APPLICATION PROFILE

CYCLONE AND DUST FILTER

INTRODUCTION

Most manufacturing processes require the removal or collection of dust particles, whether that is eliminating nuisance dust or collecting powdered products. After removal or collection of dust particles, the solid particles typically must be separated from the flowing air stream.

One method of separating the solid particles involves using a cycling and dust filter (see figure on page 3). Heavier dust particles are first separated from the air stream into the cyclone through centrifugal forces, then the smallest particles are separated from the air into the dust filter.

HAZARD

Because cyclones and dust filters are designed to handle materials produced by other process operations, sparks, flames, static electricity or smoldering embers are potential ignition sources that can cause an explosion within the dust laden atmospheres of the equipment.

SOLUTION

In this example, the process is protected by a combination of suppression, explosion isolation and flameless venting. The process cannot be simply vented because it is installed inside the room and is far away from a wall. (making ducting ineffective, or cost prohibitive). The dust filter can be protected by flameless venting, while a vent would disturb the fluent flow which is required for the proper functioning of the cyclone.

OPERATION

A suppression system was selected to protect the cyclone: a pressure detector (item 1) attached to the cyclone will detect any explosion in its incipient stage, and will signal the suppression system's Explosion Protection Controller (EPC) (item 2). The control system will activate the suppression High Rate Discharge (DRD) containers (items 3 and 5) which inject suppressant powder to extinguish the explosion. This event will typically be completed within less than 100 msec and the pressure developed will typically be limited to 0.5 barg (7 psig).

The Isolation Container (item 6) installed into the pipe between cyclone and dust filter will be activate at the same time as the HRD containers on the cyclone, thereby preventing explosion propagation from cyclone to dust filter.

The Isolation valve (item 4) installed in the cyclone's inlet will protect areas and equipment upstream against the explosion effects (pressure and flame) by providing a mechanical block to stop explosion propagation. To prevent explosion propagation to downstream process areas, an explosion proof rotary valve (item 20) in the bottom outlet of the hopper is installed.

The dust filter itself is protected by a combination of explosion venting (item 14) and a flame filter (item 16), which provides flameless venting (Fike's product tradename FlamQuench II™). The rupture indicator (item 15) of the explosion vent is tied into the EPC controller, and activates the system as well, to prevent explosion propagation back to the cyclone.

The Isolation Barrier (item 17), a floating ball type, is installed in the dust filter's air outlet. It will protect areas and equipment downstream, such as the fan, against the explosion effects.

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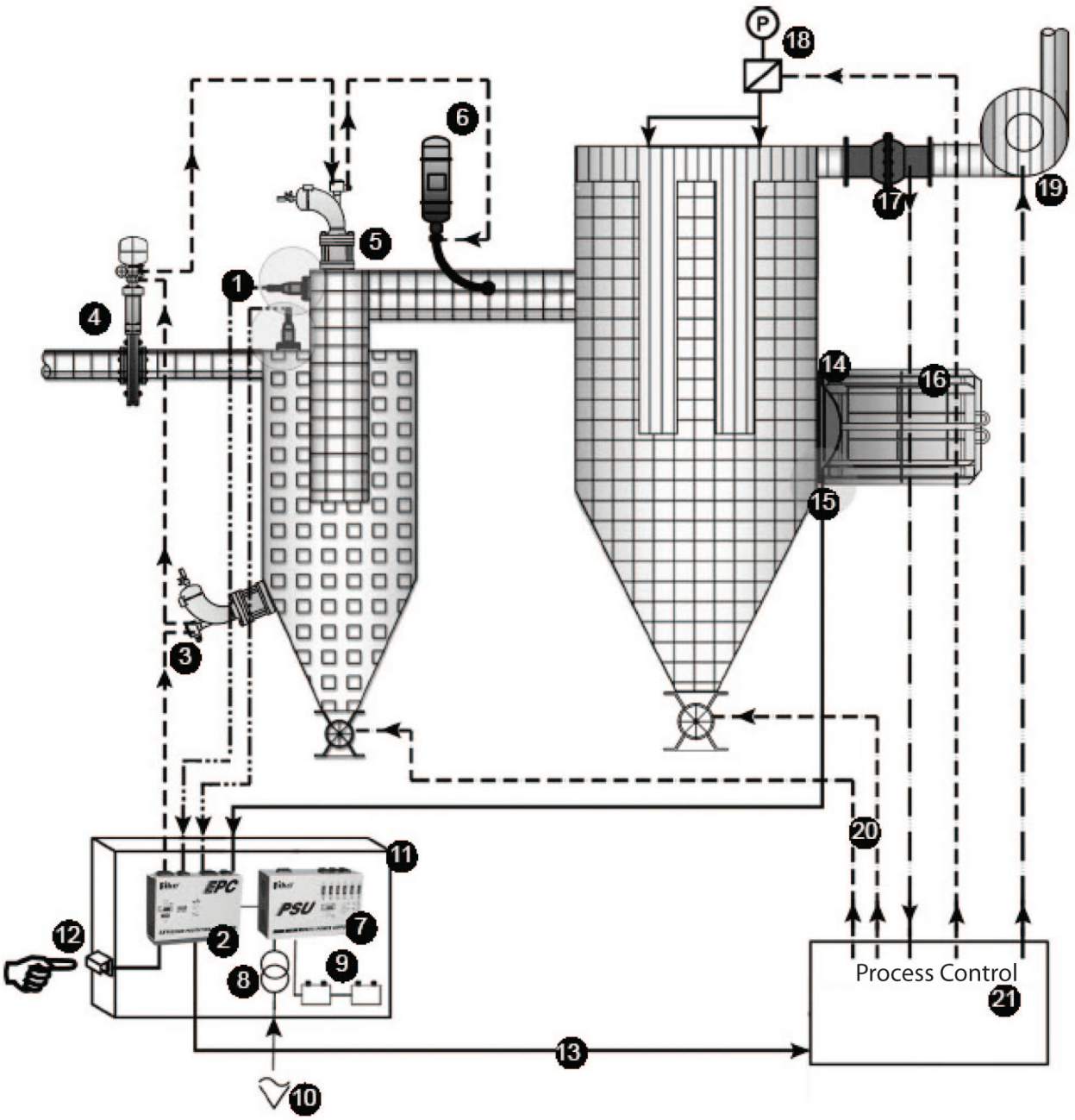
Further protection measures include:

- Item 13: Relay contacts, in the EPC, that switch over in case of a detected explosion, or system trouble. They are used to stop the process or bring it to a safe state.
- Item 18: An output from the Process Controller to stop the Reverse Jet Cleaning of the Filter Bags, preventing further development of explosible dust/air clouds into the dust filter.
- Item 19: An output from the Process Controller to stop the fan, preventing dust from becoming airborne into the process.
- Item 20: An output from the Process Controller to stop the Rotary Valves, in order to prevent hot particles from being passed or propagated further through the process.

Item	Type of Device	Information	(Safety) Function
1	Integra® Explosion Detector	Input (A*)	Detects an explosion in its incipient stage
2	Explosion Protection Controller (EPC)	I/O	Monitoring, releasing, alarming
3	HRD Suppressor on Cyclone Wall	Ouput (D*)	Injects suppressant to extinguish explosion
4	Explosion Isolation Valve	Output (D*)	Provides a mechanical block to stop explosion propagation
5	HRD Suppressor on Cyclone Central Vortex Pipe	Output (D*)	Injects suppressant to extinguish explosion
6	SRD Isolation on pipe (chemical barrier)	Output (D*)	Injects suppressant into pipe to extinguish propagating explosion
7	Power Supply Unit (PSU)	24 VDC	To provide power to the EPC
8	Power Transformer	230/110 VAC to 24 VAC	To provide power to the PSU
9	Batteries (2 in series)	2 x 12 VDC	Emergency power back-up, in case of main power loss
10	Main Power Supply	230/110 VAC	The main (permanent) power source
11	Enclosure	Rated for area	Enclosure for EPC, PSU, transformer and batteries
12	Manual Switch	I/O	To arm/disarm the EPC unit
13	Relay Contacts (trouble/alarm)	SPDT	To stop the process, to signal status
14	Explosion Vent Panel	Normally closed	Opened by the explosion pressure, releases explosion pressure and flame
15	Explosion Vent Panel Rupture Indicator	Normally closed	Signals explosion vent panel opening
16	Flamefilter (FQ)	Quenching	Extracts heat from the explosion facilitating flameless venting
17	Explosion Barrier/Ventex	Passive device	Provides a mechanical block to stop explosion propagation
18	Output from Process Control	Any type	Stops the reverse jet cleaning of the filter bags to prevent further development of explosible dust/air clouds into the filter
19	Output from Process Control	Any type	Stops the fan, to prevent dust from becoming airborne into the process
20	Output from Process Control	Any type	Stops the rotary valves, in order to prevent hot particles from progating further through the process
21	Process Control	I/O	To control the processing plant

(A): analog information, for example 4-20 mA signal*
(D): digital information, for example high/low or open/close*
I/O: input and output
SPDT: single pole, double throw



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