REINHOLD ENVIRONMENTAL Ltd.

2016 APC-Wastewater Round Table & Expo Presentation

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2016 APC – FARS Workshop

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Fly Ash Removal Systems (FARS)

- Is your Fly Ash Removal System (FARS) ignored at your plant?
- Most systems are forgotten about until other problems surface which are the result of not giving the FARS the attention it deserves.
- With the increase burdens on the ESP required for compliance, the FARS can quickly become your “Achilles' Heel”.

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True or False

A vacuum fly ash removal system is designed to sucks the ash out of ESP fly ash hopper?

False

A vacuum system refers to conveyor line pressure which is determine based on where the conveying air is produced and therefore vacuum does not mean that ash is being sucked from the hopper.

Pneumatic FARS, whether vacuum or pressure based, operate on the premise of having free flowing ash being provided to the conveying system.

FARS Types

- Mechanical
  - Drag Chains
  - Screw Conveyor
- Pneumatic
  - Air Slides
  - Vacuum (Dilute Phase)
    - Wet
    - Dry
  - Pressure
    - Medium Phase
    - Dense Phase

Mechanical Conveying

Mechanical conveying of the dry ash streams can be accomplished using a combination of drag chain conveyors, en masse conveyors, screw conveyors or bucket elevators. Air lock devices, such as rotary seal feeders or tipping valves, are used to seal the internal positive or negative pressures of the boiler gas stream.

Pneumatic Conveying

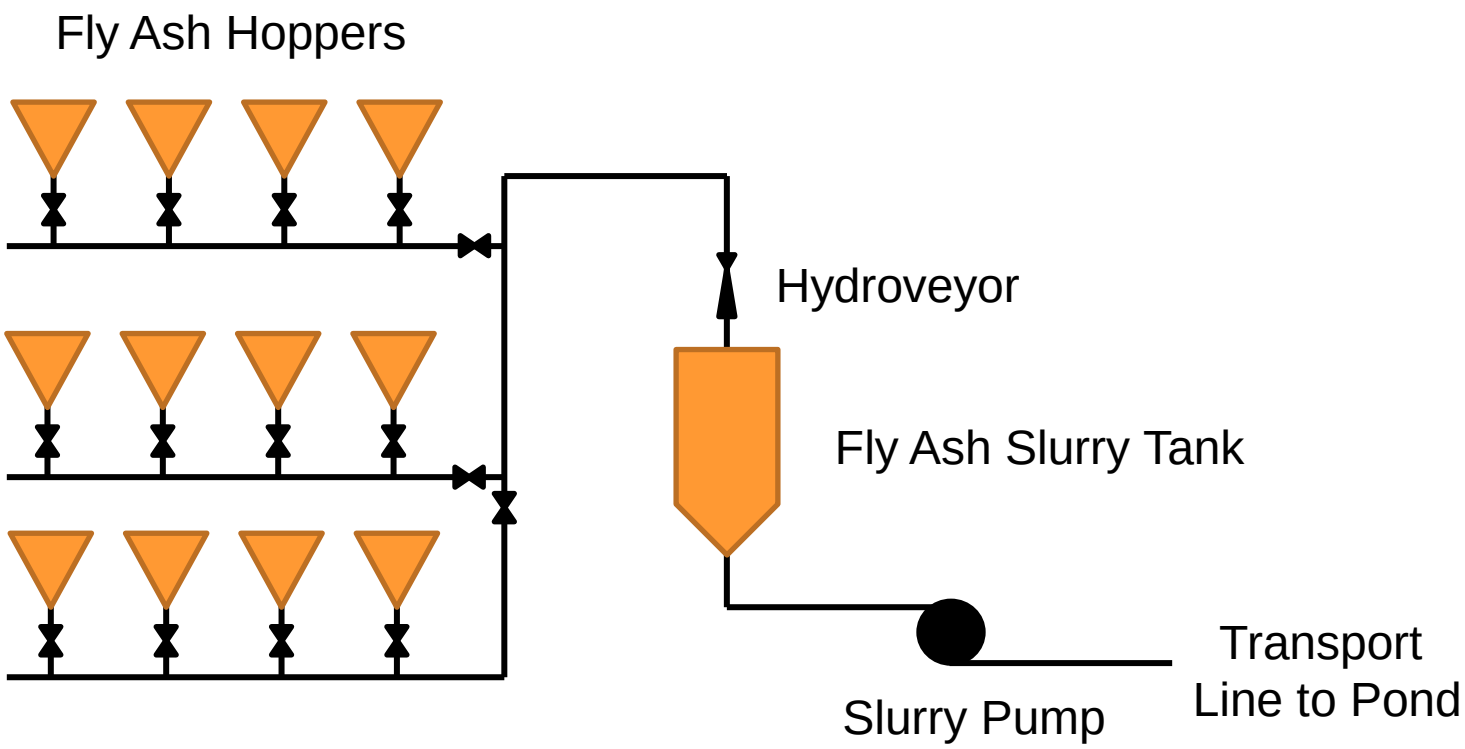
Pneumatic conveying of the dry ash streams can be accomplished using air air the transport media. The system can operate under pressure or vacuum. Pressure system are typical dense or medium phase, however a vacuum system is dilute phase.

Vacuum System

In the vacuum system, the conveying piping system is arranged with a vacuum producer at or near the end of the conveying line. The piping system operates at a negative pressure. It is routed beneath each ash disposal hopper and includes a gate at every ash feed point.

The ash is conveyed to a slurry tank (on a wet system) or storage bin/silo (on a dry system). A dry system requires a single or multi-stage filter to separate the fly ash from the conveying air before going to the vacuum producer.

Wet Vacuum System



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Wet Fly Ash Removal Systems

A recent ash pond failure has resulting in legislation which is eliminating the use on wet fly ash removal system. These systems have been or will be converted to dry systems. Most plants have until 2018 to have conversions in place. Based on other economic factors some units have been removed from service or moth balled.

2008 Containment Dike Failure

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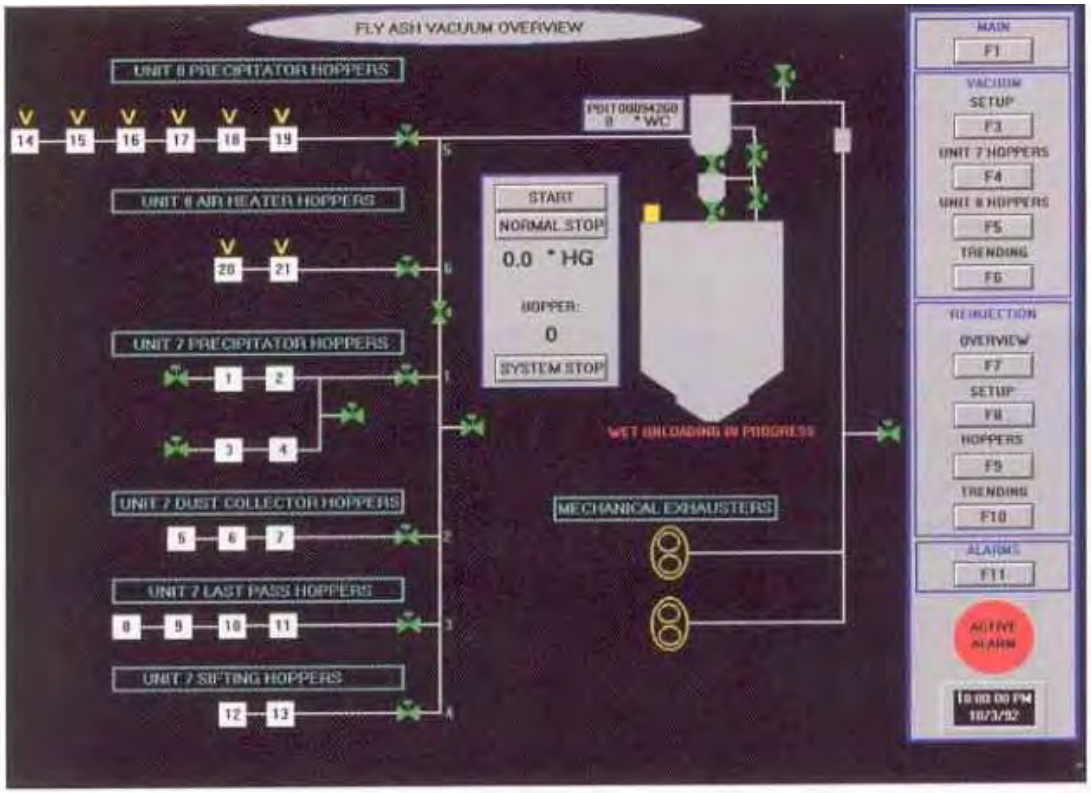
Wet to Dry Conversion Parameters

	Vacuum	Pressure	
Phase	Dilute	Medium	Dense
Maximum Distance	1500 feet (450 meters)	8000 feet (2400 meters)	5200 feet (1600 meters)
Maximum Capacity	80 TPH (75 mTPH)	175 TPH (155 mTPH)	200 TPH (180 mTPH)
Material Ratio	5-22 Ash : Air	5-22 Ash : Air	25-60 Ash : Air
Air Velocity	3000-5200 ft/min (16-27 m/sec)	2400-4800 ft/min (12-25 m/sec)	900-2700 ft/min (5-15 m/sec)
Maximum Conveyor Line Pressure	20 inches Hg (530 mm Hg)	40 psi (275 kPa)	60 psi (415 kPa)

Data from UCC Website

Dry Vacuum System



CRT graphic panel for a typical vacuum system.

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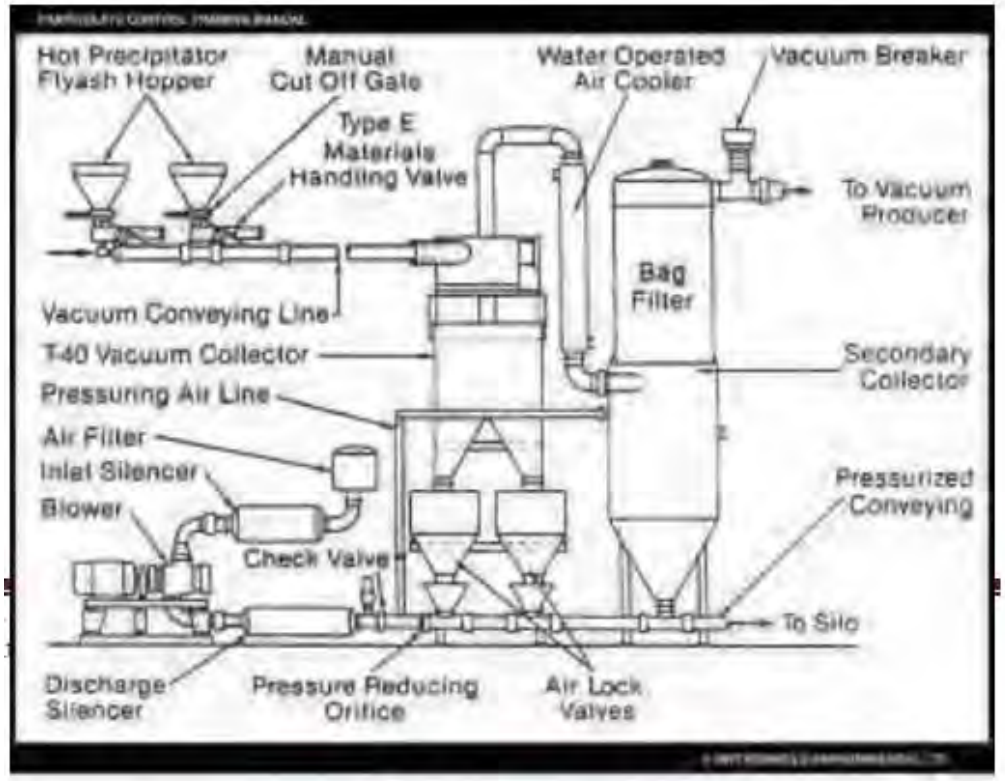
Dry Vacuum System w/Pressure Transfer System



Vacuum Type Conveying System
(Courtesy of B&W)

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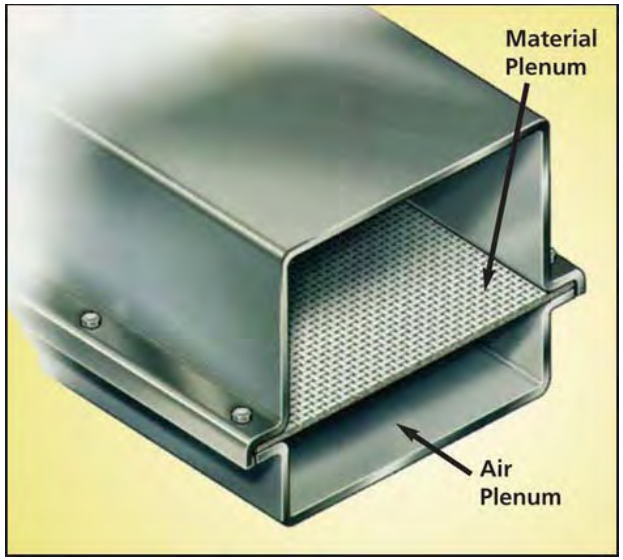
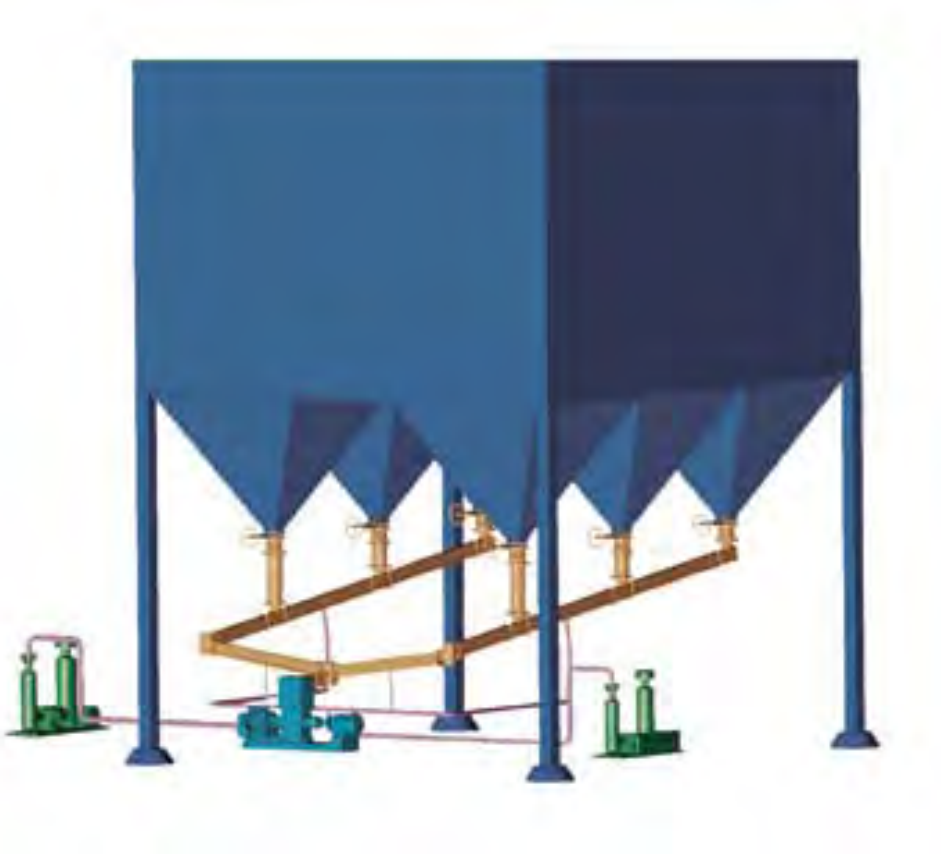
Pressure System

In the pressure system, the conveying piping system is arranged with a blower at the beginning of the conveying line. The piping system operates at a positive pressure. It is routed beneath each ash disposal hopper and includes an air seal system at every ash feed point.

The ash is conveyed to a storage bin or silo which includes a discharge filter for the fine ash particulates from the discharged conveying air, plus the air displaced when filling the silo.

Air Slide





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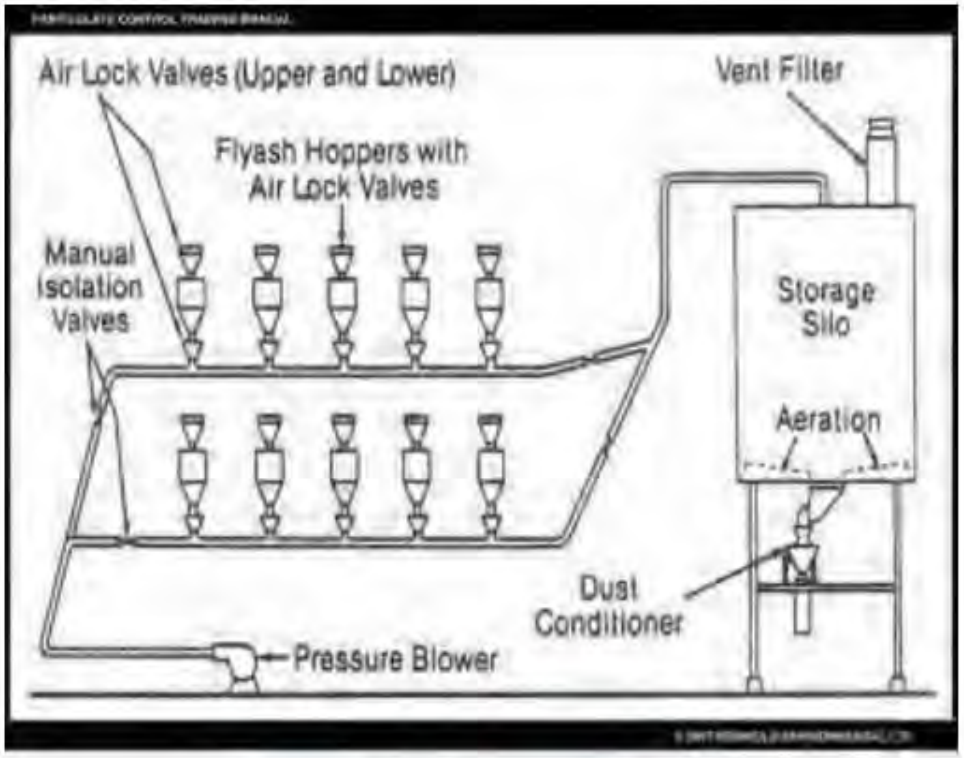
Pressure System



Pressure Type Conveying System
(Courtesy of B&W)

Body Analogy

If one thinks of a unit in terms of body components then:

- The Control Room is the Brain
- The Feed Pump is the Heart
- The Boiler is the Lungs
- The Turbine is the muscles
- The FARS is the _____

Unless this system gets constipated or has diarrhea very little attention is paid to it!

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As Rodney Dangerfield would say, “I don’t get no respect”

The FARS does not get the respect it deserves:

- Each branch line cycles from ambient temperatures to 250+F more than 24 times each day (main line cycle even more), so it under goes a tremendous amount of expansion and contraction.
- It transports a very abrasive material which is hard on elbow and gates.
- If temperatures are not maintained (in the hopper or the conveying air), the ash can fall below the sulfuric acid dew point resulting in mud plugging hopper and conveying lines.
- If the unit is near a river or lake the conveying air could be very damp at night.
- Conveying air temperatures in the winter can cause conveying issue on non-enclosed systems

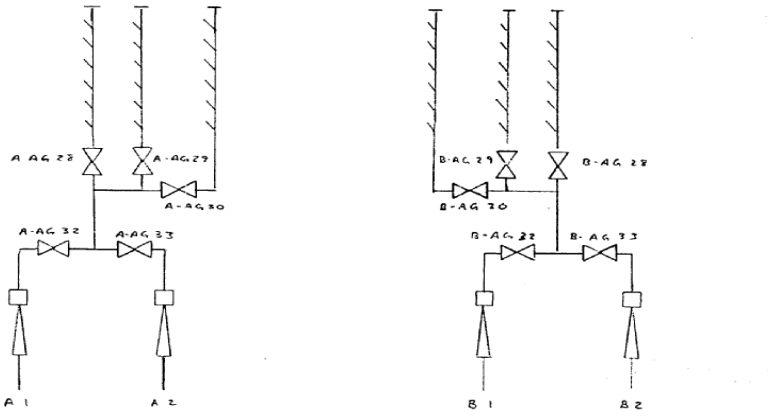
Typical System Problems

- Hopper Pluggage
- Line Pluggage
- Gate Leakage
- Lock Hopper Issues
- Line Leaks
- Vacuum Producer Deficiencies
- Filter/Separator Failures
- Operates adjusting pressure of vacuum setting just to keep the system cycling instead of addressing the problems.
- Having level detection too high in the hopper.

FARS Vacuum Check Data Sheet

CARDINAL PLANT
UNIT ____
FLY ASH SYSTEM CHECK SHEET

DATE: _____ DATA BY _____



PROCEDURE STARTS WITH ALL AG GATES CLOSED. THIS WILL ESTABLISH THE CAPABILITY OF THE HYDROVEYOR.

BOX A	SYSTEM Y's A1 OR A2	
SET-UP	LOCAL	REMOTE
ALL AG GATES CLOSED		
OPEN AG 32 OR 33 DEPENDING ON SYS Y's		
OPEN AG 28 PLUG END OF LINE		
CLOSE AG 28 OPEN AG 29 PLUG END OF LINE		
CLOSE AG 29 OPEN AG 30 PLUG END OF LINE		
RETURN SYSTEM TO NORMAL OPERATION		

COMMENTS:

BOX B	SYSTEM Y's B1 OR B2	
SET-UP	LOCAL	REMOTE
ALL AG GATES CLOSED		
OPEN AG 32 OR 33 DEPENDING ON SYS Y's		
OPEN AG 28 PLUG END OF LINE		
CLOSE AG 28 OPEN AG 29 PLUG END OF LINE		
CLOSE AG 29 OPEN AG 30 PLUG END OF LINE		
RETURN SYSTEM TO NORMAL OPERATION		

COMMENTS:

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Don’t let your FARS become your “Achilles' Heel” for your compliance strategy.

Additives for compliance strategies result in increase burden to the ESP. This burden can tax your FARS, especially the inlet row which will see the lions share of the change.

- Make sure your FARS is in good operating condition.
- Make sure you hopper heating system is operational.
- Be prepared to adjust your cycle sequence; biasing the pulling to the inlet row.
- Cycle through the hoppers in based on line pressures/vacuum using a minimum required cycle time per hopper.
- Power-Off Rapping (POR) or Power–Reduced Rapping may be required. POR has been seen to fill an inlet row hopper.
- If you don’t plan ahead, you may have to have vacuum trucks helping out your system until you get a handle on the problem.

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