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OPERATION AND MAINTENANCE OF FABRIC COLLECTORS

INSTITUTE OF
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AIR
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ICAC

The Institute of Clean Air Companies, the nonprofit national association of companies that supply stationary source air pollution monitoring and control systems, equipment, and services, was formed in 1960 to promote the industry and encourage improvement of engineering and technical standards.

The Institute's mission is to assure a strong and workable air quality policy that promotes public health, environmental quality, and industrial progress. As the representative of the air pollution control and monitoring industry, the Institute seeks to evaluate and respond to regulatory initiatives and establish technical standards to the benefit of all.

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Operation and Maintenance of Fabric Collectors

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1.0 SUMMARY

This publication establishes air pollution control industry technical guidance on proper operation and maintenance of fabric collectors as applied across a wide range of industries. The publication provides specific operational and maintenance diagnostic and corrective guidance. The publication also includes a checklist for periodic maintenance, a troubleshooting guide, and an overview of proper information contained in the operational service manual for air pollution control equipment manufacturers and suppliers. In addition, the publication guides the reader in consulting with the technology manufacturer or supplier to obtain specific operational and/or maintenance recommendations.

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2.0 BACKGROUND ON ICAC-F-3

The Particulate Control Division of the Institute of Clean Air Companies, Inc. adopted this technical guidance in November of 2002. This publication replaces the earlier (1972) *ICAC F-3* publication and includes important changes in operation and maintenance as a function of changes in filter collector technologies.

3.0 OBJECT AND SCOPE

THE GOLDEN RULE OF MAINTENANCE

Study and Keep in a Readily Accessible Location the Operating and Maintenance Manuals Furnished by the Supplier of the Basic Equipment and Any Auxiliary Devices.

Fabric-type dust collectors as manufactured by different manufacturers usually have numerous similar design features, but they also have basic design differences. Therefore:

1. The information on pre-start check, maintenance and operation contained in this bulletin must, of necessity, be a generalization and cannot cover in depth the specifics of the mechanisms produced by each individual company.

2. Insist that the fabric filter manufacturer provide written in-depth recommendations on erection, pre-start check out, initial start-up, operation and maintenance (including maintenance troubleshooting). Secure similar information on other system components such as fans, motors, and controls. *This information should be included in an "Operation and Service Manual". A typical "Table of Contents" for a proper manual is contained in Section 6.0 of this document.*

3. Be sure to study thoroughly the manufacturer's instructions before attempting any work on the collector. The importance of such study cannot be over emphasized. It is important that the instructions be stored in some place where they can be referred to periodically. All such instructions have been most carefully compiled and contain many details that cannot be found elsewhere. It is unfortunate that instructions are often discarded immediately after installation, overlooking the important maintenance information they contain. This is particularly

true when the installation is by an outside contractor without responsibility for equipment maintenance. It is wise to check with installers to be sure that manuals received with the equipment are turned over to the owners. Then be sure they are filed in some safe but accessible place of record storage and retrieval.

4. It is absolutely imperative that you recognize the importance of establishing a preventative maintenance schedule in line with the manufacturer's instruction and insist that this schedule be adhered to.

4.0 OPERATION

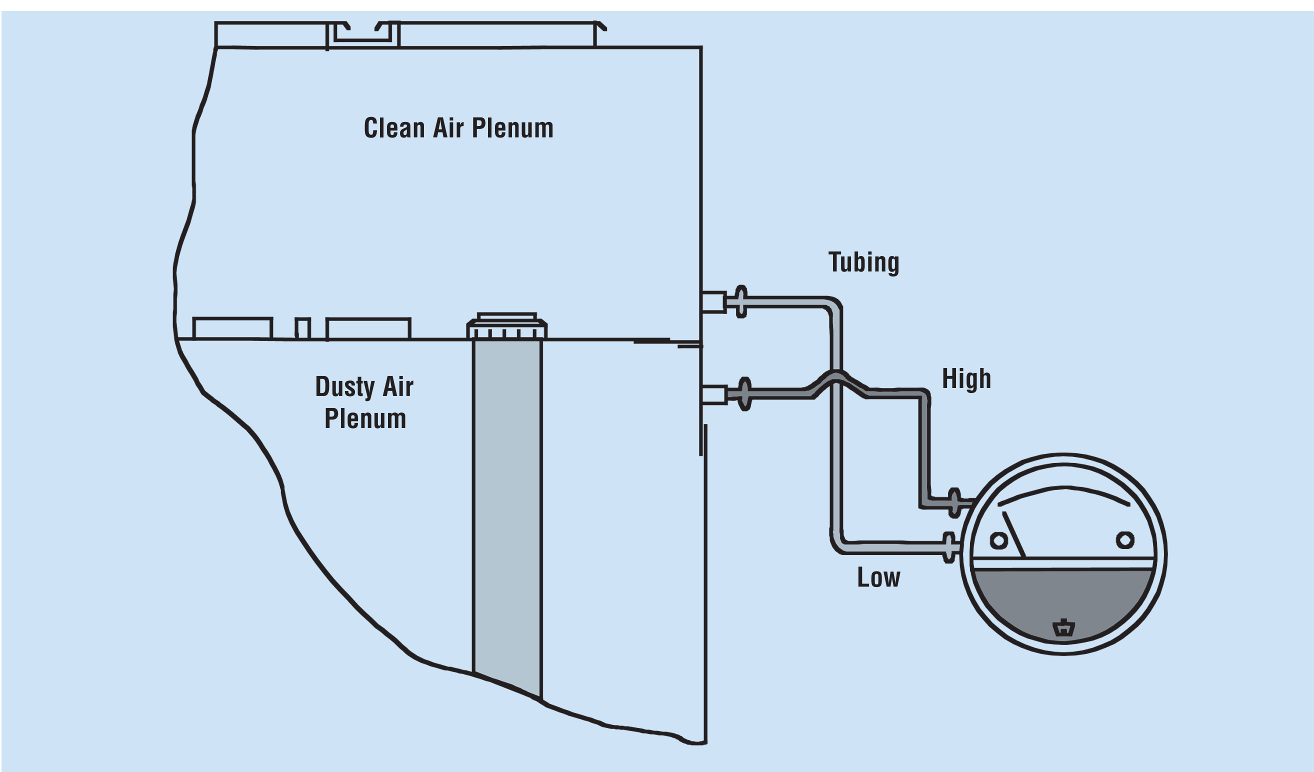
In general, two basic parameters completely define the operation of a fabric filter: the differential pressure and the cleanness of the exhaust. This assumes that air or gas is flowing at the normal design rate through the filter media. Differential pressure is addressed below while characteristics of the exhaust are addressed in sections 4.3 and 4.4.

4.1 Differential Pressure

The differential pressure across a fabric filter should be monitored and logged several times a day. If the fabric filter consists of multiple compartments or modules, the differential pressure across each compartment, in addition to the differential pressure across the entire fabric filter, should be monitored. Other information that should be recorded with pressure difference is gas temperature at the inlet and outlet of the collector, gas flow rate at the inlet (or main fan amps), and opacity. Once each shift someone should walk the unit noting the differential pressure, and when applicable, once each day observe a cleaning sequence noting individual compartment pressure loss before and after cleaning. When a fabric collector is an integral part of a process stream such as a product receiver in a drying system, a recording instrument is recommended to give complete information and history. On less critical applications such as venting mechanical conveyor transfer points, occasional checking is sufficient.

The most common differential pressure instrument is a Magnehelic® gauge that is connected across the filter media from the dust side of the collector to the clean air plenum. If the fabric

FIGURE 1
MAGNEHELIC® GAUGE CONNECTIONS



filter utilizes reverse air cleaning, the scale on the gauge should have zero in the center so that the differential pressures to the left of zero can be monitored during periods of reverse air flow cleaning.

Other differential pressure indicating devices include "U" tube manometers and well-type or single-leg manometers, that are filled with water or anti-freeze solution. The well-type manometers offer ease of reading and lessened chance of error.

Differential pressure transmitters and digital meters are becoming more popular as the cost for this instrumentation declines. Also, differential pressure switches or transmitters are frequently used to activate cleaning mechanisms or other devices and alarms.

In the event that clogging is experienced in the line from the dust side, installation of three-way valves in the tubing permit purging with compressed air is recommended.

Normal differential pressure will vary from application to application. It is possible to design a fabric collector to operate at a very low-pressure drop; however, collector cost and size seldom justify the low air-to-cloth ratio required. Alternatively, installations are sometimes designed for operation at pressure drops over 6-inches of water (14.9 mbar) to conserve capital or plant space at the expense of higher power and reduced fabric life. Realizing that there are deliberate exceptions in particular cases that should be defined by individual manufacturers, the following can be considered typical of average fabric collector performance:

1. Initial pressure drop across new media is usually very low (e.g. less than one inch of water [2.5 mbar]) prior to precoating.

2. Over time, the differential pressure across the filters will increase, depending on the amount of filter area, dust loading, cleaning frequency, and other factors.

3. Most filter medias require a dustcake on them in order to achieve the desired filtration efficiency. In these cases, the operating differential pressure across the filters should be maintained at a minimum of 3-inch water gauge (w.g.) (7.5 mbar). It may take minutes, hours, or days for the differential pressure to reach this level. It is important to not activate the filter cleaning system during this period of time.

4. If the filter media does not require a dustcake for achieving high filtration efficiency (i.e., expanded PTFE membrane and other microporous media), it is acceptable to operate at differential pressure across the filters at levels less than 3-inch w.g. (7.5 mbar)

5. Most fabric filter system fans are sized to overcome a maximum of 6-inch w.g. (14.9 mbar) pressure drop across the filters plus all mechanical losses. Therefore, this is the maximum recommended operating differential pressure. If it is exceeded, the system gas flow and dust capture may be reduced to unacceptable levels.

6. On multi-compartment fabric filters, the overall pressure drop across the entire array of compartments, inlet flange to outlet flange, will typically be 0.5 to 2.5 inches w.g. (1.2 to 6.2 mbar) greater than the individual compartment differential pressures, depending on the design of the inlet and outlet ductwork.

4.2 High Differential Pressure

Abnormally high differential pressure may be caused by insufficient filter area for a given service. Often, however, minor operational changes can bring performance within normal limits. An increase in the frequency of cleaning can usually be arranged through timer adjustment. In some cases, the level of cleaning energy can be adjusted upward, perhaps along with an increase in the duration of cleaning. However, increased cleaning frequency or intensity may also result in increased outlet emissions and reduced filter life.

Other factors that can contribute to high differential pressure are:

1. Collector overloaded by too much incoming gas flow. Check fan speed, damper adjustment, and system design.

2. Faulty or inoperative cleaning mechanism. Repair or adjust according to the manufacturer's instructions.

3. Leaky airlock or dust discharge system. Inward air leakage can prevent dust discharge and permit excessive accumulations in the collector.

4. Storing dust in the hoppers not designed for storage. These types of hoppers should be continuously emptied. Excessive accumulation in the hopper can lead to dust re-entrainment onto the filters.

5. Accumulation of material on the clean side of the collector. In pulse-jet or reverse gas collectors, reduced cleaning effectiveness can occur since the cleaning air becomes dirty and tends to contaminate and abrade the media.

6. Blinded filters. A typical cause is moisture condensation resulting in low air flow acceptance that is difficult, impracticable, or not possible to correct. Hand shaking, vacuuming, laundering, dry cleaning, as well as heat treatment of the filters may help to partially recover the filter media; otherwise, the media may need to be replaced.

   Section 7.0 provides additional troubleshooting information when experiencing high differential pressure on four common types of cleaning systems.

4.3 Dust Emissions

Detection and isolation of dust leakage is usually a visual task. Leak detection devices and technologies including triboelectric style probes, optical devices, and traceable powders are available.

Since a properly applied fabric collector operates at efficiencies over 99%, the exhaust should always be "clean" to the eye exclusive of water vapor or other condensates. Visible seepage or a "plume" of dust in the exhaust means that a portion of the media or a mechanical joint is leaking. The exception to this rule is when a woven style media is brand new; there will often be some minor seepage until the dust cake has built up to the operating level. Also, excessive cleaning of fabric, woven or felt, may lead to increased opacity.

On critical applications including toxic dusts, a fail-safe means of leak protection and detection is a back-up collector in series with the main collector. This unit can be operated with 50% or less of the cloth area of the main collector, and any rapid increase in differential pressure across the back-up unit indicates a leak in the main collector while providing retention of the escaping material.

4.4 Dust Discharge

Hopper Discharge:

Hopper discharge problems can usually be avoided by supplying the collector manufacturer with sufficient data on, or a sample of, the material to be handled so that special design features such as extra steep hoppers or live bottoms can be incorporated, if required. However, when faced with operational hopper discharge problems the following will usually help:

1. Arrange to keep the hopper empty at all times. Use an overrunning discharge device such as a rotary airlock with a capacity far greater than the rate of dust accumulation.

2. Use a large opening in the bottom of the hopper. If an 8-inch (203 mm) discharge valve bridges over, conversion to a 10 or 12 inch (254 or 305 mm) will often remedy the problem.

3. Installing vibration, rapping, or acoustic horn devices may be justified. Proper selection of amplitude and frequency will often keep material flowing well, especially when dust is not stored in collector hoppers. However, certain materials will be compacted into a more solid mass by vibration. Care must be exercised in the vicinity of stainless steel welds since vibration can be destructive in the weld heat affected zone.

4. On some applications, properly directed low-pressure dry air flow can keep material flowing. This can take the form of porous pads or simple nozzles. Improper use of compressed air, particularly fluidized air, in certain situations (e.g. ash evacuation) could lead to re-entrainment of fine particulate.

5. Conversion to a live bottom hopper. Units are available with screws, rotating arms, and special vibratory motions that will often solve the most difficult problems.

6. Removable bin for materials that cannot be handled in normal fashion. A portable container becomes the dust receiver, and is removed intact for disposal.

7. If bridging occurs as the result of condensation, insulation is required to keep internal hopper surfaces dry. Supplemental external heat can also be applied.

4.5 High Temperature Operation

Commonly used filter media allows fabric collectors to operate at temperatures up to 550°F (288°C), and even higher with ceramic or metal filters. When new filter materials are developed that operate at higher temperature, caution is recommended in selecting these materials until they have been field-tested. Elevated temperature service requires some special operational techniques:

1. When the high temperature stream contains large amounts of water vapor, insulation is required to avoid condensation. In some cases acid vapors are also present which may condense at higher temperatures than water vapor. Unless proper care is taken with respect to insulation to maintain above-the-dew-point operation, corrosion and media blinding can occur. If acid gas is present, the gas temperature must be maintained above the "acid dew point". If acid levels are high, an acid neutralization system may be required. The fabric filter alone will not remove significant amounts of acid gases.

2. Temperature instability may be a problem in some systems requiring protection to avoid over-temperature. This usually consists of emergency by-pass, cold air bleed-in systems or precooling. Spray towers, U-tube coolers, air-to-air heat exchangers and water-cooled duct are commonly used equipment for cooling gases.

3. Gasket leaks, no matter how small, can become serious due to infiltration of cold air and resultant condensation, and the possibility of corrosion. Regular inspection and prompt repair of minor flaws are required.

4. Special instructions should be provided for starting up a high temperature fabric filter. When starting up a high temperature fabric filter, it is important to heat the system above the dew point as quickly as possible.

5. When taking a high temperature fabric collector out of service, it is important to purge completely the combustion and process products before turning off the fan during the shutdown procedure.

5.0 MAINTENANCE

There are both numerous points of similarity and numerous differences among fabric-type dust collectors as made by different manufacturers. Therefore, a discussion of maintenance must be general and cannot cover the specifics of the mechanisms produced by each individual company.

One generalization, however, bears repeating often. Be sure to thoroughly study the installation, operating, and maintenance instructions before attempting any work on the collector. It is equally important that those instructions be filed in some place where they can be referred to periodically. All such instructions have been most carefully compiled and contain many details that cannot be found elsewhere.

It is unfortunate that instructions are often thrown away immediately after installation, overlooking the important maintenance information they contain. This is particularly true when an outside contractor makes the installation without responsibility for equipment maintenance. It is wise to check with installers to be sure that manuals received with the equipment are turned over to the owners. Then be sure they are filed in some safe, but accessible place of record storage and retrieval. Equipment maintenance can be enhanced by having the equipment supplier provide formal training before and/or during startup of all operators and maintenance personnel.

5.1 Before Initial Start-Up

Before start-up there are a few general points that should be checked on any fabric collector regardless of make:

1. Check housing to see that all joints are tight and sealing is in place on any points requiring it. Caution: Be sure that no painting is done on access door seals or gaskets because they will adhere to freshly painted surfaces.

2. Make sure all bolts are tight. Threaded members on clamps, door latches, etc. should be lubricated to protect them from corrosion.

3. Check all filters to be sure they are sealed into the holding device provided. Read the instructions carefully covering method of sealing and of adjustment of the tension of the filters if a method of adjustment is incorporated in the design. If filters or cages are furnished with ground wires to guard against dust explosion, make sure that they are properly connected to tube sheets.

4. Check cleaning mechanism and controls to see if the unit or system is set up in accordance with the manufacturer's recommendations.

5. Check dust removal system to make sure it is operating properly.

6. Check direction of fan rotation. A fan operating in the wrong direction still moves some air in the expected direction. Therefore, check fan rotation visually and do not rely on the fact

that air is flowing to the collector. Also, check fan for vibration and noise, overheated bearings and overload on driver.

5.2 Fan Start-Up

Since most fabric collectors are installed with centrifugal fans as the air moving device, the interrelation of the fan and collector is important. On start-up with new media, the collector resistance is considerably lower than the design level, perhaps 0.5 inches of water (1.2 mbar) instead of 6 inches (14.9 mbar).

When operating against a resistance lower than design, a centrifugal fan will inherently move more than the design flow in cubic feet per minute (cfm) or cubic meters per minute (m^3/min). This has two undesirable effects: the fan horsepower can rise to the point of motor overload and the greater-than-design cfm can lead to blinding of the filter media and/or seepage.

In systems where the filter element pressure drop is a high percentage of the total system pressure, fan start-up with unseasoned filters can cause a fan overload condition. This can be avoided by using a fan with non-overloading characteristics or by using a damper to limit motor amperage. In some systems the ductwork or other mechanical resistance is high compared to the filter element and there is no adverse affect on the fan.

Special care is needed when starting up high temperature systems with fans handling air at ambient (room) temperature. Partially close the fan dampers for start-up to reduce power consumption. Open the damper gradually when fan is up to speed and system temperature rises being careful not to overload the motor. Also, note that when dampers are closed, rough fan operation may be a possibility.

In critical systems such as air classifiers sensitive to flow change, an automatic flow control device such as a motor-operated fan inlet damper or fan speed controller is useful. Controls have the added advantage of leveling out minor fluctuations due to compartmental cleaning.

Another obvious but often overlooked start-up check is to make certain that the fan is rotating in the correct direction. Since a centrifugal fan will move some air even though turning in the wrong direction, inexperienced observers often overlook this possibility.

5.3 Pre-Coating of Filter Media

Start up procedures, especially hot gas applications, should include an initial pre-coating of new filters. An inert or neutral pH material should be injected into the collector prior to introducing the process gas. The pre-coat material should be specifically designed with varying particle shapes and sizes to form a protective initial conditioning layer on the filter media that will promote collection efficiency, but not inhibit normal gas flow through the media. Absorption capability for moisture and adsorption capabilities for hydrocarbons and other contaminates may also be desirable in certain applications.

5.4 Care of Filter Media

The type of material used in the filters varies widely depending on such factors as temperature, humidity, chemical characteristics of the dust to be collected or the gases that will pass through the filters, as well as general operating conditions. Each type of filter media has different characteristics. The manufacturer should be consulted regarding care and use of the media and selection of replacement filters. Adjustment of filter tension where recommended is usually made within two weeks after start-up and should be periodically checked in accordance with the manufacturer’s instructions.

Regular inspections of filters should be made and the pressure loss across the collector and individual compartments should be recorded frequently and compared. If the pressure drop is rising this may be an indicator that the filters are not cleaning properly or particulate is penetrating into filter media. The filters should be checked for heavy dust cake and if the problem is not that obvious, several filters should be sent out for inspection and assessment by a filter testing laboratory or service.

Filters should also be regularly checked for loose clamps, tears, holes, or other causes of leaks. Pinholes and small tears can occasionally be repaired, but the permanence of adhesives and type to be used varies with the nature of the fabric and the operating environment. The manufacturer’s recommendations should be sought and followed.

5.5 Filter Replacement

The ideal approach to filter replacement is to renew completely the media in an entire collector, or at least in a whole compartment. If a small percentage of new media is exposed to a high differential pressure the flow through the new media will start at very high levels. One new filter may operate initially at rates over 10 times the normal rate. The seepage and/or blinding tendencies are evident.

Therefore, it may be desirable to seal off any leaking filters until a significant number of them have been sealed off or the pressure drop increases significantly. At this point, all of the sealed filters or preferably the entire compartment of filters should be replaced. Be sure to condition the new filters with a pre-coat material prior to putting the compartment on line *(see Section 5.3: Pre-Coating of Filter Media).*

Replacing individual felt filters in a pulse-jet is probably less risky than putting in an individual woven filter, especially glass. The woven filter will most likely bleed dust to the stack and will fail prematurely. If the compartment inlet dampers are able to modulate, the compartment can be placed into service at reduced flow.

The constantly improving filter media technology makes it worthwhile to keep in contact with the manufacturer. As new fibers and fabrics are applied to dust collectors, the manufacturer is in the most knowledgeable position to offer advice and suggestions to improve media performance and life.

Quotations for replacement filter media should be reviewed to ensure the replacements are equivalent to original specifications. Warranties may require replacements obtained from the original equipment manufacturer. It is advisable to request a sample filter to approve before releasing a company to proceed with a production run. The original equipment manufacturer is generally a good source for information on fabric material or how the filter fits into the unit.

5.6 Filter Cleaning System

The most common fabric filter designs are pulse-jet, reverse air and shaker. These names describe the filter cleaning system used with the respective filter design. The manner in which the dust is removed from the fabric is a crucial factor in the performance of the fabric filter system. If the dust cake is not adequately removed, the pressure drop across the system will increase to an excessive amount. If too much of the cake is removed, or the cleaning activity causes particles to seep through the filter media, the filtration efficiency will be reduced.

Shaker and reverse air fabric filters operate by directing the particulate-laden gas into the inside of the filter elements; therefore, the collection of dust is on the inside surface. The filter elements are cleaned periodically by reversing the flow of gas or by mechanical shaking, causing the previously collected dust cake to fall into a collection hopper. Compartment isolation from gas flow is required for filter cleaning. The filter elements are made out of various woven fabric materials in various diameters and lengths.

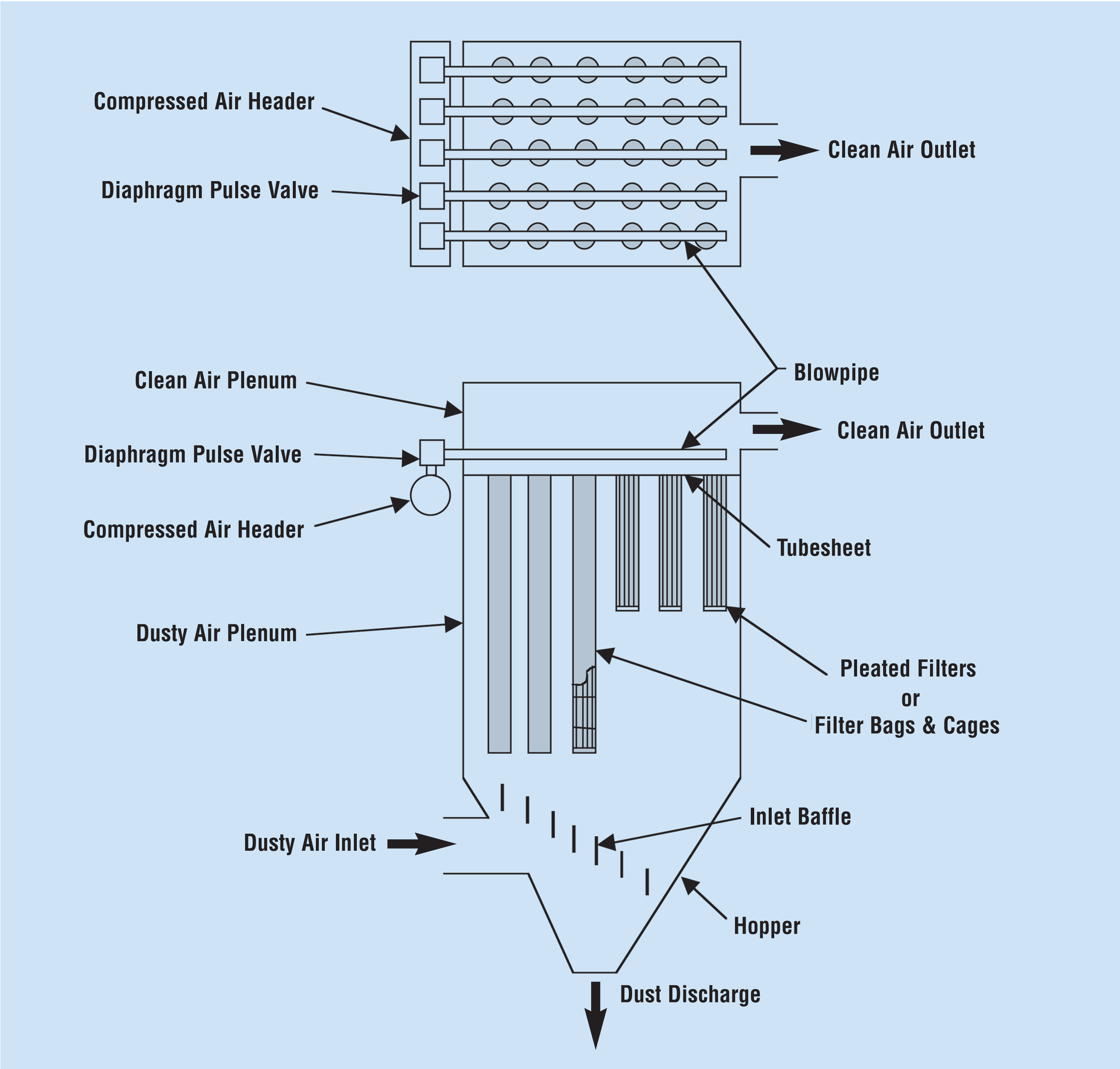
Carefully designed acoustic horns installed within the compartments of reverse air and shaker fabric filters can be used for sonic assisted cleaning. In this capacity, acoustic horns may increase the effectiveness of reverse air and shaker cleaning by reducing the operating pressure drop across the fabric filter.

Pulse-jet fabric filters are designed with internal support frame structures, called wire cages, to allow collection of the dust on the outside of the filter. A pulsed jet of compressed air into the filter periodically removes the dust cake and causes the dust to fall into a collection hopper. Pulse-jet filters are made out of various fabric materials in various diameters and lengths. Pulse-jet systems may also be designed or retrofitted with pleated filter elements. These elements may be designed to be interchangeable with the filter cage assembly. Filter cleaning can be achieved on line (while filtering) without compartment isolation.

A general procedure for inspection of each type of cleaning system is presented in ***Troubleshooting*, Section 7.0.** Also consult the Operation and Maintenance Manual for your equipment to find written description, drawings, and service instructions for the filter cleaning hardware. Periodic inspection of the filter by a factory trained service representative or reputable filter maintenance company will ensure optimal performance and prolong the life of the equipment.

FIGURE 2

TYPICAL PULSE-JET



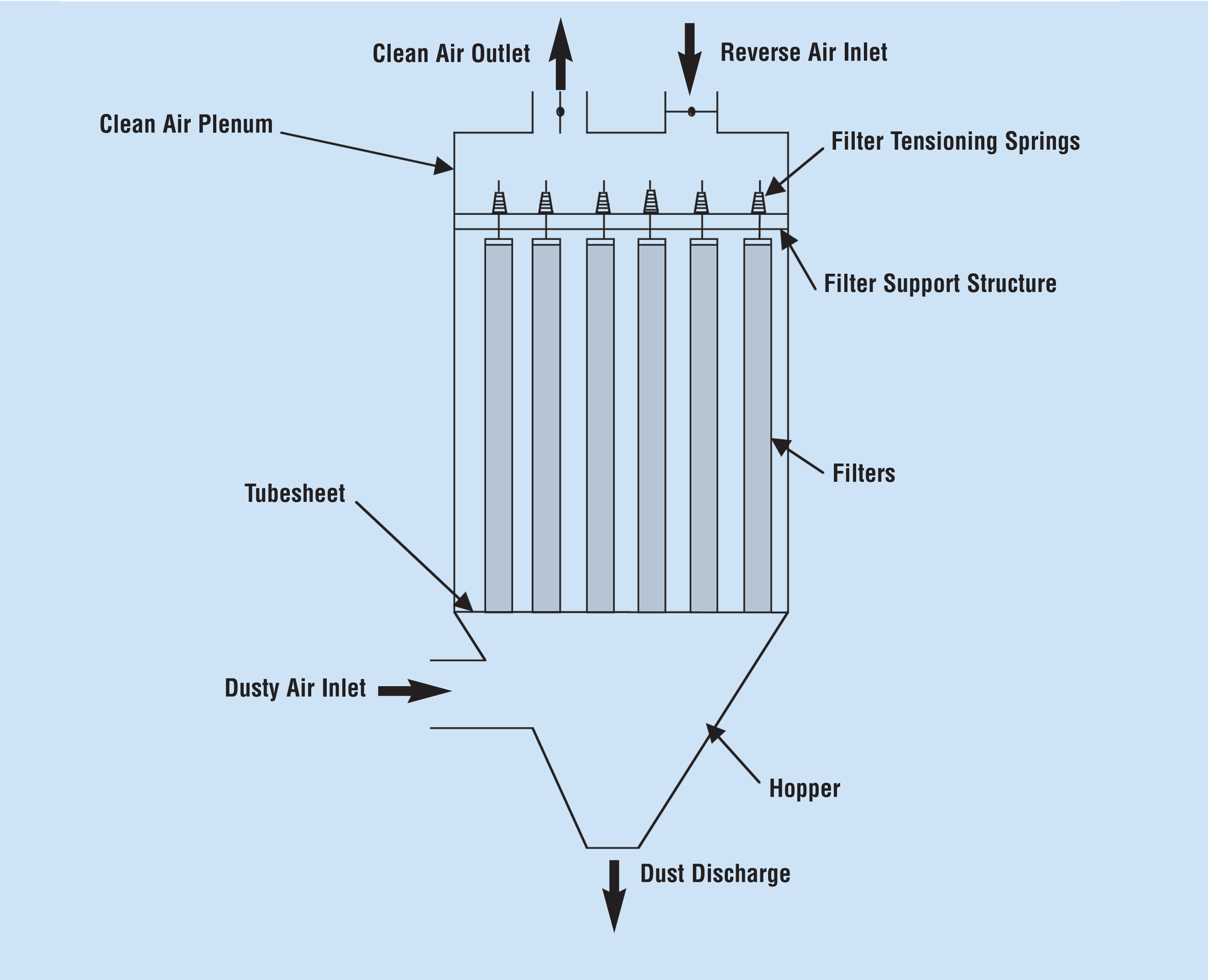
5.7 Dampers and Valves

Depending on the type of collector used, there may be dampers that isolate individual sections for on-line maintenance and/or during the media cleaning cycle. There may also be hopper unloading valves governing the discharge of the collected material. The proper operation and maintenance of the dampers or valves is basic to the proper functioning of the collector. Again, it is necessary to follow the manufacturer's recommendations and make them part of the maintenance schedule.

5.8 Motors, Fans, and Belts

Motors need the usual periodic inspection with lubrication depending on type of motor, type of bearing and severity of service. Fans should be checked especially for tightness of all bolts, bearing vibration or signs of bearing wear, plus condition of foundations.

FIGURE 3
TYPICAL REVERSE AIR COLLECTOR



The following table can be used as a guide to determine when a fan is operating with too much vibration:

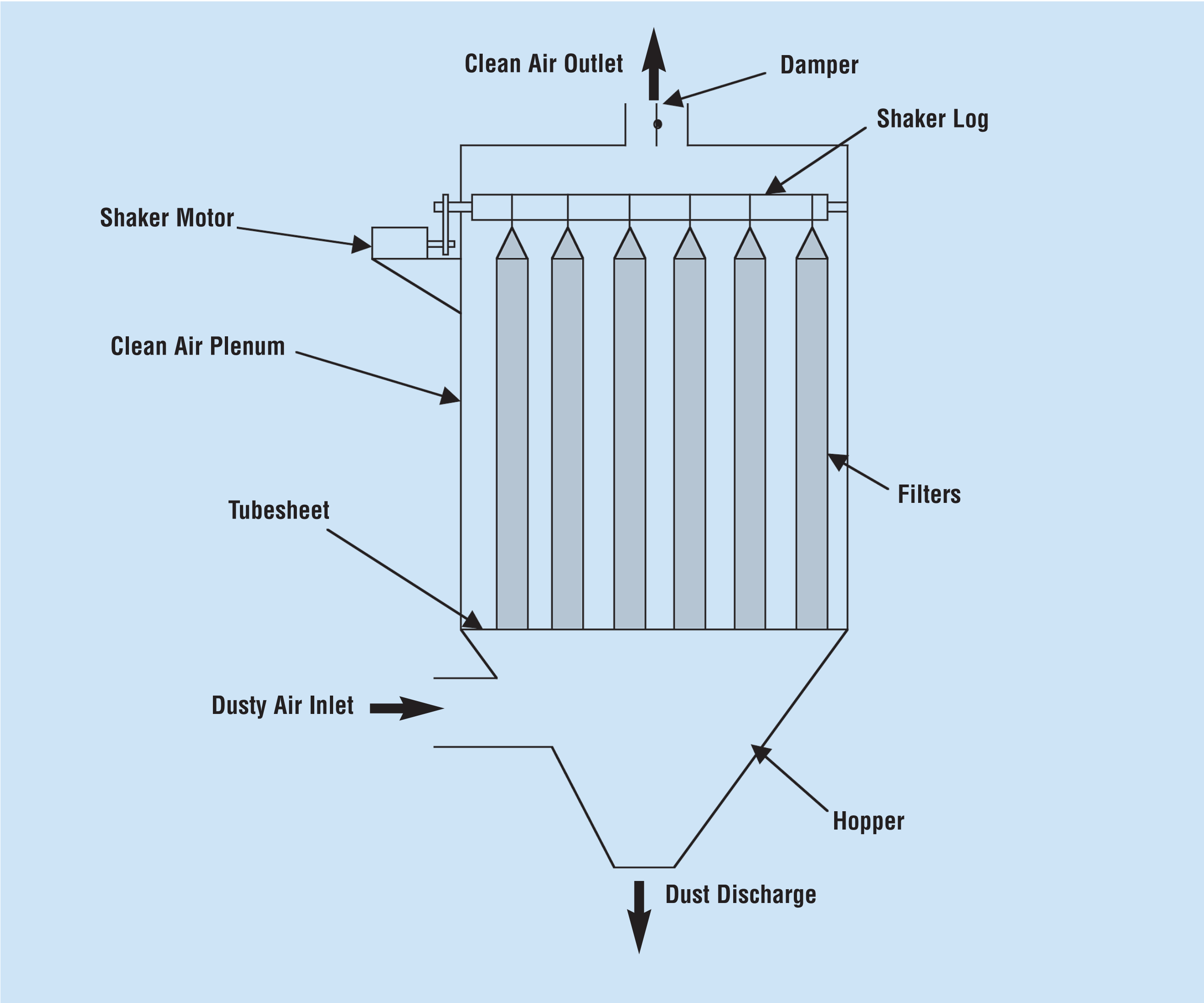
Fan Speed:

RPM	Smooth	Fair	Rough	Very Rough
600	2 mils	4 mils	8 mils	15-20 mils
900	1.5	2.75	6	8-10
1200	1.0	2.0	4.5	6-8
1900	0.75	1.5	3.5	5-7

1 mil = 0.001 inches = 25.4 micrometers

Fan housing and wheels should be inspected for wear and accumulations of dust and dirt. Clean thoroughly with steam or water jet, compressed air or wire brush. This will help prevent an unbalanced condition. Cover bearings so water and dust will not enter pillow blocks while cleaning. Fan wheels having badly worn blades, flanges, etc., should be replaced or rebuilt and rebalanced. Consult the fan manufacturer on such a situation. Bearings on high-speed fans are often designed to run hot (100º to 200º F, 38º to 93ºC). Therefore, do not replace a bearing simply because it feels hot to the touch. Check the temperature of the pillow block with a thermometer and refer to the fan manufacturer's written recommendations.

Figure 4
TYPICAL SHAKER COLLECTOR



If the motor requires factory servicing, this can usually be obtained only from the motor manufacturer and not from the manufacturer of the fabric collector. For such service, contact the local authorized service station of the motor manufacturer.

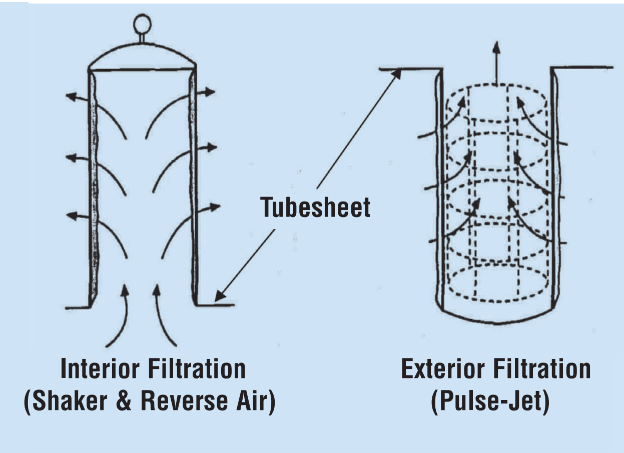
The fan is usually driven by an electric motor through a V-belt drive. Proper belt tension must be maintained to prevent undue slippage or unnecessary stress on the fan bearings. If belts squeal at start-up, they are too loose and should be tightened. Often new belts take a period of one or two month's running-in time and should be checked after the first two months for proper tension. Worn belts should be replaced and, for this purpose matched sets of spare V-belts of all sizes required by the system should be maintained in stock. Sheaves should be replaced when wear of the grooves becomes sufficient to allow slippage or belt damage.

5.9 Lubrication of Moving Parts

Each manufacturer's maintenance manual has specific instructions on the frequency of lubrica-

FIGURE 5

INTERIOR vs. EXTERIOR FILTRATION



tion necessary. These instructions vary with the exposure of the part, the type of bearings, and the kind of movements involved. Read instructions thoroughly and list on a preventative maintenance schedule the frequency and type of lubrication required for each of the points specified. ***DO NOT OVERLUBRICATE!***

5.10 Ductwork

The continuation of satisfactory operation of a dust collector system depends almost entirely on the care that is given the system and the equipment. This includes continuing maintenance of the housing, ductwork and hoods.

Regular inspection of the duct system should be made to be sure that sufficient gas is handled to prevent the dust from settling out. All ductwork should be inspected for accumulations of dust, and any settled material should be removed.

Also, look for any holes caused by corrosion or erosion. These areas should be patched immediately and if the problems are recurring, an engineering evaluation and system modifications may be warranted.

The duct system should be protected against external forces. Any sections damaged sufficiently to interfere with gas flow or to cause leakage should be replaced. Normal maintenance is required to keep the duct system in good operating condition.

5.11 Auxiliary Systems

Compressed air systems must be installed and operated according to good engineering practices. After coolers, automatic condensate traps and filters are usually indicated. Special considerations such as very low ambient temperatures will require thorough drying and/or heat tracing of piping to prevent freezing.

Valve or damper operators can be air operated or electrically driven. The instructions concerning maintenance and operation of these devices must be followed. Air operated units often require special treatment of the compressed air supply, such as filtration, addition of lubricant, or anti-freeze. When special treatment of compressed air supply is required, it is important to ensure this treatment does not contaminate the compressed air used to clean filter elements.

5.12 Checklist for Periodic Maintenance

Items that should be included on the maintenance schedule have been listed below:

1. Collector housing and duct system for leakage, corrosion or settled dust.
2. Filter media for blinding, leakage, wear, slack, tension, or loose clamps.
3. Hopper discharge pluggage due to bridging of dust or foreign material blocking valve.
4. Differential pressure and frequency of operation of cleaning mechanism as compared to manufacturer's recommendation.
5. Airlocks, valves, dampers for leakage and for synchronization and operation.
6. Fans – tightness of bolts, bearing vibration and temperature, erosion or dirt build-up in housing and on wheel, alignment of V-belt drive or coupling and driver, sheave of V-belt wear.
7. All bearings on rotating or moving parts – fans, motors, dampers, etc., for lubrication and possible binding. **Caution:** *Follow manufacturer's instructions because over-lubrication must be avoided.*
8. Any solenoid valves for dust accumulation, seating and condition of "O" rings.
9. All foundation bolts on collector, fan, motor, etc., for tightness. Also check bolts on collector housing, structural members, etc.

10. Check access door gaskets for leakage and possible replacement.

11. Frequency is not stated because it depends on the manufacturer's recommendations, on the standards in the user's plant, and on the severity of the service.

6.0 OPERATION AND SERVICE MANUAL

The following information is typical of what is contained in the manual received from an ICAC member manufacturer for the air pollution control equipment purchased. In addition, special training should be available upon request if not included in the purchase order.

Contents:

I. Introduction
- Date of purchase
- Serial Number
- Manufacturer's Contact with phone number for questions and help with any problem

II. Safety Considerations

III. System Description
- Type of equipment (i.e.: pulse-jet, reverse air, cartridge).
- Size of the equipment, number of compartments, number of filters, filter area, etc.
- Brief description of process, including gas flow rate, gas temperature, emission source.

IV. Operation
- Theory of Operation
- Precommissioning Instructions
- Precoating Filters Instructions
- Start-Up Instructions
- Shut-Down Instructions
- Troubleshooting Instructions
- Dust Leak Detector Kit - Description And Operating Instructions
- Filter (and Cage) Installation and Removal Instructions
- Filter Storage Recommendations
- Instructions for items that require routine inspection and/or maintenance, such as V-belt drives, rotary air locks, solenoid valves, manometers, etc.

V. Parts List
- Instructions for Ordering Spare Parts
- Recommended Parts List

VI. Drawings
- Arrangement Drawing
- Mechanical Assembly
- Electrical Wiring Schematics

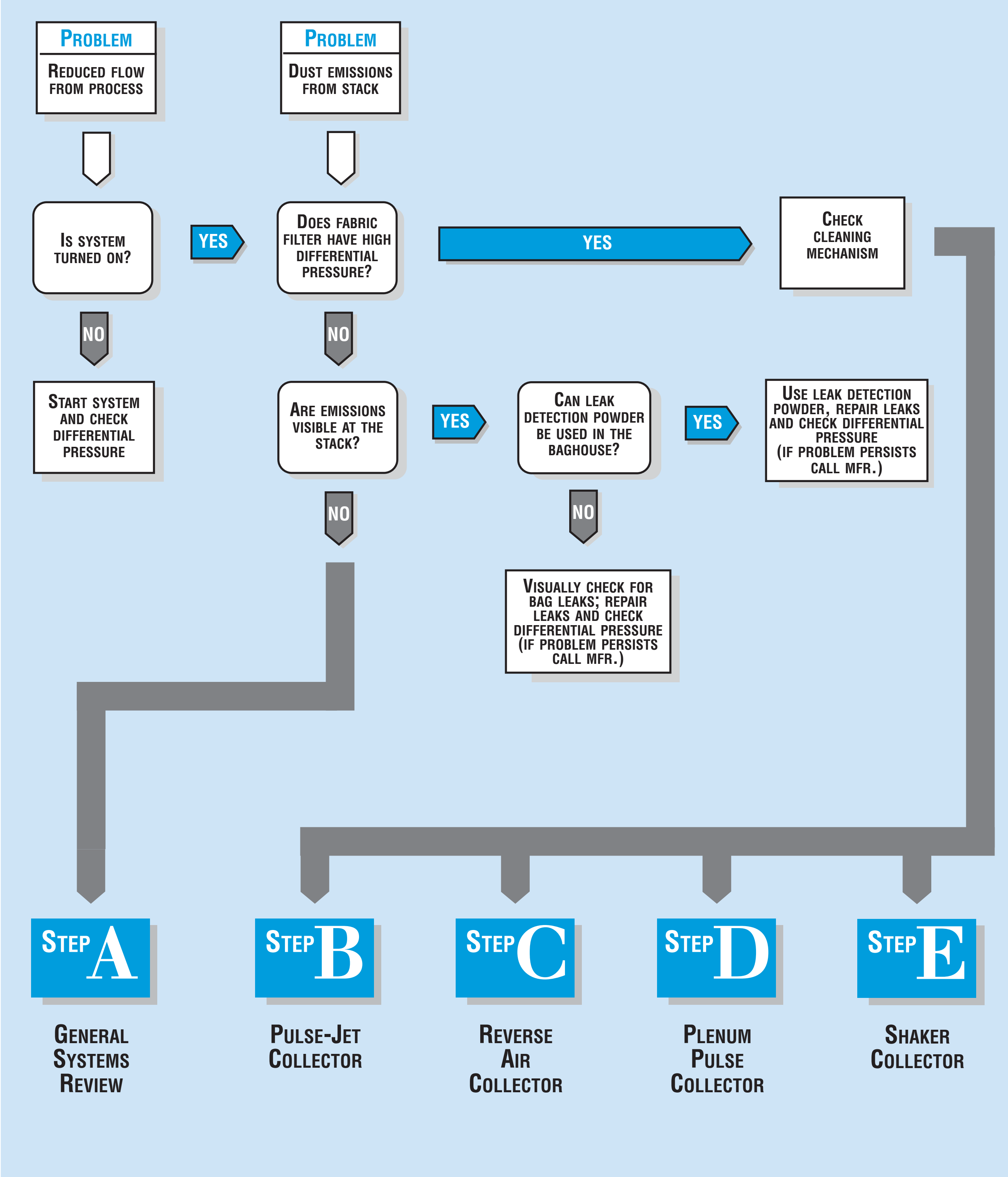
Drawings should provide sufficient information for proper maintenance of equipment.

VII. Vendor Literature
- Service instructions for auxiliary equipment supplied. This typically includes motors, conveyors, fans, transmitters, etc.

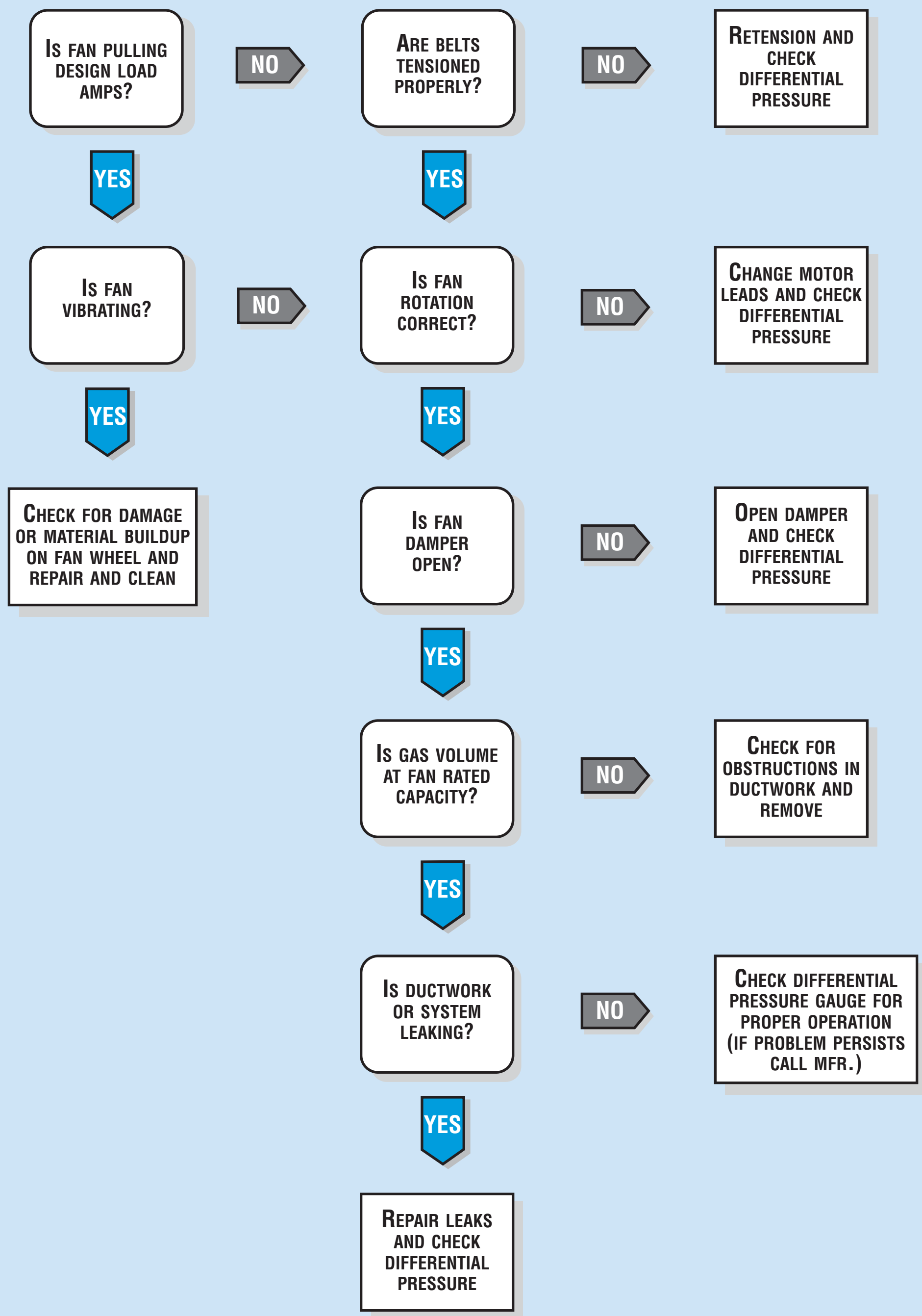
7.0 TROUBLESHOOTING

Begining on page 15, with the *"Fabric Filter Troubleshooting Chart"* and continuing through page 19, you will find flowcharts *Step A, B, C, D, E, F,* and *G*. Together these eight charts should aid in helping to quickly identify fabric filter trouble spots and what steps need to be taken to remedy most problems.

Fabric Filter Troubleshooting Chart



Step A General System Review

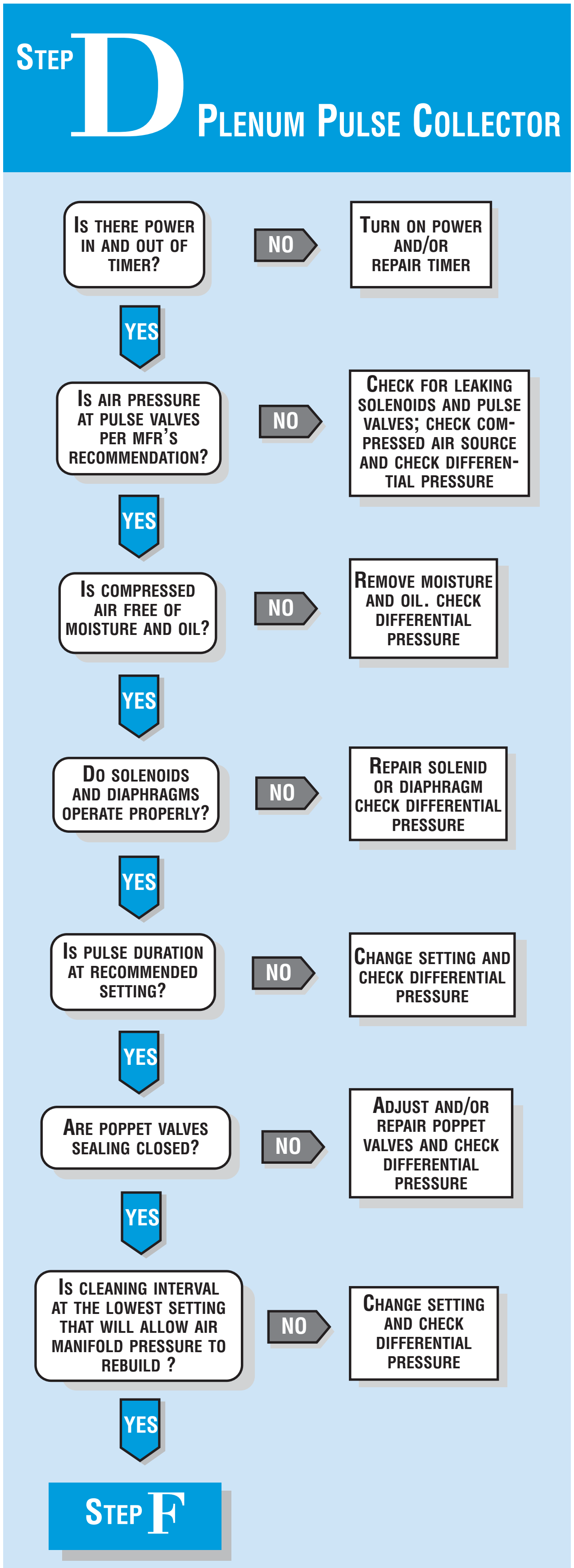


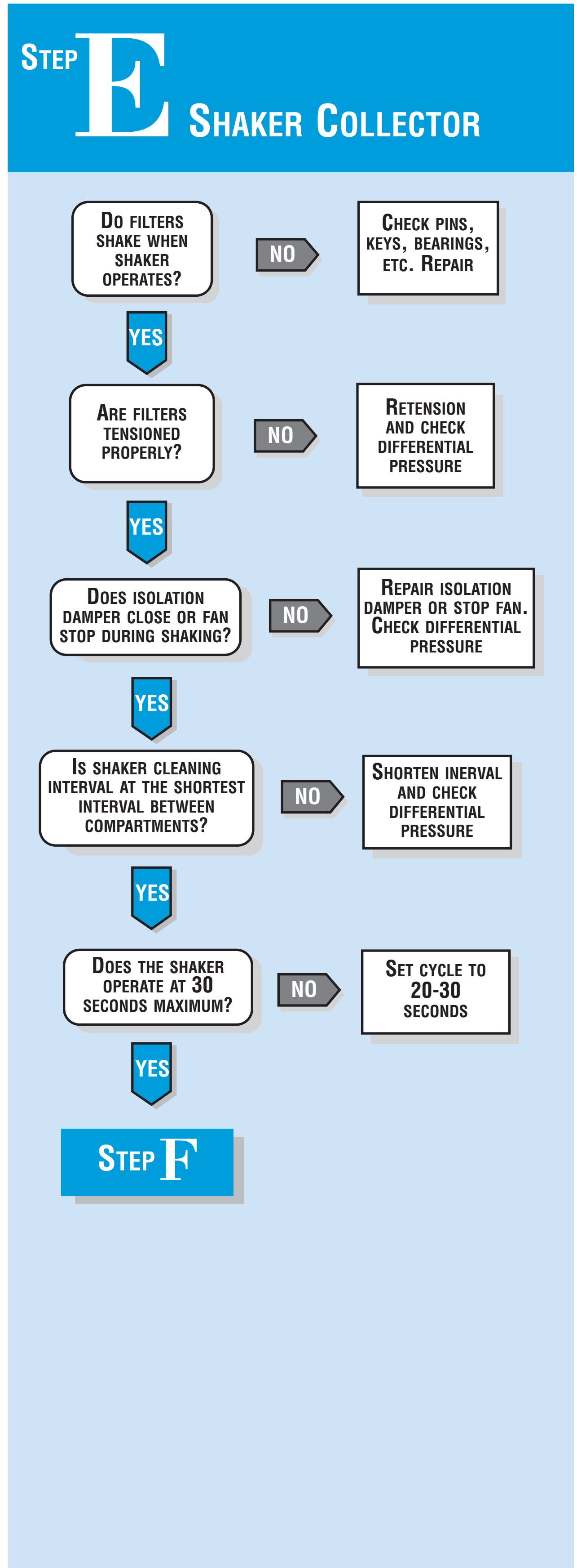
STEP B PULSE-JET COLLECTOR

- IS THERE POWER IN AND OUT OF TIMER?
  - NO → TURN ON POWER AND/OR REPAIR TIMER
  - YES ↓
- IS MANIFOLD PRESSURE AT MFR'S RECOM-MENDED SETTING?
  - NO → CHECK FOR LEAKING SOLENOIDS AND PULSE VALVES; CHECK COMPRESSED AIR SOURCE AND CHECK DIFFERENTIAL PRESSURE
  - YES ↓
- IS COMPRESSED AIR FREE OF MOISTURE AND OIL?
  - NO → REMOVE MOISTURE AND OIL. CHECK DIFFERENTIAL PRESSURE
  - YES ↓
- DO SOLENOIDS AND DIAPHRAGMS OPERATE PROPERLY?
  - NO → REPAIR SOLENOID OR DIAPHRAGM AND CHECK DIFFERENTIAL PRESSURE
  - YES ↓
- IS PULSE DURATION AT RECOMMENDED SETTING?
  - NO → CHANGE SETTING AND CHECK DIFFERENTIAL PRESSURE
  - YES ↓
- IS CLEANING INTERVAL AT THE LOWEST SETTING THAT WILL ALLOW AIR MANIFOLD PRESSURE TO REBUILD?
  - NO → CHANGE SETTING AND CHECK DIFFERENTIAL PRESSURE
  - YES ↓
- IS DIFFERENTIAL PRESSURE REDUCED BY PULSING OFF-LINE?
  - NO → STEP F
  - YES → STEP G

STEP C REVERSE AIR COLLECTOR

- IS THERE POWER IN AND OUT OF TIMER?
  - NO → TURN ON POWER AND/OR REPAIR TIMER
  - YES ↓
- ARE FILTERS TENSIONED PROPERLY?
  - NO → RE-TENSION FILTERS AND CHECK DIFFERENTIAL PRESSURE
  - YES ↓
- ARE ISOLATION DAMPERS SEALING PROPERLY?
  - NO → ADJUST AND/OR REPAIR AND CHECK DIFFERENTIAL PRESSURE
  - YES ↓
- IS REVERSE AIR FAN RUNNING?
  - NO → TURN ON AND CHECK DIFFERENTIAL PRESSURE
  - YES ↓
- IS REVERSE AIR FAN ROTATION CORRECT?
  - NO → CHANGE MOTOR LEADS AND CHECK DIFFERENTIAL PRESSURE
  - YES ↓
- IS CLEANING CYCLE SET AT MFR'S SPECIFICATIONS?
  - NO → CHANGE SETTING AND CHECK DIFFERENTIAL PRESSURE
  - YES ↓
- IS CLEANING INTERVAL SET AT ITS SHORTEST INTERVAL?
  - NO → CHANGE SETTING AND CHECK DIFFERENTIAL PRESSURE
  - YES → STEP F


Step D Plenum Pulse Collector
Is there power in and out of timer?
NO
Turn on power and/or repair timer
YES
Is air pressure at pulse valves per mfr's recommendation?
NO
Check for leaking solenoids and pulse valves; check compressed air source and check differential pressure
YES
Is compressed air free of moisture and oil?
NO
Remove moisture and oil. Check differential pressure
YES
Do solenoids and diaphragms operate properly?
NO
Repair solenid or diaphragm check differential pressure
YES
Is pulse duration at recommended setting?
NO
Change setting and check differential pressure
YES
Are poppet valves sealing closed?
NO
Adjust and/or repair poppet valves and check differential pressure
YES
Is cleaning interval at the lowest setting that will allow air manifold pressure to rebuild ?
NO
Change setting and check differential pressure
YES
Step F


Step E Shaker Collector
Do filters shake when shaker operates?
NO
Check pins, keys, bearings, etc. Repair
YES
Are filters tensioned properly?
NO
Retension and check differential pressure
YES
Does isolation damper close or fan stop during shaking?
NO
Repair isolation damper or stop fan. Check differential pressure
YES
Is shaker cleaning interval at the shortest interval between compartments?
NO
Shorten inerval and check differential pressure
YES
Does the shaker operate at 30 seconds maximum?
NO
Set cycle to 20-30 seconds
YES
Step F

Step F Filter Evaluation

Remove a filter and run a permeability test to check for blinding

YES

Is filter blinded?

NO → Step G

YES

Analyze for cause of blinding and correct. Replace filters and check differential pressure

Step G Dust Removal Review

Dust being continously removed from hopper?

NO → Remove dust continously and check differential pressure

YES

Contact MFR for further recommendations

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