Baghouse Stacktest Preparation and Maintenance

Helpful Hints

BAGHOUSE TYPE CONTROL

Normal Plant Operation

A stack test is a check of the emissions from the plant during high production operation. The test shows how well the plant is producing, how well the maintenance has been performed and how well the plant is configured and tuned. If carbon monoxide levels will be monitored, many factors may need extra attention to be in some area compliance. Air flow and fuel pressures are critical for some compliance levels. If aggregate moisture levels are above 5 percent, plant ratings may not be achieved.

Bag Leak Check

It is essential that the leak check of the bags and tube sheet be done prior to the stack test. The leak check **must** be conducted properly! Two or three days prior to the stack test are best for doing the powder "visolite" test. Tools needed to do a leak test are a black light and fluorescent tracing powder.

After **cool down of the baghouse**, dump in one pound of the tracing powder per each 1,000 square feet of cloth. The powder goes into the duct and doors in the dirty side of the baghouse, but after any pre-collector, knockout box or cyclone. After night falls, shut off all plant lights, and open each plenum door to check each bag and bag seal area, using the black light. Check the tube sheet welding. Be careful not to track any powder from one compartment to the next. Since the powder was introduced while the tube pressure drop was at the operating level, the tracing powder will seek the point of least resistance. Replace defective bags and seals. Repair air holes in defective welding. High temperature silicone caulking is often sufficient to seal the area temporarily, provided the surface is properly cleaned before silicone is applied.

Visual Inspection

Only trained personnel with baghouse experience should be used to find leaks. Inexperienced personnel should be used only as helpers and trainees. Material build up, dust in the venturi, and blow marks from the bag seals will show signs of bag seal and venturi-bag seal leaks. A visual inspection of individual venturi-bag seals will be likely show signs of leaks. Extra amount of dust will be visible inside the venturi if a hole is present in the bags. Holes in the bags can be detected from material build up on the tubesheet (the plate in which the bags are mounted). The dust pile trail should be seen trailing towards the exhaust duct. If the venturi seal is leaking, dusty blow marks will be present at the seal. These marks and build up will trail towards the exhaust duct and fan. Remove the bag assemblies to correct all damage. Fine material will also be seen in the venturi and on the blowpipes mounted above the venturi. In a last resort inspection, the bags and cages can be removed to visually inspect each bag and seal.

With careful inspection, most leaks can be detected using these procedures. After inspection and changes are made, the tube sheet should be vacuumed or blown clean. At a later date, the baghouse can be inspected and the leaks will be easier to distinguish in the bags.

There are different types of leaks in a baghouse. The above procedures will detect holes in the tube sheet seals or bags. In some cases, the bag fabric may be leaking very fine particles, sometimes called "bleeding"(material migrates through the bag). If one stands with the sun to their back and look just over the top of the stack and notice a significant puff of tan colored dust (opacity) during the pulsing cycle, this may be the bleeding of the bags and the problem in the collector. To detect this leak you will need to double the amount of powder and go though the complete pulsing cycle while you are adding powder. Leaks may show up inside the bags with a light dusting of the tracing powder. This is common with laundered, over-cleaned, overheated and/or worn bags. A light cake on the bags will lower emissions.

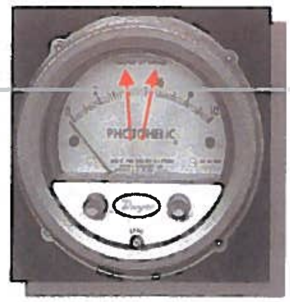
BLUE OR BLACK SMOKE

An opacity problem can exist even without any baghouse problems. "Blue smoke", as it is referred, is caused by the liquid asphalt, RAP (recycled asphalt pavement) and/or incomplete combustion from petroleum based fuels. The light ends can be stripped from the asphalt from high temperatures in the airstream. Typical causes of blue smoke are overheated recycle mix or overheated liquid asphalt. As pointed out earlier, some Asphalt vaporizes at lower temperatures. It is essential to keep the AC temperature low (290°F). Protect RAP overheating by a good veil of virgin mix. Choose liquid asphalt with the higher vaporization temperatures. Check the position of the liquid AC injection line. The position for the liquid AC injection is to be the furthest from the flame and still have good heating and mixing of the virgin materials, asphalt and RAP. Some pollution control may be effected by the lower amount of coated materials in the veil.

On the two drum systems, the AC line position will have a little effect on the blue smoke in the exhaust gas.

The burner may be fuel rich or air lean. Adjustments should be made with charts from the manufacturer and an analyzer.

Cleaning Cycle Timing



The cleaning cycle is an important part of a clean stack. The cycle should be set to maintain a tube sheet pressure drop of about 4 to 6 inches of water.

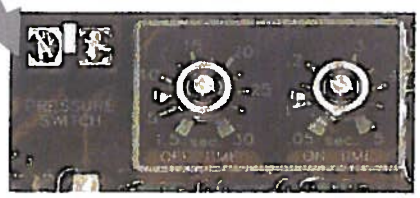
The clean side of the tube sheet should be plumbed to the LOW SIDE of the magnehelic or photohelic. The dirty side of the tube sheet should be plumbed to the HIGH SIDE of the magnehelic or photohelic.

If pressure drop can be maintained, increase the off cycle time. It is likely that emissions will decrease. A typical on time is 0.15 - 0.18 seconds on. Typically, stack emissions are highest during the pulse cycle.

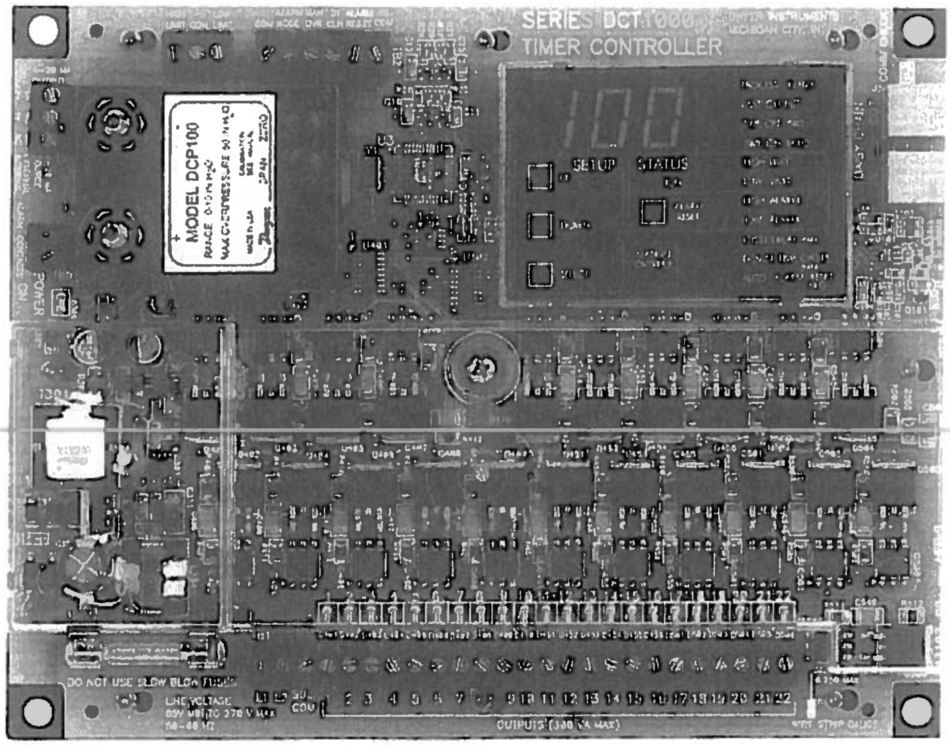
If a photohelic is used in your system, the system should allow the pressure drop to rise to the higher needle, begin the pulse cycle, and the pressure should drop below the lower needle and reset. The cycle will and should repeat. If this is not the operation of the cleaning cycle, some adjustments to the pulse off time and duration should be made.

The photohelic works with a small light beam. The sun may effect its operation. Install a cover over the face to protect from this condition.

Old Style



New Style



The DCT1000 is designed to be used with pulsejet dust collectors for on-demand or continuous cleaning applications. The DCT1000 consists of three basic modules: the master controller, the optional channel expander (slave board), and the pressure module (DCP100/200). The manual is limited to the installation and operation of the master controller and optional channel expander. For installation requirements on the pressure module, please refer to the installation and operating instructions for the DCP100/200.

Continuous cleaning applications do not require external inputs and can be used for time based "on-demand" cleaning through use of the cycle delay feature.

3.0 Master Controller Panel Features

We've made it easy to navigate the DCT1000. Menu items can be accessed, simply by pressing the "SELECT" button. The menu item that you are currently accessing is indicated by the illumination of an LED. To change menu items, all you have to do is push "UP" to increase a value or push "DOWN" to decrease a value. There are no keystrokes that you need to memorize, special combinations, or passwords that are required.

The master controller is equipped with an on board display and programming information center. The controller will power-up with the process indicator illuminated. If a pressure module is installed, the display will indicate the measured pressure in inches of water column (IWC); otherwise it will normally be blank.

3.1 Last Output Setup

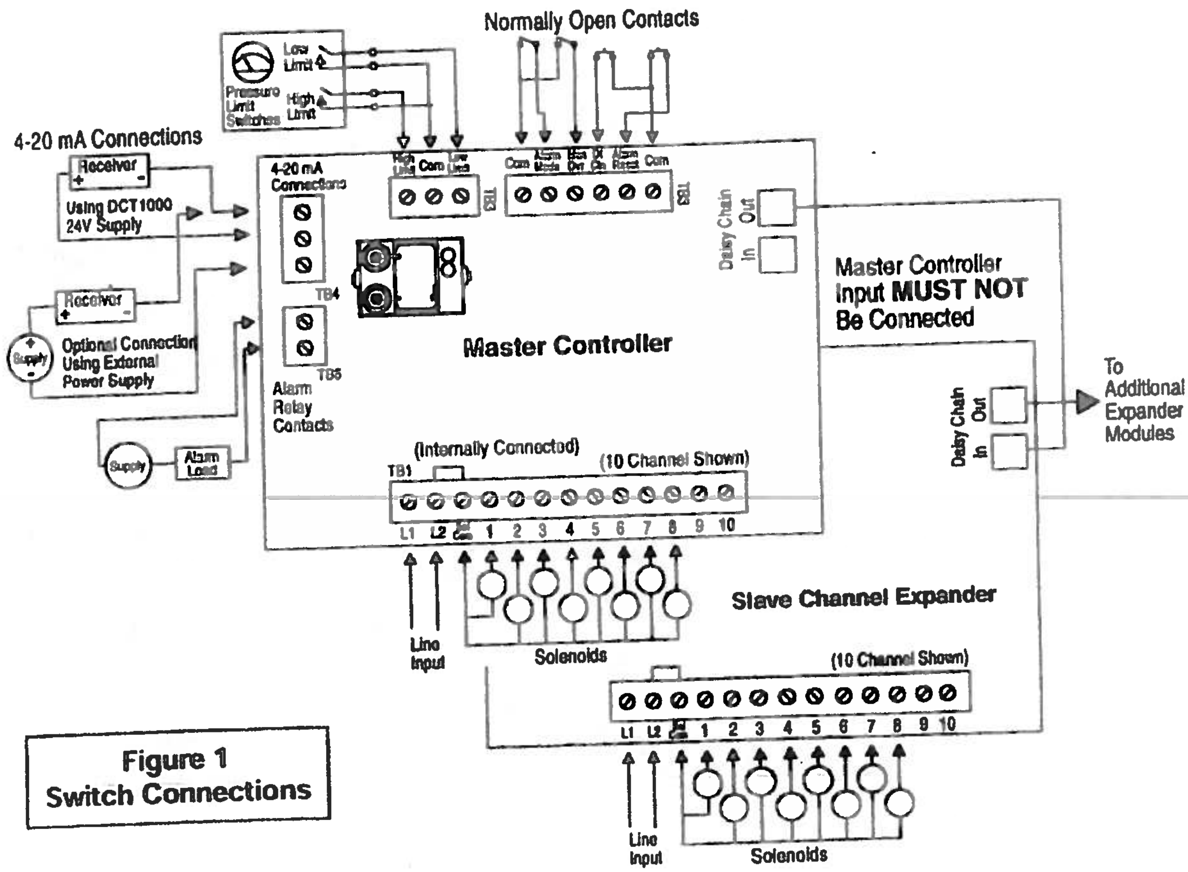


Figure 1
Switch Connections

The Last Output setup selects the last channel to be activated. When first selected, the display will flash the last output available in the system. With single board installations, this will be the number of channels installed, typically 10 or 22. This value becomes more important when multiple modules are installed. The last output value flashed will be the sum of all channels available in the system.

After the last available channel indication has completed, the currently programmed last channel value is displayed. This value may be changed using the Up and Down buttons. The minimum value is one while the maximum value is the maximum number of installed channels, including all expansion modules.

You may restore the factory default setting by pressing both Up and Down simultaneously and holding for about four seconds. The default value is the maximum number of channels. Pressing Select will change the setup mode to Time-Off Setup.

2.2 Time Off Setup

Time off defines the period of time between solenoid activation when no channels are enabled. This may be set between one second and 255 seconds. The factory default is 10 seconds. The display will show the current time off setting when the time off setup mode is entered. The value may be changed using the Up and Down buttons. Pressing both Up and Down simultaneously and holding for approximately four seconds will restore the default value of 10. Pressing the Select switch will change the setup mode to Time-On setup.

2.3 Time On Setup

Time On setup sets the solenoid on time. The display will indicate the currently programmed time on setting. This is measured in milliseconds. Using the Up and Down buttons, the value may be changed. The value may be set between 10-millisecond and 600 msec. in 10 msec. increments. Pressing the Up and Down buttons simultaneously for approximately four seconds will restore the factory default value of 100 msec. Pressing the

Select button will advance the setup mode to the High Limit setup if the pressure module is installed. With no pressure module, it will step to Cycle Delay Setup.

2.4 High Limit Setup

The High Limit Setup, available only with a pressure module installed, sets the pressure at which the cleaning cycle will begin. This value may be between zero and the pressure module calibration pressure. Normally, the High Limit should be above the Low Limit. If, however, the High Limit pressure is set below the Low Limit, the cleaning cycle will begin when the High Limit is exceeded and stop when the pressure falls below the High Limit. The Low Limit in this case will have no effect. Pressing both Up and Down buttons simultaneously and holding for about four seconds will restore the factory setting for High Limit to 5.0" water column (wc). Pressing Select will change the system to the Low Limit Setup mode.

2.5 Low Limit Setup

The operation of the Low Limit, available only with a pressure module installed, is identical to the High Limit except that the default Low Limit pressure is 3.0" wc. The upper settable value is the calibration pressure of the pressure module and the lower limit is zero. Pressing Select will change the system to the High Alarm Setup mode.

2.6 High Alarm Setup

The operation of the High Alarm Setup is identical to the High and Low Limit Setup and is only available when a pressure module is installed. The High Alarm default is 6.0" WC. The upper settable value is the calibration pressure of the pressure module and the lower limit is zero. Pressing Select will change the system to the Low Alarm Setup mode.

2.7 Low Alarm Setup

The operation of the Low Alarm Setup is identical to the High and Low Limit Setup. The Low Alarm default is 1.0" WC. The upper settable value is the calibration pressure of the pressure module and the lower limit is zero. Pressing Select will change the system to the Cycle Delay Setup mode.

2.8 Cycle Delay Setup

The cycle delay inserts a delay time between the end of the last channel and the beginning of the first channel. This may be set to between zero and 255 minutes. The factory default is zero. Setting the value to zero will disable the delay. Pressing Select will change the system to the Down Time Cycles setup mode.

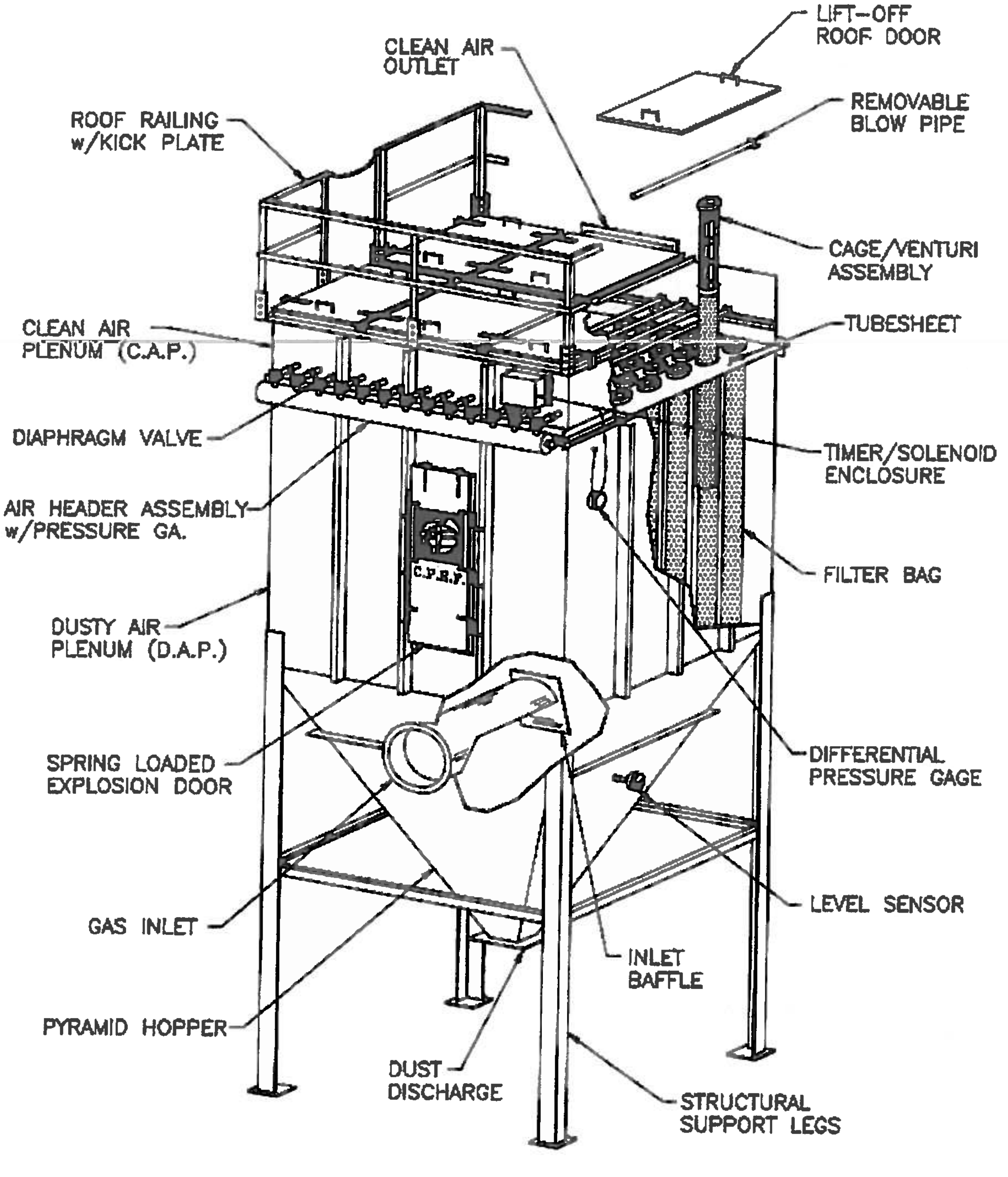
2.9 Down Time Cycles Setup

The Down Time Cycles setup will select a value between zero and 255 minutes. The factory default is one minute. Selecting zero will disable the operation. When the down time cycles is activated by shorting the down time cycles input to the common terminal, the system will enter a forced cleaning mode for the programmed duration. The cycle delay, if one is programmed, will not be inserted in the timing cycle. Pressing Select will change the system to the Auto Alarm Reset Setup mode, if a pressure module is installed, or to Process mode when no pressure module is available.

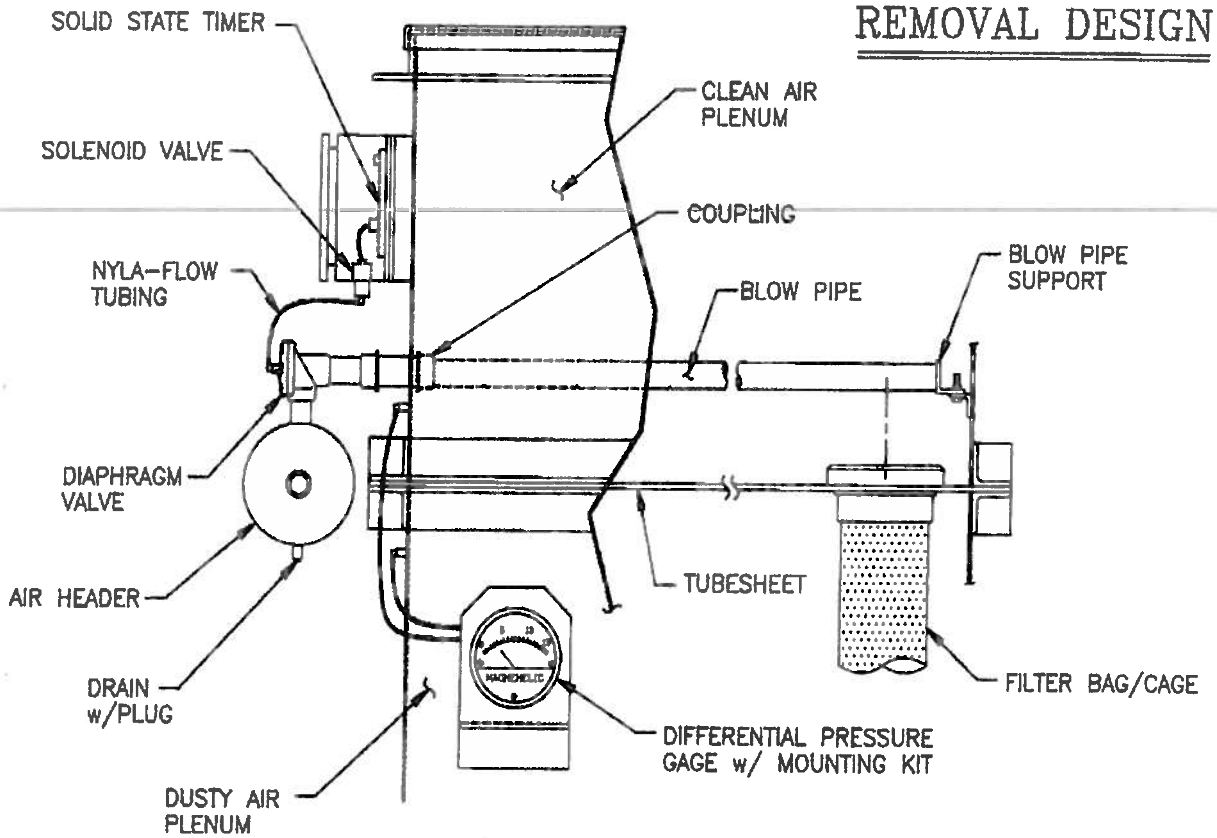
2.10 Auto Alarm Reset Setup

The Auto Alarm Reset Setup, available only when a pressure module is installed, allows the auto alarm reset time to be selected. This value may be set between zero and 255 seconds. The factory default value is five seconds. When the auto alarm reset is enabled by shorting the auto alarm reset terminal to a common terminal, the alarm will be reset after the pressure returns to the normal range and the timeout has expired. Pressing Select will change the system to Process mode.

TOP BAG REMOVAL DESIGN



TOP BAG REMOVAL DESIGN



INSPECTION AND MAINTENANCE LOG

Inspection date	Lubrication	Drive belts					

Stack test run information

ADM, Inc. WO#___________ Date_______________

Time	TPH	°F MIX TEMP	°F PROCESS AIR TEMP	°F STACK TEMP	PRESSURE FUEL	PRESSURE DROP IWC	EXHAUST FAN AMPS

Stack test run information

ADMm, Inc. WO#____________ Date________________

Time	TPH	°F MIX TEMP	°F PROCESS AIR TEMP	°F STACK TEMP	PRESSURE FUEL	PRESSURE DROP IWC	EXHAUST FAN AMPS

Stack test run information

ADM, Inc. WO#___________ Date_______________

Time	TPH	°F MIX TEMP	°F PROCESS AIR TEMP	°F STACK TEMP	PRESSURE FUEL	PRESSURE DROP IWC	EXHAUST FAN AMPS

Process Airflow in a Pulse Jet Baghouse Filter

Helpful Info

A baghouse, otherwise called a dry "fabric filter" dust collector, is a simple air cleaning device. A baghouse is placed between the drying process and the exhaust fan. Particulate laden air is drawn through the hopper by the exhaust fan. Tubular wire cages support the fabric filter bags. The exhaust gases are pulled through the filter bags. The particulate is caught on the fabric filter the same way that the filter in a household furnace or air conditioner collects dust. The clean air is then pulled from the plenum and exhausted.

A large area of fabric filter is needed to adequately clean the large volume of exhaust gases from a drum. The most popular fabric filter shape is the cylindrical filter bag. The filter bags are usually fitted over cylindrical wire forms, called cages, which support the filter bag. Cylindrical filter bags allow a maximum cloth surface area for enclosed space requirements. The filter bags are assembled in the baghouse structure under airtight conditions, to eliminate leakage air into the system. The filter bags have a clean side and a dirty side. The outside of the filter bag in most Hot Mix Asphalt (HMA) facility application is called the dirty side.

Virtually all particles with a diameter larger than 10 microns can be trapped in a well-maintained baghouse. The collection efficiency for particles between 10 microns and one micron in diameter is about 75% to 99%. The efficiency depends on the particle size, moisture content, the size distribution, the air-to-cloth ratio (which determines the pressure drop, which in turn, determines the size of particle that will get through the filter bag), and the structure of the filter-its weave and thickness. For particles smaller than five microns in diameter, the collection efficiency is closer to 75%. The overall efficiency of a baghouse, when normal clean aggregate materials are used, is 99.99%. The baghouse is a dry collector, and as such, offers several advantages over wet collectors. The baghouse returns the dust material to the drum, as the filler required in the mix design. The asphalt cement is injected with the fines in the drum to reduce intrainment of fines in the exhaust gases. The fines may al so be stored for later use. As new environmental standards are being enforced, concerns about wastewater and waste soil disposal accompany the use of a wet collector and settling basins. Baghouse collector efficiencies are improved if adequate maintenance practices are followed. An advantage the baghouse has over the venturi scrubber is its lower energy demands. The development and improvement of synthetic fabrics has intensified the use of such dust collecting systems. Also, the requirement for higher efficiencies and conservation of energy and space has resulted in increased use of the baghouse. The energy needed for cleaning the filter bags generally comes from compressed air or a centrifugal fan.

Important keys, with respect to the effectiveness of the baghouse, are the type of fabric the filter bag is made of, the ratio of the volume of exhaust gases to the exposed area of the fabric (air-to-cloth ratio), the upward air velocities, and the condition of the filter gases. In a Hot Mix Asphalt (HMA) facility, the filter fabric must be able to withstand some abusive conditions. The abrasive characteristics of the aggregate particles impact significantly on the useful life of the filter bag. The repeated flexing of the cloth during the cleaning cycle affects the useful life span of the filter bag. High dust loading particles with sharp edges and particles that are difficult to remove from the filter bag require more frequent cleaning, and tend to reduce the useful life span. When filter bags develop holes from this abuse, or fall off the cages, the clean side of the baghouse will become contaminated and the effectiveness is significantly reduced.

The filter fabric, whether woven or felted, must be dense enough to stop particles smaller than one micron, yet allow the exhaust gas to pass through with little resistance. There are fabrics that have proven effective in handling the high humidity, high dust loading and abrasive particles of the exhaust gas from a drum, as well as the repeated flexing against the cages during the cleaning cycle. A felted woven, high temperature synthetic fabric is generally a good choice. When choosing a fabric, its rated maximum temperature for continuous exposure should be a major consideration. If the cloth is frequently exposed to high temperatures for long periods of time, the life of the filter bag will be shortened. The baghouse filtering process involves the build-up of a cake of dust on the filter bag. As the dust cake builds up, more and more fine material is collected in the cake. At a certain point the cake must be removed, i.e. the filter bag must be cleaned. Therefore the maximum thickness of the cake is determined by the frequency of filter bag cleaning, among other things. However, the effectiveness of the baghouse also depends on the thickness of the cake. If the cake is not allowed to build up enough, dust can pass through the filter bag and leave with the stack gases. The cleaning cycle will vary depending on the dust loading in the exhaust gas and the shape characteristics of the particulate matter. (For example, if a base mix is being produced, the fines entrained in the exhaust gas will be significantly lower than when a surface mix is produced. Therefore, it would not be necessary to clean the filter bags as frequently with a base mix. In the case of a reverse air baghouse, the cleaning cycle generally takes a few seconds, during which time the filter bags in the cell being cleaned are not collecting dust. This often referred to as the filter bags being "off stream". The net result is that there is always one compartment off stream. It occurs for a small percentage of the entire cycle. In the case of a pulsejet baghouse, a shock wave of very short duration does the cleaning; hence there is very little " off stream" time. One or more of the following can cause excessive cake build-up:

1. Cleaning cycle is too slow or the pulse is too short.
2. Condensation of steam on the filter bag exterior.
3. Collection of soot on the filter bags.
4. Collection of unburned oil droplets on the filter bags.
5. Increase in the concentration of fine particles.
6. Light-ends from asphalt cements condensing on filter bag.

10 POSITION TIMER BOARD

Pulsing Cycle

If the pulsing cycle or cleaning cycle is not frequent enough, excessive build-up of fine particles occurs on the filter bags. Increasing the frequency of the cleaning cycle generally cures this. But beware, there are limits on the frequency of filter bag cleaning. In cases where adjusting the cleaning cycle does not improve operation, increasing the cloth area may be required (that is, longer filter bags, to an extent, or more filter bags). Consideration must be given to the air compressor. In order to have a good consistent cleaning cycle, a constant air pressure of 100 to 105 pounds per square inch (psi) should be maintained by the compressor. An undersized compressor or pulsing too frequently may cause the air pressure to drop below desired pressure and not recover sufficiently, resulting in poor filter bag cleaning, high pressure drop and ultimately a failure in the total air and combustion system. Therefore, when setting up the pulse cycle, attention must b e paid to the compressor output and recovery. Consult with the manufacturer's manual on the compressor duty cycle. Some types of piston compressors are **not** designed to manufacture air at a 100-% duty cycle.

Steam Condensation.

It cannot be emphasized often enough that water, in the form of steam, is a by-product of the drying process. While the vaporization or boiling point of water is approximately 212° Fahrenheit, the dew point o f steam (the temperature at which it condenses) varies with amount of water vapor in the gases. When the mixture is 50% (by volume) water vapor and 50% other gases, the dew point is 179° Fahrenheit. At 100% water vapor, the dew point is 212° Fahrenheit. The presence of acid, from sulfur or chlorine in the fuel, can increase the dew point temperature, meaning condensation of the acid will occur at a higher temperature than condensation of the steam. If the baghouse temperature drops below the dew point of the exhaust g as, steam or acid will condense on the filter bags. The particulate will become "glued" to the filter bags, causing them to blind, or clog, with excessive cake build-up (i.e. gases will not be able to pass through the filter bags). The "glued on" particles generally cannot be removed in the cleaning action and operations are forced to shutdown until the baghouse is cleaned out. To avoid this problem, the baghouse should be warmed up prior to introducing the aggregate into the drum, thus insuring that the surface temperature of the filter bags is above the dew point. Warm up is necessary to ensure that air ducts, interior parts, walls, etc. are above the dew point of the exhaust gas prior to passing moist gas through the baghouse. Mud or wet material on the filter bags will foul the filter bag. Careful drying may eliminate the problem, but in severe cases, the filter bags will have to be removed and washed. Equally important is to dry out the baghouse when production is ceased, using the low-fire setting on the burner.

Unburned Fuel Soot

This is an extremely fine carbon residue generated by incomplete combustion of the fuel. Generally, if there is no caking on the filter bag, the soot can clog the filter bags. However, if caking has begun, the soot will cling to the cake and be removed in the cleaning cycle. Under no conditions should soot generation be allowed to continue.

Unburned Oil Droplets.

Oil will basically act in the same manner as condensed steam, in terms of blinding the filter bags. However, the oil increases the chance of combustion occurring in the baghouse. This could result in a baghouse fire (See *NAPA "Safety procedures for the Prevention of Baghouse Fires and Explosions*"). The unburned droplets can be a result of improper atomization of the oil, an improperly functioning burner, or operation of the burner with more fuel than available combustion air (otherwise known as rich operation of the burner). "Over firing" is also a cause of unburned oil in the exhaust gas, a condition that occurs when the system "runs out" of air because the fuel valve has been opened beyond the limits of the exhaust system. Evidence of oil in the filter bags is often indicated by a brownish, greasy appearance. This problem is most likely to occur when heavy oils or waste fuels, which have not been heated to the specified viscosity for the particular burner, are used. In the case of a drum mixer it is difficult to determine whether the appearance of oil on the filter bags is a result of poor combustion or stripping of the asphalt cement.

Particulate Concentration

A change in the concentration of fine particles entering the baghouse generally occurs when the composition of the incoming aggregate is changed. Changing the mix design to one that contains high concentrations of dust and small particles, such as a surface course, or increasing the production rate are the most common ca uses. In this event, the cleaning cycle should be adjusted to a more frequent cycle, as the cake will be developing more quickly than with materials containing a lower concentration of dust and particles. If maximum adjustment is not sufficient t o eliminate clogging, then increasing the cloth area should be considered, which would in effect alter the air-to-cloth ratio. It is generally necessary to install a primary collector before the baghouse in a HMA facility, not only to prolong the life of the filter bags, but also to increase the effectiveness of the bag house. The principle of the parallel drum mixer system would suggest that a sophisticated primary collector is unnecessary. In general, this is true and nothing more than an expansion chamber is required. However, there are mixed opinions in the industry about the need for a primary collector in a drum mixer system. NAPA tests have shown that the variation in particle size and particle size distribution greatly affects the collection efficiency of a baghouse. The large particles that reach the baghouse because a primary collector is no t used can form a very porous cake, creating a low pressure drop across the baghouse. It allows the fine particles to pass through without being collected. When a primary collector is used, the large particles are recovered, so only the smaller particles get to the baghouse, which form a very dense cake. The dense cake will catch the fine particles, as well as increase resistance against the exhaust gases passing through the filter bag. In cases where the primary collector is so efficient that a little amount off "course" particles get to the baghouse, the dust may be so fine that it migrates into and through the filter cloth with out forming a dust cake. A cyclone type of primary collector may have an economic advantage when it is used as a classifier to collect, or "split off," the coarse particles of dust and return them to the hot aggregate as part of the fine aggregate fraction. The dust reclaimed by the baghouse is metered separately into the mix as mineral filler, reducing or eliminating the need to purchase mineral filler. The primary collector also acts as a pre-cooler and drops the exhaust gas temperature as it enters the baghouse. This is advantageous when operating conditions are such that the exhaust gas temperatures are on the high side. However, where the exhaust gas temperatures are lower it could reduce temperatures to the dew point. Hence, it ma y be necessary to insulate the primary collector, or in extreme cases, to heat the exhaust gas as it goes into the baghouse to avoid blinding problems.

Removing the Dust from the Filter Bags.

There are several ways to clean the filter bags. In the HMA Industry, the pulsejet or reverse air methods are the most commonly used. The filter bags are cleaned in small groups, either in a row or in a module. This means that at any one time the filter bags will have varying thickness of "dust cake". Since a baghouse is designed for specific gas volumes, the design will take t his into account. The amount of dust collected in a baghouse depends upon facility capacity and the quantity of fine material in the aggregate stockpiles. When the filter bags are cleaned, the dust falls from the filter bags into collection hoppers in the lower part of the baghouse. Usually there is a screw conveyor in the hopper that is used to move the collected dust to a transfer system, which transports the dust to storage or back into the mix. The dust removal system should be adequately sized to handle the maximum possible amount of dust. Dust discharged from the collection hoppers is either transferred to the boot of the hot elevator by a screw conveyor in a batch facility or directly into the drum of a drum mixer. In either type of facility, the dust may be transferred to a fine bin by a pneumatic system where it can be metered back into the mix or loaded into transport vehicles for sale or disposal. During normal operations the exhaust gas should not get above 350° Fahrenheit (in a drum mixer the temperature should be much closer to 300° Fahrenheit to avoid hydrocarbon smoke problems). However, when something goes wrong, the exhaust gas temperatures can increase significantly. A temperature-sensing device designed so that it can be set for a specific warning temperature should be used in the inlet duct of the baghouse. It can be set up to audibly warn the operator, or to shut down the facility when the warning temperature is sensed. This will protect the filter bags from damage in the event the exhaust gas temperature rises above the operating limit of the filter fabric. Such a temperature rise could be caused by a sudden interruption of the aggregate feed (no cold, wet aggregate to absorb the heat from the burner), or by the start of a fire in the drum. The maxim um temperature limits of the fabric filter should be reviewed. It is preferable to choose one with a maximum temperature limit of about 100° Fahrenheit to 150° Fahrenheit above the 275° Fahrenheit to 325° Fahrenheit exhaust-gas temperatures frequently found in a HMA facility. To ensure that the filter bags never exceed the maximum temperature limit, set the temperature protection device for 50° Fahrenheit **less** than the rated maximum temperature. The temperature protection device is normally set at 400° Fahrenheit, allowing a safety margin to ensure that the filter bags never exceed the 450° Fahrenheit maximum temperature. Probably, the safest protection system is one in which the temperature-sensing device audibly warns the operator, while it starts to systematically shut down the HMA facility and try to determine the cause of the excessive temperatures. While it is important to protect the baghouse from excessively high exhaust gas temperatures, it is equally important to make sure the temperatures don't get too low. Remember that the exhaust gas contains quite a bit of water vapor that was removed from the aggregate in the drying process. As long as the exhaust gas temperature remains above the point at which the vapor will turn into liquid (the dew point) the water will remain as vapor, pass through the baghouse, and exit from the stack. Should the temperature fall below the de w point, the water vapor will condense inside the baghouse, on the filter bags, on the walls and in the bottom. It will mix with dust and form mud, blinding the filter bags and blocking the screw conveyor in the hopper. In areas where cooler ambient temperatures dominate, it may be necessary to insulate the greater part of the baghouse wall area to retain heat and maintain the exhaust gas temperatures above the dew point. Other designs of baghouses are constructed with air spaces on all sides to eliminate the need for insulation. In rare cases, where the drum operating temperature is extremely low resulting in low exhaust gas temperatures (150° Fahrenheit -200° Fahrenheit), flights can be adjusted to raise the exhaust gas temperature. The gas distribution is also very important. If it all flows to one side, t hen the "dead" area will be cool, causing condensation and a s a result, cause corrosion and/or blinded filter bags in local areas.

Start-up procedures for a HMA facility equipped with a baghouse are very important. The burner should be operated at low fire for a brief period of time, with no aggregate in the drum, so that the baghouse is preheated to a temperature above the dew point. This will eliminate the chance of water condensing in the baghouse when the aggregate enters t he drum since the dew point temperature depends on the volume of the exhaust gas, the percentage of moisture in the exhaust gas, and the exhaust gas temperature. When shutting down the H MA facility, the baghouse should be dried out before the exhaust fan is also shut down, as previously mentioned. Experience will determine just how much preheating is necessary. General recommendation is the procedure run for about five minutes. The compressed air system is frequently referred to as a pulsejet cleaning system. In this system, the open end of the filter bag is fitted over a venturi shaped cylinder. A jet of compressed air is introduced into the filter bag through the venturi, creating a shock wave, which travels down the filter bag. When the filter bag is hit by the shock wave the dust cake is knocked off the fabric and drops into the collecting hopper. Then the filter bags go back on stream. The total cleaning cycle takes about 1/10 of a second. The system using a centrifugal fan is generally referred to as a reverse air cleaning system. In this system the filter bags are arranged in compartments. The compartments are cleaned individually and sequentially. At the beginning of the cleaning cycle, the compartment is closed off from the rest of the baghouse by a damper. Medium pressure air enters the compartment and goes into the filter bag. The filter bag appears to expand and collapse, shocking off the dust cake. The centrifugal fan or reverse air system is ideal for HMA facilities using coal as the primary fuel. The ash gene rated by coal burning is generally lightweight and almost spherical. In the pulse jet system, however, everything happens so quickly, that many times the coal ash is sucked back onto the filter bag, which can eventually lead to blinding. In the reverse air system, the cleaning cycle of the compartment can be adjusted to stay off-stream until the ash settles to the bottom of t he baghouse. All these systems would operate with air- to-cloth ratios in the neighborhood of 5:1 to 6:1, but it really depends on the individual application such as operating conditions, dust characteristics, etc. When a coal burner system is being used, the most important factor involved with the baghouse is the air-to-cloth ratio, regardless of whether it is a pulsejet cleaning system or a reverse air cleaning system. The air-to-cloth ratio preferred by manufacturers is about 4:1 to 5:1. This is also true when processing slag aggregates. However, there are many baghouse collectors with a 7:1 air-to-cloth ratio that are working well at meeting the NSPS emission limits. New fabrics and energy sources continue to improve the performance and desirability of baghouse systems.

The Baghouse and Exhaust Fan at Work Together

The addition of a baghouse to the drum system makes the whole system more sensitive to pressure. Depending on its design, the overall pressure demands can change. As the dust cake forms on the filter bag, the exhaust gas flow through the filter bag is increasingly restricted, causing an increase in the pressure drop through the baghouse (that is, the difference in pressure between the clean side of the filter bag and the dirty side). If the system pressure is not adjusted to accommodate the baghouse, a cycle of events can begin that can cause baghouse failure.

The Regenerative Cycle.

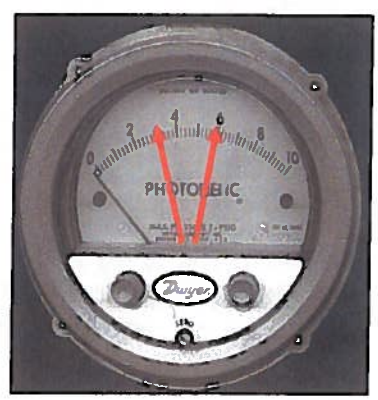
Abnormal build-up of particulate on the surface of the filter bag initiates a cycle which become s self sustaining or regenerative. The cycle begins with an abnormal build-up on the filter bag surface. This increases the pressure drop across the baghouse in increasing the pressure differential between the clean side of the filter bag and the dirty side. An increase in pressure drop across the bag house decreases the suction at all other points in the system. Remember the drum is a closed system with respect to system pressure. The overall system pressure does not change unless the exhaust fan capacity is altered.) The most likely points affected in the system are the points of total leakage and combustion air entry into the system. A decrease in suction at the burner means a decrease in the amount of combustion air drawn into the drum. Reduced combustion air will result in incomplete combustion, if the fuel firing rate is not reduced accordingly there is a decrease in the heat output, and less heat means less BTUs are available per unit of aggregate (assuming the production rate has not changed). As a result, the aggregate leaves the drum at a lower temperature. Furthermore, blinding of the filter bags can occur as a result of unburned fuel and moisture condensation from a lower exhaust gas temperature. These problems create air pollution problems, waste energy, and affect production levels. The lower aggregate temperature is sensed by the control thermocouple, which immediately increases the fuel flow to t he burner in an attempt to increase the drum temperature. Since the burner is already suffering from a shortage of combustion air, the added fuel cannot be consumed. This causes the formation of soot or unburned oil droplets. Additionally, the reduced heat output results in cooler gas temperatures. The net result is clogging of the filter bags by soot, oil droplets and/or steam condensation (as described previously). The clogging increases the pressure drop across the baghouse and the cycle begins a gain. All of this happens so quickly, that the operator only sees a drop in the material temperature, and in some extreme cases, black smoke at the stack. At this point, the system should be shut down; it must not be allowed to continue. The baghouse should be inspected to determine what caused the blinding of the filter bags. From there, system adjustments can be made to get the facility operating properly again.

MAINTENANCE

Proper maintenance is necessary to ensure maximum performance for filter bag cleaning systems generally used in baghouse operations at a HMA facility: Pulse jet cleaning.

The air damper should be adjusted so that adequate secondary airflow is provided at the burner end of the drum to ensure complete combustion. However, avoid excess airflow to prevent overload of the exhaust fan motor and excessive abrasion of the filter bags. Also, too much excess air results in a high air-to-cloth ratio, which is unnecessary. Keep the internal collector temperature above the dew point of the exhaust gas, as condensation will cause plugging. **If the dew point is unknown, it is best to keep the temperature of the exhaust gas at 250°** Fahrenheit **or higher when it enters the baghouse.** A temperature of 220° Fahrenheit at the exhaust fan inlet will generally ensure satisfactory operation. Poor combustion of oil, especially when operating on blended, used, or heavy fuel oils, creates carbon and unburned fuel that can blind the filter bags. When condensation is also present, acids may form, causing deterioration of the collector surfaces and corrosion of the filter bag cages, resulting in rapid abrasion o f the filter bags. A rapid check of the combustion efficiency can be made by checking for the presence of oil in the collected dust using the following steps:

1. Obtain a sample of collected dust.
2. Mix with water until soupy.
3. After settling, an oily film will develop on the water surface if oil is present (Note: In the case of a drum mixer, the oily film might be asphalt condensate.). Since the baghouse is operating under a negative static pressure (suction), moisture can leak into the collector at panel joints or other areas that were not properly sealed during construction. Caulk with epoxy or silicone rubber sealant, after properly cleaning the area. When shutting down the baghouse it should be dried out. During this drying out period, the pulsing sequence should not be operating. This pulsing of the system would remove the dust cake from the filter bags. In the past it was believed that the dust cake should be removed from the filter bags each time the HMA facility was shut down. However, unless shutting down for extended periods of time or in cold weather, this procedure is not recommended. This is particularly important in systems using the direct feed method of returning the baghouse fines to the mix. If the cake is removed from the filter bags, the next time the HMA facility is started up, there could be a shortage of fines in the mix until the filter cake builds up again. Some manufacturers don't pulse the baghouse when the asphalt cement flow into the drum is stopped (generally diverted to "re-circulate"). The burner should be operated on low fire for a short time, until the system has been dried out. The normal static pressure drop across the baghouse may vary over a wide range.



Typically it would be 3" to 6" water column (IWC.) for a pulse jet system (the lower end of range is preferred). Operating at pressure drops above the normal operating range can cause excessive wear of the filter bags. The high-pressure drop should serve as a warning that something unpleasant may be happening in the baghouse. Following are some typical problems that will occur during the life of a filter bag, along with suggestions to minimize their effects on the equipment.

Wear at the Bottom of the Filter Bag

Very abrasive material will cause this. If wear at the bottom of the filter bag is a problem, one should consider installing a pre-cleaning system or proper baffling at the inlet. Minimize the excess air to decrease the operating air-to-cloth ratio, the particle velocity in the baghouse, and size of the particle that is carried out of the drum.

External Wear

The filter bags are too loose, and they rub against each other during the pulsing cycle. If they cannot be snugged up on the wire cages, it may be necessary to replace them with ones that will fit the cage tightly. If there are any questions about how the filter bag should fit, consult with the filter bag manufacturer. Generally, a slight "pinch" lap is necessary.

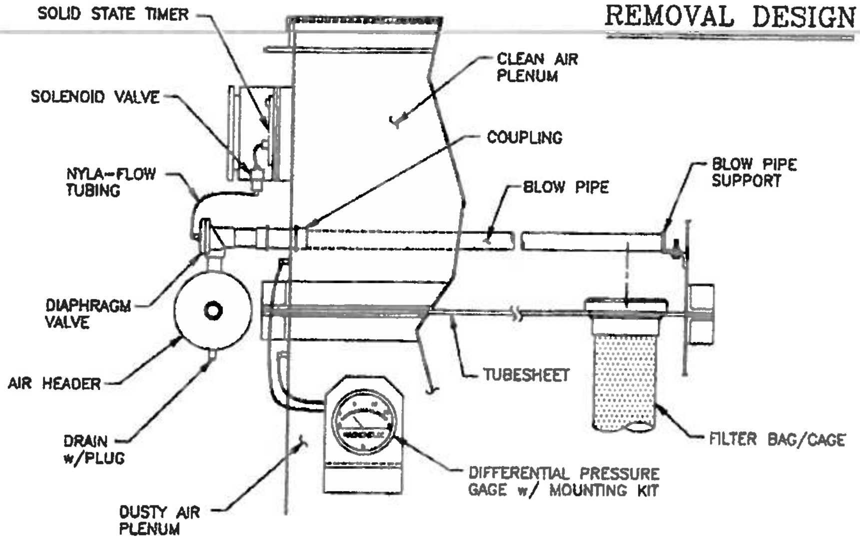
Internal Wear

The presence of dust on the "clean air" side of a filter bag can rapidly deteriorate the inside of the filter bag when the dust becomes entrained in the pulse of the cleaning air. Dust can usually be seen on the top of the tube sheet and in the bottom of the filter bags. However, a good way to determine the inside condition of the filter bags is to take one from the baghouse and cut in lengthwise. Check the insides visually for cage wear. This is usually where dust bleed-through occurs. Clean the baghouse collector and replace or repair the deteriorated filter bags.

Misarranged Cleaning Air

f the cleaning air jet is out of alignment it will jettison the air at the filter-cloth, instead of straight into the filter bag, and will quickly wear out the inside top of the filter bag. Adjust the air jet so that the cleaning air is jettisoned straight into the filter bag, add a cuff to the filter bag, or insert a shield.

TOP BAG REMOVAL DESIGN



Corroded Cages

If the cages become corroded, the coarseness of the rust may cause severe abrasion where the filter fabric is in contact with the cage wire. If corroded cages are a problem, check the combustion efficiency for possible condensation. Also, check the halogen levels (particularly chloride) if used or reprocessed oil is being burned. Chloride can also enter the system if ocean sand is used or from nitrate blasting explosives. If acids are expected to be a problem, corrosion-resistant wire should be used for cage construction.

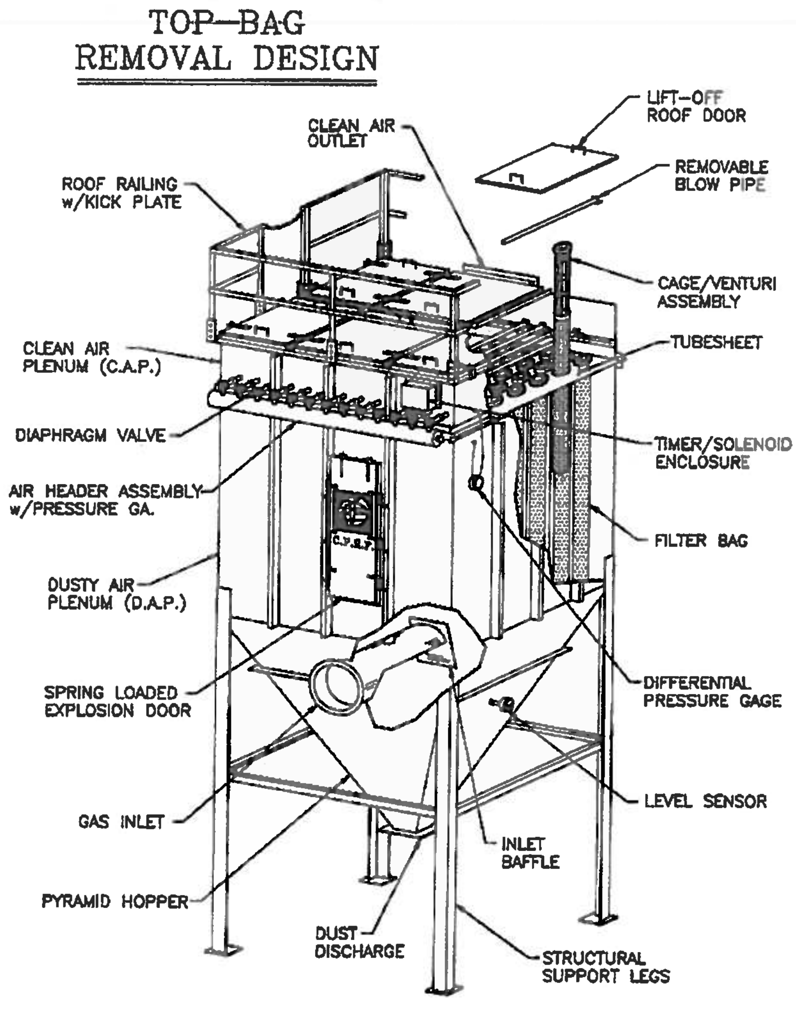
Holes and Burning

Hot glowing particles carried into the baghouse may singe the filter bags and cause holes. This problem would require a pre-cleaner or screen. The glowing particles frequently originate from failing refractory lining in the ignition cone and combustion chamber or foreign combustible materials in the aggregate or RAP. If the gas temperature exceeds 400° Fahrenheit for an extended period, the filter bags will deteriorate rapidly. Deterioration is evidenced by browned easy to tear filter fabric. The filter bag life can be longer if the exhaust gas temperature is maintained as low as practical.

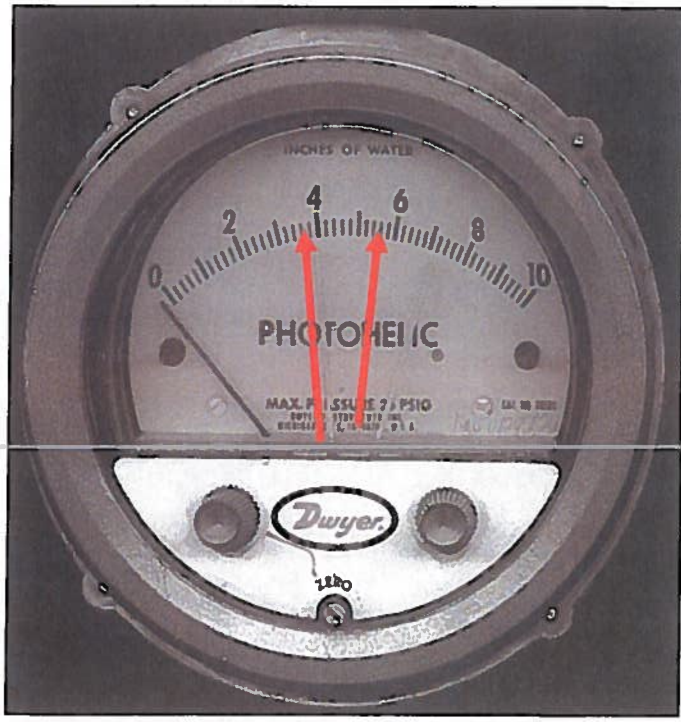
Acid Condensation

Sulfuric acid and hydrochloric acid are formed when sulfur or chlorine is present in the fuel or aggregate. These acids will con dense on the filter bags when the exhaust gas temperature reaches the dew point of the acid vapor. Both of these acids will start to eat away at the filter cloth and result in holes. If this should occur, it may be necessary to add lime to aggregate or increase the exhaust gas temperature. Lime is used to absorb and neutralize the acid. All baghouses have some areas where the filter bags are subjected to greater stresses by abrasion or temperature. A periodic inspection schedule for the filter bags should discover the ones that are failing.

Probably the easiest type of filter bag inspection is the black light test. This test must take place in the dark. A fluorescent powder is pulled through the baghouse by the exhaust fan. After the exhaust fan is shut down, the tube sheet of the baghouse is inspected with a black light. If a filter bag is leaking, there will be a significant accumulation of the fluorescent powder around the top of the filter bag or the tube sheet. For the longest filter bag and compressor life, the frequency of the cleaning cycle should be periodically checked and readjusted for a maximum interval, consistent with the desired pressure drop, the required secondary air flow at the burner and the amount of baghouse fines required in the mix. The life of an individual filter bag may al so be extended by patching small holes and worn areas. Small repair patches may be attached with a high temperature adhesive; other must be sewn onto the filter bag. Some filter bags can be cleaned or reused. The thing to consider when deciding to clean and repair the filter bags, versus purchasing new ones, is the wear life left in the filter bag. Try to rip the filter bag from the hole to determine if there is adequate life left in the filter bag. If the fabric can be ripped at all, it has marginal value left and replacing the worn filter bag with a new one is necessary. Washing the filter bag may be enough if the soil is not oily (filter bags of blended fibers should not be washed unless it is recommended by the filter bag supplier). In the case of oil on the filter bags, dry cleaning may be required. Procedures used by conventional industrial laundries will normally prove satisfactory. It may be best to have a couple of filter bags cleaned by the cleaner to check for shrinkage and other problems before sending all of them to t he cleaners. It is preferable to do final drying on the cages in the baghouse if at all possible. When repairing broken seams and patching holes, use sewing thread appropriate for the filter fabric. Most industrial laundry services are equipped to do such rep air work. For small holes, a high temperature silicone can be used to seal these spots. Cleaning components that malfunction, such as pilot valves, pulse valves or plenum valves, can cause uneven and inadequate cleaning, reducing the system "air" (reduced drum capacity) and increasing dust emissions. Poor compressor pressure will also affect the cleaning air. A compressor that is unable to maintain the required pressure for knocking the dust from the filter bags may be worn, or a valve is leaking due to a damaged diaphragm or its failure to close. Air leaking into the clean air plenum indicates a faulty diaphragm, while leakage out of the plenum indicates a faulty pilot valve. Car e must be taken not to increase the pressure too much, because too much air pressure will shorten the life of the filter bags and other components. It is important to insure that the compressor air is clean and oil-free. This is best achieved by installing a moisture trap or coalescing filter to remove oil and condensation from the compressed air. It is preferable to install these filters upstream of the baghouse.



Photohelic



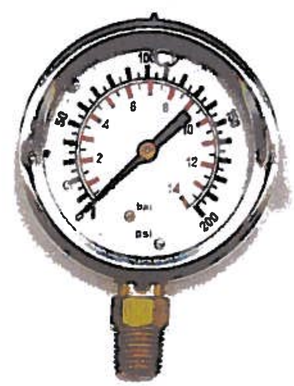
The purpose of the "Photohelic" is to measure the amount of vacuum or pressure drop across the baghouse tubesheet. With the damper closed, approximately 0 inches of water (IWC) can be read. As the damper is opened more pressure is seen.

Use the damper to achieve correct airflow. Close the damper before the exhaust fan motor is started. This reduces the load for the exhaust fan motor and the load on the generator or power source. Open the damper and increase the burner for normal production. To obtain maximum efficiency of the plant burner, open the damper to achieve 0.5 INWC at the burner breaching. If wisps of black smoke appear at the burner end of the drum, the suction is not enough. A Magnehelic or Photohelic can be used to show suction at the burner end of the unit.

When running the plant at full production, a pressure drop of 3-6 inches of water pressure should be seen on the photohelic.

Photohelic units are mounted inside of a box for protection from sunlight. The bright sunlight may effect the sensors in the unit.

Air Pressure



The pulse jet baghouse cleaning system is designed to remove the particulate on the felt bags inside of the Baghouse unit. If the bags are not cleaned and kept at 3-6 +/- 1 inch of water column of pressure drop, the airflow will be lowered. Wear and bleed through is much higher when the pressure drop is below or above the set points.

The normal air supply pressure should be set **at 90 to 100 pounds per square inch (PSI). The timer should be set for on time of 0.15 seconds and 8 - 20 seconds off time.**

Efficient Asphalt Mix Production

Helpful Hints

"How can I get more production out of the plant and lower the production costs per ton?"

It will not depend on what part of the world, or the type of plant you own, this question will almost always come up. Follow below to learn several ways to answer this often asked question.

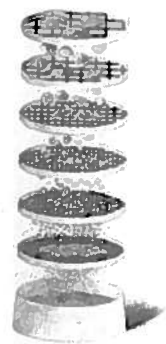
MOISTURE

Manufactures of asphalt equipment build equipment with a rated *Ton Per Hour* at a given percent of moisture and discharge temperature. The moisture rating is normally 5 percent. If moisture levels are higher, an average of 10 percent or higher production decrease can be expected per one-percent moisture rise.

Some attention should be applied to the material handling to help reduce the moisture percentage. The loader can be used to aerate the aggregate piles. The loader operator should work around the edge of the piles to get the dryer material. The aggregate piles should be on a surface that slopes away from the other piles of material. This will allow water to run away from the materials.

If the moisture levels are below the manufacturer's rating of the equipment and the production rates are low. Several other items may cause low production rates.

MATERIALS



Gradations of the virgin aggregate should be performed to insure specification. If the materials have a large amount of fines, production levels may be lowered. More liquid asphalt is needed for the fine material to get good compaction. With fine materials, an increase in fuel consumption can be expected. Using clean washed materials will enable higher production rates, lower fuel consumption and use less liquid asphalt oil. Spending a little extra for good materials will not only increase production and lower costs, but also produce a better product.

EXHAUST FLOW

The exhaust system has a dramatic effect on asphalt mix production system. For example, if an open fired burner is used on the plant, most do not realize that the exhaust fan supplies 60% to 70% of the air needed for complete combustion. The exhaust system removes moisture and the products of combustion.

If a change in production occurs, and moisture percentages have not changed, the problem could be something as simple as tightening or changing the belts on the exhaust fan. By recording of the exhaust fan amperages, a record can be used to see loses in the exhaust system.

If a bag house is used for pollution control, a manometer (slack tube, magnehelic, or photohelic) is used for measuring the differential pressure across the bags. A high pressure reading (8+ inches) may cause a low airflow. A high pressure may indicate the cleaning cycle may be out of adjustment. On a jet pulse baghouse the air solenoids may not be functioning correctly. The air used for the cleaning of the filter bags should be free of moisture and oil. Draining the air compressor tank daily should be a standard maintenance procedure.

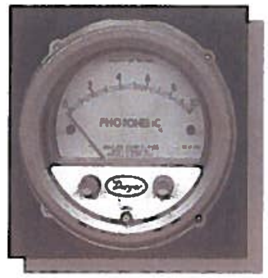
The process air temperature will have dramatic affects to the volume of air, which, can be pulled through the fan and system. As the temperature increases, the air density is thinner and more energy is needed to pass the correct airflow for production. If the air flow temperatures are above normal, several items may need attention. Flights may need replaced or upgraded for a more efficient heat transfers.

Aggregate moistures may have dramatic effects causing high process temperatures. See material handling.

These are only a few items, which can help find problems with asphalt production.

COMBUSTION EFFICIENCY

Burner efficiency can be approached in several ways. A burner has a maximum BTU rating. The rating is determined by the flow of fuel and air supplied from the blowers. Depending on the types of fuels used, some type of flow meter is used in the fuel delivery system. If natural gas is used, an orifice plate and manometer should be installed in the gas line to measure flow. The flow meters should be used to calculate actual fuel flows. These devices should be checked periodically and readings used for analysis of the production. The blower fan or fans should also be inspected for dirt and or wear. If the blower does not operate smoothly, a problem may exist. The blowers can be checked for correct pressures, by using an ounce gauge or magnehelic. Low-pressure readings may indicate possible impeller problems. An inspection of the burner body should performed often to remove or detect blockage from material or other foreign debris.



During firing conditions an analyzer should be applied into the exhaust stack, cross duct or the drum depending on the type of plant. The analyzer will measure combustion efficiency by the oxygen and carbon dioxide and carbon monoxide levels. The combustion efficiency is corrected from these readings. It is a good idea to have this testing performed once a year. This analysis may uncover problems in system. Unburned fuel could be passing through the exhaust system can cause further problems. Unburned fuel may collect in a bag house. This unburned fuel may block or blind the bags. This may have a big impact on bag life and determine the amount of air pulled through the filter bags. The unburned fuel may even cause a baghouse fire.

CONTROL OF AIR FLOWS AND FUEL MANAGEMENT

Airflow has a critical influence in a HMA (Hot Mix Asphalt) facility. Production rates, air quality, fuel usage, wear, electrical usage, and most significantly the dollars saved, all depend on the airflow.

Even though the airflow is such an important part, most plant operators still don't know how to use it to its full potential. For most, the costs and information involved seems unimportant to their facility. In most cases, any increased costs are low compared to the benefits gained.

The best way to control air flow and fuel management is by using a combustion analyzer, but its cost is the highest. The analyzer will show accurately how much air is needed to burn fuel efficiently and how much air is needlessly heated.

Some of following airflow information may be used to influence some procedures to correctly operate your HMA facility. This information can help maximize your bottom dollar and also help the many other (above) issues, which are just important to the facility.

Most discuss excess air in a HMA facility in terms of "maximum operation parameters" such as 12% to 22% to completely burn natural gas and 25% to 35% to burn lighter oils. It is important to give some information that specifies the amount to which excess air is wasteful and also the amount to which a lack of air becomes even more wasteful.

First, let us look at excess air in HMA facility. Excess air can be wasteful in many ways.

1. Fuel consumption increase as a result of increased ambient air drawn into the system, which needs energy to reach the temperature of the exhaust gases.
2. Decrease in production. The excess air can be replaced with the products of combustion (burner) and steam from the wet aggregates.
3. An increase of the exhaust gas velocity through the drum. This increases intrainment of fines in the exhaust gas, which decreases the collection efficiency of the pollution control devices. It is especially worse in a HMA facility equipped with a wet scrubber, because the fines are not returned to the mix as they are when a Baghouse is used.
4. A decrease in the retention time of air flow in the drum. This will decrease the contact time between the mix and the exhaust gas. As the two stay in contact less, less heat is transferred from the exhaust gases into the mix, resulting in higher exhaust gas temperature.
5. Electrical costs increase from the load on the exhaust fan motor, when production rates are lower than the maximum capacity and rated moistures.

The difference in efficiency at 300° Fahrenheit (148° Celsius) and between 25% excess air to 90% excess air is only about 4 1/2% when burning natural gas and 4% when burning light oil.

Although, if a HMA facility ran at 25% excess air instead of 90%, production could be potentially increased from 75% to 100% or a 33% increase (IS-52 page 2-11). Production as effected by excess air, is far more important and significant than the effects on efficiency.

If we also review information on the waste of fuel from the lack of air, some startling observations can be made.

For example, in burning natural gas, a perfect ratio requires about 10 cubic feet of air to 1 cubic foot of gas at 0% excess air, under perfect conditions. If 10% of air was deficient, then a 10% loss of efficiency occurs due to unburned fuel.

With the many changes of the asphalt production process, it is easy to have the airflow vary 10% to 20%. To avoid losing 10% to 20% in efficiency, an increase in the exhaust flow is suggested. Efficiencies should be much lower if excess air is slightly higher rather than the lack of air for combustion.

One will ask, "**How do we get the correct information and then know how to control the air flow?**" Most people have learned to run a HMA facility by several different ways. If a combustion analyzer and information about draft are available in the early stages of the learning of HMA production, the HMA facility is probably being run more efficiently than most. Before the analyzer, others have been trained to close the damper until the drum puffs and then just open the damper slightly. Some set the damper or the amps of the exhaust fan motor to a certain position. Some operators do not understand what the damper does to the airflow. This lack of understanding still allows the production of asphalt mix, but at a significant effect on the operating costs.

Adjustments to the exhaust flow can be controlled by several ways. The best control is by an automatic damper control system, which the operator presets the static pressure on the controller. The automatic system will control the draft at the burner, constantly making adjustments. The automatic system will not be able to control an inadequate amount of airflow. Using a manual operated system requires complete attention, to compensate for the many changes in the production process.

A. Moisture and production rates

B. System static losses

C. Pollution control static pressure

D. Percentage of burner (fuel and air)

E. Flame characteristics

F. Ambient aggregate and air temperatures

G. Retention of materials

H. Process air and mix temperatures

I. Stack or fan temperatures

J. Altitude and/or atmospheric pressures

Both ways of control should consist of a sensing line from the burner breaching to a measuring device; magnehelic, photohelic, pressure transmitter and/or slack tube manometer. Even a piece of clear tubing mounted in a u-shape, colored water, and a tape measure can be used.

Suction pressures are normally expressed in ("IWC) "inches of water column". This is the actual measurement of the displacement of water in inches. If the water lifts 2.25" in a tube with the open end to atmosphere, then the suction pressure is 2.25" WC or 2.25" WC.

The burner manufacturers and HMA manufacturers have suction pressures designed for different processes.

For example, an open fired burner may need 0.20" WC at low fire to possibly 0.50" WC or higher at a high fire or percentage of burner. These pressures are very small in comparison to the actual pressures, which can be produced or lost in a HMA facility. Thus, the better the suction at the burner can be viewed and controlled; the more accurate the air flow and fuel management can be controlled.

The manuals supplied for the burner give the information to maintain process parameters.

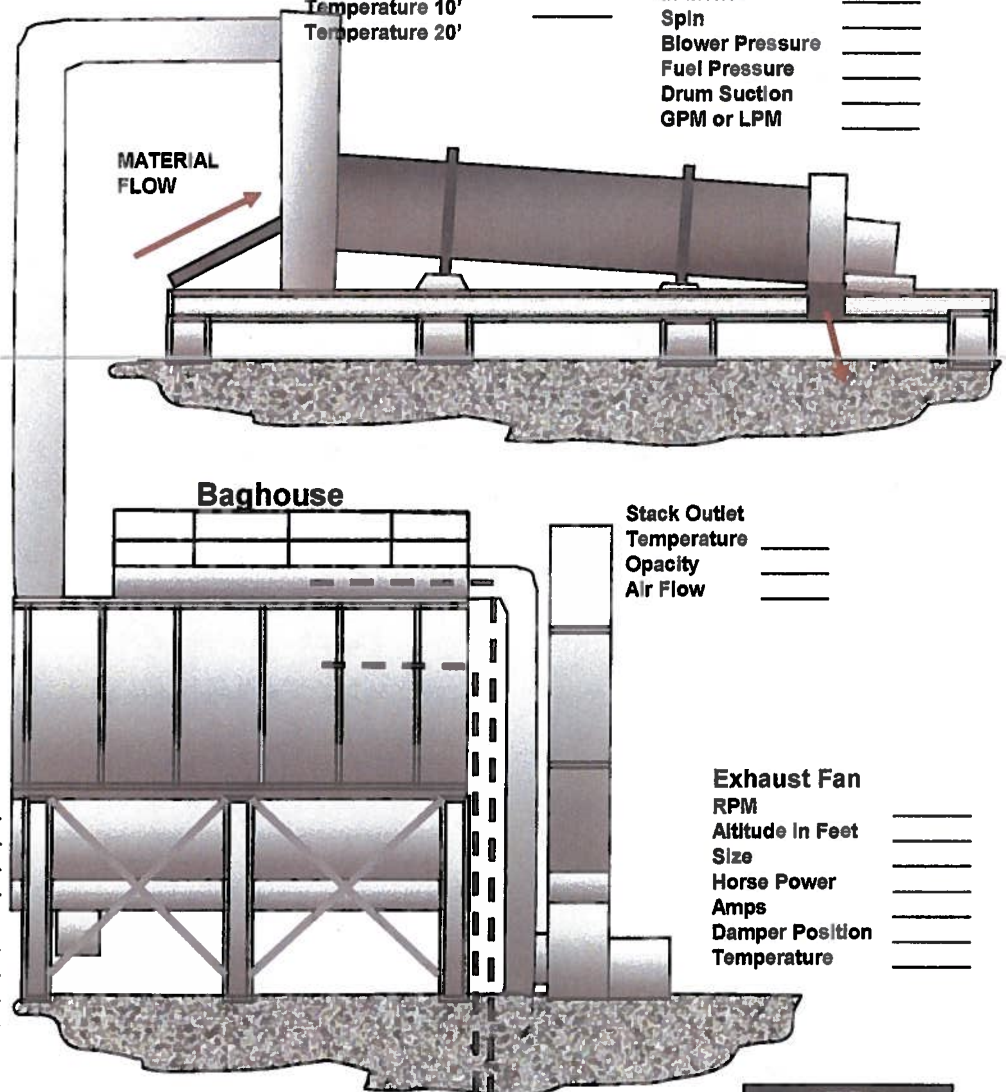
Analysis Sheet for Counter-Flow Plant with Baghouse

Trouble Shoot

Drum Mixer
Serial Number ______
Model Number ______
Ton Per Hour
In Operation ______

Drum Zones
Outside Shell Temperature from Burner End
Temperature 2' ______
Temperature 6' ______
Temperature 10' ______
Temperature 20'

Burner
Fuel Type ______
Altitude in Feet ______
Size ______
Nozzle Adjust in Inches ______
Spin ______
Blower Pressure ______
Fuel Pressure ______
Drum Suction ______
GPM or LPM ______



Process Air
Air Temperature ______
Altitude in Feet ______
Size ______
Nozzle Adjust in Inches ______
Spin ______
Blower Pressure ______
Fuel Pressure ______
Drum Suction ______

Baghouse Inlet
Temperature ______
Suction Pressure ______

Stack Outlet
Temperature ______
Opacity ______
Air Flow ______

Vane Feeder
RPM ______
Size ______
Horse Power ______
Amps ______

Baghouse Screw
RPM ______
Size ______
Horse Power ______
Amps ______

Exhaust Fan
RPM ______
Altitude in Feet ______
Size ______
Horse Power ______
Amps ______
Damper Position ______
Temperature ______

Photohelic
Inches of water differential ______
On Time ______
Off Time ______

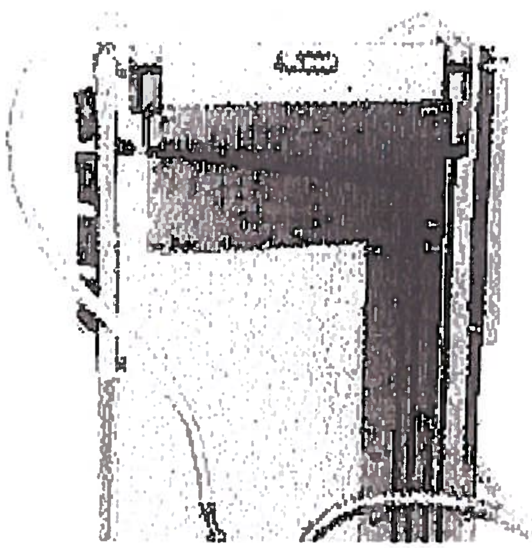
Plant Data Air Flow Survey Instructions

Note: Survey should be taken in a straight run of ducting or stack free of obstructions and area changes.

Airflow can be taken at different locations to show airflow at certain locations. The stack will show total system flows.

Survey Procedures

1. Follow data Sheet (next page) procedure. Obtain all data possible.
2. Make as complete a survey as possible with as many points as possible.
3. Use a 0 to 3-inch draft gage type manometer connecting the total pressure tap to high-pressure side and static pressure tap to low pressure. The pitot tube reads differential which is velocity pressure.
4. Choose the survey location. Measure the duct and determine where to insert pitot for point survey.
5. Zero and level gage. Start production and insert pitot into duct or stack parallel to duct sides and flow. Read each reading and record. Take the square root of each and average the velocity pressure. $\sqrt{V.P.}$
6. Measure duct, air temperature, and record. Calculate area and velocity. Also, measure suction upstream fan, pressure downstream fan, fan speed, motor speed, amps, volts, and nameplate data at the time survey is taken.
7. If possible measure oxygen levels.



PLANT AIR FLOW DATA SHEET

DATE ____________________ PERFORMED BY ______________

CUSTOMER____________________

____

BAGHOUSE ☐ WET WASH ☐

EXHAUST FAN MODEL AND RPM

____

MOTOR HP______ RATED AMPS______

ACTUAL AMPS

DUCT SIZE____________________

DUCT AREA________ SQUARE FEET___

TEST LOCATION____________________

DAMPER POSITION____________________

BURNER BLOWER ON ☐ OFF ☐

CORRECTION TABLES

MOISTURE WET WASH STACK TEMP.	MCF	ALTITUDE ALT. FT	ACF
140	1.04	1000	0.96
150	1.05	2000	0.93
160	1.07	3000	0.90
170	1.09	4000	0.86
180	1.11	5000	0.83
BAGHOUSE = 1.05		6000	0.80
		7000	0.77

TRAVERSE	$\sqrt{TR}$	TEMPERATURE
TOTALS		
AVERAGE		

ABSOLUTE TEMPERATURE

AVG TEMP. *ABSOLUTE TEMP.*

(   ) + 460 = (   )

Multiple by 0.84 if using a s-tube.

$$(174)\times\left(AVERAGE\sqrt{TR}\right)\times\sqrt{ABSOLUTETEMP.}\times(DUCTAREA)\times\sqrt{\frac{29.92}{BARPRESS.ACF}}\times(MCF)\sum ACFM$$

$$(174)\times(\_\_\_\_\_\_)\times(\_\_\_\_\_\_)\times(\_\_\_\_\_\_)\times(\_\_\_\_\_\_)\times(\_\_\_)\sum \_\_\_\_ ACFM$$

NOTES____

PLANT AIR FLOW DATA SHEET

DATE ____________________ PERFORMED BY ______________

CUSTOMER____________________

____

BAGHOUSE ☐ WET WASH ☐

EXHAUST FAN MODEL AND RPM

____

MOTOR HP______ RATED AMPS______

ACTUAL AMPS ____________________

DUCT SIZE____________________

DUCT AREA________ SQUARE FEET___

TEST LOCATION____________________

DAMPER POSITION____________________

BURNER BLOWER ON ☐ OFF ☐

CORRECTION TABLES

MOISTURE — ALTITUDE

WET WASH

STACK TEMP.	MCF	ALT. FT	ACF
140	1.04	1000	0.96
150	1.05	2000	0.93
160	1.07	3000	0.90
170	1.09	4000	0.86
180	1.11	5000	0.83
BAGHOUSE = 1.05		6000	0.80
		7000	0.77

TRAVERSE	$\sqrt{TR}$	TEMPERATURE
TOTALS		
AVERAGE		

ABSOLUTE TEMPERATURE

AVG. TEMP. *ABSOLUTE TEMP.*

( ) + 460 = ( )

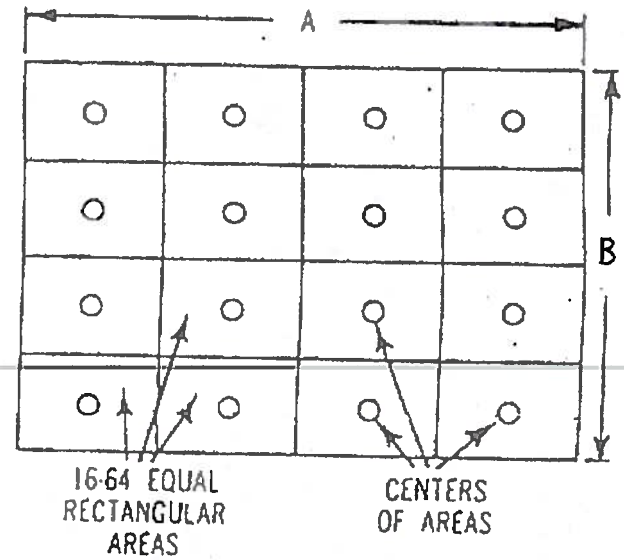
Multiple by 0.84 if using a s-tube.

$$(174)\times\left(AVERAGE\sqrt{TR}\right)\times\sqrt{ABSOLUTETEMP.}\times(DUCTAREA)\times\sqrt{\frac{29.92}{BARPRESS.ACF}}\times(MCF)\sum ACFM$$

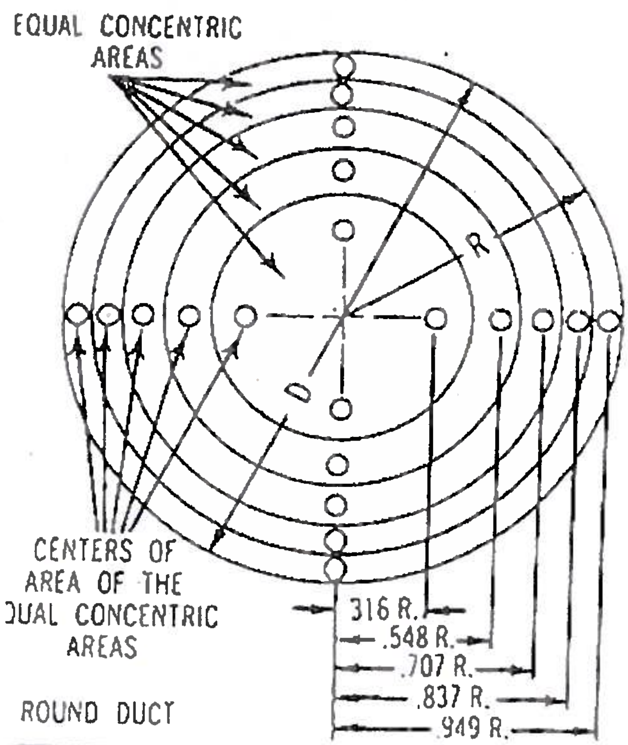
$$(174)\times(\_\_\_\_\_\_)\times(\_\_\_\_\_\_)\times(\_\_\_\_\_\_)\times(\_\_\_\_\_\_)\times(\_\_\_)\sum \_\_\_\_\_\_ ACFM$$

NOTES____________________

PITOT TUBE STATIONS INDICATED BY ○



RECTANGULAR DUCT



ROUND DUCT

OPERATION AND MAINTENANCE MANUAL

1.0 INTRODUCTION

1.1 SHIPPING AND RECEIVING

1. Most dust collectors will be shipped in one (1) piece, with the clean air plenum, tubesheet, dusty air plenum and hopper (when applicable) completely assembled. There are instances, such as in the large TNF and BH series, in which the unit may be shipped in several sections in order to be in compliance with over-the-road shipping restrictions.
2. All collector parts (i.e. bags, cages, instrumentation, etc.) will be shipped separately in clearly tagged cartons.
3. All exterior carbon steel surfaces of the unit, unless otherwise noted, will receive a single shop applied coat of a medium oil alkyd primer. All interior surfaces will be uncoated.
4. Prior to accepting shipment, care must be taken to inspect all equipment received both for proper count and any damage. Any and all irregularities must be noted on carrier's copy of the shipping receipt to assist in settling any claims for damage or shortages. Most equipment is shipped F.O.B. point of origin, whether on a collect or prepaid basis.

Any claim for damage in transit or shortages, must be brought against the carrier by the purchaser.

1.2 EQUIPMENT INSPECTION

1. Dust Collector Housing - Particular attention should be given to the sheet metal housing of the collector. The unit should be inspected for serious dents, cracks, and/or rips. A damaged housing may seriously affect the structural integrity of the collector as well as proper operation once in service. In addition, the unit should be checked against the certified drawings for correctness and any discrepancies should be noted immediately to C.P. Environmental Filters. Authorization of the manufacturer is required prior to any changes or corrections, otherwise the warranty could be void.
2. Dust Collector Components: A count should also be made of all items received and this should be verified against the carrier's manifest. Boxes should be inspected for rough handling, which may result in hidden damage.

2.0 ASSEMBLY OF DUST COLLECTOR

2.1 HOUSING ASSEMBLY

When the dust collector is shipped in one (1) piece, the lifting lugs furnished on the unit should all be utilized during unloading and set-up. A lifting frame or spreader beam must be used so that no horizontal force components are applied to the lifting lugs.

During the lift, the usual procedures employed by experienced riggers to insure a safe lift should be employed. During the initial stages of the lift, the unit should be watched for excessive deflection and if it occurs, the rigging should be corrected as necessary.

For those units in which shipping restrictions prohibit shipment in one (1) piece, the following guidelines should be adhered to:

A. UNLOADING

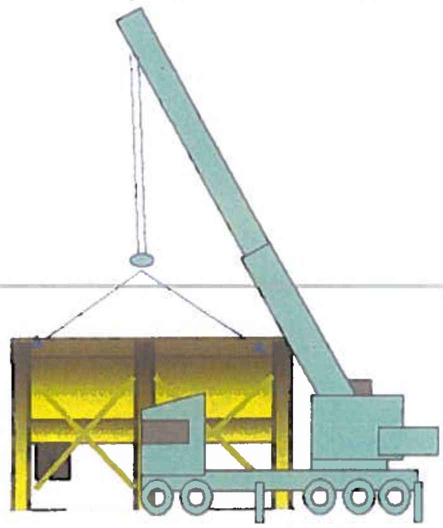
When preparing the site for unloading, it should be noted that the hopper is shipped inverted and it will be necessary to rotate it 180-degrees before hoisting into place. Sufficient space must be available to do this.

If a flat and level surface is not available for unloading the subassemblies, timbers should be placed to receive the units. Timbers should be placed parallel to the short walls of the collector and should be longer than the short walls. Place timbers under each end wall, or short side and at intermediate locations approximately 96 inches apart. Locate the intermediate timbers under wall stiffeners. The timbers should be level; shim where necessary.

B. LIFTING THE DUSTY AIR PLENUM

The dusty air plenum is provided with lifting lugs; the **number** and locations are shown on the general arrangement drawing. **During a lift, all lugs provided must be used.** A lifting frame or spreader bar/beam must be used so that no horizontal force components are applied to the lifting lugs.

During the lift, the usual procedures employed by experienced riggers to insure a safe lift should be employed. During the initial stages of the lift, the unit should be watched for excessive deflection and if it occurs, the rigging should be corrected as necessary. Pay particular attention to the bottom of the long walls of the dusty air plenum. Since the lifting points are offset from the wall, a moment is imposed on the wall, which tends to cause the bottom of the wall to bow outward.



C. LIFTING THE CLEAN AIR PLENUM

In most instances, the clean air plenum is provided with lifting lugs. Where lifting lugs are provided, the lifting procedure is the same as that for the dusty air plenum.

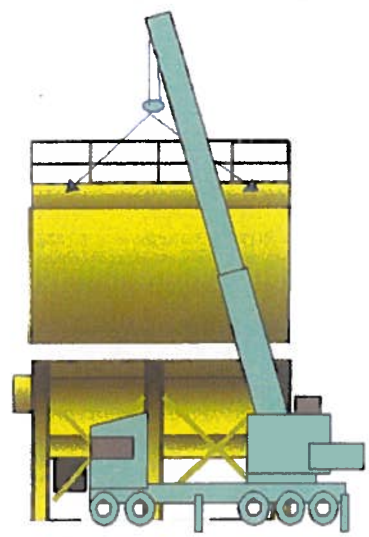
D. LIFTING AND TURNING THE HOPPER

Hoppers are not normally provided with lifting lugs. Small pyramid hoppers can be unloaded with a fork lift or, alternately, a sling can be attached under the stiffeners near the dust discharge flange.

In the first stage of the turn, the hopper should be turned so that it lies on the side opposite the inlet. Both the girth channel and the dust discharge flange should be protected during this operation,

Timbers should be placed so that when the hopper is on its side, it rests on the timbers. The girth channel and dust discharge flange should not contact the ground. During the turn, the bottom of the hopper should be supported so that when it is rotated past the balance point, it will not drop violently.

With the hopper on its side, lifting rigging can be attached to the girth channel or hopper flange and the hopper can be hoisted onto the steel.



E. ASSEMBLY OF HOPPER AND HOUSING

The following sequential procedures will help to minimize any assembly difficulties:

STEP 1: Set up the supporting steelwork for the dust collector level and square. Preciseness at this point will facilitate erection and bolt hole alignment of the dust collector sections to follow.

STEP 2: Place the hopper with its girth channel on the supporting steelwork. Check for squareness, and for bolthole alignment between the hopper flange and the girth channel. Apply the tape gasket around the periphery of the hopper flange and remove the backing paper.

STEP 3: Lift the dusty air plenum, with tubesheet, into place. Do not lower the plenum onto the hopper flange until preliminary alignment is accomplished.

With the plenum suspended over the hopper (1/2 to 1 inch), begin bolt hole alignment, starting at the center and working toward the ends, by using tapered drift pins with about 3/161, tips. If the wall(s) has flexed out of square, it will be necessary to pry or pull it back into alignment. When the mating holes are properly aligned, finish lowering the plenum. Install the remaining bolts, washers and nuts, and torque down for a secure connection.

STEP 4: Check the tops of the dusty air plenum for squareness, and for bolt-hole alignment between the dusty air plenum and the tube sheet. Make sure the tape gasket has been applied between the top flange of the dusty air plenum and the underside of the tubesheet flange. Next, apply the tape gasket around the periphery of the topside of the tubesheet flange and remove the backing paper.

STEP 5: Lift the clean air plenum into place, and assemble in same fashion as in STEP 3. Again, do not lower the clean air plenum completely until preliminary *alignment is* accomplished.

Start drift pin alignment at the center of plenum on the compressed air header side, since the stub pipes make access to the flange more limited. When alignment is complete, install the remaining bolts, washers, and nuts, and torque down for secure connection.

2.2 AIR HEADER ASSEMBLY

Inspection of the air header assembly (Figures 2A and 2B) is essential to insure **proper operation** of the cleaning system when the dust collector is in operation. The following items should be checked:

A. Pull gently on the 1/4" OD tubing to check tightness of fittings.

B. Check the 1/4" OD tubing for kinks or breaks.

C. Inspect solenoid valves to insure that the plugs have been removed from the exhaust ports.

D. Rock the solenoid valve bodies by hand. If a loose valve body is located, tighten by removing the solenoid /timer box cover and securing the retainer.

After inspecting the air header assemblies and tightening any loose components, a compressed air source can be connected to the air header(s).

2.2.1 MOUNTING AIR HEADERS TO COLLECTOR

In the event the air header assembly is not shipped attached (due to shipping constraints) to the clean air plenum, the assembly will have to be performed in the field.

The following steps are to be performed for attaching the header to the dust collector:

A. Lift the header into position onto the clean air plenum.

B. Align the diaphragm valve stub pipes with its respective blowpipe stub on the dust collector and begin fastening /tightening the connector (union or quick-joint connector).

C. Once all of the blowpipes have been joined, align the air manifold, so that valves line-up properly with the thru-the-wall pipes.

D. Position and fasten air manifold support bracket (when furnished).

E. Tighten the blowpipe connectors.

2.2.2 AIR HEADER INTERCONNECTION

For those dust collectors equipped with multiple air headers, an air manifold connecting kit must be utilized to couple the air headers together.

The connecting kit, which consists of two (2) nipples and a union, are installed after mounting the air headers and tightening the blowpipe connectors. Teflon tape is recommended to seal all pipe threads.

2.2.3 AIR HEADER PRESSURE GAUGE MOUNTING

Each pulse-jet dust collector is equipped with a pressure gauge kit that consists of a pressure gauge and a bushing. The kit is normally mounted in the unused header pipe coupling which is the farthest from the air supply piping.

2.3.2 TOP BAG REMOVAL

STEP 1. Insert the filter bag in the tubesheet (Figure 4A) by slowly feeding the bag through the hole using the seam as a guide to keep the bag straight. A twisted bag will hinder the insertion of the bag cage/venturi assembly. Care should be taken in dropping the filter bag through the hole making sure the fabric does not rub against the edge of the hole.

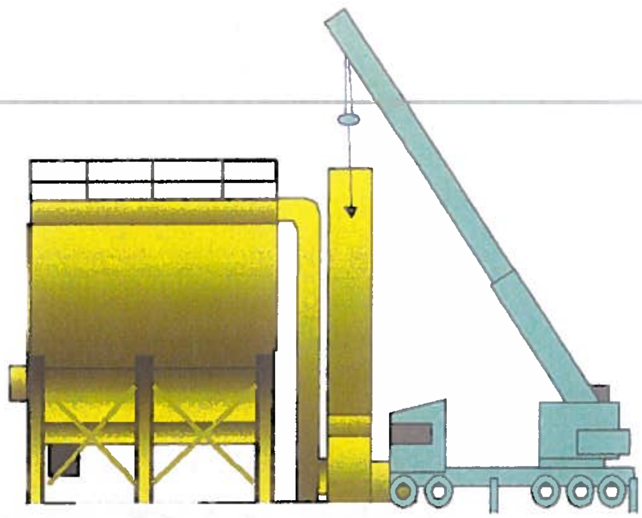
STEP 2. Grip theopen end of the filter bag and bend the stainless steel band that is sewn in the collar so it forms into a kidney shape configuration (Figure 4B).

STEP 3. Position the bag collar on the tubesheet such that the top bead of the cuff is above the tubesheet and the bottom bead is below the tubesheet (Figures4C and 4D).

STEP 4. Roll the bagcollar into the hole of the tubesheet allowing it to snap into place. Smooth the collar by hand making sure the beads are uniformly in place above and below the tubesheet (Figures 4B and 4D). It is imperative that this step be closely followed to insure a good dust seal. In addition, the bags must not be walked-on prior to installing the cage assembly.

STEP 5. Insert the bag cage/venturi assembly into the bag, making sure the turned-down collar of the cage rests uniformly against the tubesheet (Figures 4C and 4D).

STEP 6. After a complete row of bags and cages has been installed, mount the blowpipe onto its supports (Figure 4E). Fasten the blowpipe to the support angle at the far end of the collector, making sure the pulse pipe holes are directed downward. Attach and tighten the coupling on the opposite end of the blowpipe to complete the installation.



Baghouse Lubrication and Inspection Schedule

WARNING:
To ensure that the drive is not unexpectedly started, turn the power off and lock out, and tag out power source before proceeding. Failure to observe these precautions could result in bodily injury.
See Baghouse Sketch

ITEM Some items do not pertain to all units	OIL CHANGE INTERVAL	SAE OIL WEIGHT AND CAPACITY	GREASE INTERVAL	GREASE TYPE
Hopper Screw End Bearings (1)			100 hours or Bi-Weekly	High Temperature Moluballoy #896
Exhaust Fan Bearings (4)			100 hours or Bi-Weekly	Multi-purpose NLGI No.2 See Next Page.
Cross Screw End Bearings (2 & 3)			100 hours or Bi-Weekly	High Temperature Moluballoy #896
Screw Reducers (5 & 6)	First 500 hours Every 2500 hours or 6 month	ISO220-90W See Chart on Reducer		
Air Compressor (7)	First 500 hours Every 2500 hours or 6 month	ISO220-90W See Chart on Compressor		
Trailer Axle Bearings (8)			Annually	Lithium Based
AC Motors Bearings (9)			300 hours or 3 Month	Lithium Based
Fines Blower	4500 hours or 6 Month	AEON PD Synthetic blower oil See Chart on Blowers	500 hours or 6 Month	NLGI Grade 2 EP
	1500 hours or 3 month	ISO220-90W		
Vane Feeder	First 500 hours Every 2500 hours or 6 month	ISO220-90W See Chart on Compressor		

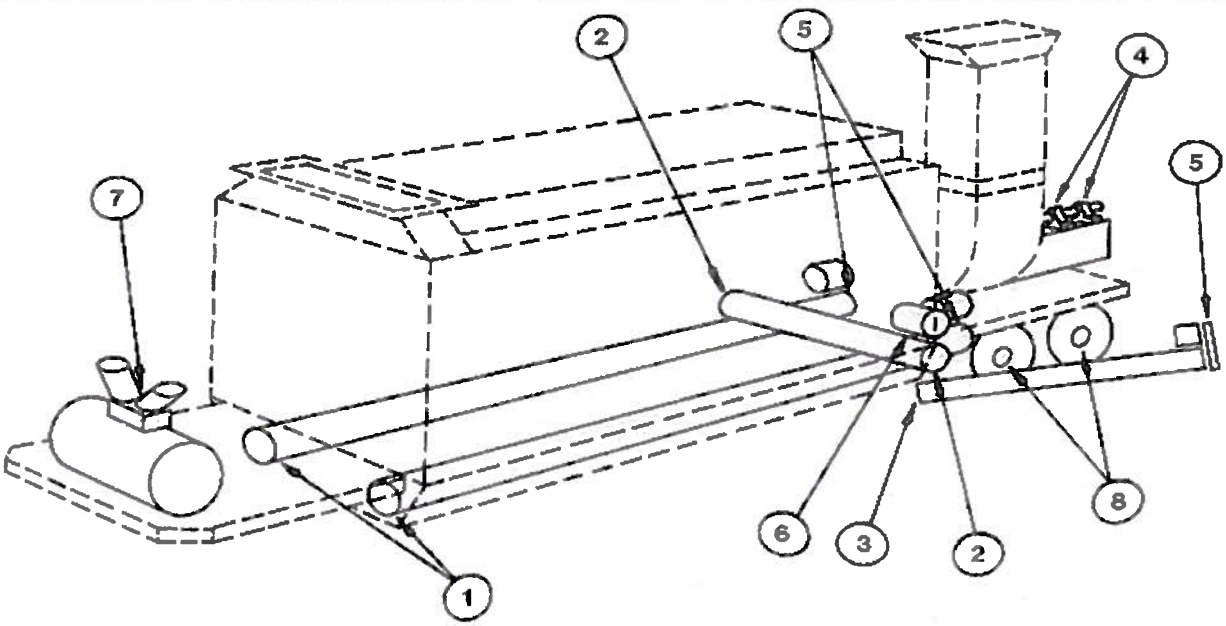


Figure 8. Safety & Lubrication Instructions for Fans with Ball Bearings

WARNING

1. This equipment must not be operated without proper guarding of all moving parts. While performing maintenance be sure remote power switches are locked off. See AMCA Publication 410 for recommended safety practices.
2. Before starting: Check all setscrews for tightness, and rotate wheel by hand to make sure it has not moved in transit.

Relubrication Schedule (Months)* Ball Bearing Pillow Blocks									
Speed (RPM)	500	1000	1500	2000	2500	3000	3500	4000	4500
Shaft DIA									
1/2" thru 1-11/16"	6	6	5	3	3	2	2	2	1
1-15/16" thru 2-7/16"	6	5	4	2	2	1	1	1	1
2-11/16" thru 2-15/16"	5	4	3	2	1	1	1		
3-7/16" thru 3-15/16"	4	3	2	1	1	1			

* Suggested initial greasing interval: Relubricate while running, if safety permits, until some purging occurs at seals. Adjust lubrication frequency depending on condition of purged grease. Hours of operation, temperature, and surrounding conditions will affect the relubrication frequency required.

1. Lubricate with a high quality NLGI No. 2 or No. 3 multipurpose ball bearing grease having rust inhibitors and antioxidant additives. Some greases having these properties are:

   Shell - Alvania No. 2   Mobil - Mobilith AW2/Mobilith SHC100
   Gulf - Gulfcrown No. 2   American - Rykon Premium 2

2. Lubricate bearings prior to extended shutdown or storage and rotate shaft monthly to aid corrosion protection.

Figure 9. Safety & Lubrication Instructions for Fans with Unit Roller Bearings

WARNING

1. This equipment must not be operated without proper guarding of all moving parts. While performing maintenance be sure remote power switches are locked off. See AMCA Publication 410 for recommended safety practices.
2. Before starting: Check all setscrews for tightness, and rotate wheel by hand to make sure it has not moved in transit.

Relubrication Schedule (Months)* Spherical Roller Bearing - Solid Pillow Blocks									
Speed (RPM)	500	1000	1500	2000	2500	3000	3500	4000	4500
Shaft DIA									
1-3/16" thru 1-7/16"	6	4	4	2	1	1	1	1	1/2
1-11/16" thru 2-3/16"	4	2	1-1/2	1	1/2	1/2	1/2	1/2	1/2
2-7/16" thru 3-7/16"	3	1-1/2	1	1/2	1/2	1/4	1/4		
3-15/16" thru 4-15/16"	2-1/2	1	1/2	1/4					

*Suggested initial greasing interval: Relubricate while running, if safety permits, until some purging occurs at seals. Adjust lubrication frequency depending on condition of purged grease. Hours of operation, temperature, and surrounding conditions will affect the relubrication frequency required.

1. Lubricate with a multipurpose roller bearing NLGI No. 2 having rust inhibitors and antioxidant additives, and a minimum oil viscosity of 500 SSU at 100°F. Some greases having these properties are:

   Shell - Alvania No. 2   Mobil - Mobilith AW2/Mobilith SHC100
   Texaco - Premium RB2   American - Rykon Premium 2

2. Lubricate bearings prior to extended shutdown or storage and rotate shaft monthly to aid corrosion protection.

Recommended
PRODUCT
4092 ULTRA
PLEX GREASE NO. 2

DESCRIPTION
4092 is an outstanding lithium complex base grease compounded with outstanding anti-wear characteristics. An E.P. Lubricant with a 50 O.K. Timken Load. 4092 is water resistant, tacky, very mechanical stable and performs well at elevated temperatures and has excellent reversibility characteristics when cooled. Anexceptionally long life type lubricant. Contains LYVAN.

Purchase from:
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BREMEN, IN. 46506   TELEPHONE 1-219-546-2129
TOLL FREE 1-800-6ET-LUBE   1-800-638-5823

AMERICAN Industrial Oils

Method	Property	Typical				
	ISO-VG Brand and Number	100 44355	150 44365	220 44375	320 44395	460 44415
	AGMA Number SAE Crankcase Grade SAE Gear Lube Grade	3 30 85W	4 40 90W	5 50 90W	6 50 140W	7 -- 140
D-92	Flash Point, F Flash Point, C	511 266	543 284	532 278	554 290	568 298
D-97	Pour Point, F Pour Point, C	-10 -24	-10 -24	+15 -9	+10 -12	+10 -12
D-287	Gravity, API Specific Gravity, 60/60 F	28.2 0.886	26.6 0.895	26.4 0.896	26.4 0.896	26.6 0.895
D-445	Viscosity, 100 F, SUS 210 F, SUS 40 C, cSt 100 C, c St	 524 64.3 100.3 11.1	 782 77.4 149 14.4	 1168 96.5 221 18.9	 1705 122 320 24.6	 2420 155 453 31.7
D-2270	Viscosity Index	95	94	96	98	101
D-665A D-665B	Rust Test, Distilled Water Synthetic Sea Water	Pass Pass	Pass --	Pass --	Pass --	Pass --
D-943	Oxidation Stability, Hrs. to 2.0 Acid Number	2500	2500	2600	2600	2600
D-974	Acid Number, mg KOH/g	0.07	0.08	0.08	0.07	0.07
D-1401	Emulsion 3 ml or less at 15 minutes	Pass	Pass	Pass	Pass	Pass
D-1500	Color, ASTM	L3.0	L4.0	4.0	4.0	3.5
	Pounds per Gallon Gallons per Pound	7.38 0.1358	7.45 0.1349	7.46 0.1347	7.46 0.1344	7.45 0.1343

WARNING:
This chart should only be used as a guide. For complete operating instructions on bearings and/or reducers, read the instructions provided by the manufacturer. Most bearings used are sealed type bearing. Do not over fill the bearings; damage to the seals will occur.

WARNING:
To ensure that the drive is not unexpectedly started, turn the power off and lock out, and tag out power source before proceeding. Failure to observe these precautions could result in bodily injury.

WARNING:
This chart should only be used as a guide. For complete operating instructions on bearings and/or reducers, read the instructions provided by the manufacturer. Most bearings used are sealed type bearing. Do not over fill the bearings; damage to the seals will occur.

INSPECTION AND MAINTENANCE LOG

Inspection date or hour	Item	Adjustment	Lubrication	Oil Change	Guards	Replacement

Potential Problems in a Baghouse

Trouble Shoot

Twenty-one items you can perform to help prevent potential problems in your baghouse:

Older model RB220Baghouse with insulation installed. New models have no insulation. Optional insulation installed.

There are a number of factors that can affect a baghouse, things that are both environmental and operational in nature. The flow of air, the abrasive nature of dust, and the extremes of temperature are three of the more obvious factors. But we must also take into consideration the presence of moisture in the baghouse, either as a vapor or as a liquid. And of course, there are also potentially caustic chemicals that are sometimes found in the airstream. Here is a list of things you can do to help your baghouse reach its optimum level of efficiency:

Temperature

The most important consideration for a baghouse is the level of the internal temperature during normal plant operations. The temperature cannot be too hot or be too cold. Above all, the temperature must be kept above the dew point. The term "dew point" is defined as the temperature at which moist air begins to condense. In a baghouse, there are a lot of factors that contribute to what the dew point will actually be. As a rule of thumb, most people put the dew point of a baghouse no higher than 215° Fahrenheit (102° Celsius). In the morning before starting the flow of materials through the drum mixer or dryer, one should pre-heat the baghouse for about 10 or 20 minutes - long enough to get the steel heated up to a typical operating temperature. If one doesn't pre-heat the baghouse properly, the hot airstream hitting the cold steel will cause moisture to condense, and most of the dust is going to turn into a muddy mess on the bags and the metal. This mud will clog the bags and lower the performance of the baghouse. On the other hand, if temperature of the baghouse is kept too high, there is the possibility of causing heat damage to the filter bags. As a general rule of thumb, the temperature in a baghouse should not be allowed to fall below 220° Fahrenheit (104° Celsius) - and it should not climb above 350° Fahrenheit (177° Celsius). Most operators prefer to maintain the baghouse temperature at about 230° to 240° Fahrenheit (110°-116° Celsius) for counter-flow drums and 300° to 325° Fahrenheit (148°-177° Celsius) for parallel-flow drums. Bags are rated for 450 degrees Fahrenheit (232° Celsius) for about 3 seconds depending on dust load on the bags.

Pressure drop

One should maintain a level of 3 to 5 inches of negative pressure between the inlet side of the baghouse and the outlet side. This difference in pressure is how much dust is on the bags at any one point in time. If the pressure differential becomes much greater than the targeted level, one should adjust (reduce) the pulse-interval timing on the compressed-air valves. If the differential begins to be less than the targeted level, the interval between pulses should be lengthened.

Damper control

One of the things that affect the operations of a baghouse as much as anything is the ability to properly regulate the amount of air being admitted into the system. An automatic damper is an (optional) essential piece of equipment on a modern HMA facility - primarily because it senses the negative pressure on the front end of a drum or dryer and then controls the amount of air flowing through the system to keep it stable and even.

Ductwork

Any excess air that is being sucked into the system can create a cooling effect that might cause moisture to condense. For this reason, someone should conduct regular inspections of the airflow system to check for rust holes or loose joints in the ductwork.

Primary Chamber

An over-sized primary chamber may remove the larger particles and only allow the very small particles to be carried to the baghouse. Different sized particles are needed for proper filter bag cleaning. Baffles may need to movable to achieve correct particle ranges.

Compressed air

The accumulation tanks and manifolds of the compressed-air system, that is used to pulse the baghouse, can contain a large amount of moisture at various times during the day. If one lets this situation persist, one will end up squirting water onto the filter bags every time the system pulses. To prevent this from happening, drain the compressed-air tank and manifolds each morning to remove any water that might be trapped there. It is also a good idea to drain the tank several times during the day.

Blue Smoke Return

Some facilities (MileMaker plants and Batch plants, for example) are designed to use scavenger air to pull blue smoke of the mixer, drag slat, and the pugmill. If there is an excessive amount of this air, it can cool down the baghouse gasses and create a problem with condensation. Pay attention to this airflow and keep it as low as possible.

Valve pulsing

It is important that one have the valves pulsing properly so that the bags will be cleaned and so the pressure differential will be maintained. If you suspect that one of the valves is not pulsing at all, one might want to use a simple test to help spot the failed valve. Before one starts the baghouse in the morning, place a small piece of ¾-inch masking tape over the exhaust port of each valve. Then start the baghouse. All of the valves that are working will blow the masking tape off their exhaust ports, and one will know for certain that those rows have been pulsed. If one finds a valve with tape still covering the exhaust port, one will know that it is inoperative. Then, having isolated the inoperative valve, you can look at the solenoid, the wiring, and the valve itself to determine the problem.

Valve pulsing sequence

The filter bags are normally pulsed in rows. The pulse valves in each row should be wired for random pulse from row to row. Do not allow the rows to be pulsed in sequence or next to a row just pulsed. Several rows apart should be used. When pulsed, the dust will be sucked to the clean bags and may lead bleed-through problems. If the rows are being pulsed in line, the wires can be changed at the timer board to allow random pulsing sequence.

Pulse board

Sometimes, if a valve isn't operating, it can be traced to a failure of an output circuit on the pulse board. If you check and discover a failed output, you can get the valve pulsing again with a temporary repair. Just take the *wire off the failed output and slip it on one of the adjacent outputs, either above or below. The system will be operational again - except instead of pulsing just one valve with a particular output, the system will be pulsing two valves. When you have changed three of the outputs, it is time to either get a new pulse board or have the old one repaired. It is probably a good idea to keep a spare pulse board on hand. Then one can pull the faulty board so it can be sent back to the manufacturer for repair - and install the spare board without interrupting operations.)*

When to start pulsing

There should be a specific point in your daily operations when you will want to start pulsing your baghouse – but the actual timing will depend on your particular facility. With a drum-mixer facility, you won't want to start to pulse the baghouse until you start pumping liquid AC into the drum. To pulse the baghouse any earlier would be to start bringing dust through the fines-return system, which would result in a dust slug inside the drum.

Filter bag leaks

You should check frequently to see if there are any bad or leaking filter bags anywhere in the baghouse. The first place to look is around the air inlet because the airflow velocity is generally greatest at that point. Checking for bad bags is important because just one leaking bag can contaminate the entire system with dust. What happens is pretty simple: If one of the filter bags is leaking, the fan is going to draw dust from the dirty side of the baghouse through the hole in the bag and over to the clean side. If the leaking bag is near the inlet end of the baghouse, the dust will flow back over the other bags toward the outlet. The dust can settle out of the airstream at any point, of course. When it does, the chances are good that it will fall into some of the non-leaking bags, thus contaminating them. And every time the baghouse pulses, some of the dust in the bottoms of those contaminated bags is going to be blown out into the clean-air plenum, and there'll be a sudden puff of dust from the stack of the baghouse.

Someone should be assigned the responsibility for making periodic checks to determine if there are any leaking bags. A visual inspection is an acceptable way to make the search, although the best way to find leaks in filter bags is to use the Visolite Leak-Detection System.

Chart the replaced filter bags

It is a good idea to keep a record of which filter bags are replaced from time to time. Draw a diagram that shows the layout of the tubesheet and the bags. Then, whenever a bag is replaced, mark its location on the chart, along with the date it was replaced. In this way, if the chart eventually begins to show that you have been replacing bags in a particular area, you will know you have a problem in that area and you can do something to eliminate the problem. For example: If your chart indicates excessive bag-wear near the inlet, you might want to build some simple baffles in that area to break up the airflow and reduce the wear. Without keeping detailed records, you might not be able to spot such a pattern. This chart serves as a useful preventive-maintenance tool.

Clean-air plenum

Whenever personnel enter into the top part of the bag-house, check to see if there is a build-up of dust in any areas. If one does do spot an excessive amount of dust, take an air wand and blow off the dust so it won't get inside any of the filter bags and contaminate them. It is probably a good practice for someone to climb inside the clean-air plenum at least once a month to make a visual inspection for dust build-up. If one finds the slightest amount of dust, take the time to stop your operations and fix the problem.

Dust hopper

A little bit of dust is okay, but if you let it accumulate until there is an excessive amount in the hopper, the air can begin to pick up dust and re-entrain it in the airflow. It doesn't hurt to make periodic visual inspections when the proper safety precautions have been taken.

Portable baghouse units have a smaller hopper than the stationary units. Multiple screws feed up into a cross screw removing dust from the hopper. This smaller hopper is from the limited height needed for transportation.

Dust-return system

This is another item that should be on the list of things to check periodically. Inspect the augers inside the bottom of the baghouse to make sure they are operating properly. And if there is a pneumatic conveying system that handles the dust, one should inspect the airlock for proper operation. Anytime anyone goes inside *the baghouse, observe the safety precautions: make sure to shut it down, lock out the breakers, and disconnect everything.*

Acid condition

There are a number of factors that can lead to an acid condition in a baghouse. Some fuel oil has high sulfur content. When the exhaust from this type of fuel is mixed with moisture, the result is sulfuric acid. An acid will attack and quickly damage or destroy filter-bag cages, tube sheet, and other metal parts in a baghouse. Chlorides can also create a potentially damaging acid condition in a baghouse. It is not unusual for waste oil to contain a high level of chlorides. Fortunately, it is relatively easy to prevent the acid condition from forming, even if sulfur and chlorides are present. Keep the baghouse temperature above the dewpoint and one can prevent the water condensation that leads to the formation of the acids. As mentioned earlier, it's a good idea to keep the baghouse temperature between 220º and 350º Fahrenheit (104º-177º Celsius). Most operators maintain 230º to 240º Fahrenheit (110º-116º Celsius) or 300º to 325º (148º-163º Celsius) Fahrenheit temperatures, depending on the type of operation.

Burner fuel

The type of fuel being used in the burner of the plant's drum-mixer or dryer - and even the way the fuel is burned can have an effect on the operation of the baghouse. Typically, the heavier oils require more air, more heat, and more attention to the combustion process. You should pay attention to the viscosity of the fuel oil - and adjust the burner as necessary to achieve optimum performance. It's a good idea to run a viscosity test on every load of fuel oil you receive.

Rain leaks

Although most people never stop to think about it, rain water leaking into a baghouse can create the same type of problems that are brought on by water condensing out of the airstream: wet, sticky dust, clogged filter bags, and the formation of caustic acids. If one sees signs of rainwater inside the baghouse, take immediate steps to plug the leaks.

End-of-day cleaning

Many plant operators make it a practice to clean the baghouse thoroughly at the end of each day, pulsing down and removing all dust from the hopper. This is not recommended unless baghouse performance is poor and catch-up is needed. Other operators would think such end-of-day cleaning is overkill. They argue that if the system is working properly, capturing dust and removing it from the baghouse efficiently and effectively, it should not be necessary to clean the baghouse every single day. If one is having some problems with dust handling or if you are getting slug loading, then one should certainly clean out the baghouse at the end of each day.

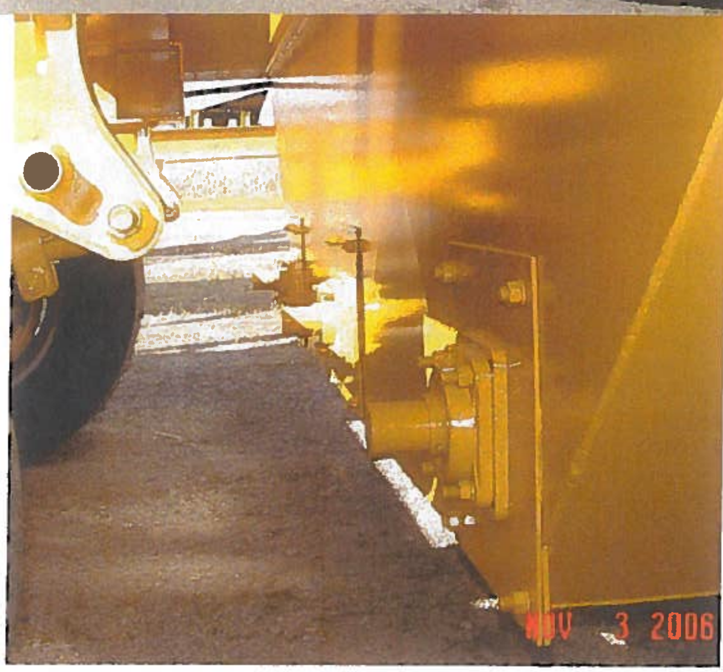
End-of-year cleaning

With the coming of winter or the end of the paving season, one should definitely give the baghouse a complete and thorough cleaning. Pulse it down, clean it out, use an air wand to remove dust accumulations, run a Visolite test on all of the bags, replace bags as necessary, check for rain water leaks, make any repairs that might be necessary. Remove all rust, and give the baghouse whatever paint touch-up might be necessary. The best time for a thorough cleaning is at the end of the season. If you put it off until next season, any damage will just get worse, and any hard-to-clean conditions will just get harder to clean and more expensive.


NOV 3 2006


DANGER
PELIGRO
DANGER


NOV 3 2006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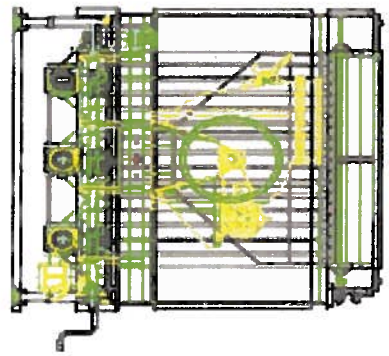
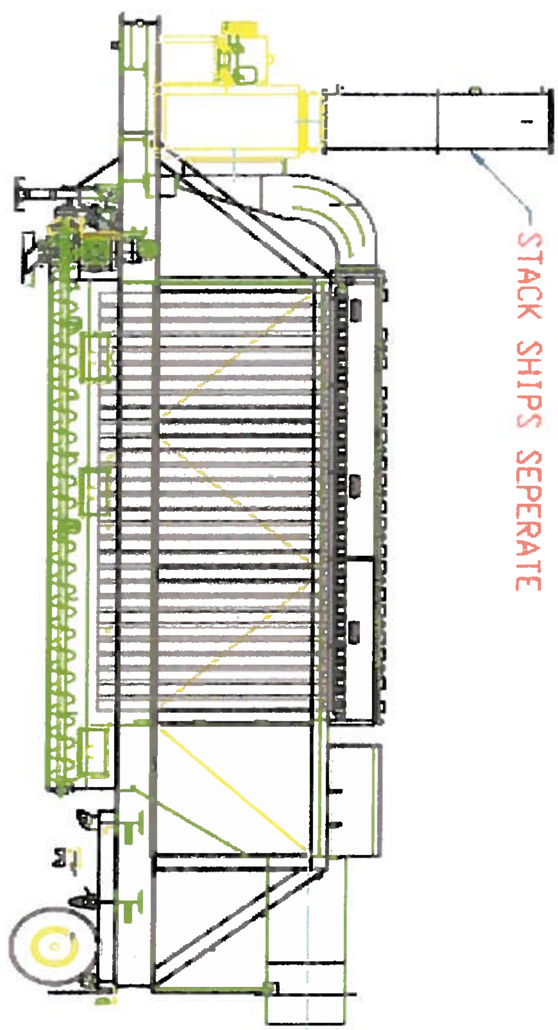


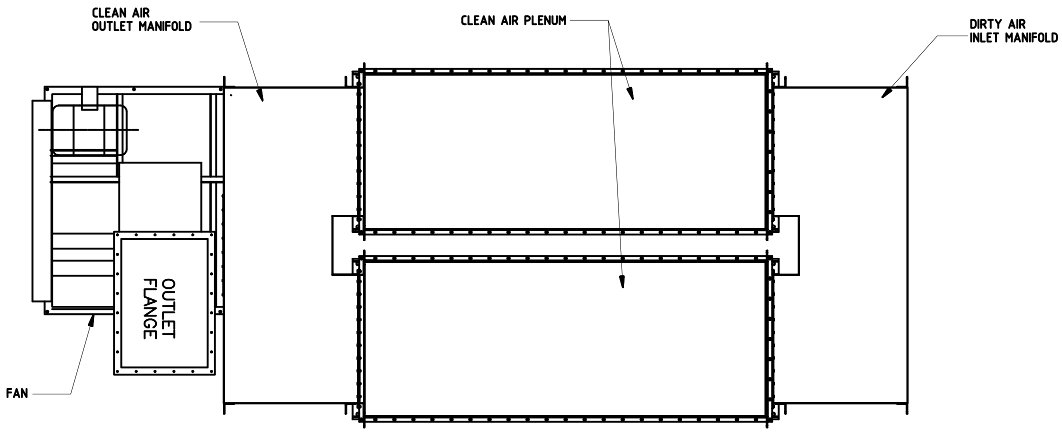


PORTABLE 30,000 ACFM BAGHOUSE

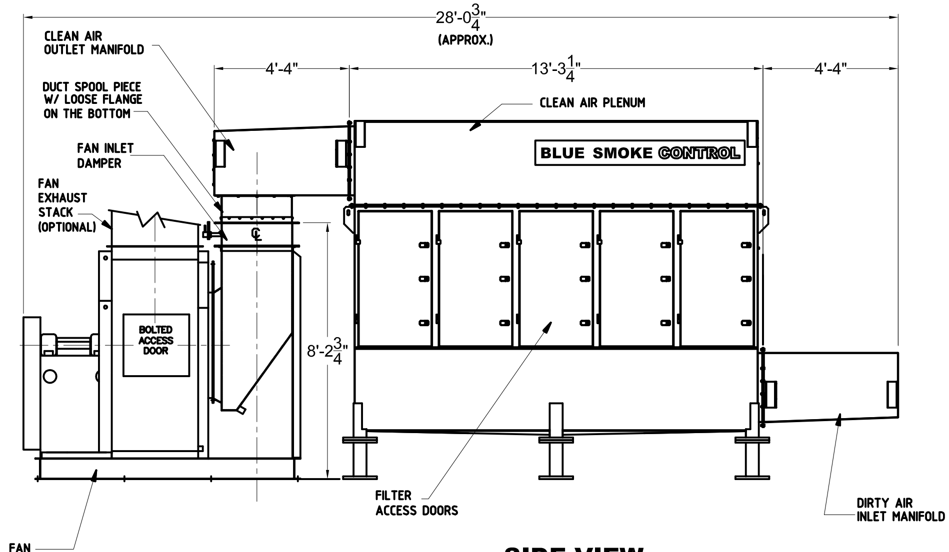
HEIGHT	14'-6"
WIDTH	13'-11"
LENGTH	46'-8"
WEIGHT	57,000 lbs

INSPECTION AND MAINTENANCE LOG

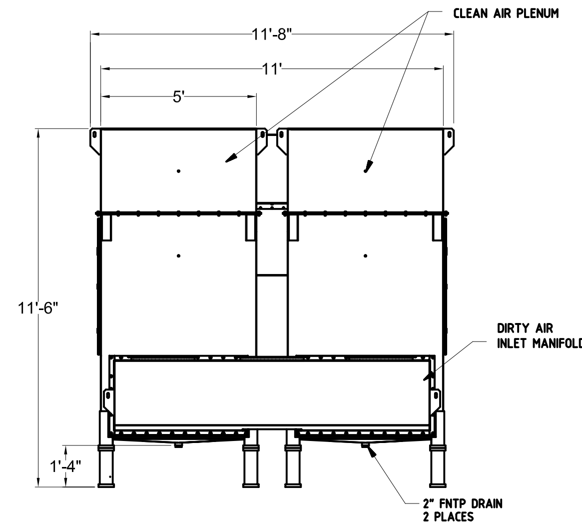
Inspection date	Item	Action	Cleaning	Replacement



TOP VIEW



SIDE VIEW



INLET END VIEW

SPECIFICATIONS

MODEL 6S20C BLUE SMOKE CONTROL COLLECTOR

COLLECTOR MAXIMUM RATED CAPACITY________40,000 CFM
COLLECTOR WEIGHT APPROX.________12,300 LBS
FAN________75 HP,1800 RPM for 40,000 CFM
FAN WEIGHT APPROX.________5,500 LBS
NO. PRIMARY FILTERS___20 (STAGE 6)
PRIMARY FILTER DIMENSIONS___25.50 LG X 26.00 DIA
PRIMARY FILTER AREA___220 SQ FT EACH (STAGE 6)
NO. PREFILTERS_____100(STAGES 1-5 INCLUDING WRAP AROUND FOR STAGE 6)
FINISH________LIGHT GRAY

SCALE : NONE

BLUE SMOKE CONTROL
5594 E. La Palma Ave, Anaheim, CA 92807
Phone (714) 696-7595 Fax (714) 696-7595
Blue Smoke Control is a division of Butler-Justice Inc.

EQUIPMENT DESCRIPTION

6S20C Collector with Fan
Price Book Illustration

DRAWN	DATE	DRAWING NO.
M.J.	03/06/05	BSC-PB-20C

Maximum Rated Capacity 40,000 CFM

CAD CODE: Price Book Collector 6S20C with Fan.dwg

Proprietary Filters are A Vital Part of the System

Original Blue Smoke Control Filters provide efficiencies that have allowed our collector to be recognized as "BACT" - Best Available Control Technology - in the Asphalt Industry.

- Our final filter is a 95% DOP filter that provides 95% control at .3 microns.
- Our 6th stage cartridge is rated 98% efficient at 1.8 microns.

What All The Buzz is About

"We found the Blue Smoke Control System gives us the emissions control we need at a reasonable cost. The Blue Smoke Control guys know their stuff."

"We changed to the Blue Smoke Control System to achieve better compliance with regulatory requirements. The results are amazing!"

Blue Smoke Control
a Division of Butler-Justice, Inc.
5594 East LaPalma
Anaheim, CA 92807

(714) 696-7599
email: mikeb@butlerjustice.com

When you want the Highest Standard of Emission Control for Your Hot Mix Asphalt Plant

Blue Smoke Control®

A Division of Butler-Justice, Inc.

Read About . . .

- Blue Smoke Control - the Company and Technology
- Seven Steps to Better Emissions Control
- How the System "Eats" Blue Smoke
- Typical Applications
- The Proprietary Filters
- What All The Buzz is About

FOR MORE INFORMATION:
Contact us at (714) 696-7599
www.bluesmokecontrol.com
www.butlerjustice.com

You Can't Beat the System . . . (Blue Smoke Control, that is!)

Mike Butler, CEO
Blue Smoke Control
A Division of Butler-Justice, Inc.

"We are proud that during the past decade, our Blue Smoke Control group has become a leading provider of blue smoke control systems for the hot mix asphalt industry throughout California, the United States and Mexico.

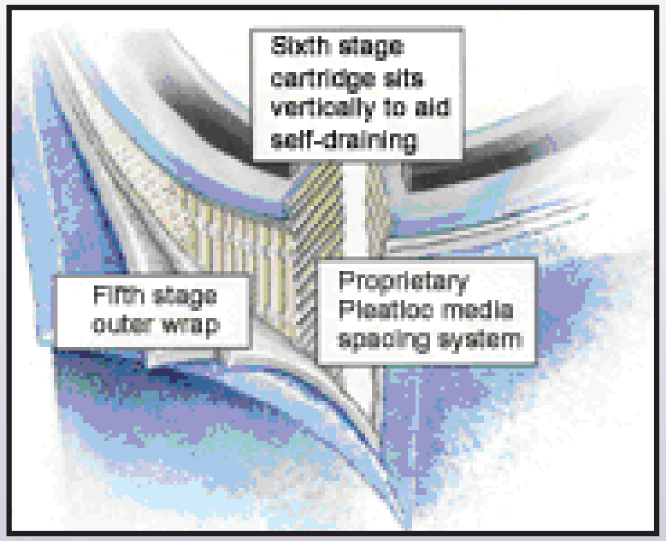
"At our Anaheim, California headquarters and in the field, we have worked extremely hard on technological breakthroughs that bring the highest standards of asphalt pollution control while achieving reasonble initial investment costs and economical ongoing operational and maintenance expenses.

"A significant part of our emissions control strategy has been the development of a system to capture blue smoke from numerous points in the asphalt process. The result is an innovative, efficient and cost effective system that provides state-of-the-art solutions to blue smoke control issues at the (1) Top of Silos, (2) Conveyor Transfer Points and (3) Truck Loadout Areas.

"Since introducing our patented system in 2002, hundreds are operating, with superb results."

"What a Sweet System!"

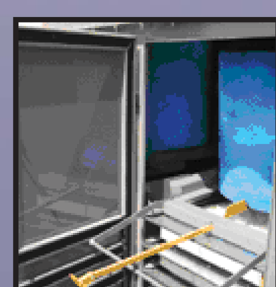
Seven Key Steps to Achieving Clean Emissions in Your Plant



The Blue Smoke Control filter cartridge is made from a proprietary filter media developed exclusively for collecting oil mist. Blue Smoke Control filter cartridges sit vertically inside the collector, allowing gravity to aid the drainage process.

All Stages of filters are readily accessible through the filter access doors. Filters or stages are installed two deep behind each door.

Each of the first four (4) stages are readily accessible. The filter removal handle, illustrated here with the first stage partially removed, enables access to the back filter without reaching deep into the collector.

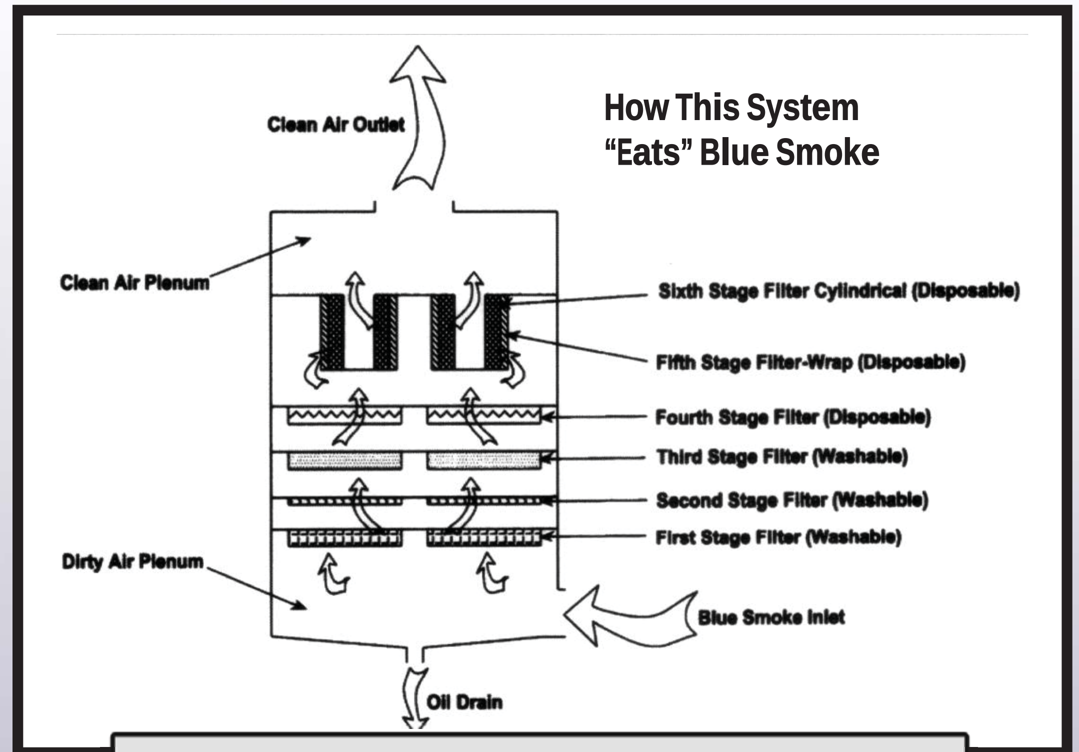


The fifth and sixth stage filters ar, sixth and seventh stage filters are also accessible without reaching deep inside the collector. The filter removal handle enables the rear filter to be pulled out to the access opening for service.

The Blue Smoke Control Filter System Collects Blue Smoke Like No Other

Blue smoke is actually tiny oil droplets that make up the blue haze typically associated with paving and hot mix asphalt production. Blue haze carries much of the characteristic asphalt odor.

Air pollution control agencies are becoming more concerned with blue smoke; especially as RAP: rubberized asphalt and polymer blends are more routinely specified. These specialty mixes are often known to produce an increased amount of blue smoke. More blue smoke means a greater number of neighborhood complaints for visible emissions and odor - AND more visits from the regulatory agencies.



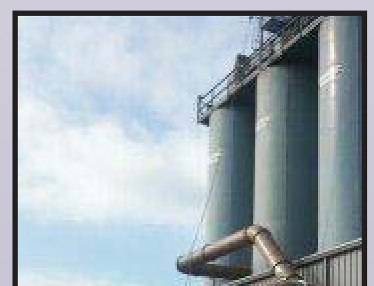
Blue Smoke Control®

The Blue Smoke Control collector utilizes the principal of vertical air flow or "up flow" to process the polluted air stream. Up flow enables the collected oil to drip down into the dirty air plenum, thus preventing the collected liquid from entering the clean air stream.

This also allows gravity to aid the drainage process, resulting in more efficient collection, longer filter life and easier maintenance!

Typical Applications:

Top of Silo Loading



Drag Slat Conveyor Transfer Points

Truck Loadout Areas

Blue Smoke Control ®

5594 E. La Palma Ave.
Anaheim Ca. 92807
714-696-7599 Fax 714-696-7595

Blue Smoke Control *is a division of* Butler-*Justice Inc.*

Blue Smoke Control Permitting Parameters
Model 6S20C

The Blue Smoke Control collector, designed for controlling blue smoke that typically comes from in-plant transferring and loading hot mix asphalt, is a patented product of Butler-Justice Inc., Anaheim California. The equipment is marketed under the registered trade name BLUE SMOKE CONTROL.

With installations in several states, we have learned that each state has their own unique set of permitting requirements. Nevertheless, the following specifications will likely meet the needs of most agencies.

GENERAL DESCRIPTION
The Blue Smoke Control collectors are high efficiency cartridge mist collectors. Constructed with a steel housing, the filtration is accomplished in cells with each cell having seven stages. Each stage is more efficient than the previous. The first three stages are metal and designed to be cleaned when necessary. Stages four, five, six and 7 are disposable and are to be replaced when they become plugged.

Model 6S20C

Number of cells … 20 with maximum capacity each cell … 2,000 CFM

Maximum collector rated capacity for the Model 6S20C … 40,000 CFM

Fan …75 HP, rated for 40,000 CFM at 8 inches SP

Number of Primary and secondary filters … 20 sets (Stages 6&7)

Primary stage 6 filter dimensions … 25.5" Long x 26" Diameter. (This is a pleated cartridge type filter with a 220 sq ft of filter media per cartridge.)

Filter efficiency is 98% on 1.8 Micron (Refer to filter manufacturer's data sheet-Dryflo filter),

Secondary Stage 7 filter insert is 95% efficient at .3 microns (refer to manufacturer's data sheet 95-DOP)

Number of pre-filters … 100 (Stages 1-5 including a 5th stage wrap around stage 6)

Plan and elevation views of this equipment are illustrated on Blue Smoke Control drawing number BSC-PB-20C. Also, refer to the product brochure for photographs of typical installations, explanation of the equipment, and illustrations of the six stages of filtration. For further information, call 714-696-7599.

Pollution Control Systems for the Hot Mix Asphalt Industry.