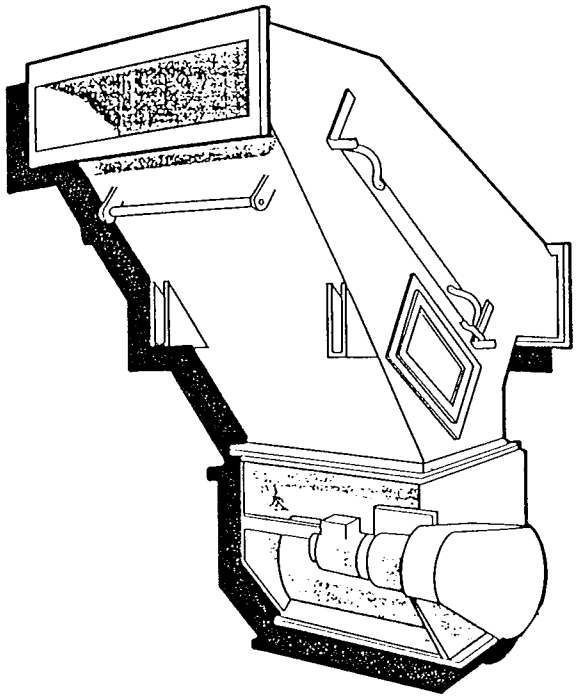
Series APS™
Air Product Separators



Installation, Operation and Maintenance Manual

PAPER AND DUST PROS, INC.
13000 2nd Street Grandview, MO 64030
(816) 966-1473 PHONE (816) 966-9379 FAX

Installation, Operation, and Maintenance of APS™ Air Product Separators

IMPORTANT: READ ALL INSTRUCTIONS AND IN PARTICULAR WARNINGS BELOW BEFORE PROCEEDING. NOTIFY INTERNATIONAL INDUSTRIAL FAN INC. BEFORE PROCEEDING WITH ANY ACTIONS YOU BELIEVE MAY BE COVERED UNDER WARRANTY.

WARNING:

- DO NOT ATTEMPT TO OPEN WINDOW/ACCESS PORTS OR REMOVE SCREEN FROM A UNIT IN OPERATION AS SERIOUS PERSONAL INJURY MAY RESULT FROM OBJECTS EJECTED.

- NEVER ATTEMPT TO WORK ON OR ACCESS AN APS™ AIRLOCK WITHOUT FIRST ELECTRICALLY LOCKING OUT AND/OR REMOVING THE POWER LEADS FROM THE MOTOR.

- NEVER OPERATE A CHAIN DRIVEN AIRLOCK WITHOUT PROPER GUARDING OF THE CHAIN DRIVE.

- NEVER ENTER AN APS™ WITHOUT ELECTRICALLY LOCKING OUT ALL SUPPLY FANS, AND ELECTRICALLY LOCKING AND REMOVING POWER LEADS FROM APS™ AIRLOCK OR OTHER DEVICE BELOW UNIT. BE SURE TO FOLLOW APPLICABLE CLOSED AREA POLICIES AND PROCEDURES.

- NEVER PLACE ANY OBJECT IN AN OPERATING AIRLOCK INCLUDING STICKS, POLES, HANDLES, OR BODY PARTS. SERIOUS PERSONAL INJURY OR DEATH CAN RESULT FROM ATTEMPTING TO REMOVE A JAMB FROM AN OPERATING AIRLOCK.

● NEVER ALLOW AN EXPLOSIVE MATERIAL OR MIXTURE TO ENTER AN APS™ OR AIRLOCK. EQUIPMENT IS NOT FOR USE IN NATIONAL ELECTRIC CODE HAZARDOUS LOCATIONS.

● ELECTRICALLY GROUND APS™ BODY AND AIRLOCK TO REDUCE THE POSSIBILITY OF STATIC ELECTRIC BUILDUP AND DISCHARGE.

NOTE: All portions of the received equipment should be inspected for damage immediately upon receipt from the carrier. Any and all damage should be immediately reported to the carrier, and if possible should be noted upon the bill of lading on receipt. Any shortage or incorrect shipment should also be made immediately known, and should be confirmed against the shipping list accompanying the shipment.

Installation

Installation of the APS™ Air Product Separator™ is relatively easy; however, good planning will make the process smoother. In planning the installation, allowance for not only the weight of the various portions of the APS™ but also the weight of the material that the APS™ may contain should be made. Weights for the various portions of the APS™ are:

APS™ model	Body - pounds	Airlock - pounds	Spacer - pounds	Volume - cubic feet
1	175	140	27	3.2
2	200	170	31	4.6
3	214	196	38	6.6
3A	247	243	50	10.6
3B	315	272	59	13.3
4	346	369	55	15.9
5	429	442	69	23.9

6	478	522	77	28.8
7	576	610	94	38.4
8	674	716	110	48.0
9HV	798	1100	110	62.5
10	734	1242	207	53.4
10HV	864	1283	207	72.9
11HV	1103	1421	252	93.8
12HV	1305	1701	298	179.8
14HV	1529	2057	349	215.9
15HV	1698	2331	390	245.4
16HV	1885	2350	436	278.1
17HV	2029	2361	470	302.7
18HV	2167	2377	504	327.2

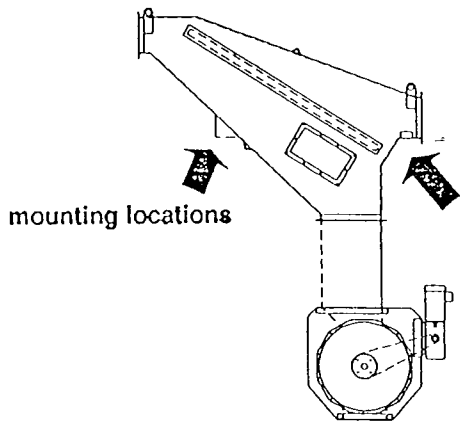
NOTE: Data above is for standard units. For non-standard units, contact factory for appropriate data or see equipment general arrangement drawing. Volumes as shown above are for the material side of the APS™, ie., from the inlet and screen down through the spacer chute and the rotary airlock. This volume is for use in calculation of the weight of the installed unit. An allowance should be made for accidental filling of the unit by material in the case of jamming from below. This allowance may be calculated by multiplying the volume shown by the density of the material to be collected.

In planning the installation, the above data can also be used for rigging.

● WARNING: THE LIFTING LUGS WHICH MAY BE PROVIDED ON THE APS™ BODY ARE FOR LIFTING OF THE APS™ BODY AND SPACER CHUTE ONLY. PROVISION FOR LIFTING THE APS™

AIRLOCK SEPARATELY SHOULD BE MADE. ATTEMPTING TO LIFT UNITS AS AN ENTIRE ASSEMBLY MAY RESULT IN FAILURE OF THE LIFTING POINTS AND SERIOUS PERSONAL INJURY.

The APS™ is normally supported from below at the points as shown at the right. Normally a structural member of the supporting system passes under the front brackets and the rear duct section of the unit. The exact location of these mounting points are shown on the equipment general arrangement drawing. The APS™ can also be supported from below through the airlock/chute/baler chute assembly; however it should be guyed to prevent swaying. Should such an installation be contemplated, it is suggested that you contact the factory for additional information.



We highly recommend that, in addition to providing support for the APS™, consideration be given to providing support for a inspection walkway or platform. Normally after the unit/system is fully installed and adjusted little access to the unit is required; however, a platform will ease installation, start-up, and maintenance when required. We suggest you consult with a professional engineer in the design of such a platform as well as the proper support of the APS™, and that all state, local, and federal regulations be satisfied as a part of the design.

During installation, care should be exercised to prevent damage to the screen in the interior of the unit. The screen assembly is somewhat fragile and subject to denting, creasing, and punctures, and in some cases it may be advisable to remove the screens from the units during installation to prevent damage.

Be sure to tighten all fasteners on the unit prior to placing the unit. Fasteners may have loosened in shipment/storage and damage can be caused by not retightening. Fasteners to be tightened include (but are not

limited to) set screws on bearings, shaft to blade airlock bolts, mounting bolts for motor, mounting bolts for gear reducer, etc.

Depending upon the gearbox used, it may also be necessary to install breathers in the gearbox after placing the unit. If this is necessary, the drains will be shipped loose with the units and will have the gearbox manufacturers instructions with respect to their installation.

While APS™ airlocks are lubricated and run tested at the factory, be sure to check lubrication prior to putting unit into service (particularly if the unit has been in storage prior to installation). This consists of lubricating the airlock bearings and checking the oil level in the gearbox. See below under maintenance for lubrication instructions, or see component manufacturer's instructions that may be included with the shipment.

During installation, care should also be taken in positioning the airlock (if provided). Particularly in those cases where a spacer chute is not provided, the airlock should be positioned such that the slope of the APS™ body is continued in the material inlet side of airlock. Normally this orientation is used even in those cases where a spacer chute is provided (consult equipment general arrangement drawing for specific details). Also provision for access to the airlock motor should be provided for wiring. Unit should be wired in accordance with local and state wiring codes. We would suggest the use of a certified electrician who can provide compliance with these codes. Also we suggest that a disconnect switch be provided local to the airlock to provide positive lockout for servicing.

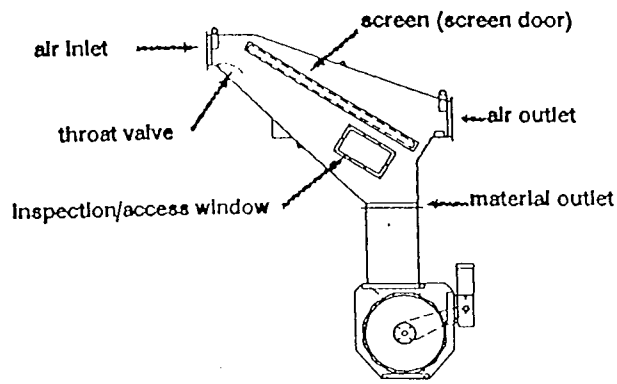
● WARNING: UNLESS SPECIFICALLY INDICATED ON THE EQUIPMENT GENERAL ARRANGEMENT DRAWING UNITS ARE NOT FOR USE IN HAZARDOUS LOCATIONS AS DEFINED BY THE NATIONAL ELECTRIC CODE.

Also when wiring the unit, we would suggest that airlock be wired in such a fashion as to allow operation separately from the balance of the system (this is to allow material to be removed from the APS™ after jamming or blocking of the screen).

Operation

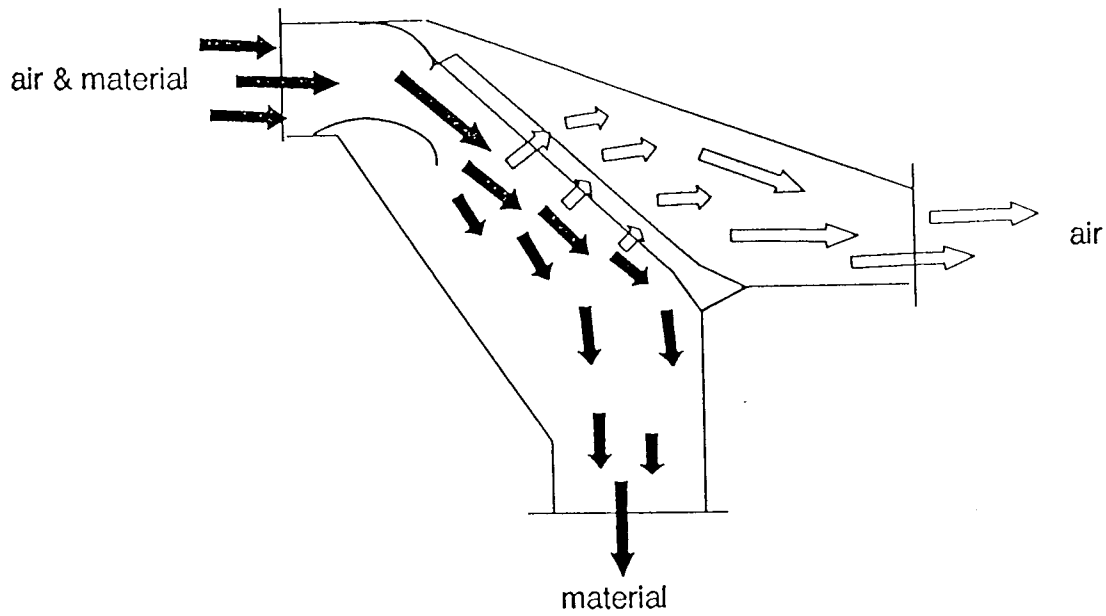
In order to operate an APS™, it will be helpful to understand the principle of operation. The key to understanding the operation of an APS™ is, 'When adjusted properly, material collected by an APS™ never touches the screen.'

Air enters the APS™, a roughly triangular box in elevation (see illustration at right), at one 'corner' of the triangle. Almost immediately the air is deflected downward at about thirty degrees by the first of two deflectors. After having been turned in this manner, the air flows along and parallel to the face of an inclined screen and may be considered to be under the influence of two forces, one of which is the momentum of the air acting in the direction of the flow, which is parallel to the screen. The second force is that due to the pressure difference across the screen (see illustration below) which is considerably smaller and acts at roughly ninety degrees to the first force and creates a movement of air through the screen. Because of the relative sizes of the forces (the force parallel to the screen being relatively large in comparison to the force through the screen) a boundary layer or pillow of air is formed in front of the screen. This layer constantly moves through the screen but does so slowly enough to prohibit material being carried on to the screen. [An example of a similar phenomenon is the path taken by snow in front of a high speed automobile. From inside the car one sees snow approach the windshield and then turn up and away as it enters the boundary layer in front of the windshield with the snow never touching the windshield.]



It is critical that the relative sizes of the forces remain such that the boundary layer be created at all points on the screen. This critical factor is adjusted by the throat valve which allows an adjustment of the velocity of the air (the force) parallel to the screen. The second force (velocity

through the screen) is determined by the amount of air moving through the unit (and is controlled by the fan or fans in the system).



In practice, the APS™ is adjusted at startup by closing the throat valve to the limit of its travel (closing is moving the throat valve up towards the top of the unit). The system is then started with a minimum of the material being fed into the system. The throat valve is then slowly opened while the lower or downstream side of the screen is observed. The valve is opened until such time as material starts to impinge upon this area of the screen. At this point the system is shut off (which should allow the material to fall from the screen and be removed normally), and the throat valve is closed slightly. The amount that the throat valve is closed depends upon the stability of the system with respect to airflow. If the system is a single line without major variations in airflow, then it needs only to be

closed slightly, perhaps ½ inch. Alternately, if the system is multiple lines with the possibility of large flow changes then the throat valve is closed considerably more. The initial setting provided by this procedure can be modified as experience with the system is obtained.

A second practical aspect of operation, nearly as important as the first, is the concept of 'dead air' at the material outlet. In this case, 'dead air' means no net air flow in or out of the unit. The reason for this requirement is a flow of air into the unit will effectively change the net direction of the forces in front of and across the screen (as explained above). This change may cause material to contact the screen causing wear and/or blockage. Also, with light material, this inward flow of air can prohibit material from dropping out of the unit. This will cause the material to accumulate in the unit, eventually plugging the unit. Outflow from the unit at the material discharge is not as critical as inflow. However, almost all systems on which APS™ separators are used have air which contains significant amounts of dust. For the system to be successful this dust must be contained in the system (removed with a secondary filter after the APS™).

It is to solve the 'dead air' problem as described above that we recommend the use of an APS™ airlock on almost every system. While it is possible to eliminate the airlock it requires a specially designed system, and describing the requirements of such a system are beyond the scope of this document (contact the factory for additional details). The important point to note is that worn rotor tips in the airlock, ill fitting access doors, or poor joint sealing can also allow air into the material outlet side of a unit. These conditions must be avoided and repaired when found for proper operation.

The final operating variable is the amount of air passing through the unit. As noted above this is the second force acting on the airflow and is controlled by the system fan or fans. It is also related to the air velocity in that, outside of the range of adjustment of the throat valve, ultimately the proper airflow is necessary to establish the boundary layer (pillow of air) in front of the screen.

It is relatively easy to recognize a system in which the airflow is too low. At the extreme, material is very gently conveyed into the unit (and depending upon the transition from pipe to APS™, may even clog in the transition area) and may gently contact the screen. Even with the throat valve in the fully closed position, it is impossible to keep material from contacting the screen (however, while it contacts it sticks only gently). The solution for this problem is of course to increase the airflow, generally by increasing fan speed or lowering system resistance.

A system with too great an airflow is a bit more difficult to identify. Like a system in which the airflow is low, the only method of keeping material off the screen is with a throat valve setting at maximum closed position. (This is because the force of the air moving through the screen has become relatively large in comparison to the velocity of the air parallel to the screen, and hence, the maximum closed setting is necessary in order to make the velocity in front of the screen as large as possible.) The identifying difference is the manner in which material sticks to the screen. At the point at which material starts to stick, it will stick hard then be 'ripped off', then stick again. A second possible difference (which may or may not be present) will be such violent turbulence at the material outlet or in the spacer chute that the material may not 'fall' out of the airstream (similar to inflow air leaks it will eventually built up in the unit and lead to a clog). Similar to too little air, the solution is to slow the fan (or fans) down or increase system resistance.

A word of advice: While it is possible to start and operate an incomplete system, it will cause problems. This is particularly true of larger more complex systems with multiple lines and fans. It is likely that because the airflows are not as designed (due to open branches, low flows in mains, etc.) that plugging in lines and possibly in the APS™ will occur. If it is necessary to start a system prior to having it fully installed, we would suggest advising all concerned of these problems, and at some point it will likely be necessary to entirely shut down and inspect the system such that a 'clean start' can be made. Then after the 'clean start' a resetting of the system likely will be required before release to normal operation.

Upset Conditions

The most common upset condition is a material build up on the screen. The normal method of correcting this condition is to stop the airflow through the unit by shutting-off the fan or fans. (In doing so, be sure to stop the material feed into the system prior to shutting off the fan, since not doing so risks material settling in the lines and causing blockages.) After the air pressure on the material is removed, it should fall away from the screen. It can then be removed normally from the unit without any intervention. (It is to accommodate this situation we suggest that the APS™ airlock have the capability of operation separately of the balance of the system.) After the material has been removed, the system can be restarted and any necessary adjustments made to prohibit the problem from reoccurring (see above for adjustments).

In some cases either the material will not fall away from the screen or the material is balled in the separator. In these cases it may be necessary to access the interior of the APS™.

● DO NOT ATTEMPT TO OPEN WINDOW/ACCESS PORTS OR REMOVE SCREEN FROM A UNIT IN OPERATION AS SERIOUS PERSONAL INJURY MAY RESULT FROM OBJECTS EJECTED.

● NEVER ATTEMPT TO WORK ON OR ACCESS AN APS™ AIRLOCK WITHOUT FIRST ELECTRICALLY LOCKING OUT AND OR REMOVING THE POWER LEADS FROM THE MOTOR.

● NEVER ENTER AN APS™ WITHOUT ELECTRICALLY LOCKING OUT ALL SUPPLY FANS, AND ELECTRICALLY LOCKING AND REMOVING POWER LEADS FROM APS™ AIRLOCK OR OTHER DEVICE BELOW UNIT. BE SURE TO FOLLOW APPLICABLE CLOSED AREA POLICIES AND PROCEDURES.

● NEVER PLACE ANY OBJECT IN AN OPERATING AIRLOCK INCLUDING STICKS, POLES, HANDLES, OR BODY PARTS. SERIOUS PERSONAL INJURY OR DEATH CAN RESULT FROM ATTEMPTING TO

REMOVE A JAM FROM AN OPERATING AIRLOCK.

Access to the interior is through the inspection window or alternately through the access door in the spacer chute if provided. Shut off and lockout all fans in the system as well as the APS™ before removing the window. We would suggest removing material from the unit manually prior to restarting the system so as to eliminate the need to repeat the process.

If material is adhering to the screen even after the airflow has stopped, it may be removed by gently brushing the screen with a soft broom. This can be done by either reaching through the window or by partially removing the screen from the unit. Be sure to follow any necessary safety precautions with respect to the dust including, but not limited to, breathing of the dusts.

General cleanliness of the unit is also important. Since the primary principle of operation is the creation of a boundary layer (the air pillow) in front of the screen, it is important that damage to the screen or foreign objects do not impede this effect. Any material that is lodged in or sticking to the material side of the screen should be removed. While not as important, material accumulations at the sides of the unit and/or throat should be removed as well.

Should the APS™ airlock jam, it can be cleared by manual operation of the airlock.

● NEVER ATTEMPT TO WORK ON OR ACCESS AN APS™ AIRLOCK WITHOUT FIRST ELECTRICALLY LOCKING OUT AND/OR REMOVING THE POWER LEADS FROM THE MOTOR.

A flat spot suitable for use with a large standard wrench is provided on the end opposite of the drive on larger units. On the smaller units a pipe wrench can be used directly on the shaft extension on the non-drive end. It may be necessary to work the airlock rotor back and forth to clear the jam. This can easily be done manually but is impossible to do under power (an attempt to do so by reversing the electrical connection may

severely damage the airlock, chain drive, or gear reducer). After having cleared the jam, the blade seals should be inspected for damage before placing the unit into service.

Periodic Maintenance

Periodic maintenance of the APS™ system is simple. With the exception of housekeeping cleaning (both inside and out) and preventing corrosion by painting as necessary (unless otherwise directed, paint only the exterior of the unit) maintenance of the APS™ is limited to:

O lubrication of airlock bearings once every three months with No. 2 Lithium base grease or equivalent

O inspection of the chain drive once every three months. Relubricate with light machine oil as necessary by applying oil with brush to the sides of the chain. Do not over-lubricate as this will speed the collection of dust on the chain. Similarly do not use grease.

● NEVER OPERATE A CHAIN DRIVEN AIRLOCK WITHOUT PROPER GUARDING OF THE CHAIN DRIVE.

● PREVENT BUILDUP OF COMBUSTIBLE DUST ON THE CHAIN OR SPROCKET. COMBINED WITH OIL/GREASE THIS MATERIAL MAY CAUSE A FIRE.

O check oil level in airlock gearbox every three months and change oil once every six months. Specific instructions for checking and changing oil are found on the gearbox manufacturer's instruction which should be included in the shipment.

O after three months operation the airlock rotor tips (rubber blade end seals) and end seals should be inspected. Based upon that inspection, the inspection interval may be increased; however, it should not be greater than once per year. Seals should be springy, have no large (bigger than ¼ inch) holes at tips, and should be straight ends parallel to the shaft. Small

cuts in the end of the blades are not and issue for concern; however, they do indicate the likely necessity of replacement at the next inspection.

Rotor tips are replaced by unbolting the retaining brackets and matching holes in rubber seals to holes in blade and retaining brackets and re-bolting. Correct seal orientation is automatically provided by this process.