www.qamanage.com
T: 1-800-267-5585

Retrofitting Baghouse Pulse-Jet Dust Collectors

Environmentally Friendly

90% of all existing dust collectors are retrofit candidates

- **Increase efficiency** and **lower particulate emissions** coming from the dust collector by 90% or more. Meet legal and process requirements.
- Reduce dust penetration (puffing) by 70-90%, reducing exposure to everyone in vicinity and endangering the environment.
- **Lower power consumption by 25-40%;** lower pressure drop across bags by as much as 75%.
- Increase bag life and reduce replacement costs by 50-80%.
- **Lower operating cost by 30-60%.**
- Future servicing costs will be 1/4 of the current servicing cost. That's a very **attractive payback**.

Dust collector retrofitted due to moisture and filter clogging problems

- Upgrade to the **best available technology**.
- **Most economical approach**; usually purchased in operating rather than capital budgets to make project approval very fast. Cost is less than present bag change out.
- **No risk.** Modifications installed and running before invoice is due. No special requirements or training required. It takes less time and labor than a change out of existing filter elements. No permanent changes to the collectors.

Symptoms to look for:

1. Pressure drop over 3 inches water column across filter elements.
2. Particulate emissions at collector outlet are over 30 x 10^{-4} grains per cu. ft. (it should be 4 x 10^{-4}).
3. Filter element life is under 4 years.

The Problem: Serious flaws in equipment design by all major baghouse dust collector suppliers. Basic laws of physics and air dynamics were not considered in product development. The main design flaw is that it is believed that volume (CFM) per filter element is solely a function of filter area. The truth; it is related strictly to cleaned filter area.

The Solution: QAM's exclusive Retrofit / Rebuild Service. Apply ten year old proven advanced technology, with over 500 units in service, to the conventionally designed dust collector. Alternatively, purchase one of the very few well designed advanced technology dust collector systems available today.

Problems to Correct:

- Poor Performance; dust penetration through filter media, high pressure drop, frequent filter replacements.
- Poor filter design; leaking, plugging (or blinding), tears and ruptures.
- Poor Inlet Position and Air Distribution; abrasion problems, excessive dust loading, inefficient pulse cleaning.
- Fine dust hanging up in the bags due to excessive upward "can" velocity.
- Poor pulse-jet dynamics; air-jet does not properly clean the filter, as low as only 10% of the filter bag gets cleaned.
- Condensation in filter cake; caused by cooling of cleaning air jet, adversely affects media permeability
- Excessive use of compressed air to properly clean the filters

LAB TESTING: will examine the bags for, presence of moisture or condensation, evidence of dust leaks or penetration to the clean side, oil in the media, permeability of the media, strength test, type of dust and its characteristics.

Dust Collector Retrofits
Justification

For 30 years, we have fought the war against ignorance concerning pulsejet dust collector design. We are convinced that the latest retrofit approach we came up with, can be the key to really selling the concept that it gives the user more performance at an affordable price. Typically pressure drop will decrease by at least 35% and cleaning frequency will be cut in half.

For bag collectors, top removal, the approach is simple. When the customer changes bags, often he can retrofit the collector for a comparable cost as a bag change.

Limitations of contemporary dust collector designs

A) Media Blinding

As the jet enters the bag through the venturi, it has velocities that drive dust from the bag which is in cleaning mode to an adjoining bag. As the bag cleaning continues the media is partially plugged until as little as 5% of the media is effective. The pressure drop increases and the dust holding capacity between cleanings drops to as little as 5% of the original area. This means the bag must be cleaned up to 20 times as often to maintain equilibrium. In an attempt to compensate for this serious design flaw, the approach has been to lower the filter ratio. This has limited success, in that the bags last longer since it gives the cleaning system more bag area to plug before the cleaning frequency and pressure drop increases enough to indicate a bag change. A collector at 3:1 filter ratio, compared to a conventional design at 6:1 filter ratio, assuming the same cleaning system jet velocity and flow will last nearly twice as long, but the cleaning frequency will. be nearly the same. The dust penetration through the bag on a limestone dust will be in the 0.0100 to 0.080 grains per cu. ft. range. It must be understood that for the above to be valid, the dust must have densities of over 20 lb./cu.ft.. No matter what the jet velocity, foam or paper dust cake will not be driven through the media. If the can velocity is low these collectors can operate at low pressure drop and low cleaning frequencies.

B) Can velocity

Can velocity is defined as the vertical velocity component as the process air enters the bag section from the inlet. You determine cross-sectional area of the bottom of the collector housing and subtract the cross-sectional area of the bags.

Most existing collectors use bottom (hopper) inlet. Typically operating at a 6:1 filter ratio with 8 foot long bags the can velocity is 275 to 300 ft per minute. If the bag is lengthened say from 6 feet to 12 feet, the filter ratio drops to 4 but the can velocity remains unchanged. On dusts with a significant component of dust below three microns and densities under 50 lb per cu.ft., this can velocity range impedes dust from falling into the hopper.

The QAM Solution

1) discard all bags and cages
2) plug half of the holes in the tube sheet with snap in collar bag plugs
3) plug every second hole in the pulse pipes with aluminum rivets.
4) drill second hole in the pulse pipes over the remaining holes in the tube sheet, Re-position pulse pipe.
5) replace bags and cages in holes not plugged with special proprietary designed bags and cages

Example:

Mikropul Model 100S-10-20, 7000 cfin @ 6:1 filter ratio
Unit has ten pulse pipes each with ten 1/4 inch orifices and 100 bags, 10 feet long, pressure rating is 20”w.c.

QAM costs:

4 5/8" diameter x 120" overall length bags; Snap band top disc bottom. Fabricated of 16 oz singed polyester felt
Quantity: 10-99 $11.95each
Same as above but 9" Stubby bag for plugging off holes $6.45 each
Cages; 4 1/2" diameter x 119 3/4" overall length; Turned down flange welded pan bottom. Fabricated of 11 gauge, 12 vertical wires, 8" centers. Quantity: 10-99 $18.00each

Cost of customer to change bags

100 bags @ $9.50 each	$950.00
Labor at $35 per hour at 10 bags per hour	$350.00
Replace 10% cages $18.00 each	$180.00
Total	$1485.00

/… 2

Cost to retrofit

50 bags @ $11.95	$597.50
50 Cages @ $18.00	$900.00
50 Plugs @ $6.45	$322.50
Pop rivets, drill bit, tool for rivet	$ 60.00
Labor at 10 bags per hour	$ 175.00
Labor stubby bags, 20 per hour	$ 87.50
Redrill and plug pulse pipes, 2hrs	$ 70.00
Total	$2212.50

Net cost for redesigned collector with new cages, new bags resulting in emissions reductions, pressure drop reduction, 2-3 times longer filter life; compared to only bag change out is $727.50

Future bag changes	
50 bags at $11.95 each	$597.50
Labor	$175.00
10% cage replacement	$ 90.00
Total	$862.50

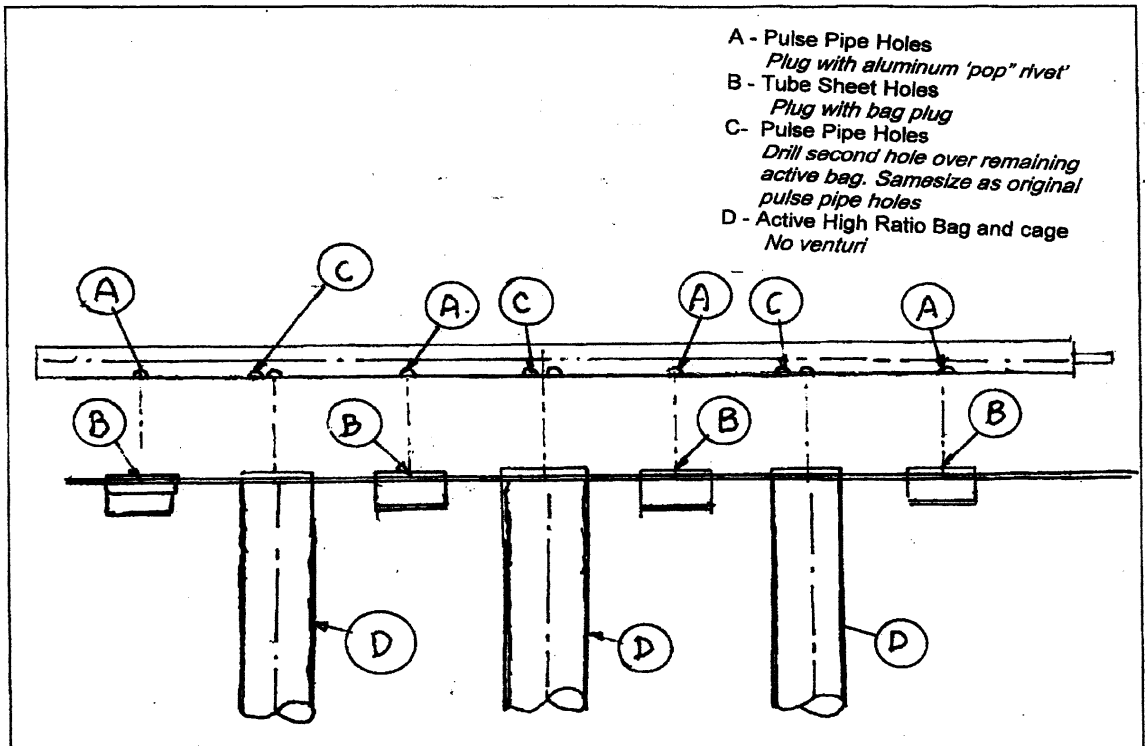
Savings on future bag changes $1485.00 - $862.50 = $622.50 each change
(these changes would be at half the previous frequency)

The customer really has no risk.

We reduce the can velocity on this particular unit from 284 FPM to 222 FPM.

The cost to the customer to get the best design in the world is :
$727.50 per 7000 cfm or $0.10 per CFM over regular bag change out

None of the changes are irreversible.
The customer drills out pop rivets and plugs extra holes in pulse pipe to get back to original configuration. Since it takes one or two days to convert, he/she will know it works within three days. If it does not work he/she would not pay the invoice.



Baghouse Dust Collector Retrofits (Example)

The latest retrofit approach gives the user more performance at an affordable price. Typically pressure drop will decrease by at least 35% and cleaning frequency will be cut in half.

For bag collectors, top removal, the approach is simple. When the customer changes bags, often he can retrofit the collector for a comparable cost as a bag change.

Limitations of contemporary dust collector designs

A) Media Blinding

As the jet enters the bag through the venturi, it has velocities that drive dust from the bag which is in cleaning mode to an adjoining bag in filtering mode. As the bag cleaning continues the media is partially plugged until as little as 5% of the media is effective. The pressure drop increases and the dust holding capacity between cleanings drops to as little as 5% of the original. This means the bag must be cleaned up to 20 times more often to maintain equilibrium. In an attempt to compensate for this serious design flaw, the approach has been to lower the filter ratio. This has had limited success, in that the bags last longer since it gives the cleaning system more bag area to plug before the cleaning frequency and pressure drop increases enough to indicate a bag change. A collector at 3:1 filter ratio, compared to a conventional design at 6:1 filter ratio, assuming the same cleaning system jet velocity and flow, will last nearly twice as long, but the cleaning frequency will be nearly the same. The dust penetration through the bag on a limestone dust will be in the 0.0100 to 0.080 grains per cu. ft. range. It must be understood that for the above to be valid, the dust must have densities of over 20 lb./cu.ft..

B) Can velocity

Can velocity is defined as the vertical velocity component as the process air enters the bag section from the inlet. You determine cross-sectional area of the bottom of the collector housing and subtract the cross-sectional area of the bags. Most existing collectors use bottom (hopper) inlets. Typically operating at a 6:1 filter ratio with 8 foot long bags, the can velocity is 275 to 300 ft per minute. If the bag is lengthened say from 8 feet to 12 feet, the filter ratio drops to 4:1 but the can velocity remains unchanged. On dusts with a significant component of dust below three microns and densities under 50 lb per cu.ft, this can velocity range impedes dust from falling into the hopper.

The QAM Solution:

1) **Discard all bags.**
2) **Discard all cages that have a venturi or cut the venturi out of the cage.**
3) **Plug around half of the bag openings in the tube sheet. Which openings are cancelled depends on the type of collector inlet and the particular application.**
4) **Replace with new specially designed bags and cages for high-ratio operation. Only half of the original number bags are re-installed.**
5) **Plug the orifice in the pulse pipes, corresponding to the plugged openings referred to in step 3.**
6) **Drill new orifices in the pulse pipes over the remaining openings in the tube sheet, using a specially designed tool for that specific application, supplied by QAM.**
7) **Re-position the pulse pipes.**
8) **Re-set the pulse controller, according to instructions supplied by QAM, for optimal operation and much lower operating cost.**

The Result:

A. **90% reduced dust emissions from the collector.**
B. **Increase bag life from 18-36 months to 60-84 months**
C. **Reduce power consumption by 20-40%**
D. **Reduce operating cost by 40-80%**
E. **Reduce “can” velocity by 50-80%**

Example:

Mikropul Model 100S-10-20, 7000 SCFM @ 6:1 filter ratio. Unit has ten pulse pipes each with ten 1/4 inch orifices and (100) 10 feet long bags.

Cost to change set of bags

100 bags @ $15.92 each	$1592.00
Labor at $35 per hour at 10 bags per hour	$350.00
Replace 10% cages $40.00 each	$400.00
Total	$2342.00

Cost to retrofit

50 bags @ $15.92	$796.00
50 Cages @ $35.00 (no venturi)	$1750.00
50 Plugs @ $10.00	$500.00
Special pulse pipe drilling tool, rivets etc	$ 60.00
Labor at 10 bags per hour	$ 175.00
Labor stubby bags, 20 per hour	$ 87.50
Re-drill pulse pipes, 1 hrs	$ 35.00
Feasibility study & engineering	$500.00
Total	$3903.50

Net cost for redesigned collector with new cages, new bags resulting in emissions reductions, pressure drop reduction, 2-3 times longer filter life; compared to only a bag change out is $1561.50

Future bag changes:

50 bags at $15.92 each	$796.00
Labor	$175.00
Replace 10% cage	$175.00
Total	$1146.00

Savings on future bag changes $2342.00 - $1146.00 = $1196.00

Power Consumption: (based on hours per day & 5 days per week operation)
Original collector = 19.12 kW x 8 hours x 250 days = 38,240 kWh per year @ $5277.00
Retrofitted collector = 10.35 kW x 8 x 250 = 20,700 kWh per year @ $2856.00
Power saving is 46%.

8 Year Operating Cost Analysis:
We assume original bag changes were done every 2 years

	Original Collector	**Retrofitted Collector**
1st & 2nd year	$2342	0 bags - $4842 power saving = minus $4842
3rd & 4th year	$2342	$1146 bags - $4842 = minus $3696
5th & 6th year	$2342	0 - $4842 = minus $4842
7th & 8th year	$2342	$1146 - $4842 = minus $3696
Total cost	$9368	minus $17,076

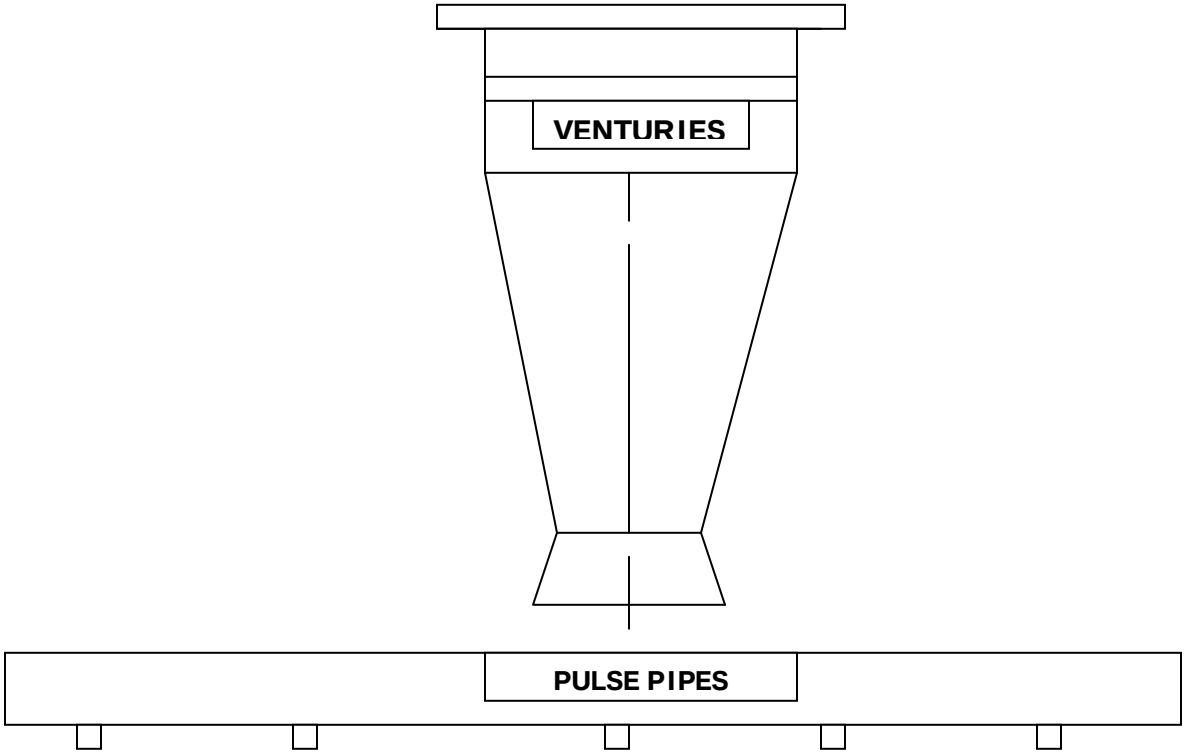
Operating Cost Savings = $26,444.00 can be re-invested in other plant operations!!!!!

NO RISK

1. None of the changes are irreversible; you get back to original configuration at will.

2. Since it takes one or two days to convert, the operator will know it works within three days.

3. If it wouldn't work, the client would not pay the invoice. Payment terms are 30 days (O.A.C).



WANTED DEAD OR ALIVE
POWER BANDITS

PULSE PIPE FAMILIES and VENTURI FAMILIES
Found by the hundreds in Fabric Pulse Jet Dust Collectors

IMMEDIATE REWARDS AND POWER SAVINGS

Long term savings in longer bag life, lower pressure drop, and higher collection efficiency

Criminal Charges against PULSE PIPES

- Turning energy above 35 psig into noises and turbulence
- Stealing power from cleaning system
- Aiding and abetting venturies in nefarious crimes against good cleaning system design

Criminal Charges against VENTURIES

- High pressure drop across bags
- High dust penetration and endangering the environment by these emissions from the dust collector
- Lowered dust holding capacity between cleanings
- Lower bag lives by 50 to 80%

FOR YOUR REWARD

Call
Quality Air Management Corp.
Toll-free (800) 267-5585; email at info@qamanage.com

Rebuilds

The rebuilds come in three levels.

First Level is to reduce compressed air consumption by over 40%. The filtering capacity, pressure drop and bag life remain same. It involves only changing out the pulse pipes with computer generated nozzles, installed in the original pulse pipes.

Second Level is a radical conversion to the new advanced technology cleaning system. Usually the collector will require new bags and cages that do not have venturies. The inlets, outlets and fan connections remain the same. Half of the bags are removed and the filtering capacity of the remaining bags is increased to 300% of the filter flow before the rebuild. The pressure drop across the collector, with the original flow through the collector, is decreased by at least 50%.
Compressed air consumption is decreased by 60% with the same flow through the collector. (Often the timer must be replaced to allow longer intervals between pulses)
The dust penetration through the collector is reduced by more than 75%, because of the change in velocity of the cleaning jet entering the bags.
The upward can velocity is reduced by over 50% to allow the finer dust that was previously blown out the exhaust to be collected and fall into the hopper.
The bag life for the remaining bags is extended two or three times.
The total volume filtered by the collector remains the same except the reduced pressure drop across the collector might result in increased airflow through the exhaust system. This increase on most systems will be barely discernable.

Third Level is the most radical. The flow through the collector can be doubled. Only enough bags are removed to allow relocation of the inlets into a housing inlet. Typically 15-20% of the bags are blocked off. Usually an additional new inlet, an additional new outlet and a parallel fan are required to take advantage of the increased capacity through the unit.
The pressure drop across the collector with double the original flow is decreased by at least 50%.
Compressed air consumption is decreased by 20% with double the original flow. (Often the timer must be replaced to allow longer intervals between pulses)
The upward can velocity component is eliminated or even reversed near the bottom of the bags.
The finer dust that was previously blown out the exhaust is collected and falls into the hopper unimpeded and even assisted by the downward velocity vectors.
The dust penetration through the collector is reduced by more than 75% on a per CFM basis.
The bag life for the remaining bags is extended two or three times.

Examples and guaranteed results

Sample collector specifications

64 bags and 614 sq.ft. of cloth. With 60 CFM per bag or 3850 CFM at 6.25 filter ratio, 1.625 inch diameter venturi throats, 1/4 inch diameter orifices, 85 psig compressed air in header

3/4 inch schedule 40 pipe supply connection to header.

Cleaning cycle: "On time" setting 0.100 seconds (mechanical time), "Off time" setting 30 seconds that cleans collector every four minutes

LEVEL 1 Rebuild - Pulse Pipe replacements

Replace orifices in blow pipes with computer generated expansion nozzles that increase velocity entering the at top of jet from 1030 ft./second to 1750 ft/sec.

These compressed air pressure evase nozzles require less 40% of compressed air per pulse to produce identical pressure and flow characteristics in the pulsed cleaning jet.

BEFORE REBUILD

With 1/4 inch orifice and 85 psig compressed air supply, we use 0.15 standard cubic foot per pulse for each bag. Every minute we clean

16 bags: 16 bags x 0.15 SCF per orifice = 2.4 SCFM

AFTER REBUILD

With size 200 special nozzle for 85 psig operation, we use 0.088 standard cubic foot per pulse for each bag. Every minute we clean 16 bags:

16 bags x 0.088 SCF per nozzle= 1.4 SCFM

SAVINGS

2.4 SCFM at 85 psig minus 1.4 with nozzles = 1.0 SCFM

LEVEL 2 Rebuild

Modify cleaning jet design to clean with a better velocity and flow characteristics. Half of the bags are removed and the holes plugged. New jets will have three times the volume and half the velocity of the original jets.

The lower velocity will allow collector to clean all of the bag media. During a cleaning cycle with old pulse jet technology the dust leaves the bags during cleaning at velocities between 18,000 fpm and 28,000 fpm, developing pressure of 2O and 49 inches w.c., respectively. This allows only cleaning of 25 to 30% of the media when dust densities are over 25 Ib/sq. ft.

IN LEVEL TWO REBUILD

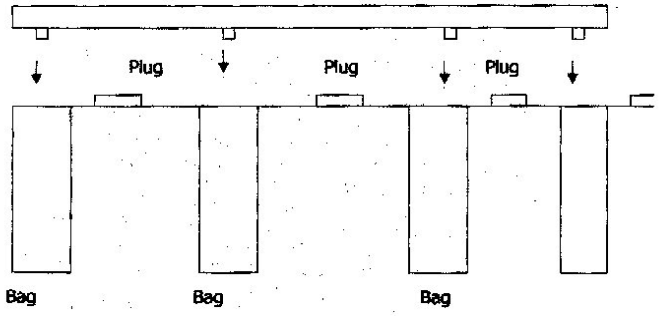
We design a new cleaning jet by removing the venturi and modifying pulse pipe that will do the following.

THE RESULTS ARE AS FOLLOWS:
Reverse jet will have triple the cleaning volume. This will allow the one bag to have, triple the filtering capacity and to clean and maintain 80 to 100% of the bag media. The collector will operate with half the bags and double to triple the volume per bag.
The velocity of the jet as it enters the bags will be between 10,000 and 12,000 feet per minute and will exert velocity pressure of 6.3 to 9 inches water column. The dust penetration will stop completely. The pressure drop across the media and filter cake will drop to between 1.2 and 1.75 inches w.c.. At this filter ratio, the cleaning frequency will drop to about one sixth of the previous level or every twenty-four minutes.

FOR 30 BAGS
Each bag requires 0.199 SCF per pulse. Collector will require cleaning an average of 2-4 bags every minute. "On time" setting is 0.10 seconds, same as level 1 above. "Off time" setting is 180 seconds. Every minute the collector will clean an average of 4 bags.
New air consumption is: 0.199 SCF x 4 bags = 0.8 SCFM at 85 psig

SAVINGS
Decrease in air consumption Is 2.4 SCFM - 0.8 SCFM = 1.6 SCFM.

OTHER SAVINGS AND IMPROVEMENTS
Bag life doubles or triples with half the bags
"Can velocity" is cut buy more than 50%
Penetration through collector (in proportion to cleaning frequency) is cut by 80%.
Below is the arrangement on each Pulse Pipe for level 2 rebuild



Level **3 Rebuild**
Modify cleaning jet design to clean with a better velocity and flow characteristics. New jets will have three times the volume and half the velocity of the original jets. This is same reverse jet design as outlined in level 2 rebuild. Some bags will be blocked to provide space in the housing for a high housing inlet design. The outlet must be enlarged. Sometimes two outlets are indicated.

THE RESULTS ARE AS FOLLOWS:
We obtain the same results as level 2 rebuild, and, in addition:
The volume through the collector will be increased to at least 2 times that of the original collector rating.
The pressure drop across the media and filter cake will drop to between 1.2 and 1.75 Inches w.c.
At this filter ratio, the cleaning frequency will drop to about one sixth of the previous level or every twenty-four minutes.

For this example, we will replace 48 bags (30 bag collector usually too small for this): Volume increase will go from 3850 CFM to 7700 CFM.

FOR 48 BAGS
Each bag requires 0.199 SCF per pulse
Collector will require cleaning an average of 5-7 bags every minute.
"On time" setting is 0.10 seconds same as level 1 above. "Off time" setting is 180 seconds.
Every minute the collector will clean an average of 6.5 bags.
New air consumption is: 0.199 SCF x 6.5 bags = 1.3 SCFM at 85 psig

SAVINGS
3.6 SCFM at 85 psig minus 1.3 with nozzles = 2.3 SCFM

OTHER SAVINGS AND IMPROVEMENTS
Double the volume of air that the collector can handle
Bag life doubles or triples with half the bags
'Can velocity" is cut buy more than 50%
Penetration through collector (in proportion to cleaning frequency) is cut by 80% per unit of flow.

quality air management
240 Camille Crescent, Waterloo, ON N2K 3B7
(519) 746-2424
(800) 267-5585
Fax: **(519) 746-6159**
www: qamanage.com
email: info@qamanage.com