STINGER SERIES INLET ISOLATION VALVES

Installation, Operation and Maintenance Manual

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STINGER™
Patent Pending

camfil
AIR POLLUTION CONTROL

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Table of Contents

Installation, Operation and Maintenance

Introduction

Dust collector inlet isolation valves are important safety devices that have been prescribed by the National Fire Protection Association for many years. Flow Activated Flap Valves were added to NFPA 69 Standard on Explosion Prevention Systems in 2014. Previously these valves were not recognized by NFPA but they were available as a performance based design option when tested by a third party under the European CEN standard. Currently NFPA recognizes valves tested to the EU standard but also accepts third party certifications as long as the device is proven adequate for the hazard present and the device is applied within the specific limits of performance determined during testing. Camfil APC valves are tested per the EN 16447 standard since it is the only test protocol for flow activated flap valves.

Prescribed Design Considerations

The Stinger flow activated flap valve is designed based on the NFPA prescribed criteria. Deviations from this criteria should be documented in the process hazard analysis and risk evaluation. The authority having jurisdiction must accept any deviations.

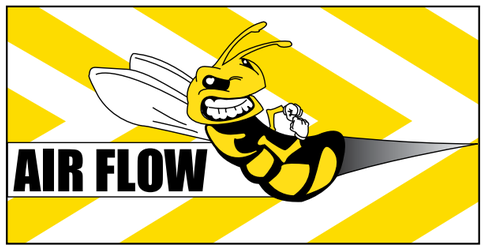
NFPA	CAMFIL
The flap valve closing pressure must be less than the anticipated pressure during a deflagration.	Camfil APC flap valves do not incorporate springs or counter weights to hold them open therefore there is not a resistant pressure to closing.
The valve should close and remain closed via a locking mechanism to prevent flame and burning material propagation upstream of the valve.	The locking mechanism on Camfil APC flap valves is self adjusting which compensates for blade deformation during activation.
An inspection door is required for periodic inspection of the flap and seals.	The inlet of the Stinger has a quick open inspection door and the top of the valve is a removable cover that allows complete access to the interior of the valve for inspection and blade replacement.
An interlock (if needed) should be provided in order to insure automatic shutdown of protected processes.	The interlock, if provided, is a magnetic reed switch that does not require a separate power supply.
A continuous signal senses dust build up in the valve that would compromise the valve. This signal would be used to shut down the process. Alternately a risk assessment and inspection program acceptable to the AHJ in leu of the sensor is allowed.	Camfil APC recommends frequent inspection procedures over a dust build up sensor. There is not a reliable method or device available that can detect and monitor dust build up in a duct. Camfil APC valves are designed to have minimal impact on conveying velocities and do not contain obstructions or blind spots that allow dust build up.
Duct work between the valve and the dust collector should be of sufficient strength to handle 2 x Pred of the dust collector.	Camfil APC recommends that ducting between the valve and the collector be designed to handle 14.5 psi (1 bar) and be fully welded.

Safety Precautions

Camfil APC relies on the skills and expertise of its customer and any consulting engineers and/or installing contractors hired by that customer to properly design and install the dust collection system of which Camfil APC equipment is a part. It is the responsibility of the end user of this equipment to take the necessary precautions to minimize the inherent risks. Read this manual thoroughly and comply with the precautionary statements relative to worker safety. Precautions must be taken to ensure that all electrical/air connections and regulation devices are installed and operating properly.

Indicates the importance of referring to the owner's manual for correct installation information and inspection procedures required by the National Fire Protection Agency.

Marks the location of a bonding screw with instruction. Bonding screws are required in order to assure the parts are electrically connected and will not acquire a static charge.



Indicates the direction of Air Flow on the Stinger Isolation Valve by following the point of the graphic.

Lock Out / Tag Out

Control of this equipment must be in accordance with OSHA Standard 1910.147 "Control of Hazardous Energy (Lock-Out / Tag-Out)". This standard "requires employers to establish a program and utilize procedures for affixing appropriate lock-out / tag-out devices to energy isolating devices and to otherwise disable machines or equipment to prevent unexpected energizing, start-up or release of stored energy in order to prevent injury to employees".

For further information on Lock-Out / Tag-Out requirements, see your company's Safety Director or refer to OSHA Standard 1910.147.

Before inspecting or servicing this equipment perform an approved Lock-Out / Tag-Out procedure on the electrical service, the compressed air (or other gas) supply or any other energy source.

Installation

Performance Limits

Isolation valves must be installed within their tested performance limits. Following are the limits for the Camfil APC ST series Flap Valves:

SPECIFICATIONS:
NFPA Compliant: Yes

COMBUSTIBLE MATERIAL:
Dry organic and metal dust with:
50≤KST≤200 bar*m/s
MESG≥2.3mm
Not suitable for flammable gases/vapors or hybrid mixtures of dust and gases/vapors

PROTECTED VESSEL:
Vented with non-reclosing venting devices

SYSTEM CONFIGURATION:
Pull flow through valve and protected vessel only

FLOW DIRECTION CHANGES BETWEEN VALVE AND PROTECTED VESSEL:
1 including an abrasion resistant inlet, 2 without an abrasion resistant inlet connecting vertically frombelow the valve.

OPERATING TEMPERATURE: -4° to 122° f

INSTALLATION POSITION: Horizontal only

VALVE MAXIMUM PRESSURE RESISTANCE: 14.5 psi

MAXIMUM METAL DUST LOADING: 174 grains/ft3

Table 1. Performance Limits Organic Dust

Size	Flow Capacity (cfm)		Length	Installation Distance "L"		Pred	Min Volume of Protected Vessel
inches	Min	Max	inches	Lmin ft	Lmax ft	psi	ft³
6	590	1050	30.31	6.5	19.5	11.6	14.1
8	1050	1750	33.25			8.7	31.7
10	1640	2730	38.93				
12	2360	3930	40.75				
14	3210	5350	45.56				
16	4190	6980	48.18				
18	5300	8840	50.93	9.75		7.25	120
20	6540	10910	53.37				
22	7920	13200	55.87				
24	9420	15710	58.50				
28	12830	21380	64.18			6.5	211.8
32	16760	27930	69.37				
36	21210	35340	74.56				
40	26180	43630	80.75				

* Maximum flow velocity 5900 fpm. Exceeding recommended flow rates above will result in higher pressure loss and abrasion.

WARNING

Failure to install this device within the tested limits could result in injury, loss of life and property damage.

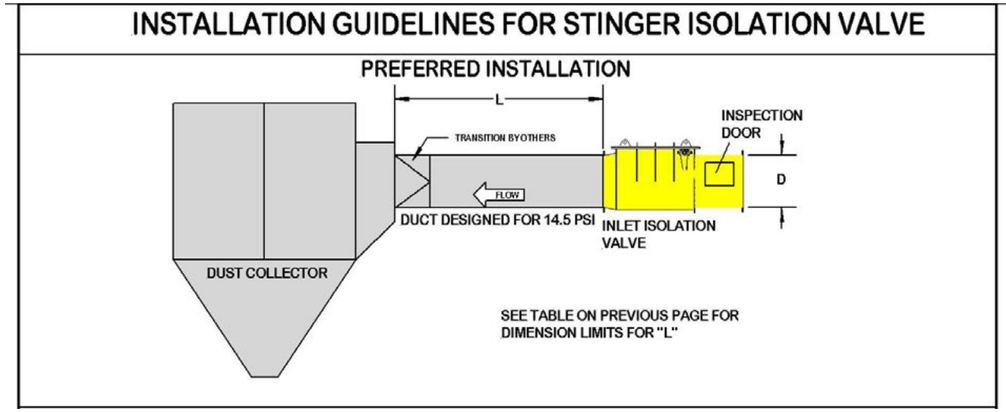
Table 2. Performance Limits Metallic Dust

Diameter Model	ST1 Metal	Min protected volume* ft³	Lmin – LMax** ft	Max Pred*** psi
305 mm (12')	X	31.7	11.4 - 16.4	7.2
355 mm (14')	X	56.5	11.4 - 16.4	4.3
400 mm (16')	X	56.5	11.4 - 16.4	4.3
450 mm (18')	X	56.5	11.4 - 16.4	4.3
500 mm (20')	X	56.5	11.4 - 16.4	4.3
560 mm (22')	X	56.5	11.4 - 16.4	4.3
610 mm (24')	X	56.5	11.4 - 16.4	4.3

* The valve can not be used to protect a smaller volume than the minimum protected volume.
** The valve must be installed at a distance between Lmin and Lmax from the protected vessel.
***The protection of the vessel must be designed not to exceed the maximum allowed Pred.

Follow these installation guides.

1. Locate the valve some distance from the collector that is within the Lmin and Lmax above. Lmin<L<Lmax
2. The duct between the valve and the dust collector should be fully welded including bolted angled flanges.
3. The duct between the valve and dust collector should be designed for 14.5 psi (1 bar).
4. The valve must be adequately supported to carry its weight and the weight of the duct.
5. The valve must be mounted horizontally as shown. Inclined or vertical mounting is prohibited.

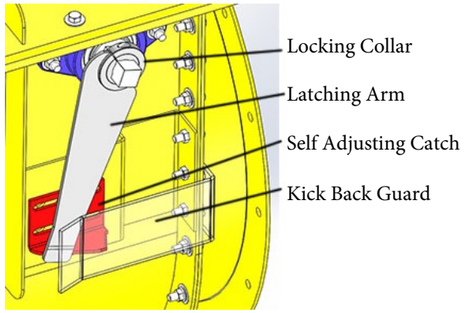


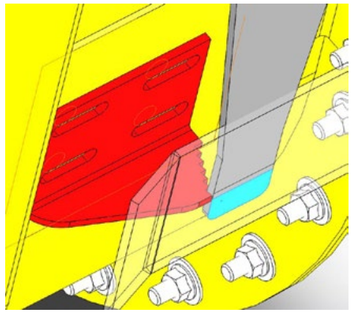
Operation and Maintenance

Locking Mechanism (patent pending)

The locking mechanism components are shown in the figure to the right. A spacer between the locking collar and the bearing sets the correct factory adjustment for the locking arm. There should not be a gap between the locking collar and the spacer or bearing and the spacer.

The locking mechanism is factory set. If for some reason it requires adjusting follow the following procedure. The kick back guard is positioned so that there is a barely visible gap between it and the self adjusting catch. The self adjusting catch should be adjusted so that the locking arm engages the first tooth as shown to the left. With the valve fully closed, loosen the locking collar and slide the latching arm away from the bearing and tighten the collar bolts. Loosen the bolts on the self adjusting catch and position it so the latching arm rests on the first notch as shown to the right. Tighten the bolts on the catch. Remove the latching arm from the shaft. Open the blade and install the latching arm on the shaft. The locking arm should be snug against the spacer on the shaft and in the position shown in the top right picture. Double check all bolts and collar screws for tightness.





Inspection and Maintenance Cover

The valve has an inspection and maintenance cover that allows full access to the interior of the valve. This cover can be used for routine inspections (see section on inspection) or access to the flap blade during replacement.

A built-in inlet inspection duct with access door will provide access for routine inspection of wear and build up of dust in the valve. This is available from Camfil APC or an access door could be installed by the ducting contractor in the pipe in front of the valve. This offers a quick and easy way to provide access to the interior of the flap valve.

NOTE

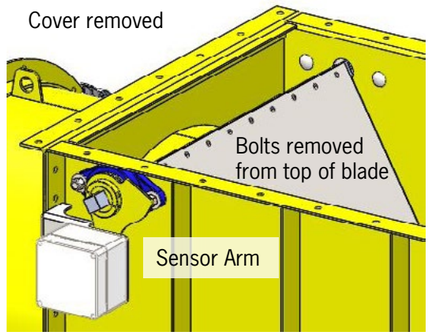
NFPA requires frequent inspections of explosion isolation devices. See section on inspections. Camfil APC recommends adding an inspection door on the pipe on the inlet side of the valve.

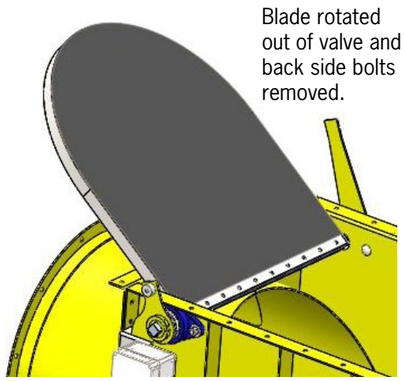
Flap Blade Replacement

If the wear liner is worn or if there has been an explosion you will need to replace the flap blade. If there was an explosion refer to the section on explosions and valve activation to determine if other parts are damaged.

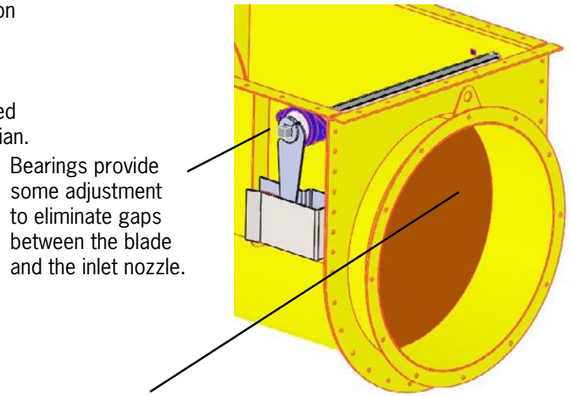
To remove and replace the blade refer to the following steps:

- Remove the maintenance cover.
- Loosen the sensor arm (this may require the removal of the sensor control box).
- Slide the sensor arm away from the bearing so it will not hit the valve body when the blade is rotated out of the valve.
- Remove the bolts on both sides of the flap blade.
- Remove the flap blade
- Follow these steps in reverse to install the new blade. In the picture to the right, orange denotes the side with the 1/8" thick wear liner. Be sure to mount the blade in the correct position where the liner rests on the inlet nozzle when the blade is closed.
- Check that there are no gaps between the blade and the inlet nozzle larger than 0.02" or 0.5 mm.
- If there are gaps present loosen the bearing bolts and try to move the blade to close the gap. If you are unable to close the gap consult the factory.
- Check that the sensor works after it is reinstalled. See the section on the Activation Sensor next and the section on inspections.
- Before the Stinger valve is put in operation after an explosion it's necessary to have the valve inspected by an authorised Camfil APC technician.





Sensor arm moved away from bearing.



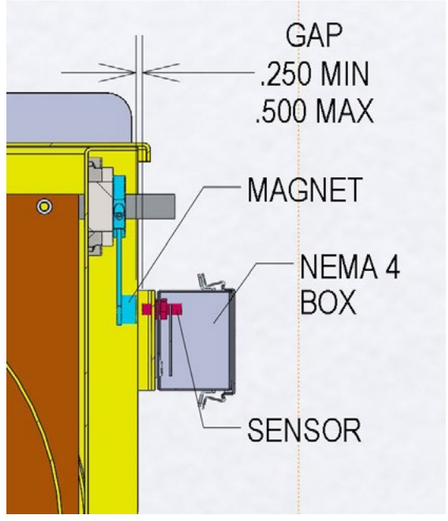
Activation Sensor

Your Camfil APC flow activated flap valve, the Stinger, may be equipped with an activation sensor. This sensor will signal if the valve has been activated by a deflagration. It should not signal when the valve closes during system shut down. If a signal is received when the system fan is shut down then the valve latching mechanism is not working properly and should be inspected and adjusted immediately.
A process hazard analysis will determine if this isolation valve should be interlocked with the processes that produce the combustible dust that your dust collector is collecting. In most cases this analysis will determine that an interlock is needed to stop dust producing processes and to shut down the dust collector fan. Shutting down the fan during a deflagration will significantly reduce damage to the dust collector from ensuing fires that are almost always present after a deflagration.

The Gold Series dust collector is built to survive most vented or suppressed deflagrations with minimal damage. In many cases they can be put back into service after filters and gaskets are replaced. Without an interlock, a fire will lead to much greater damage to the collector so Camfil APC recommends that an interlock should be used on systems handling combustible dust. However, your system may have sensors on other equipment that can provide the signal to shut down the process. Explosion vents may have sensors and suppression systems already provide an activation signal. A thorough hazard analysis would take this redundancy into consideration and through a risk evaluation it would be determined if redundant interlocks are necessary.

Sensor Specifications

Magnetic sensors are actuated by the presence of a permanent magnet. Their operating principle is based on the use of reed contacts, whose thin plates are hermetically sealed in a glass bulb with inert gas. The presence of a magnetic field makes the thin plates flex and touch each other causing an electrical contact. The plate's surface has been treated with a special material particularly suitable for low current or high inductive circuits. Magnetic sensors compared to traditional mechanical switches have the following advantage:



Advantages

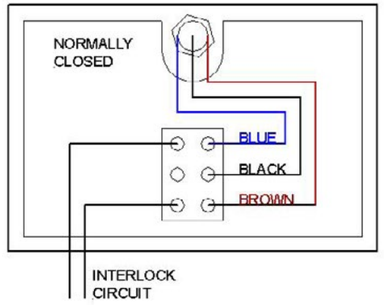
- Contacts are well protected against dust, oxidization and corrosion due to the hermetic glass bulb and inert gas; contacts are activated by means of a magnetic field rather than mechanical parts
- Special surface treatment of contacts assures long contact life
- Maintenance free
- Easy operation
- Reduced size
- Does not require an external power source
- High operating distance
- Threaded metallic case
- Protection degree of IP 67
- Hermetically sealed
- Compliant to the EMC directive CE
- Operating Gap = 0.25" min 0.50" max

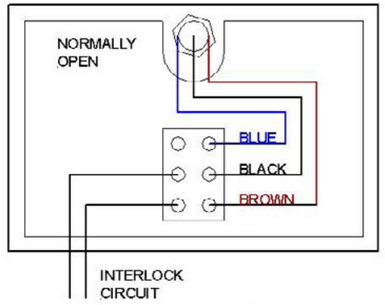
Sensor Wiring

The activation sensor can be wired in normally open or normally close positions. Use the wiring schematic below to connect your interlock circuit. Camfil APC recommends that the circuit be wired using the normally closed position so that cable faults would be detected.

Electrical:

Output	VA	V	A
NO + NC	20	150	1





Not Recommended

When An Explosion Activates Your Valve

Post Activation Inspection

If you have had a combustible dust explosion in your dust collector Camfil APC stands ready to get you back up and running as fast as possible. Use this section to determine what parts may need to be replaced and what information you will need to send to Camfil APC Technical Services. apctechnicalservices@camfil.com

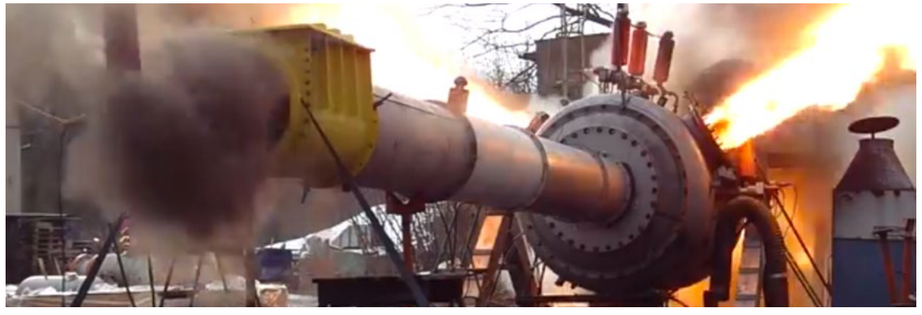
The first thing to do is inspect your valve. Fill out the inspection sheet found at the back of this manual as you inspect the valve

What to look for:

1. Deformation of the face of the blade.
2. Cracks on the edges of the blade.
3. Damage to the self adjusting catch.
4. Bent locking arm.
5. Damage to the sensor arm and magnet
6. Damage to the valve inlet seat.
7. Loose bolts on the locking mechanism components.

Photograph all the items in the list above and submit them to Camfil APC technical services for evaluation. They will help you determine which parts can be reused and which need to be replaced. **apctechnicalservices@camfil.com**

Uniform blade deformation from explosion tests. Note, this is the 5th blade consumed in 10 tests. It is highly probable that your valve will survive an explosion activation.

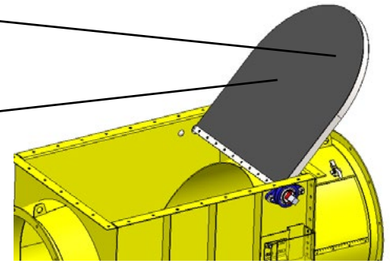


Explosion testing of the Stinger

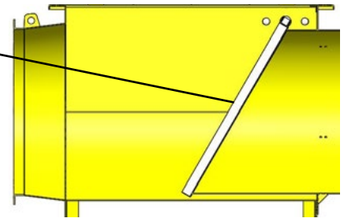
Post Activation Inspection Cont'd

Damage to the blade edges:
Cracked edges require replacement.

Deformation on the blade face:
Structural deformation of the blade requires replacement.

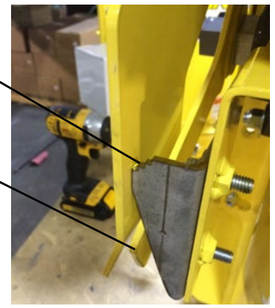


Damage to the inlet seat:
Any damage here requires blade replacement



Damage to self adjusting latch:
If the teeth are flattened or damaged then replace this part

Damage to locking arm:
If the edge is damaged or the arm is bent replace it.



Sensor arm and magnet:
Check for damage.
Check for gap between magnet and sensor. 1/4" to 1/2".

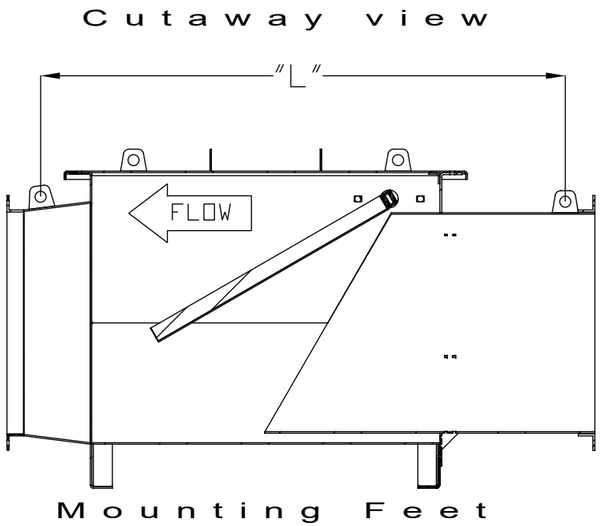
- Before the Stinger valve is put in operation after an explosion it's necessary to have the valve inspected by an authorised Camfil APC technician.

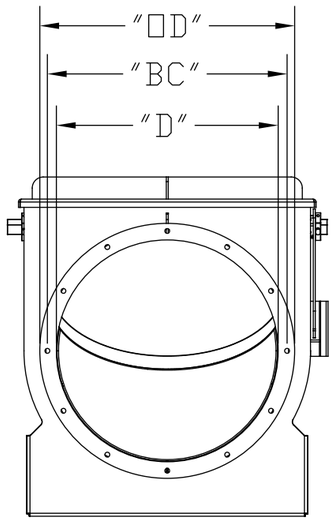
Replacement / Spare Parts

Valve and Blade				Locking Mechanism arm and brackets			
Model and Size (inches)		Top Assy	Blade / rubber assy	Locking Arm	Latch Base	Catch	Guard
ST1-	6	226873006	226873206	226878004	226878005	226878502	226878503
ST1-	8	226873008	226873208				
ST1-	10	226873010	226873210				
ST1-	12	226873012	226873212				
ST1-	14	226873014	226873214	226881004	226884005	226884502	226884503
ST1-	16	226873016	226873216				
ST1-	18	226873018	226873218				
ST1-	20	226873020	226873220	226884004			
ST1-	22	226873022	226873222				
ST1-	24	226873024	226873224				
ST1-	28	226873028	226873228				
ST1-	32	226873032	226873232	226892004			
ST1-	36	226873036	226873236				
ST1-	40	226873040	226873240				

Common Parts	
Sensor kit, box, sensor, magnet	225095001
Sensor	225095103
Sensor Magnet	225095104

Dimensions





Model-Size		D	L	BC	OD	Hole Dia	No Holes	Weight(lbs)
ST-	6	6	30.31	7.3125	8.03125	0.28125	6	90
ST-	8	8	33.25	9.5625	10.125	0.375	6	110
ST-	10	10	38.93	11.8125	12.875	0.4375	6	140
ST-	12	12	40.75	14.00	15.125	0.4375	8	170
ST-	14	14	45.56	16.00	17.125	0.4375	8	200
ST-	16	16	48.18	18.00	19.125	0.4375	8	240
ST-	18	18	50.93	20.00	21.125	0.4375	8	280
ST-	20	20	53.37	21.75	23.125	0.4375	12	320
ST-	22	22	55.87	23.75	25.125	0.4375	12	360
ST-	24	24	58.50	25.875	27.125	0.4375	12	410
ST-	28	28	64.18	30.375	32.125	0.4375	16	510
ST-	32	32	69.37	34.375	36.125	0.4375	16	610
ST-	36	36	74.56	38.375	40.125	0.4375	16	730
ST-	40	40	80.75	42.375	44.125	0.4375	24	870

Installation, Inspection and Maintenance of Explosion Control Systems

Specific and extensive requirements for documentation, installation, commissioning and periodic inspections of explosion control systems are detailed in NFPA 69, Standard on Explosion Prevention Systems. The NFPA standards can be purchased online at NFPA.ORG. This standard is inexpensive and available to download in PDF format. Camfil APC highly recommends that any facility handling combustible dust should own a copy of the relevant fire protection standards. The relevant NFPA standards that govern combustible dust applications are found in NFPA 652, Standard on Fundamentals of Combustible Dust. This standard will inform you about which other standards apply to your operation.

The following is a summary of the responsibilities of end users of explosion control devices. For complete details on what is required of the facility handling combustible dust please refer to the standards.

Installation

Documentation Requirements
The standard states that a design record file should be kept for the life of this process. This file should contain data sheets from the manufacture, manuals design calculations, specifications, equipment lists, operation sequences, inspection and maintenance forms, certifications, combustible material properties, a process hazard analysis, system drawings, process control details and employee training requirements. This applies to the whole process, not just the explosion control devices.

Mechanical and Electrical
The standard contains further specifications for the mechanical and electrical installation of your process equipment.

System Acceptance
The standard has a section outlining 16 items to be included in final assessment of the installation prior to acceptance.

Inspection
The standard requires routine inspections of the control equipment at 3 month intervals. It allows this interval to be increased as operating experience is gained if both the AHJ and the prevention system designer approves. See NFPA 69 paragraph 15.7.1.3 and its appendix. The standard provides a comprehensive check list and inspection forms in its appendix.

The rest of the standard defines record keeping requirements, training and management of change. OSHA has been emphasizing combustible dust hazards since 2008. Combustible dust is at the top of their top 30 violations check list. Camfil APC cannot stress enough how important it is to follow the requirements for documentation and record keeping found in this standard.

Camfil APC recommends inspection of the Stinger flow actuated flap valve on a quarterly basis. The inspection list below should be used in combination with the inspection form in NFPA 69, Annex A.15.7.3. (The design an installation requirements for the valve have been defined in the body of this manual.)

Inspection Points:

1. Corrosion
The valve is a pressure shock resistant device. Corrosion will weaken the housing and should be repaired. If excessive, the valve should be replaced.

2. Grounding and Bonding
All components of the valve should be bonded.
Check continuity between:

- Shaft and labeled bonding screws
- Access cover and shaft
- Valve housing and attached ducting
- Ducting should be grounded and bonded also

Be sure to replace the bonding screws when the inspection is complete.

3. Activation Sensor Circuit
To test do not force the valve blade closed. Follow the instructions below:

Step 1. Remove sensor arm with magnet from the shaft by loosening the shaft collar bolts.

Step 2. Connect a continuity meter across the sensor contacts. See the electrical schematic in the activation sensor section of this manual. Test both the NO and the NC circuits.

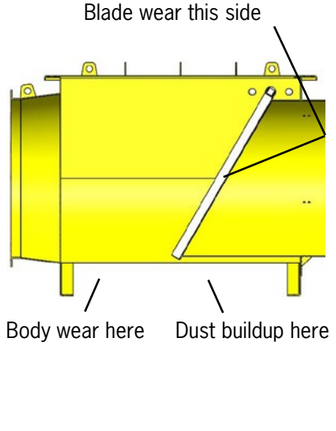
The sensor should open when the magnet is passed in front of it on the normally closed, NC, circuit. The normally open circuit should close when the magnet is passed in front of it. If the sensor does not pass this test it should be replaced.

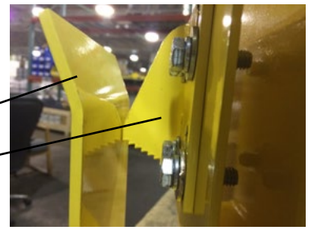
4. Blade Wear
Remove the access cover or open the inspection door on the inlet duct to the valve. Look for wear on the blade. The blade has an abrasion resistant rubber surface. You should photograph the blade to document the wear. If you can see metal, the blade needs to be replaced as soon as possible.

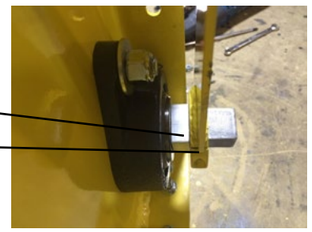
5. Blade to Seat Gap
Any gaps between the blade and the seat should not exceed 0.020 in (0.2mm). If a gap is present review the “Flap Blade Replacement” section on adjusting the bearings.

6. Body Wear
Inspect the bottom of the valve for wear. Excessive wear in the valve body will require replacement of the complete valve.

7. Dust Buildup
Dust buildup in the bottom of the valve could impede the operation of the valve. Check for dust buildup and photograph the inspection area even if there is no dust build up. Clean out the dust if present. If dust was found in the valve, you should check the velocity of the flow in the duct preceding the valve and compare it to the original design. Velocities above 3500 fpm should not allow dust to drop out of the airstream.







8. Latching Arm
Check to make sure there is not a gap between the back stop and the self adjusting catch. If there is a gap loosen the bolts holding the back stop in place and slide it towards the catch.

There should not be any gaps between the latching arm and the spacer and between the spacer and the bearing. If a gap is present, loosen the shaft collar screws on the arm and slide the arm towards the bearing. Tighten the collar bolts.

9. Bolts
Check for tightness on bearings, cover, and ducting bolts. Check the locking arm collar and the sensor arm collar screws. Check the bolts on the self adjusting latch and the back stop.

NOTE

Flow activated flap valves are not suitable for abrasive dusts or sticky dusts. If you are experiencing excessive wear and/or dust build up please consult the factory. An alternate isolation device may be required.

NOTE

NFPA requires flap valve to have dust build up sensors unless an inspection protocol is followed starting out with quarterly inspections. Wear and dust build up are the two main concerns. Documenting that wear is not happening or dust is not building up allows the frequency of the inspections to be extended.

If significant dust build up is present, Camfil recommends that the time between inspections is decreased.

Manufacturers Inspection Form for the Stinger Isolation Valve

This form outlines the manufacturers recommended inspection points. It should be used in conjunction with the inspection form provided in NFPA 69. Figure A.15.7.3

Company Name:		Date Inspected:	
Equipment location:		Inspected By:	
System Identification:		Equipment Inspected:	

Inspection point:	Comments	Pass	Fail
1. Corrosion			
2. Grounding and Bonding			
3. Activation Sensor Circuit			
4. Blade Wear			
5. Blade to Seat Gap			
6. Body Wear			
7. Dust Buildup			
8. Latching Arm			
9. Bolts			
Notes:			
Inspected By: Signature and Date			

camfil
AIR POLLUTION CONTROL

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