Introduction

This document provides a comprehensive overview of the fire and explosion protection measures required for wood-dust collection systems, with particular emphasis on compliance with applicable National Fire Protection Association (NFPA) guidelines.

Its purpose is to identify and explain the principal safeguards used to reduce the risk associated with combustible wood dust, including explosion venting on the dust collector, a No Return Valve (NRV) for explosion isolation, a spark detection and suppression system, and an abort damper where filtered air is recirculated back into the building.

The document combines equipment specifications, installation requirements, system drawings, and NFPA references to demonstrate how these devices work together as an integrated protection strategy rather than as independent accessories. This is particularly important because combustible wood dust can create both fire and deflagration hazards within dust collectors and interconnected ductwork; where such hazards exist, NFPA 660 requires appropriate explosion protection and isolation to help prevent flame and pressure from propagating through connected equipment and into occupied work areas.

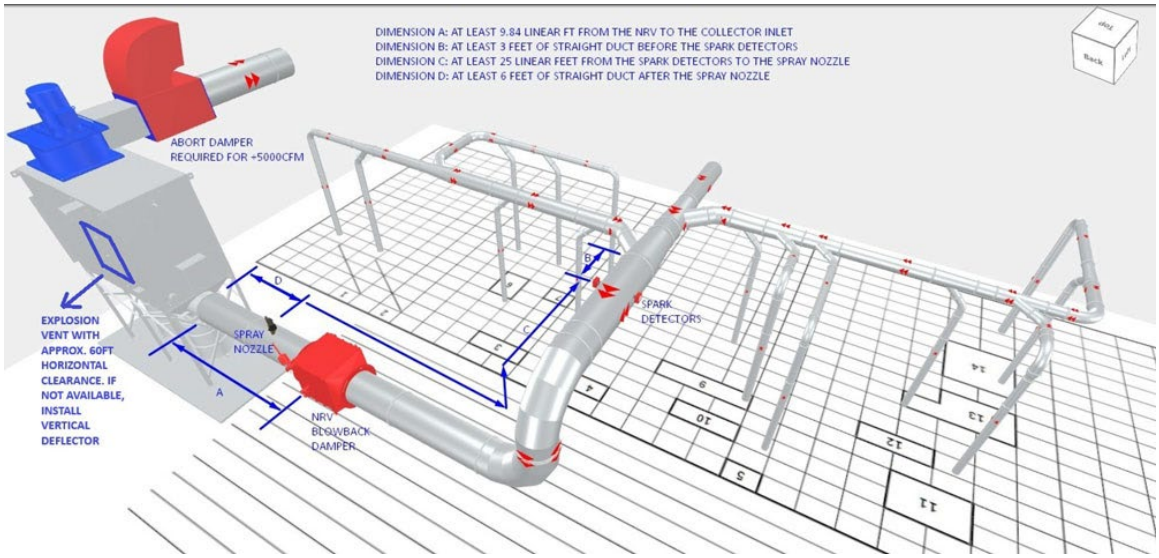
The explosion vent provides a controlled means of relieving deflagration pressure in accordance with the principles of NFPA 68, while the NRV provides passive explosion isolation in accordance with NFPA 69, helping prevent an explosion originating in the collector from propagating upstream through the duct system.

Spark detection and suppression further reduce risk by detecting potential ignition sources traveling through the ductwork and activating extinguishing measures before they reach the dust collector, while an abort damper provides an additional layer of protection on applicable air-recirculation systems by diverting potentially hazardous air and burning material to the atmosphere rather than allowing it to return to the building.

Collectively, these measures are important not only for NFPA compliance, but also for protecting personnel, equipment, and the facility from the potentially severe consequences of combustible-dust fires and explosions.

The information contained in this document should therefore be considered an important basis for the proper selection, design, installation, interconnection, and operation of the dust-collection safety equipment, subject to the applicable hazard

analysis, manufacturer requirements, and approval of the Authority Having Jurisdiction (AHJ).



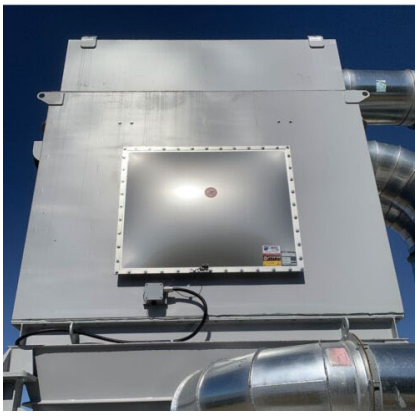
Explosion Vent on Dust Collector

Domed Explosion Vent Panel: Vacuum resistance: 3 psi / 83'' w.g.

The Domed Explosion Vent Panel VD is specifically designed for high negative pressure applications and installations where high psi pulse cleaning mechanisms could cause metal fatigue over time. The dome design is optimal for Hi-Vac filter systems where explosion relief venting is required. Typical applications included dust collector filters, cyclones, and high-pressure vessels.



The Domed Explosion Vent Panel VD is pressure tested and certified in compliance with a variety of test standards. It is ideal for OEM and retrofit applications. It is easy to install with premium gaskets and integral flanges.



Standard burst pressure is 1.45 psi / 0.1 bar. Application specific burst pressures between 1.45 psi up to 7 psi are available for special orders.

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No Return Valve (NRV) in Inlet Duct

No Return Valve Combo/Metal

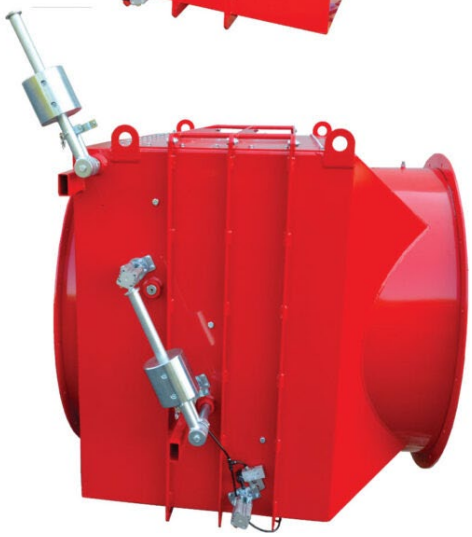
Specifications

- ATEX Certified; NFPA 69 Compliant
- Heavy Duty Welded Steel Construction
- Epoxy Powder Coated Safety Red Finish
- Flanged Inlet and Outlet with Co-Flanges
- Grounding Lugs
- Locking Mechanism



NRV Combo Rated for:

- Class ST 3 Applications
- Kst max: 325 bar m/s
- Pred max: 1.0 bar (4”-7”) 0.6 bar (8”- 36”) 0.5 bar (40”- 48”)
- Certification EN 16447



NRV Metal Rated for:

- Metallic and organic dusts
- Class ST 3 Applications
- Kst max: 400 bar m/s
- Pred max: 1.0 bar (8”-16”) 0.6 bar (22”)
- Certification EN 16447

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NRV Combo/Metal Specifications (NRVC/M Ø)

Standard Features (All Sizes)

Heavy Duty Welded Steel Construction | Epoxy Powder Coated Safety Red Finish | Flanged Inlet and Outlet with Co-Flanges | Grounding Lugs | Locking Mechanism(s)

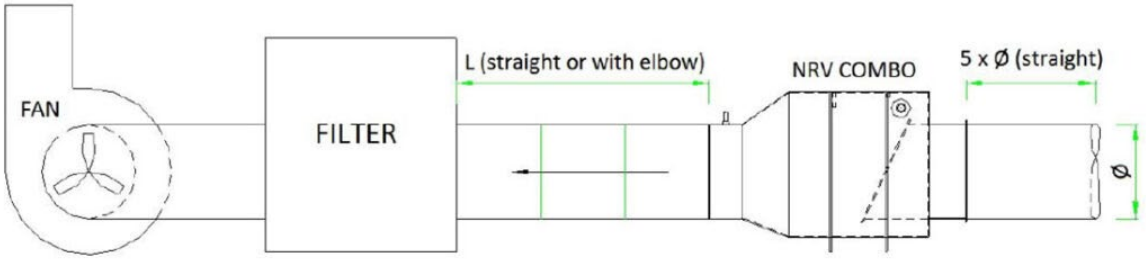
NRV Sizes	4"-7" (100-180mm)	8"-16" (200-400mm)	18"-20" (450-500mm)	22" (550mm)	24"-28" (600-700mm)	32"-36" (800-900mm)	40"-48" (1000-1200mm)
Model Type	NRV Combo	NRV Metal	NRV Combo	NRV Metal	NRV Combo	NRV Combo	NRV Combo
Dust Type Certification	Organic Only	Metal and Organic	Organic Only	Metal and Organic	Organic Only	Organic Only	Organic Only
Application Class	ST3 K_{st}: 325 bar $^{m}/_{s}$	ST3 K_{st}: 400 bar $^{m}/_{s}$	ST3 K_{st}: 325 bar $^{m}/_{s}$	ST3 K_{st}: 400 bar $^{m}/_{s}$	ST3 K_{st}: 325 bar $^{m}/_{s}$	ST3 K_{st}: 325 bar $^{m}/_{s}$	ST3 K_{st}: 325 bar $^{m}/_{s}$
Max P_{red}	1.0 bar	1.0 bar	0.6 bar	0.6 bar	0.6 bar	0.6 bar	0.5 bar
P_{max}	9.5 bar	9.9 bar	9.5 bar	9.9 bar	9.5 bar	9.5 bar	9.5 bar
Minimum Vessel Size	1.2m³	1.2m³	5.0m³	2.5m³	5.0m³	5.0m³	10.0m³
Minimum Distances	9.84ft (3m)	9.84ft (3m)	9.84ft (3m)	11.5ft (3.5m)	9.84ft (3m)	9.84ft (3m)	9.84ft (3m)
Maximum Distances	16.4ft (5m)	16.4ft (5m)	16.4ft (5m)	16.4ft (5m)	16.4ft (5m)	19.7ft (6m)	19.7ft (6m)
Maximum Velocity	5905 FPM	5905 FPM	5905 FPM	5905 FPM	5905 FPM	5905 FPM	5905 FPM
MIE Rating	10-30mJ	2mJ	10-30mJ	2mJ	10-30mJ	10-30mJ	10-30mJ
MIT Rating	410 °C	540 °C	410 °C	540 °C	410 °C	410 °C	410 °C
No. of Elbows Permitted	1	2	1	0	1	1	1

NRVC/M Specifications

Certified ATEX EN16447 | NFPA 69 Compliant | Horizontal Duct Only | Pull Flow Only

NRV Combo Specifications (EM-NRVC Ø) Cont.

Installation of the NRV Combo can include an (1) elbow between the valve and the filter. Must have 5x diameter straight duct upstream of the valve. See image below.



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Spark Detection & Suppression System in Inlet Duct

120-1 OPTICAL SPARK DETECTOR

The 120-1 detector provides fast response, high sensitivity, and flexible output options to meet application needs. NEMA 4 rated enclosure ensures detector works in many environments reliably. Simple mounting system makes installation and maintenance easy.

The 120-1 Detector is a fast response spark detector that monitors visible to near-infrared light.



Ideal in such industries as:

- Pulp/paper industries
- Wood processing
- Food
- Pharmaceutical

Features

- Fast response times of 0.5 ms
- High sensitivity of 0.1 μW/cm2
- NEMA 4 rated enclosure for indoor and outdoor applications
- Sensitivity testing
- Simple connector and cabling requirements.
- Simple mounting flange makes it easy to install and clean detectors

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901-1 Spray Assembly



The 901-1 Spray Assembly is used in conjunction with Hansentek panels to provide water suppression.

A strainer is provided that should be installed directly to solenoid valve.

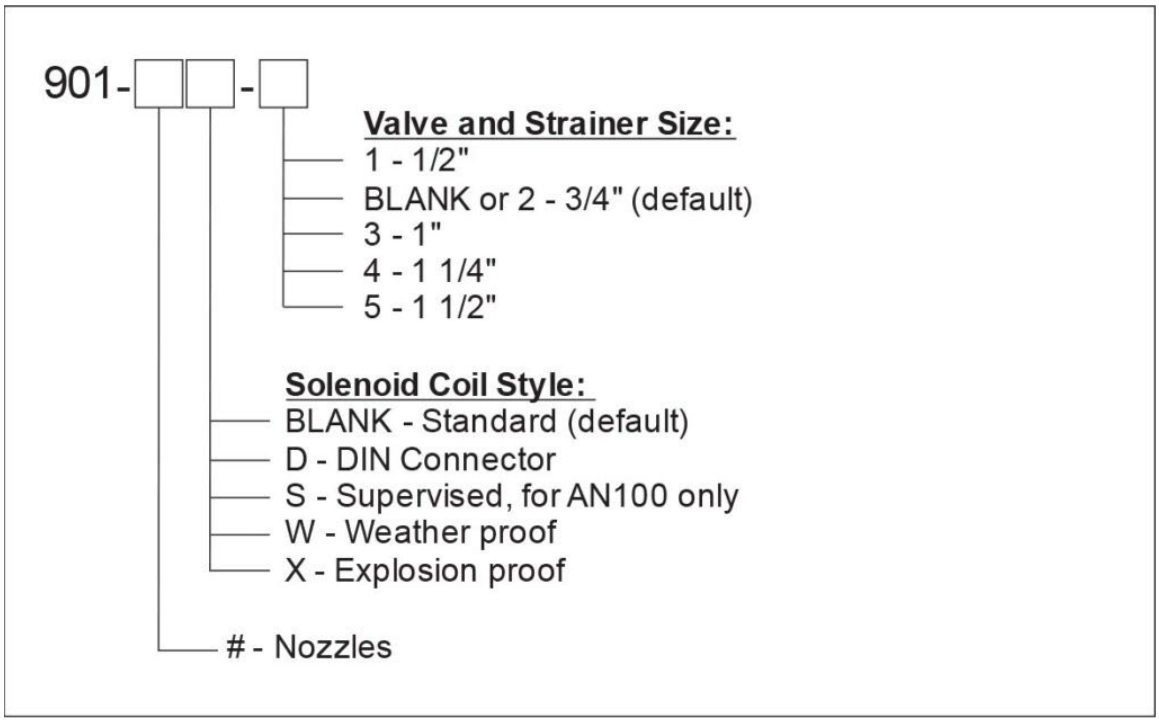
The solenoid valve should be connected directly to the nozzle which is normally installed at the top of the duct.

The 901-1 is a water spray assembly for use with a Hansentek Spark Detection System.

Features

- Simple mounting flange makes installation easy
- Standard 3/4" NPT fittings

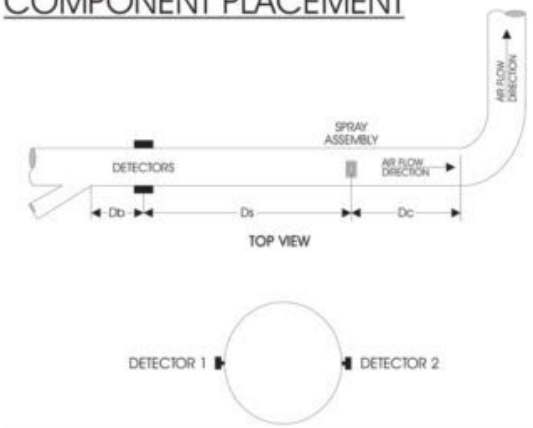
Options



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COMPONENT PLACEMENT



CALCULATION FOR COMPONENT PLACEMENT (MINIMUM DISTANCES)	
AIRFLOW VOLUME	_____ cfm
DIAMETER OF DUCT	__ inches
AIR SPEED	4500 feet per minute
Minimum Distance DETECT TO SPRAY DISTANCE (Ds)	25 feet
STRAIGHT DUCT DOWNSTREAM FROM SPRAY (Dc)	6 feet
LAST BEND / BRANCH DIAMETER	_____
BEND / BRANCH TO DETECTOR DISTANCE (Db)	3 feet
TOTAL DISTANCE REQUIRED4 (Db + Ds + Dc)	34 feet

BILL OF MATERIALS			
ITEM	PART #	DESCRIPTION	QTY
1	AN104	One Zone Control Panel	1
2	120-1	Infra-red Spark Detector	2
3	901-1	Water Spray Assembly	1
4	902-1	Deluge Water Spray Assembly	0
5	922-1	1" Ball Valve & Supervisory Switch	1
6	920-1	Water Flow Switch	0
7	930-1	Heat Detector - 190 °F	0
8	940-1	4.5 Amp Hour Batteries	1
9	910-1	24 Volt Alarm Horn	1

GENERAL NOTES

1. Dust collecting or conveyance duct velocities must be confirmed prior to Spark Detection System installation.

2. All wiring shall be as per all local and National electrical codes. An earth ground is required regardless of local code requirements.

3. All panels, enclosures, conduits and devices shall be grounded to a good earth ground.

4. All low voltage wiring to Detectors, Horns, Spray Assemblies and inputs must be in metallic conduit and at least 24" away from high voltage lines (above 400 volts).

5. A clean, uninterrupted source voltage must be used. The circuit breaker must be dedicated to the Spark Detection System and must be lockable.

6. All wiring to abort dampers and starters must be taken from a separate electrical circuit. No electrical needs can be sourced from the circuit breaker that is being used by the Spark Detection Panel.

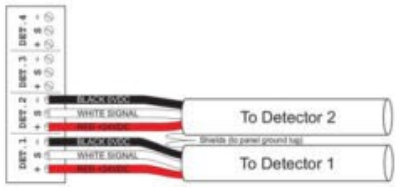
7. Installation and equipment must conform to the requirements of the Authority Having Jurisdiction.

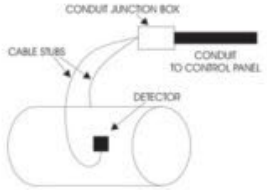
8. Notes are to be read in conjunction with the installation and user manual.

WIRING



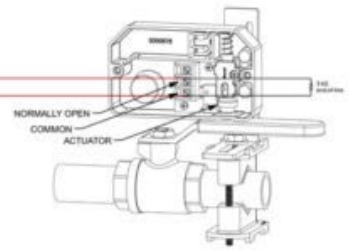
DETECTOR WIRING

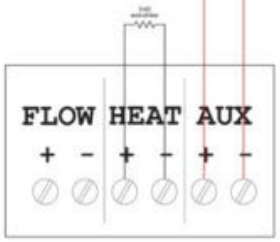




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INPUT WIRING





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GENERAL PLUMBING NOTES

1. The water pressure at the valve must be at least 50 PSI and must not exceed 125 PSI. The water supply must deliver a minimum of 16.6 US gallons per minute per nozzle. A pressure reducer must be used if water pressure exceeds 125 PSI.

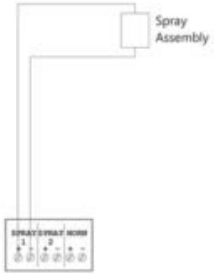
2. Water pipe, strainers, valves and nozzles installed outside must be heat traced and insulated. Heat tracing and insulation must be adequate to withstand the temperature extremes and environmental conditions of the area where it is installed.
Note: A Glycol loop must not be used.

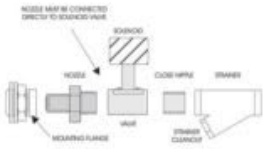
3. Strainer must be connected directly to solenoid valve. The solenoid valve must connect directly to the nozzle. Nozzle to be installed at the top of the duct.

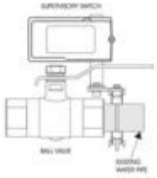
4. Piping and fittings must conform to ASTM and NFPA standards. Minimum water supply line for a single nozzle should be ¾" but 1" is preferred.

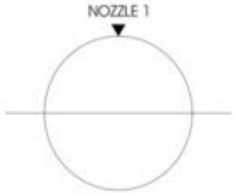
5. Notes to be read in conjunction with installation and user manual.

SPRAY WIRING









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GENERAL ELECTRICAL NOTES

1. No branching of wires permitted on supervised circuits. End of Line resistors must be at the last device in order to detect an open circuit. Remove any temporary End of Line resistors in the control panel when any input circuit is connected.

2. Field wiring must be checked for shorts or grounds before connecting to the control panel. DO NOT MEGGER LINES.

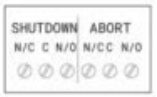
3. Detector wires shall be run in separate conduit away from all high voltage wiring. Spray Assembly wiring may be in the same conduit.

4. The Main Control Unit should be mounted on a wall, at least 48 inches away from any high voltage sources (greater than 400 volts).

5. Wiring minimum sizes: Power Input - 14 AWG/600 Volts; Detectors - 18 AWG stranded and shielded; Auxiliary Inputs, Horn, Alarm/Trouble - 18 AWG; All other wiring - 14 AWG.

6. Notes to be read in conjunction with installation and user manual.

ABORT DAMPER WIRING



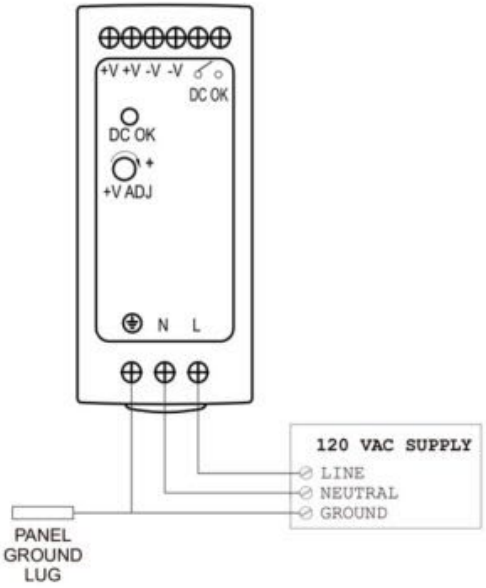
SHUTDOWN WIRING

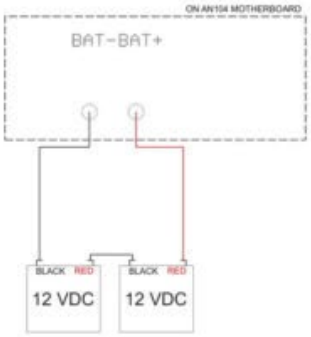


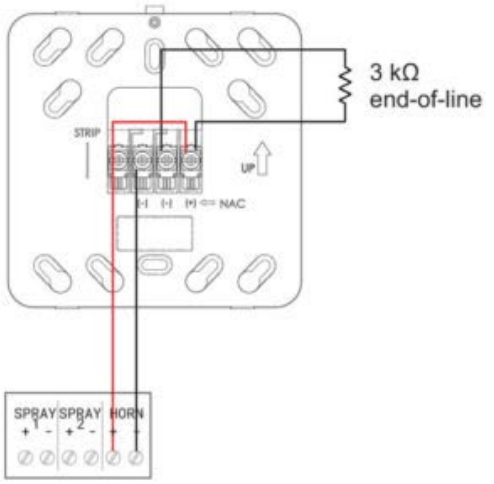
THE AN104 SPARK DETECTION SYSTEM		
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SYSTEM WIRING







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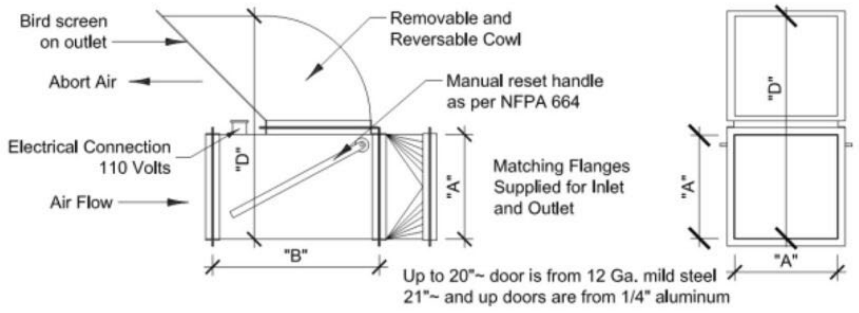
Abort Damper (if filtered air is recirculated and above 5000cfm)

The Hansentek high speed Abort Gate is used prior to returning air from the dust collector back into the building. In the event of an explosion, the purpose of the Abort Gate is to redirect flames and pressure to the atmosphere, protecting personnel and the building.

The Abort Gate is controlled by an electrical signal generated by a spark detection system. The electrical signal releases the latching device, allowing the gate to open to the atmosphere. The gate is reset by a manual handle as per NFPA Code 664 (8-4).

Features of a Hansentek Abort Gate include:

- 110V A.C. power input
- Square or round inlet and outlet
- Reversible outlet cowl
- Bird screen on outlet cowl
- Rubber seal on door frame to create an airtight seal
- Can be used on positive or negative pressure ducting
- Heavy duty reinforced construction
- Custom sizes to suit – up to 72” sizes available
- Reversible reset handles



A – Size *	10	12	14	16	18	20	22	24	26	28	30	32	34
B – Overall Length **	20	23	26	29	32	34	37	40	43	46	48	51	54
C – Overall Width	18	20	22	24	26	28	30	34	36	38	40	44	54
D – Overall Height	23	27	31	35	39	43	47	52	56	60	64	70	74
Approx. Weight (lbs)	146	180	22	280	340	390	440	460	565	625	660	775	890

* Also available in odd increments
** Overall Length is body length only – add ~12” for transitions

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REFERENCES

NFPA 660®, Standard for Combustible Dusts® (Quincy: National Fire Protection Association, 2025)

NFPA 68®, Standard on Explosion Protection by Deflagration Venting (Quincy: National Fire Protection Association, 2023)

NFPA 69®, Standard on Explosion Prevention Systems (Quincy: National Fire Protection Association, 2024)

What is NFPA?

- The National Fire Protection Association (NFPA) develops consensus codes and standards intended to reduce the risk of fire, explosion, and related hazards.
- NFPA standards are adopted or referenced by regulatory authorities and industries worldwide.
- Many insurance companies use NFPA standards when evaluating combustible-dust hazard mitigation and determining facility insurance coverage.

NRV (No Return Valve)

The NRV meets the applicable requirements of NFPA 69® (2024 edition) for passive explosion isolation and supports compliance with NFPA 660® (2025 edition) explosion-isolation requirements when installed in accordance with the manufacturer's certification and installation instructions.

KEY CONSIDERATIONS:

NFPA Requirement	Requirement Met
NFPA 69® §12.2.3.4.2 - Locking mechanism to seal valve	Standard feature
NFPA 69® §12.2.3.4.3 - Inspection door for periodic inspections	Standard feature
NFPA 69® §12.2.3.5 - Certification by a recognized testing organization	All NRV Combo/Metal Valves are ATEX certified
NFPA 69® §12.2.3.4.4 - Automatic shutdown of the protected process	Accomplished by optional NRV-MS Microswitch
NFPA 69® §12.2.3.4.5 - Continuous signal verifying valve operability	Accomplished by optional NRV-DLS Dust Level Sensor
NFPA 660® §9.4.3.3.5 - Spark arrester where required	Compatible with approved spark-detection/arresting systems; see §9.4.3.3.5 below.
NFPA 660® §9.4.4.2 - Protection of dry AMSs	NRV provides passive explosion isolation as part of the protection strategy described under §§9.4.4.2 and 9.8.
NFPA 660® §9.8.2 - Explosion-protection requirements	See the grouped AMS and explosion-protection section below. The NRV provides the isolation component.
NFPA 660® §9.8.3 - Explosion-isolation requirements	NRV provides passive explosion isolation to prevent flame and pressure propagation between interconnected equipment.

NFPA 660®, Standard for Combustible Dusts® (Quincy: National Fire Protection Association, 2025)

Chapter 9: Hazard Management: Mitigation and Prevention

9.8.3 – Explosion Isolation and NRV Application

Where a dust-explosion hazard exists, explosion isolation shall be provided to prevent flame and pressure propagation between interconnected equipment.

9.8.3.1 – Explosion Isolation

Where a combustible-dust explosion hazard exists, isolation devices shall be installed in accordance with NFPA 69® to prevent flame and pressure propagation between interconnected equipment.

9.8.3.2 – Isolation Exceptions

Isolation devices are not required where the oxidant concentration has been reduced in accordance with NFPA 69®, or where the dust has been rendered noncombustible using an approved method.

9.8.3.3 – Ductwork Isolation

Where a combustible-dust explosion hazard exists, isolation devices shall prevent flame and pressure propagation from process equipment through connected ductwork into work areas.

NFPA 69®, Standard on Explosion Prevention Systems (Quincy: National Fire Protection Association, 2024)

Chapter 12: Deflagration Control by Passive Isolation

Section 12.2.3.2 requires that, upon detection of an explosion, the valve close automatically due to the pressure wave preceding the flame front. The NRV performs this passive isolation function when selected, installed, inspected, and maintained in accordance with its certification and the applicable NFPA requirements.

Spark Detection & Suppression

NFPA 660®, Standard for Combustible Dusts® (Quincy: National Fire Protection Association, 2025)

Chapter 9: Hazard Management: Mitigation and Prevention

9.4.3.3.5 – Spark Detection / Spark Arresting

Where required by the hazard analysis, spark arrestors or equivalent spark-mitigation methods shall be provided to reduce ignition sources entering combustible-dust collection systems. Dust-collection systems handling processes capable of generating sparks, flames, or hot material shall include a means of preventing these ignition sources from entering the Air Material Separator (AMS) or interconnected ductwork.

Typical methods include:

- Listed spark-detection and extinguishing systems
- Listed spark-detection systems actuating a high-speed abort gate

These measures reduce ignition hazards but are not explosion-isolation systems. The NRV complements them by providing passive explosion isolation between interconnected equipment. Explosion-protection requirements must still be evaluated in accordance with Section 9.8.

NFPA 660®, Standard for Combustible Dusts® (Quincy: National Fire Protection Association, 2025)

Chapter 9: Hazard Management: Mitigation and Prevention

9.4.4.2 and 9.8 – Dry Air Material Separators and Explosion Protection

Dry Air Material Separators (AMSs) with a dirty-side volume greater than 8 ft^3 (0.2 m^3) that present a combustible-dust explosion hazard shall be protected using an approved explosion-protection method.

9.8.1 – General

Where a combustible-dust explosion hazard exists within an enclosure, explosion-protection measures shall be provided to protect personnel and equipment.

9.8.2 – Equipment Protection

Equipment with an internal or dirty-side volume greater than 8 ft^3 (0.2 m^3) handling combustible dust shall be protected against the effects of an explosion where a dust-explosion hazard exists, using methods acceptable under NFPA 69® or other applicable standards.

9.8.2.2 – Approved Protection Methods

Explosion-protection systems shall incorporate one or more of the following methods:

- Oxidant-concentration reduction in accordance with NFPA 69®
- Deflagration venting in accordance with NFPA 68®
- Flame-arresting vent devices in accordance with NFPA 68®
- Deflagration pressure containment in accordance with NFPA 69®
- Deflagration suppression systems in accordance with NFPA 69®
- Dilution with a noncombustible dust to render the mixture noncombustible

9.8.2.3 – Design Requirements

Protected equipment and interconnected systems shall be designed to withstand the pressures generated during a deflagration event.

9.8.2.4 – Fire and Explosion Hazards

Where both explosion and fire hazards exist within an Air Material Separator (AMS), protection shall be provided for both hazards.

Abort Damper

NFPA 660®, Standard for Combustible Dusts and Particulate Solids (Quincy: National Fire Protection Association, 2025)

Chapter 24: Wood Processing and Woodworking

Filtered exhaust air may be recirculated back into the building provided the concentration of combustible particulate solids in the recycled air remains below the applicable industrial hygiene exposure limits, in accordance with Section 24.9.4.4.6.1. Where the air originates from air-material separators or dust collectors that present a fire hazard, the system must comply with the applicable requirements of Section 24.9.4.4.6.2.

- For dust collection systems with a capacity of 5,000 cfm (2.36 m^3/s) or less, the system must either:
  - be equipped with a listed spark detection system connected directly to a listed spark extinguishing system, or
  - meet the protection requirements specified in Section 24.9.4.4.6.2(B).
- For dust collection systems with a capacity greater than 5,000 cfm (2.36 m^3/s), the system must include:
  - a listed spark detection system installed upstream and downstream of the dust collector (or on the exhaust side, as applicable),
  - a high-speed abort gate that diverts burning material to the atmosphere before it can enter the building, and
  - a manually resettable abort gate that cannot be reset automatically or remotely.