not crushed by vacuum
Mostly Blocked Filter
Test 3 with nut just snug

Filter barely moves if at all.
Test 4 with nut fully tightened

Filter barely moves if at all.
Conclusions

- Filter will bypass if completely plugged, collapsed, and nut is not tight
- A mostly plugged filter could bypass only if the nut is not tight
- Alternate filter designs and sealing methods are being investigated
The belt tension is checked by applying moderate pressure midway between the sheaves - the belt deflection should be between 1/4” and 1/2”. 

Horizontal Blower Mount

Vertical Blower Mount
New blower belt guard (PN: 418097)
Blower vacuum relief valve must be set to maintain the minimum vacuum level specified on the Dust System Approval Plate. However, do not set vacuum relief valve excessively high.

**NOTE:**

LOOSE SET SCREW BEFORE ATTEMPTING TO ADJUST RELIEF VALVE. MAKE SURE SET SCREW IS RE-TIGHTENED AFTER RELIEF IS SET.
Check vacuum blower relief valve by installing vacuum gauge over drill head chuck.

Part No.: 132121
FLETCHER 132121 VACUUM ASSEMBLY

The 132121 Vacuum Gauge Assembly has been provided to assist in maintaining the dust suppression of your Fletcher Roof Drill in proper operating condition.

There are three (3) important reasons for maintaining the drilling vacuum within the specified operating range.

FIRST, the dust suppression system is a safety device, designed to prevent potentially harmful fines from escaping into the mine atmosphere. Due to this, the design and maintenance of this system is regulated by MSHA (30 CFR—Part 33). Every roof drill must be equipped with an approved dust suppression system and display a tag indicating the dust suppression system approval number along with the minimum vacuum relief valve setting.

SECOND, drilling cannot occur any faster than the cuttings can be removed from the hole. Therefore maintaining the system properly, with the vacuum set correctly will assure maximum drilling efficiency.

FINALLY, maintaining the vacuum within recommended limits will prevent damage to the blower.

The first step in using the vacuum gauge assembly is to determine the proper vacuum operating range for your machine.

The minimum vacuum relief valve setting, which must be maintained to satisfy MSHA approval, is stamped on the permissibility plate (generally located in the tram deck).
The maximum vacuum level should never exceed 20 in-hg. Operation at vacuum levels above 20 in-hg will result in decreased blower life.

PREPARING TO CHECK DRILLING VACUUM:

Make sure the dust system is in proper operating condition:
- Dust tank clean
- Dust filter element in operating condition (not clogged)
- All clamps installed on dust hoses
- Dust tank door—all gaskets and sealing surfaces are clean and in proper operating condition
- Dust tank latches—installed in operating condition and latched
- Blower drive belts properly tensioned

CHECKING DRILLING VACUUM

1. Locate the machine in a safe area—outdoors—under permanent roof support.
2. Start the machine.
3. If the machine is equipped with a pre-cleaner, make sure the pre-cleaner is closed—there is airflow through the drill chuck.
4. Perforate rubber plug to vent gauge.
5. Place the vacuum gauge in the drill chuck as shown in the photograph to the bottom right.
6. Allow the gauge reading to stabilize, then note the gauge reading—this will be the vacuum reading in in-hg. (inches of mercury)

WARNING

DO NOT ENGAGE DRILL ROTATION OR DRILL FEED:
JUST BEFORE INSERTING VACUUM GAUGE IN CHUCK
WHILE VACUUM GAUGE IS INSERTED IN CHUCK
SERIOUS OR FATAL INJURY CAN OCCUR AS A RESULT OF OPERATING DRILL FEED OR ROTATION WITH VACUUM GAUGE INSTALLED IN DRILL CHUCK.

After installation, perforate plug to vent gauge.
• Generally no maintenance required.

• If the system gets “dusted out” then the mufflers can get filled with dust to the point that their performance is adversely affected. The mufflers can be removed and flushed with water. A plug is provided for draining the muffler after flushing.
Here is a suggested method to clean the system.

1. Open the dust-box; remove all loose dust and the filters.
2. Remove the hoses attached to the “Roots” blower, both inlet and outlet.
3. Without operating or running the blower, flush clean water through the hoses/muffler/dust-box with a water hose. This would flush the blower hose and dust-box chamber and the hose and muffler. (Also follow the manufacturer’s recommendation given in their 20005-2 News Letter http://www.jhfletcher.com/newsletter.htm Maintenance Q&A on p.2 concerning the muffler) Run water through both the inlet and the outlet blower hoses.
4. Dry or mop up the leftover water and reattach hoses.
5. Install new filters.
6. Check for leaks.
Some important things to note:

1. Some types of dust may resist water or be too caked to remove. One might need to replace certain components or use other aggressive methods (digging or scraping).
2. Separate the other components to really “get” to the trouble spots.
3. Each type of dust collector may need some additional thought to the cleaning process. Same cleaning method, just different components.
4. Don’t get very much water around the blower or in the blower. This is an air or gas handling device and not a pump.
Results calculated using MSHA supplied qualitative data and overall dust volumes measured by J. H. Fletcher & Co.
DUST BAGS

Adaptable with most dust systems

New design with basket
### TABLE OF CONTENTS:
- MISCELLANEOUS
- ELECTRICAL
- PUMP SYSTEM
- TRAM SYSTEM
- DRILLING UNIT
- DUST COLLECTION
- SAFETY COMPONENT
- VALVES
- WATER (OPTIONAL)

### ORDER FORM

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**NOT SHOWN, NOT PART OF ASSEMBLY:** 57302 DUST BAG

**SHEET NO.** SP-110

**TITLE** DUST BAG MOUNTING KIT

**DATE** 10-31-00

**J. H. FLETCHER & CO.**
402 HIGH STREET HUNTINGTON, WV
Water Box

• OPTIONAL: Not required to operate dust system
NOTES:

1. Two (2) exhaust outlets are provided. Only one (1) outlet is required.

MAINTENANCE:

Maintenance must be performed periodically so that sludge does not build up in the bottom of the enclosure. To clean the water chamber, drain the water by removing one or more of the three (3) plugs located at the bottom side of the enclosure. Remove the \( \frac{3}{8} \) inch pipe plug on the opposite end of enclosure. Approximately 5 \( \frac{1}{2} \) inches from bottom of enclosure, flush water chamber with clean water until the water exiting is clean. Replace drain plugs in the bottom of enclosure and refill to where the water is at the bottom of the fill plug. This should allow for approximately five (5) inches of water.

Please note:
The water chamber is baffled therefore requiring the water to be under pressure.

AP-247 Exhaust Conditioner
Exhaust Flow Schematic

Side View

End View
NOTE: THE WATER LEVEL IN THE EXHAUST CONDITIONER, MUST BE PROPERLY MAINTAINED AT ALL TIMES.

PART #  DESCRIPTION  QTY
366626  EXHAUST CONDITIONER  1

PART #  DESCRIPTION  QTY
372466  EXHAUST CONDITIONER  N/A

NOTE: FOR FURTHER INFORMATION IN REGARDS TO DUST CIRCUIT PLEASE SEE SHEET DCC.
Notes on Dust System

• The drill feed control valve package must be correctly set to allow the dust system to operate properly.
  – Proper penetration rates
  – Cannot drill any faster than dust can be collected
• Sharp drill bits improve dust collection
• OEM components must be used in order to maintain the dust collection system. J. H. Fletcher & Co. can not guarantee operation when non OEM components are used.
• The dust suppression system of the machine is covered by an MSHA 25B federal approval. Maintaining the validity of this approval requires that the dust suppression system be operated and maintained as approved.
INNOVATIONS
Dust Agitator

AGITATORS

FIG. 1
Evaluation of Dust Collector Bags for Reducing Dust Exposure of Roof Bolter Operators

Objective

To evaluate the effectiveness of dust collector bags for reducing dust liberation from a roof bolter dust collection system.

Background

Respirable dust exposure in underground coal mines during the roof bolting process continues to be a problem for roof bolter operators. During 2000–2004, Mine Safety and Health Administration (MSHA) inspectors collected nearly 5,000 respirable dust samples for roof bolting occupations. Of these samples, 29% exceeded a respirable silica dust concentration of 100 μg/m³, a level that MSHA considers excessive. From these data, it is clear that roof bolter occupations exhibit a continued risk for overexposure to respirable silica dust.

Most roof bolting machines use an MSHA-accepted (30 CFR 33) vacuum dust collection system to capture dust as holes are drilled. A vacuum pump on the machine draws the dust through the bit and drill stem into an enclosed dustbox. The box has several compartments and functions as a rough size classifier, allowing the coarser dust sizes to settle out of the airstream first in the large compartment (about 95% of all the dust entering the box). The dust that passes through the large compartment is routed through cyclones and then into the filter chamber for deposition on a paper canister filter. The filtered air flows through the vacuum pump, a noise-reducing muffler, and then is exhausted into the mine environment. The dustbox and filter are usually cleaned on a preselected schedule to avoid overfilling the box and/or overloading the filter. Normally the dustbox is emptied at the end of every cut. As the filter accumulates fine particles of dust, resistance increases and flow through the system decreases, requiring removal and cleaning of the filter, usually after several cuts.

The majority of the dust is collected in the main (large) chamber of the collector. This dust is removed from the collector box by opening the door and pulling a “rake” toward the opening to drag the dust out, allowing it to dump onto the mine floor. Operator exposure occurs when this dust is entrained into the air as it falls from the box to the floor. Another source of exposure is from the canister filter. Dust that is too fine to be captured in the main and subsequent dustbox chambers passes through to the filter. Typically, filters are cleaned by shaking or tapping against the rubber tie of the bolter or a hard surface. This method of cleaning often creates a respirable dust cloud that contaminates the breathing area of the operator. The operator must take care not to damage the filter, filter seal, or dustbox door seal during the cleaning cycle, as dust not captured by the filter or that bypasses the filter seal is exhausted into the mine air. In addition, care must be taken to stay upwind of the dustbox during cleaning.

Approach

A laboratory study was conducted to evaluate the use of vacuum bags in the dust collector for improving dust capture efficiency. A Fletcher dust collector box, typical of many found on underground bolters, and a model AP-228 dusting were configured in the lab to simulate roof bolter drilling dust collection. The bags are MSHA-accepted for retrofit in Fletcher dustboxes. Testing was performed with and without the bag installed. Airflow through the box was provided by a vacuum pump rated at 60 cfm at 20 inches Hg. Dust was fed into the box using an Accu-Scan dust feeder with a 2/3-in screw.

Fifty pounds of ground limestone, similar in size distribution to dust collected from bolt dust collectors in use, was used as feed material for each test. The bags and canister filter were weighed after each test to determine the dust capture inside the box. Dust concentrations in the exhaust were recorded continuously in a 6-in-diam pipe using a RAM-1 instantaneous dust monitor. Aerodynamic particle sizes were measured in the exhaust using a TSI Aerodynamic Particle Sizer (APS). A laptop computer was interfaced with the APS and data acquired using the available TSI software. A column was drawn indiscernably into the diluter at 5 L/min through a 4-ft length of 0.31-in ID conductive tubing. Particle sizes were measured in the 6-in-diam pipe, roughly 8 ft away from the entry of the 2-in hose into the PVC pipe. Vacuum pressures within the bag and across the filter were also recorded continuously during each test. A total of 60 tests were conducted (30 with the bag installed and 30 without).
Laboratory and field evaluation of dust collector bags for reducing dust exposure of roof bolter operators

Introduction
Respirable dust samples taken by the Mine Safety and Health Administration (MSHA) show that roof bolter operators are still at high risk for overexposure. From 2000 to 2004, MSHA inspectors collected nearly 5,000 respirable dust samples at roof bolting operations (MSHA, 2004). Of these samples, 20 percent exceeded a respirable silica dust concentration of 100 μg/m³, a level that MSHA considers excessive. Previous studies have shown that the contents of the roof bolter dust box can contain high amounts of respirable silica dust (Colinnet et al., 1985; Kole et al., 1985). A study by Ondrey et al. showed that mining downwind of the continuous miner was the major source of dust on roof bolting operations (Ondrey et al.). However, improper ventilation and poor dust-box cleaning procedures can add to the overexposure of bolter operators.

Most roof bolting machines use an MSHA accepted (30CFR, Part 25) vacuum dust collection system to capture dust as holes are drilled. The drill steel, bit, dust box, filter and hoses together form a single unit approved by MSHA for use in underground coal mines. It is not possible to modify or change any part of this dust-control system without violating approval from MSHA.

The system uses a vacuum pump on the machine to create negative pressure in the drill holes and draw the dust cuttings through the bit and drill steel. Many of these dust cuttings settle out of the dust stream in the main chamber (about 56 percent of all the dust entering the box). A field sample showed that 26 percent of the dust in the main chamber is sized under 10 μm. The dust that passes through the main chamber is routed through cyclones and then into the filter chamber for deposition on a paper canister filter. The filtered air goes through the vacuum pump, a noise-reducing muffler and then into the mine environment. Figure 1 shows the schematic of the dust-collector system. Normally, the dust box is emptied at the end of every cut. As the filter accumulates fine particles of dust, the resistance increases and the flow through the system decreases. This requires the removal and cleaning of the filter, usually after several cuts.

The dust that is collected in the main chamber of the collector box is removed by opening the door and pulling a rake toward the opening to drag the dust out, allowing it to dump onto the mine floor. If cleaned improperly or is poorly ventilated, exposure can occur as the operator drags the dust from the box, entraining it into the air as it falls to the floor. A study by Goodman and Organisciak (2002) showed that using open containers constructed of either steel or line brattice helped contain dust in the main chamber for disposal against the rib, thus reducing operator exposure during cleaning. The four-sided reusable containers are fitted into the bottom of the main chamber and contained the dust as it settled. The containers are then removed, carefully dumped near the rib and then replaced.

Another source of operator exposure comes from the canister filter. Dust that is too fine to be captured in the main and subsequent dust box chambers passes through the canister filter. When the filter is removed for cleaning, it is shaken or tapped against the rubber tire of the bolt or a hard surface to dislodge the dust. This method of cleaning often creates a respirable dust cloud that contaminates the breathing area of the operator if he or she is not upwind of the dust. The operator must take care not to damage the filter or filter seal while cleaning, as dust not captured by the filter or that bypasses the filter seal is exhausted into the mine air. Care must be taken...
For further information on the Fletcher Dust System
Contact J. H. Fletcher & Co.

www.jhfletcher.com
“Our goal is to manufacture equipment for underground mining that increases safety and production through engineering innovation, quality control, experienced service and ownership stability”

- J. Robert Fletcher

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