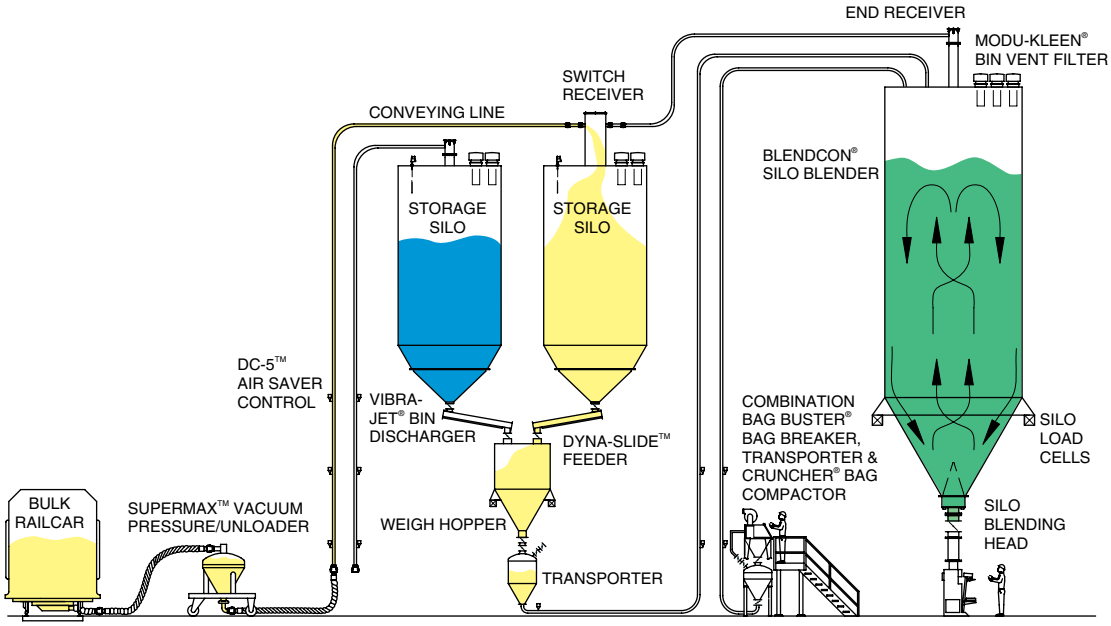
DYNAMIC AIR®
Conveying Systems

Pneumatic Conveying Systems



GENERAL INSTALLATION AND TROUBLESHOOTING GUIDE

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www.dynamicair.com

Introduction

Dynamic Air Pneumatic Conveying Systems

The purpose of this manual is to provide you with the basic fundamentals necessary to operate and troubleshoot your system. Remember, your system has been designed to process particular materials under specifically designed conditions only.

The performance of your system will reflect how well you understand how to operate and troubleshoot it. Improper operation may mean voiding our equipment warranty.

We strongly recommend that you carefully study this manual, the individual component manuals, all drawings and other documentation. With the conscientious application of these operation instructions, we feel assured that you will become another *satisfied* owner of a Dynamic Air pneumatic conveying system. Dynamic Air is committed to assisting you in making it a profitable addition to your material handling operation.

Thank you for purchasing a Dynamic Air conveying system. This manual contains information that will allow you to get the best results from your equipment while operating it safely. Please read it carefully before installing and operating this equipment. It is critical that the people operating and maintaining this equipment have a copy of this manual. All information in this publication is based on the latest product information. Dynamic Air Inc. reserves the right to make changes at any time without notice and without incurring any obligation.

SAFETY MESSAGES

Your safety and the safety of others are very important. We have provided important safety messages in this manual and safety labels on the equipment. Please read these messages carefully.

A safety message alerts you to the potential hazards that could hurt you or others. Each safety message is preceded by a safety alert symbol and one of three words, DANGER, WARNING, or CAUTION.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

These signal words mean:

DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.

Each message typically identifies the type of the hazard, the consequence of not avoiding the hazard, and how to avoid the hazard.

DAMAGE PREVENTION MESSAGES

NOTICE indicates information or a company policy that relates directly or indirectly to the safety of personnel or protection of property.

Symbol	Typical Warning/Meaning
	This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.
	Pressurized Source, or Contents under Pressure
	Crush Hazard from Above
	Read and understand user's guide before operating equipment. Follow all operating and other instructions carefully.
	Risk of Explosion
	Remove Power and Lockout/Tagout Before Servicing
	Use of safety harness is mandatory when working greater than 6 feet above ground level.

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Dynamic Air Pneumatic Conveying Systems

RECEIVING EQUIPMENT

The equipment shipped to you by Dynamic Air has been packaged with the utmost care to prevent damage during transit. If you notified Dynamic Air of any specific unloading conditions at the job site, the equipment has been packed and shipped to facilitate effective off-loading. This is the customer's and/or his selected contractor's responsibility and Dynamic Air will not be responsible for damages to equipment during this deployment.

INSPECT FOR DAMAGE

Dynamic Air strongly suggests a thorough inspection of your shipment for external (visual) damages. If any damage is obvious or questionable, a claim must be made against the carrier. Dynamic Air will not be responsible for any equipment damaged in transit.

BILL OF LADING

Customer is responsible for checking the number of pieces received to the number indicated on the "Bill of Lading" before signing it. **Your right to claim damages or shortages against the delivery agent is waived upon signing the "Bill of Lading."**

COMPLETE AN INVENTORY

A complete inventory of all items received should be performed before installation is started. This inventory will assure the customer or contractor that all items on the packing list (Equipment List as described in Section 10) have been received and not damaged. Any discrepancies between quantities and descriptions of items received must be reported to the Dynamic Air Shipping Department within 10 days of delivery (see Section 11.1 for contact information).

STORAGE AND UPKEEP

All Dynamic Air equipment is shipped and packed for immediate installation and start-up. No provisions have been made for extended storage or storage in an area unsuitable for mechanical equipment. Some equipment may have working surfaces which may corrode if improperly stored. Consequently, all warranties and guarantees will be forfeited when it's apparent that such precautions were not exercised prior to installation.

PAINTING EQUIPMENT

Standard Dynamic Air components are provided with one finish coat of paint. Normally, tubing is provided unpainted and all hoppers, bins, silos, and structural steel are provided with one coat of primer only. After installation, you will find touch-up painting necessary. Take care to not paint any moving parts or sliding surfaces of the equipment. (Depending upon job site conditions, painting may not be considered necessary. However, Dynamic Air strongly recommends that it be done to insure maximum life of the system.)

SAFE AND PROPER INSTALLATION

All equipment should be installed only by qualified craftsmen and according to normally accepted industry standards to insure a safe and proper installation. In every case, local and national building codes must be followed. Supervision of field installation by a qualified Dynamic Air service person is recommended and is available at an extra charge. Consult with our Service Department for details (see Section 11.1 for contact information).

FASTENERS

All fasteners, unless specifically stated otherwise, for attaching and connecting equipment during erection is the responsibility of the customer or installation contractor. Fasteners used on pressure vessels must be S.A.E. grade one or A.S.T.M. A307 minimum with coating to prevent rusting. Fasteners used on all other components must be S.A.E. grade five or A.S.T.M. A325 minimum with coating to prevent rusting. A fastener schedule is provided on the tubing detail drawing (see Section 10) and describes the size, length, and quantity which will be required. Please note that the quantities indicated on the fastener schedule is exact, leaving the amount of overage on each item to the customer's or the installation contractor's discretion.

FIELD WELDING

Any field welding or modifications of any kind done to any of Dynamic Air's equipment must be agreed to in writing by Dynamic Air prior to any of the work being performed.

AIR PIPING

Air supply, including the pipe, shut-off valves, fittings, filters and check valves is to be supplied by the installation contractor.

For proper operation, system should be piped exactly as shown on piping diagrams. Unions should be installed where good piping practices dictate. Any changes in piping arrangement must first be approved by the Dynamic Air Engineering Department.

⚠ WARNING

All pressure relief valves and emergency bleed-off valves installed on any pressure vessel (including transporter, blender, etc.) must be piped downward to no more than 18" (457 mm) from the floor.

All piping must first be deburred before assembling.

Piping from air supply to regulator control (ACM) must not exceed 20 ft (6.1 m) in length, nor should piping between regulator control (ACM) and transporter or air blender exceed 20 ft (6.1 m) in length. Any further distances must first be approved by the Dynamic Air Engineering Department.

⚠ WARNING

All equipment operated in excess of 15 psig (1.03 barg) must conform to the A.S.M.E. code for unfired pressure vessels and should not be modified, added to or changed in any way without written permission from Dynamic Air. Failure to do so may result in personnel injury or damage to equipment.

MATERIAL BEING HANDLED

Each Dynamic Air system is specifically designed to convey a particular material and the consistency of the material conveyed will be reflected in the performance of the system itself. Since there is an optimum air pressure and air volume needed to convey every material a given distance in a given amount of time, it is important to understand that when anything changes, such as the material itself, so will everything else. This includes conveying time, air pressure, etc. Even variables such as inherent moisture, atmospheric moisture, temperature, particle shape and size, etc. have an effect on the material being conveyed.

If a material has not been tested prior to operating a system, no real assurances can be obtained beforehand. Therefore it is highly recommended to test the material prior to putting a system into production.

Whenever starting up a system, only qualified start-up personnel should be utilized to insure optimum performance. There are numerous field adjustments which are required for most Dynamic Air systems and components. These adjustments to fine tune the system must only be performed by qualified and experienced personnel prior to start-up. Although adjustments will vary with each system provided, they typically include, but are not limited to, settings for transporters, air saver controls, limit switches, air regulators, pressure switches, level controls, timers, etc.

While each Dynamic Air installation has many similarities in system design, each is unique unto itself. Any changes made to the system will affect performance, even though they may be positive. **If the change in material or specifications is accomplished without Dynamic Air approval, the result may have a negative effect causing damage to equipment and/or create a danger for injury or death to plant personnel.** All operators and plant personnel must be properly notified should any change occur, and they must consult with and obtain in writing from Dynamic Air the proper design to accommodate the change(s). Failure to follow this procedure could result in disaster and this must be avoided.

Equipment manuals for each piece of equipment supplied by Dynamic Air is available to insure fast, efficient and safe installation and operation. Two copies are normally provided free with each order and additional copies are available at extra cost upon request. Equipment installation must be performed in strict accordance to these manuals.

THE BASICS OF PNEUMATIC CONVEYING

It is important to understand the basic operating principles behind any pneumatic conveying system in order to recognize normal operating characteristics from “abnormal” or possibly dangerous conditions.

When material is conveyed through a conveying line, the actual conveying velocity is always substantially lower at the beginning of the system and highest at the end of the system (see Fig. 1).

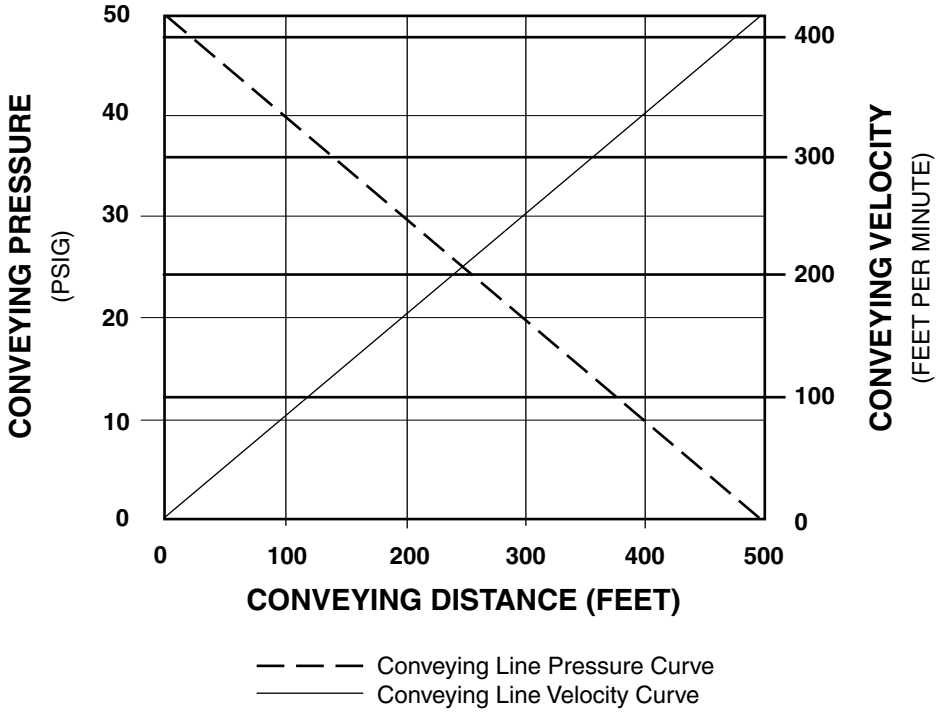


Fig. 1

Also, the conveying line pressure is always highest at the beginning of a system and lowest at the end of a system (see Fig. 1). Regardless of system type (dilute phase, dense phase, etc.), conveying pressure, etc., these basic laws of physics apply.

Depending upon the type of material conveyed, the dynamic forces generated as a result of the conveying velocity or material being conveyed will produce higher forces in the conveying line at the end of the system. Because of these forces, the conveying line must be supported to effectively counteract both the dynamic and static loads generated during conveying. **Failure to effectively support the conveying line could result in damage to equipment and injury or death to plant personnel (see Section 3.1).**

Compressed air must expand to do work during any pneumatic conveying process and its volume will increase between the beginning and end of a conveying line proportional to the conveying pressure applied. Since the conveyed material cannot expand or stretch in volume, the air gaps or air volume will expand accordingly and thus slugs and air gaps will normally start appearing as shown in Fig. 2 and Fig. 3.

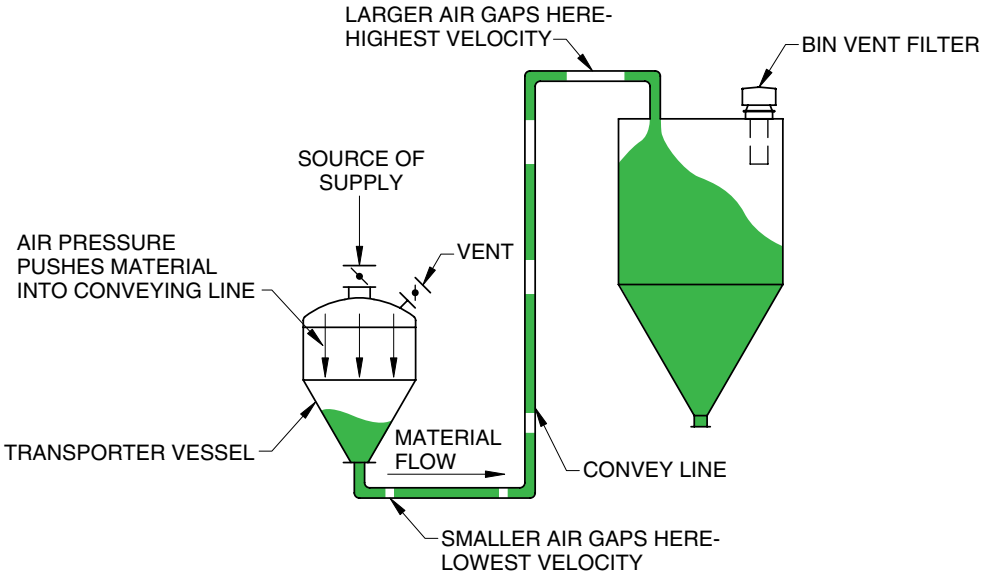


Fig. 2

High Pressure System

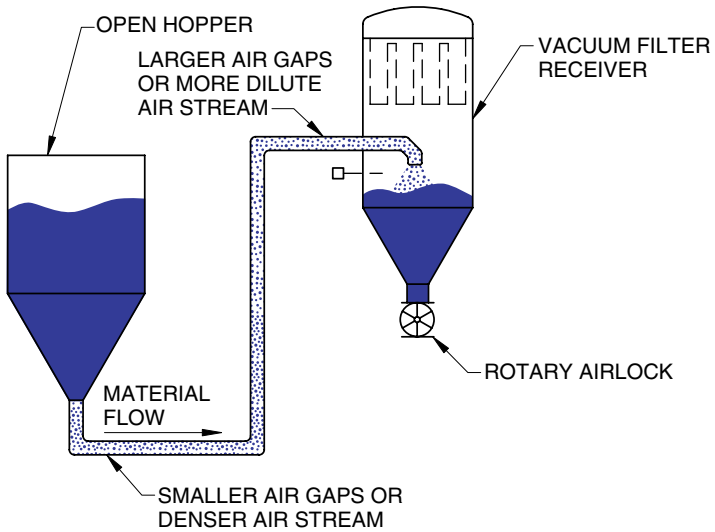
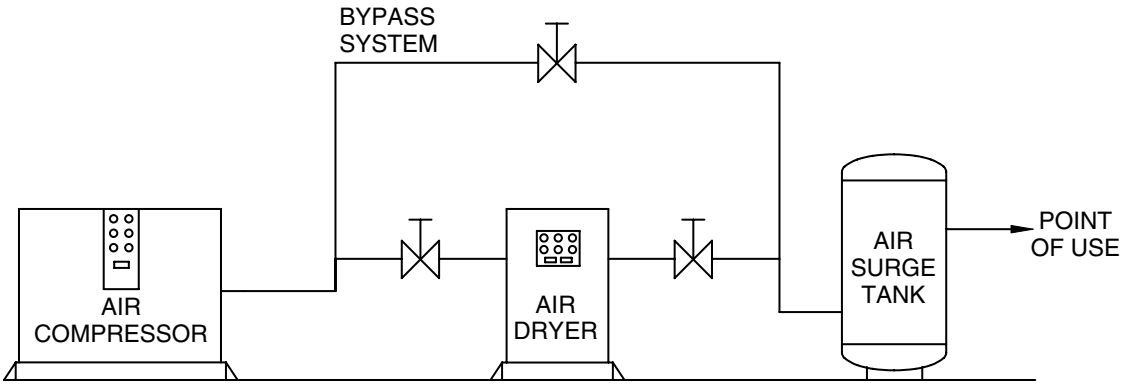


Fig. 3

Low Pressure Vacuum System

Since the air pressure and the air volume are critical to any system performance, the design of the air supply system must have ample capability. As part of every system design, Dynamic Air will provide the compressed air requirements. However, when designing and purchasing a compressed air system, the air requirements provided do not include any safety factors for such things as leaks, air surges, pressure losses thru filters, dryers, piping systems, purging of the system, unusual atmospheric conditions, pipe pressure losses, etc.

Should you need help with the design of a compressed air system (if it is not already provided as part of the system purchased), Dynamic Air can provide this service at extra cost. (See Fig. 4 for a typical compressed air supply system).



Compressed Air System

Fig. 4

NOTICE

Conveying equipment has operational and individualized characteristics that provide for a wide variety of application. All personnel responsible for installations and application of this equipment must satisfy themselves that each intended application of the equipment is acceptable. In no event will Dynamic Air Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment. All examples and diagrams in this manual are intended solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Dynamic Air cannot assume responsibility or liability for actual use based on the examples and figures.

Conveying Line Installation

GENERAL INSTALLATION

1. Before installation begins, a thorough review must be made of all drawings, equipment manuals, etc. provided to insure all aspects of the installation are fully understood and complied with. This should reduce any misunderstandings which could cause delays during construction of the system. Access to the construction areas for the various trades should be coordinated for maximum efficiency.
2. All equipment should be installed in accordance with all local, state and national building codes and standards.
3. Pipeline alignment is critical to the performance of the equipment and should be of primary concern. Pipeline clearance considerations should include, if required, mounting of air saver controls, diverters, couplings, etc. Allowance should be made for adequate and proper access to perform maintenance and/or adjustments to all equipment provided. This is very important should an upset situation occur.
4. Internal obstructions on the conveying line such as burrs, leading edges and gaps must be avoided. Remember that the conveying line must be installed according to the engineering detail drawings provided and any deviations must first be approved by Dynamic Air's Engineering department or you could risk danger to plant personnel and possible damage to equipment.
5. Follow the mechanical tubing detail layouts provided with your system for your conveying line, using the working points and dimensions outlined on the engineering documents. Remember that bends and elbows will require special rigid supports designed for periodic removal and replacement. Special tubing bends such as ceramic backed and total ceramic bends are very heavy and may require special considerations during installation. (See Locating Rigid Supports, Section 3.3).

HINTS FOR ROUTING THE CONVEYING LINE:

Whenever the conveying line is to be routed from one point to another, try to adhere to the following guidelines:

1. **Minimize the number of tubing bends throughout the system:**

   Since every tubing bend adds considerable resistance to the conveying line, they must be minimized. Adding tubing bends will increase energy and air consumption to convey a given material. In addition, maintenance increases proportional to the air consumed.

2. **Minimize tubing bends at the end of the system:**

   Since the conveying line velocity is always highest at the end of the system, try to avoid the location of tubing bends in this area of the system. Likewise, since the conveying line velocity is always lowest at the beginning of the conveying line, it is far more acceptable to locate tubing bends, if they are required, in the front section of the conveying line.

3. **Avoid putting tubing bends back to back!:**

   Since tubing bends add considerable resistance to the conveying line, tubing bends back to back exaggerate the frictional resistance making it more difficult to achieve optimum performance and a consistent flow of material through the conveying line.

4. **Avoid short radius tubing bends of less than eight (8) to ten (10) times the pipeline diameter:**

   Although short radius tubing bends of less than eight (8) to ten (10) times the pipe diameter can be used, they will add considerably to the conveying line resistance and consume more energy than longer radius tubing bends. With most applications, short radius bends can be used and are usually more acceptable, if required, at the beginning of the system where the conveying velocity is lowest.

5. **Take the shortest distance possible when routing the conveying line to its intended destination:**

   Since long distance conveying lines use more energy to convey than short distance lines and consume additional compressed air to convey, the designer should determine the shortest distance to the intended destination. This will result in lower conveying pressures, less energy consumption and less maintenance.

6. **Try to convey vertically as close to the beginning of the system as possible:**

   Since conveying vertically is generally more efficient than conveying horizontally, due to a perfect counter flow condition, it is generally best to achieve this condition in the first part of the conveying line by conveying vertically first and then horizontally.

7. **Never decrease the pipeline diameter size:**

   Since decreasing the pipeline diameter adds considerably to frictional resistance and increases conveying velocity, it must be avoided. Increasing the conveying line size, however, is acceptable as it reduces velocity due to the larger area.

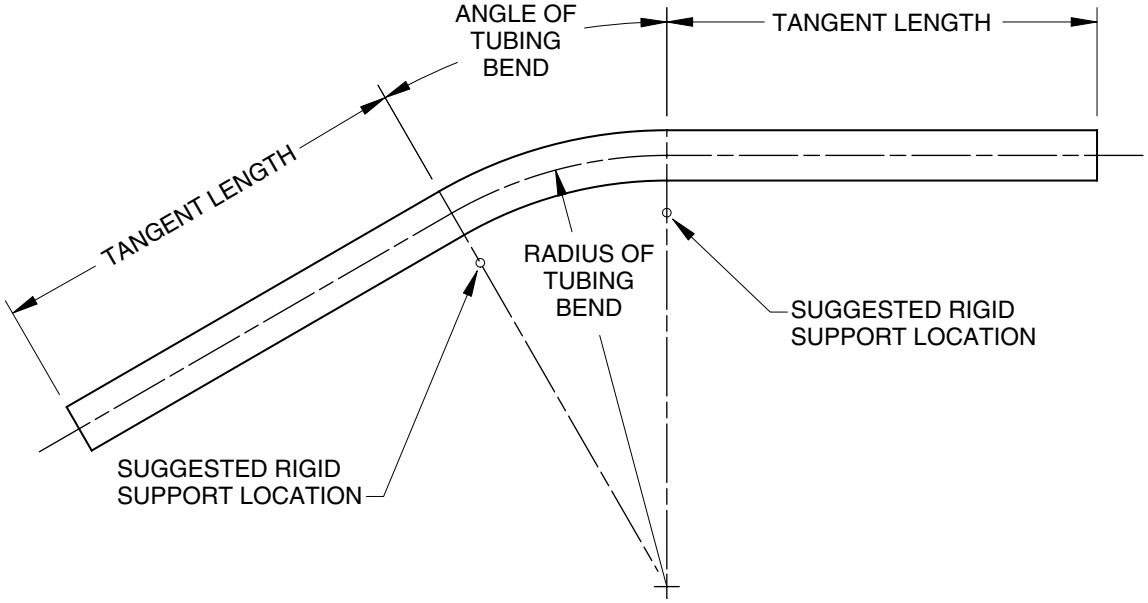
LOCATING RIGID SUPPORTS

1. As a result of material moving through the conveying lines, pneumatic conveying systems generate dynamic loads on the conveying line. Whenever the material changes direction, such as at a 90 degree tubing bend, even higher dynamic and static loading will result.

   Therefore, the tubing bends require a stronger pipe support system than do straight tubing runs and the conveying line must be rigidly supported to handle the static as well as the dynamic loads.

   The velocity and density of the material conveyed will determine the magnitude of the dynamic loading. Due to such static and dynamic loading, all tubing supports should be designed to prevent conveying line movement in all directions.

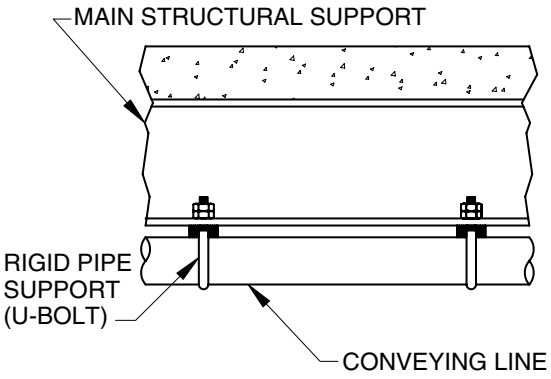
2. Always fabricate **rigid** conveying line supports; tie into available or added structural steel to anchor conveying line and tubing bends to prevent lateral movement or swaying (see Fig. 1).



Locating Rigid Supports

Fig. 1

3. Use either appropriate commercially manufactured U-bolts or hold down clamps for the conveying line (see Fig. 2).

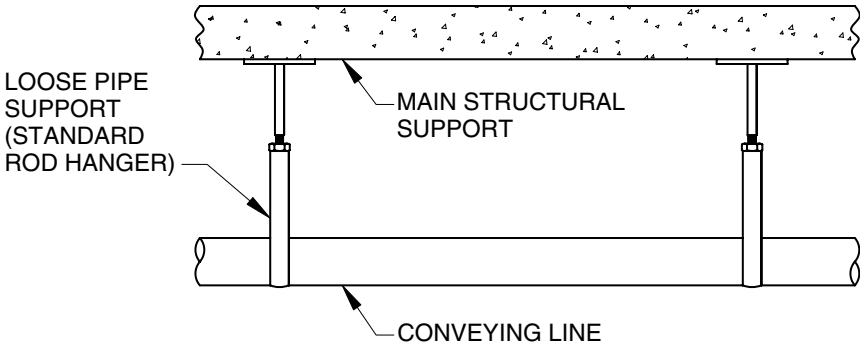


CORRECT INSTALLATION

Fig. 2

⚠ WARNING

Vertical threaded rod hangers (see Fig. 3) are NOT recommended supporting members and can lead to excessive conveying line movement, presenting a danger to plant personnel.



INCORRECT INSTALLATION

Fig. 3

4. All conveying line longer than 4 ft (1.2 m) with compression coupling connections should be supported rigidly in two (2) places (see Fig. 4).

   All conveying line longer than 11 ft (3.3 m) with compression coupling connections should be supported rigidly in three (3) places (see Fig. 5).

   All conveying line longer than 4 ft (1.2 m) with weld rings, self-aligning flanges, and/or Tuf-Lok pipe couplings should be supported rigidly in two locations (see Fig. 6).

   Conveying line couplings should not be designed as supporting connections between two different line sizes and should not be subjected to dynamic loading in all cases.

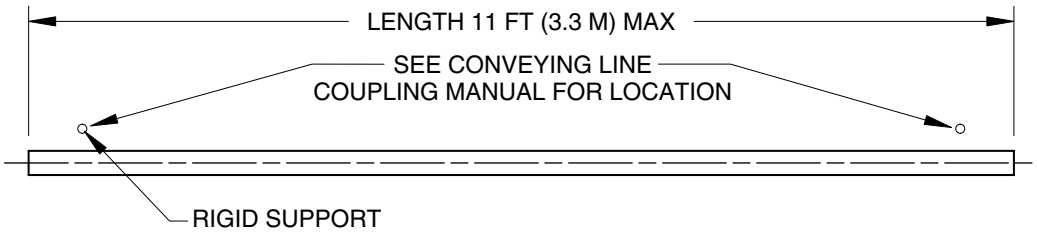


Fig. 4

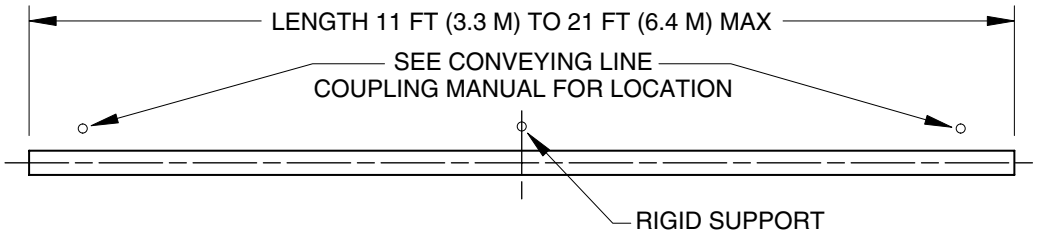


Fig. 5

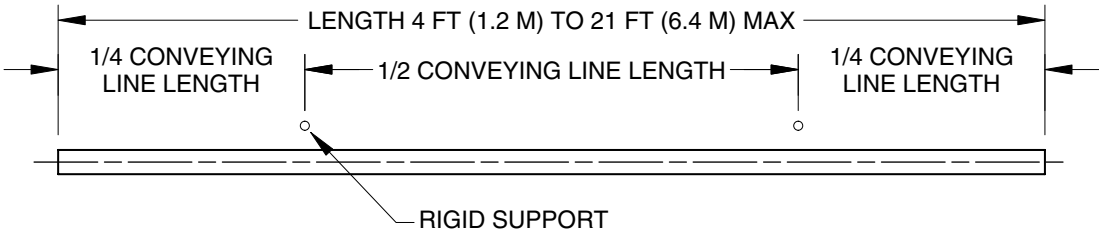


Fig. 6

5. Field cutting of the conveying line tubing will normally be necessary. This cutting should be performed using a band saw or an abrasive cutting wheel to obtain straight and square unchamfered ends (see Fig. 7).

   Under no circumstances is flame cut tubing acceptable.

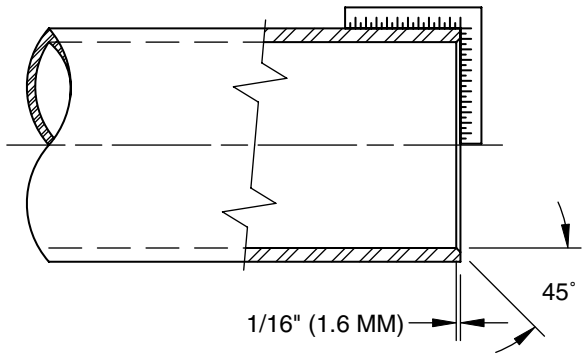
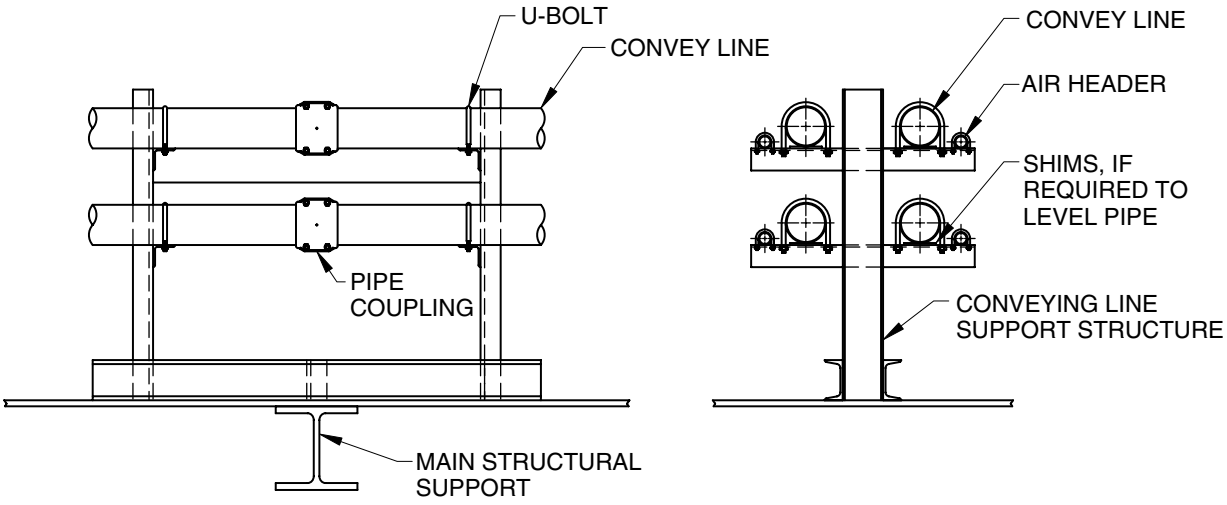


Fig. 7

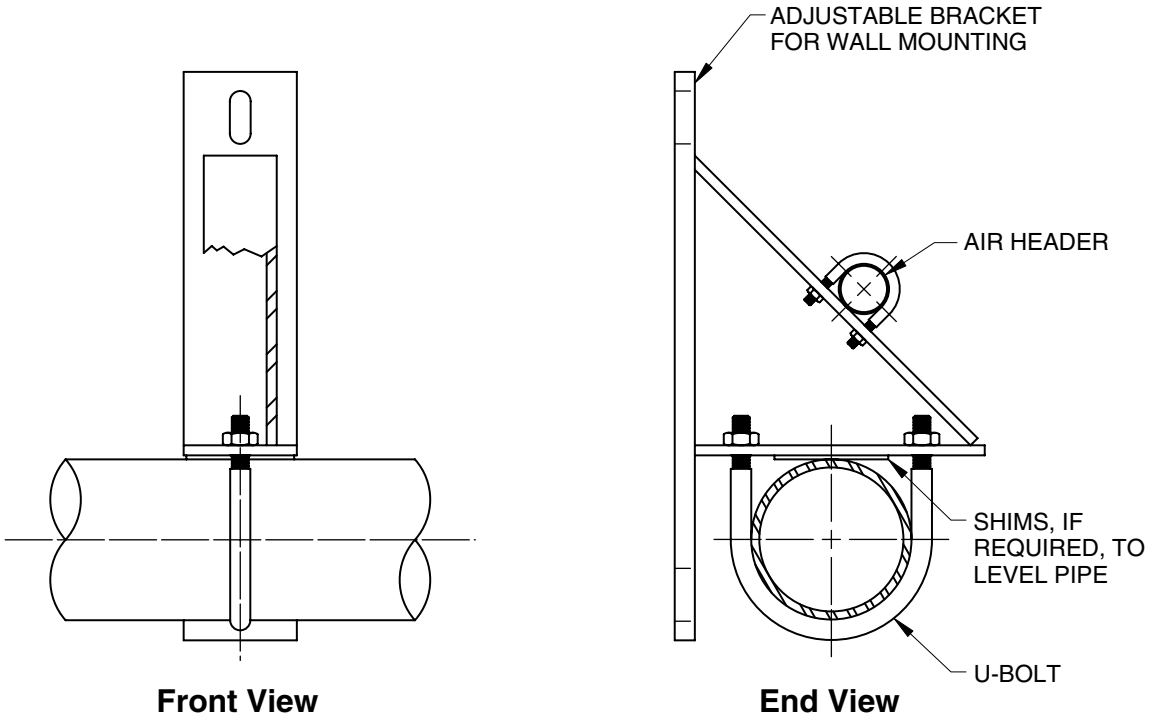
6. Care must be taken to manually align the conveying tubing since conveying line couplings will align the joints of two sections of tubing only and not the tubing itself. Install conveying line coupling to proper bolt torque. (See individual coupling manuals for further details).

Section 3.7 thru Section 3.14 illustrate several recommended constructions for locating rigid supports in a variety of circumstances. Contact Dynamic Air's Mechanical Engineering or Service Departments for other configurations.



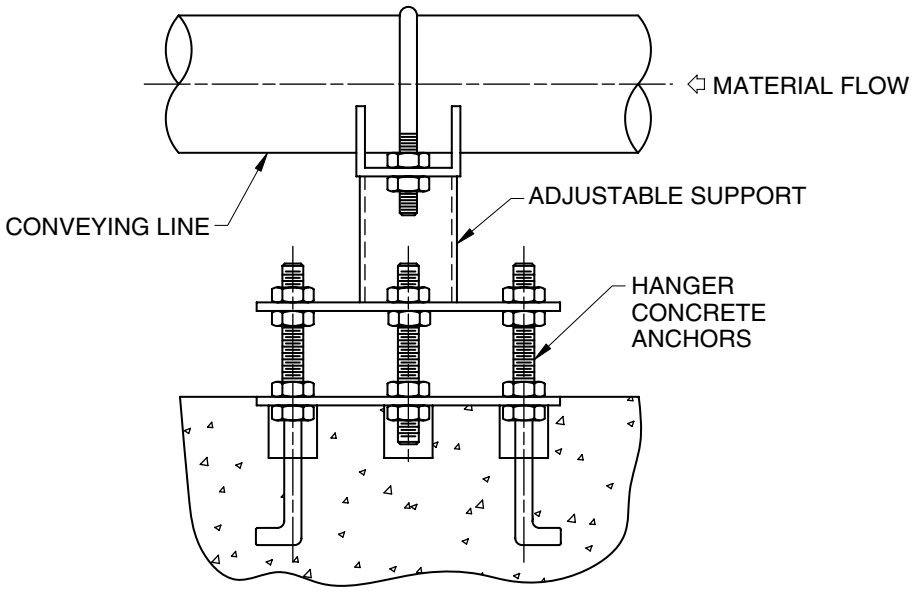
Front View **End View**

Multiple Conveying Line Support
(Roof or Floor Mounted)

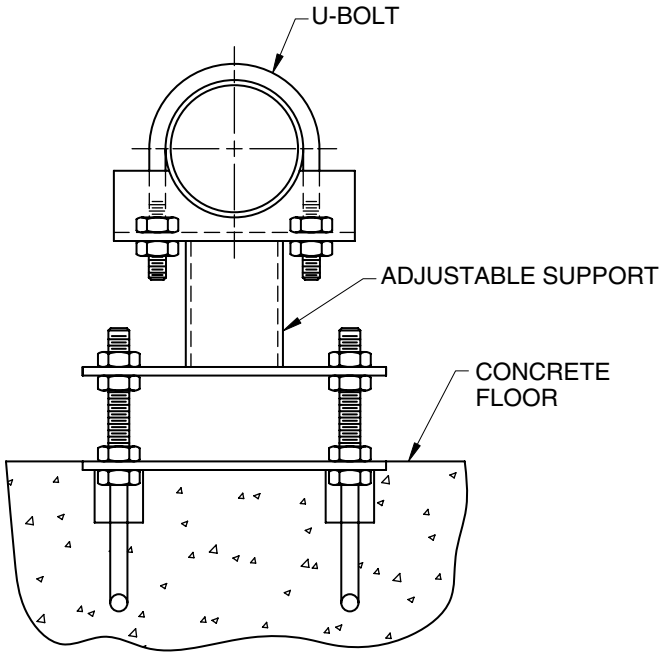


Front View **End View**

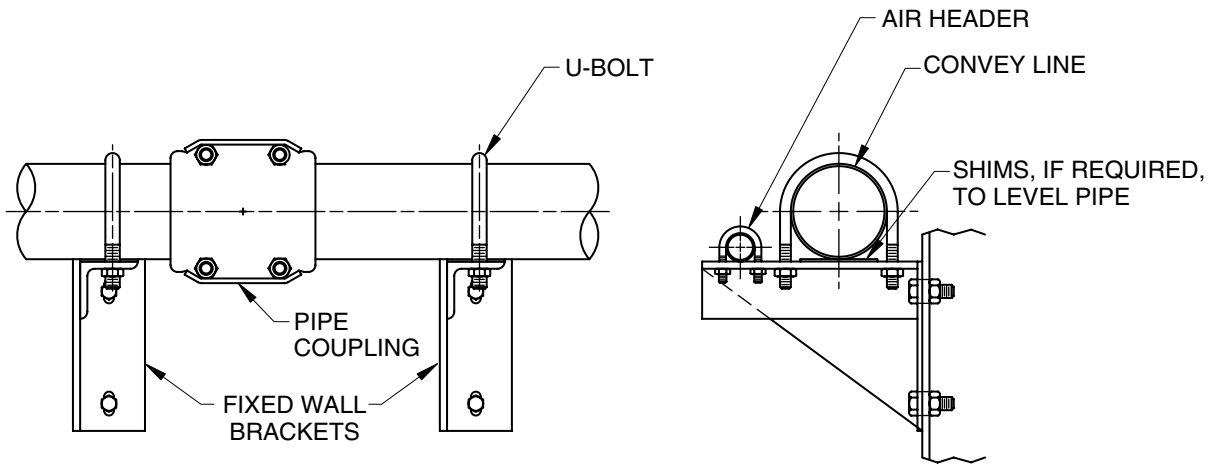
Single Conveying Line Support
(Wall or Column Mounted)



Front View
Single Conveying Line Support
(Floor Mounted in Concrete)

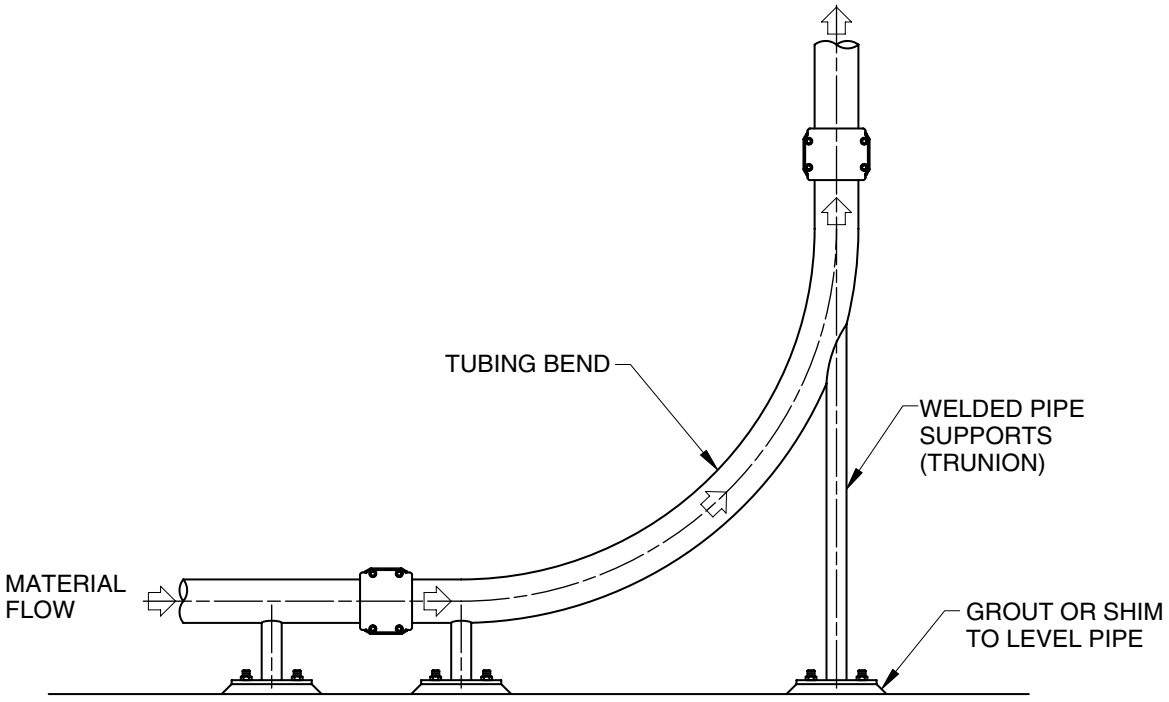


End View
Single Conveying Line Support
(Floor Mounted in Concrete)



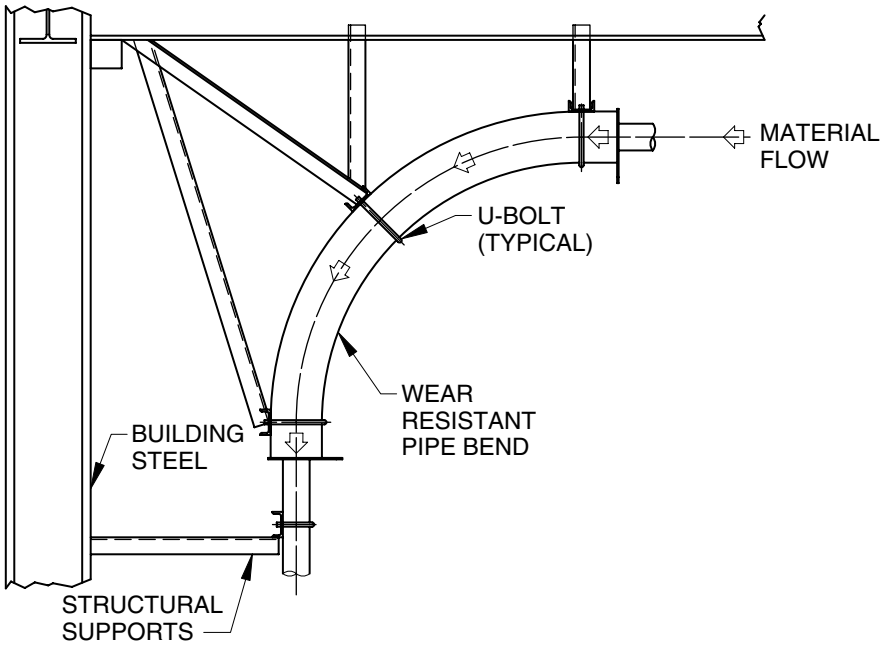
Front View **End View**

Single Conveying Line Support
(Wall or Beam Mounted)

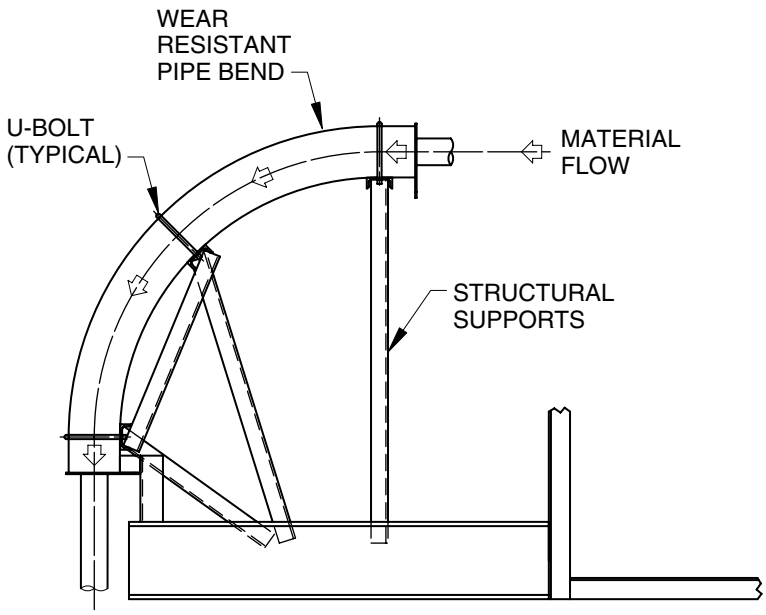


Front View

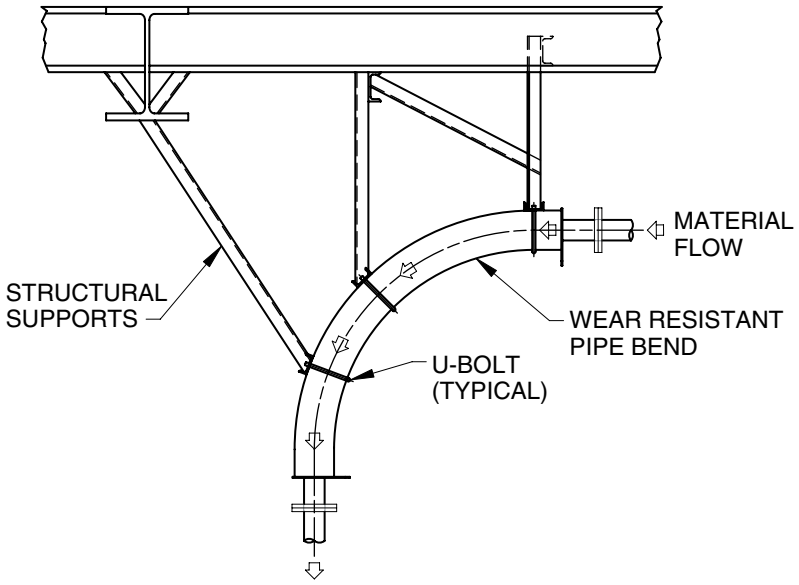
Single Conveying Line and Elbow Support
(Trunion Type Floor Mounted)



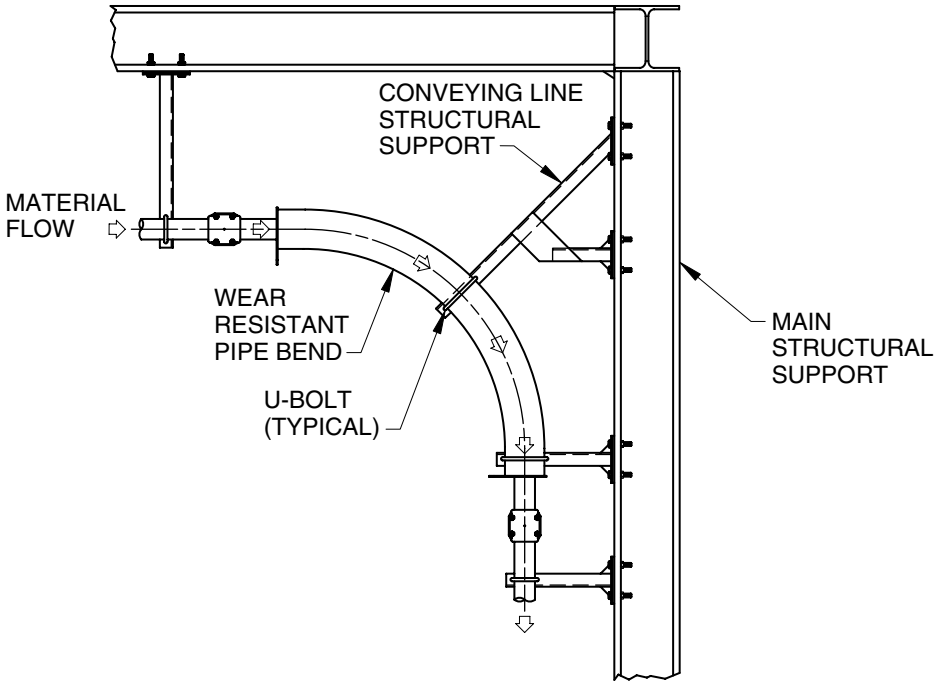
Front View
Single Conveying Line Elbow Support
(Ceiling and Wall or Column Mounted)



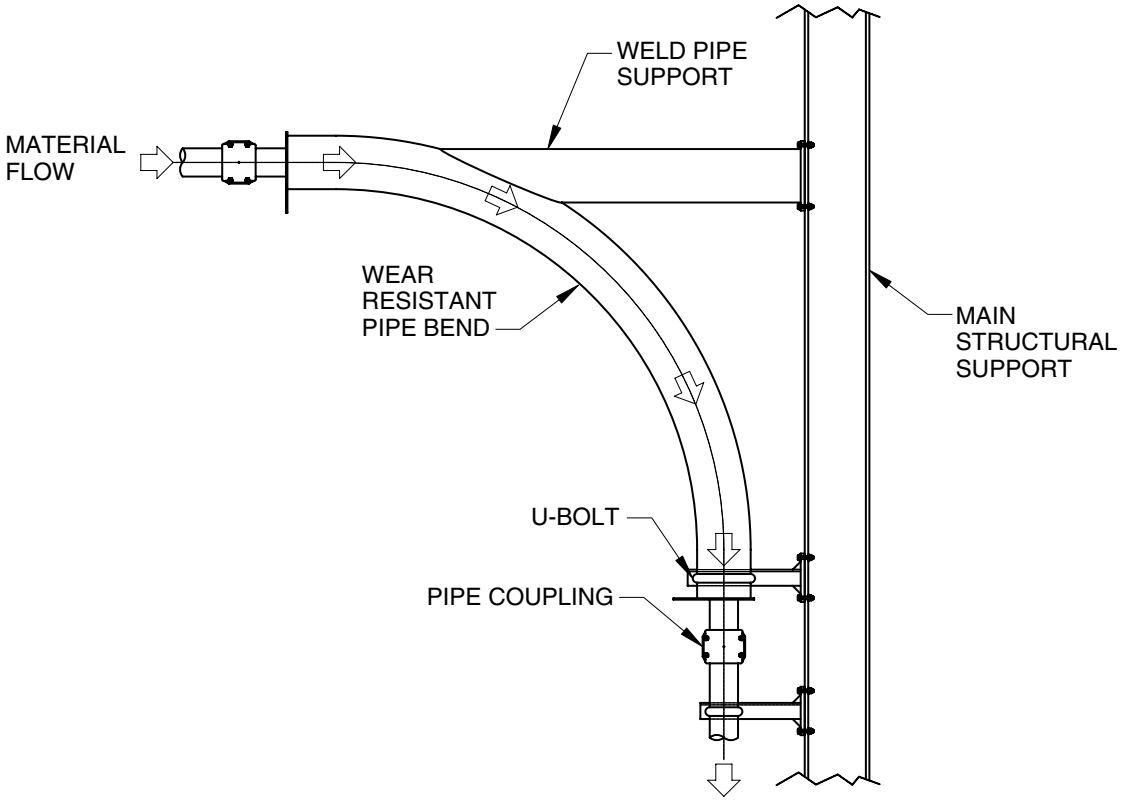
Front View
Single Conveying Line Elbow Support
(Beam Mounted)



Front View
Single Conveying Line Elbow Support
(Beam Mounted)



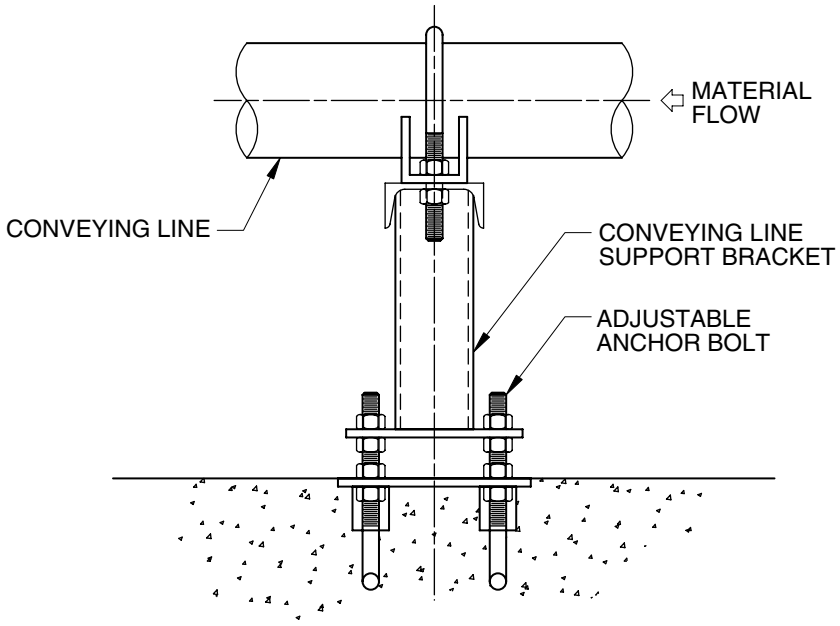
Front View
Single Conveying Line Elbow Support
(Beam and Column Mounted)



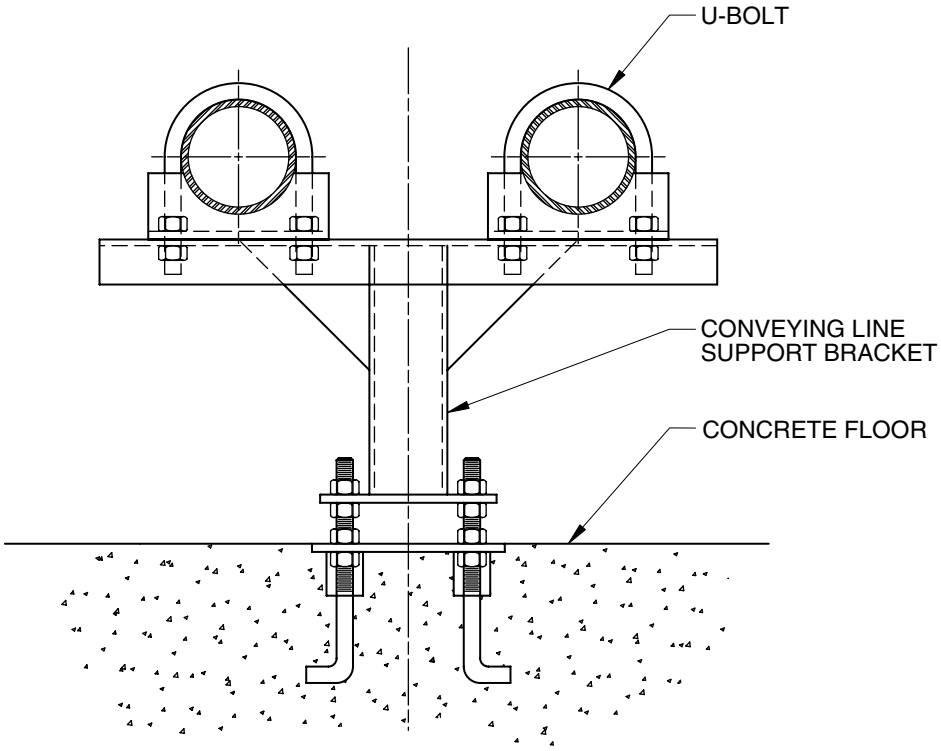
Front View

Single Conveying Line and Elbow Support

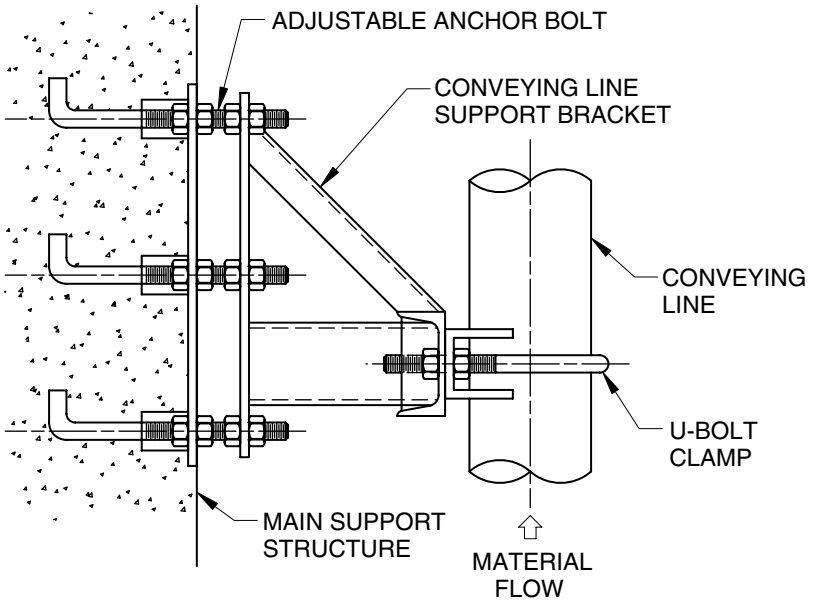
(Trunion and Structural Type Beam Mounted)



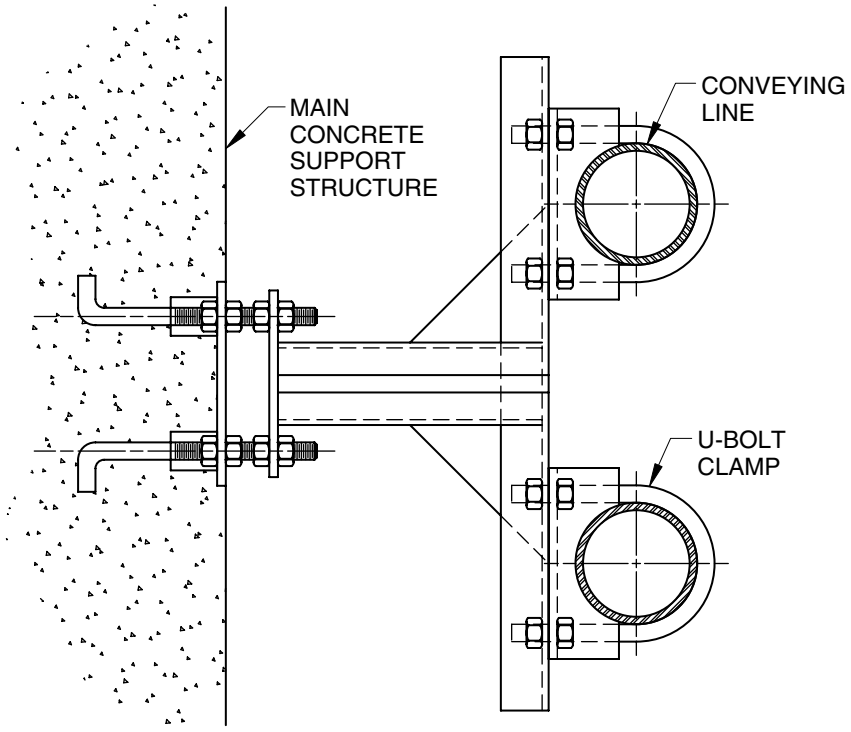
Front View
Dual Conveying Line Support
(Floor Mounted In Concrete)



End View
Dual Conveying Line Support
(Floor Mounted In Concrete)



Front View
Dual Conveying Line Support
(Wall Mounted In Concrete)



End View
Dual Conveying Line Support
(Wall Mounted In Concrete)

CONVEYING LINE GROUNDING

If grounding of conveyor piping is required, including jumping across non-conductive insulators such as gaskets and most types of couplings, three recommended methods are illustrated in Figures 1, 2 and 3.

The grounding strap for a Dynamic Air pipe flange field installation in Fig. 1 requires the customer to remove flange paint to insure a complete ground between flanges. The strap should be bent as shown or a wire can be utilized.

Fig. 2 illustrates the grounding strap or wire installation on other pipe flange configurations.

Fig. 3 shows how the grounding strap or wire should cross the coupling of the Dynamic Air Superslik Tubing Bend.

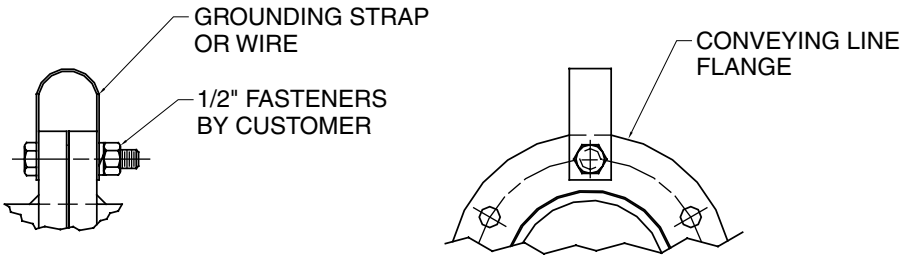


Fig. 1

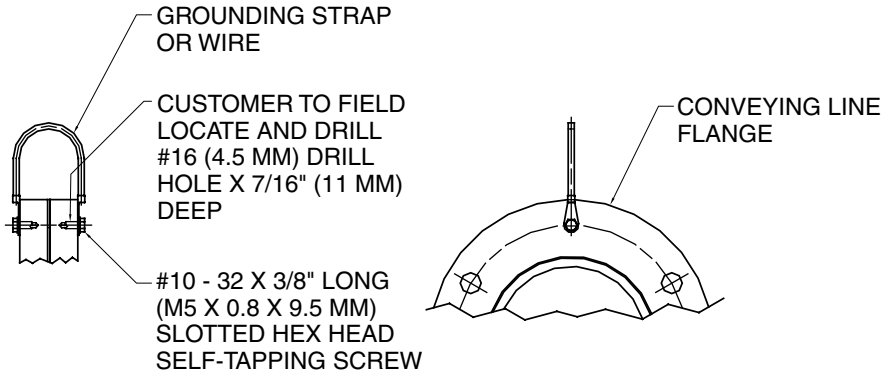


Fig. 2

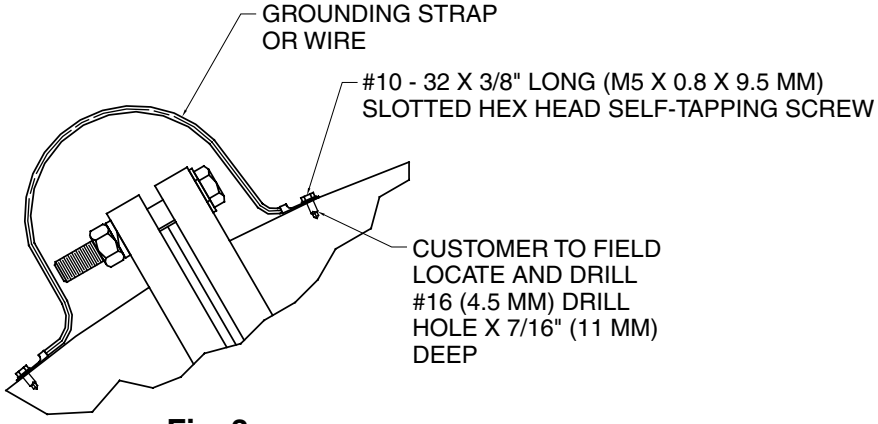
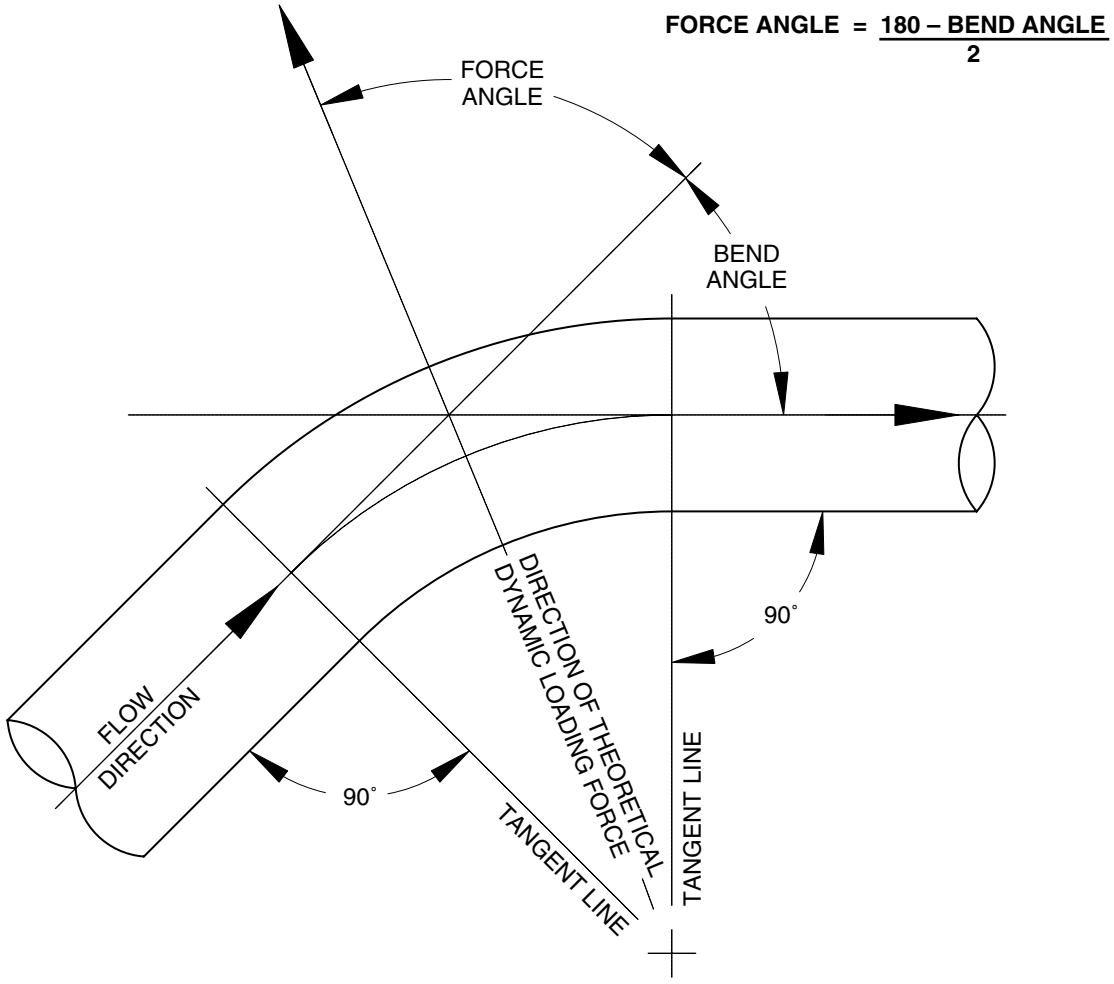


Fig. 3

Theoretical Dynamic Loading Forces

The dynamic loads seen by a particular system during operation are estimated in the following Theoretical Dynamic Loading Chart, Sections 4.2 and 4.3, and applied in the direction shown in the drawing below. These loading estimates are applicable only to systems that are installed and operated in accordance with all Dynamic Air installation and operations manuals, drawings and any other technical recommendations provided. In the event the system is being operated outside of Dynamic Air's recommendations, the dynamic loading force could be significantly higher than shown on the following charts.

Due to the extreme difficulty in determining the actual dynamic loading forces which the conveying line generates as a result of the material being conveyed, the theoretical dynamic loading forces provided herein are only estimates and not the actual loads which will result. Since the actual dynamic loading is a function of the conveying line velocity, and the conveying line velocity is always highest at the end of the system, the dynamic loading forces will be greatest at the end of the system. Also, because the theoretical dynamic loading forces provided here are based upon theoretical calculations and can not be easily verified for accuracy or credibility, use an appropriate safety factor and/or consult a local civil engineer to properly design the piping supports.



Theoretical Dynamic Loading Forces

CONVEYED MATERIAL BULK DENSITY - lbs./cu. ft. (kg/cu. m)	DYNAMIC LOADING FORCE - lbf (kN)						
	CONVEYING LINE SIZE - inches (mm)						
	2 (51)	3 (76)	4 (102)	5 (127)	6 (152)	8 (203)	10 (254)
10 (160)	43 (0.19)	96 (0.43)	171 (0.76)	266 (1.18)	384 (1.71)	682 (3.03)	1066 (4.74)
20 (320)	85 (0.38)	192 (0.85)	341 (1.52)	533 (2.37)	767 (3.41)	1364 (6.07)	2132 (9.48)
30 (481)	128 (0.57)	288 (1.28)	512 (2.28)	799 (3.55)	1151 (5.12)	2047 (9.11)	3198 (14.22)
40 (641)	171 (0.76)	384 (1.71)	682 (3.03)	1066 (4.74)	1535 (6.83)	2729 (12.14)	4264 (18.97)
50 (801)	213 (0.95)	480 (2.14)	853 (3.79)	1332 (5.92)	1919 (8.54)	3411 (15.17)	5330 (23.71)
60 (961)	256 (1.14)	576 (2.56)	1023 (4.55)	1599 (7.11)	2302 (10.24)	4093 (18.21)	6396 (28.45)
70 (1121)	298 (1.33)	672 (2.99)	1194 (5.31)	1865 (8.30)	2686 (11.95)	4775 (21.24)	7462 (33.19)
80 (1281)	341 (1.52)	767 (3.41)	1364 (6.07)	2132 (9.48)	3070 (13.66)	5458 (24.28)	8528 (37.93)
90 (1442)	384 (1.71)	863 (3.84)	1535 (6.83)	2398 (10.67)	3454 (15.36)	6140 (27.31)	9594 (42.67)
100 (1602)	426 (1.89)	959 (4.27)	1706 (7.59)	2665 (11.85)	3837 (17.07)	6822 (30.34)	10660 (47.42)
110 (1762)	469 (2.09)	1055 (4.69)	1876 (8.34)	2931 (13.04)	4221 (18.78)	7504 (33.38)	11726 (52.16)
120 (1922)	512 (2.28)	1151 (5.12)	2047 (9.11)	3198 (14.22)	4605 (20.48)	8187 (36.42)	12791 (56.89)
130 (2082)	554 (2.46)	1247 (5.55)	2217 (9.86)	3464 (15.41)	4989 (22.19)	8869 (39.45)	13857 (61.64)
140 (2243)	597 (2.66)	1343 (5.97)	2388 (10.62)	3731 (16.60)	5372 (23.89)	9551 (42.48)	14923 (66.38)
150 (2403)	640 (2.85)	1439 (6.40)	2558 (11.38)	3997 (17.78)	5756 (25.60)	10233 (45.52)	15989 (71.12)
160 (2563)	682 (3.03)	1535 (6.83)	2729 (12.14)	4264 (18.97)	6140 (27.31)	10915 (48.55)	17055 (75.86)
170 (2723)	725 (3.22)	1631 (7.25)	2899 (12.89)	4530 (20.15)	6524 (29.02)	11598 (51.59)	18121 (80.60)
180 (2883)	767 (3.41)	1727 (7.68)	3070 (13.66)	4797 (21.34)	6907 (30.72)	12280 (54.62)	19187 (85.34)
190 (3044)	810 (3.60)	1823 (8.11)	3241 (14.42)	5063 (22.52)	7291 (32.43)	12962 (57.65)	20253 (90.09)
200 (3204)	853 (3.79)	1919 (8.54)	3411 (15.17)	5330 (23.71)	7675 (34.14)	13644 (60.69)	21319 (94.83)

CONVEYED MATERIAL BULK DENSITY - lbs./cu. ft. (kg/cu. m)	DYNAMIC LOADING FORCE - lbf (kN)						
	CONVEYING LINE SIZE - inches (mm)						
	12 (305)	14 (356)	16 (406)	18 (457)	20 (508)	24 (610)	30 (762)
10 (160)	1535 (6.83)	2089 (9.29)	2729 (12.14)	3454 (15.36)	4264 (18.97)	6140 (27.31)	9594 (42.67)
20 (320)	3070 (13.66)	4179 (18.59)	5458 (24.28)	6907 (30.72)	8528 (37.93)	12280 (54.62)	19187 (85.34)
30 (481)	4605 (20.48)	6268 (27.88)	8187 (36.42)	10361 (46.09)	12791 (56.89)	18420 (81.93)	28781 (128.02)
40 (641)	6140 (27.31)	8357 (37.17)	10915 (48.55)	13815 (61.45)	17055 (75.86)	24560 (109.24)	38374 (170.69)
50 (801)	7675 (34.14)	10446 (46.46)	13644 (60.69)	17268 (76.81)	21319 (94.83)	30700 (136.55)	47968 (213.36)
60 (961)	9210 (40.97)	12536 (55.76)	16373 (72.83)	20722 (92.17)	25583 (113.79)	36839 (163.86)	57562 (256.04)
70 (1121)	10745 (47.79)	14625 (65.05)	19102 (84.97)	24176 (107.53)	29847 (132.76)	42979 (191.17)	67155 (298.71)
80 (1281)	12280 (54.62)	16714 (74.34)	21831 (97.10)	27630 (122.90)	34111 (151.73)	49119 (218.48)	76749 (341.38)
90 (1442)	13815 (61.45)	18803 (83.64)	24560 (109.24)	31083 (138.26)	38374 (170.69)	55259 (245.79)	86342 (384.05)
100 (1602)	15350 (68.28)	20893 (92.93)	27288 (121.38)	34537 (153.62)	42638 (189.65)	61399 (273.10)	95936 (426.72)
110 (1762)	16885 (75.10)	22982 (102.22)	30017 (133.52)	37991 (168.98)	46902 (208.62)	67539 (300.41)	105530 (469.40)
120 (1922)	18420 (81.93)	25071 (111.52)	32746 (145.65)	41444 (184.34)	51166 (227.59)	73679 (327.72)	115123 (512.07)
130 (2082)	19955 (88.76)	27161 (120.81)	35475 (157.79)	44898 (199.71)	55430 (246.55)	79819 (355.03)	124717 (554.74)
140 (2243)	21490 (95.59)	29250 (130.10)	38204 (169.93)	48352 (215.07)	59694 (265.52)	85959 (382.35)	134310 (597.41)
150 (2403)	23025 (102.42)	31339 (139.40)	40933 (182.07)	51805 (230.43)	63957 (284.48)	92099 (409.66)	143904 (640.08)
160 (2563)	24560 (109.24)	33428 (148.69)	43662 (194.21)	55259 (245.79)	68221 (303.45)	98239 (436.97)	153498 (682.76)
170 (2723)	26095 (116.07)	35518 (157.98)	46390 (206.34)	58713 (261.16)	72485 (322.41)	104378 (464.27)	163091 (725.43)
180 (2883)	27630 (122.90)	37607 (167.28)	49119 (218.48)	62167 (276.52)	76749 (341.38)	110518 (491.58)	172685 (768.10)
190 (3044)	29165 (129.73)	39696 (176.57)	51848 (230.62)	65620 (291.88)	81013 (360.35)	116658 (518.89)	182278 (810.77)
200 (3204)	30700 (136.55)	41785 (185.86)	54577 (242.76)	69074 (307.24)	85276 (379.31)	122798 (546.21)	191872 (853.45)

Electrical Installation

1. All electrical equipment must be installed exactly as shown on the electrical and process related drawings and documentation. These drawings include the Piping and Instrumentation Diagrams, Wiring Diagrams, Electrical Schematics, Enclosure Assemblies, and installation manuals of the equipment installed.
2. All electrical equipment must be installed in accordance with the National Electrical Code (NEC) and all state and local electrical codes.
3. All wire termination points must have self-laminating wire labels which corresponds with the Wiring Diagrams and Electrical Schematics.
4. All wire used must be rated for the service installed based on the current, voltage, and the environment (i.e. hot, cold, oily, corrosive, etc.) and must be United Laboratories (UL) listed.
5. All analog, digital, and communication cables must be shielded with the shield wire grounded at the control panel end only.
6. All single conductor wire insulation colors must conform to the following unless other wise stated:

Wire Type	Color
240/360/480 3-Phase Motor Wire or other high voltage wire	Black
120/240 Ungrounded Control Wire	Red
120/240 Grounded Control Wire (neutral)	White
24 VDC Control Wire	Blue
Ground Wire	Green

Note: All multi-conductor cable, including analog twisted pair cable, must follow the Wiring Diagram color assignments.

7. All electrical conduit must be rigid and galvanized. Flexible, liquid-tight, metal core conduit can be used at field devices to allow for removal of the device. All flexible conduit lengths should be limited to 3 ft (0.9 m).
8. All electrical conduit, raceways, and cable trays for AC circuit wiring must be separate from analog, digital, and communication circuit wiring.
9. Wire splicing is allowed only at solenoid valves and other devices which have permanent “pigtail” leads that are 18" (457 mm) or shorter. All splices must have self-laminating wire labels which corresponds with the Wiring Diagrams and Electrical Schematics. All splices must be accessible by either a junction box, pull box or conduit fitting with a removable cover. All splices must be secured with electrical tape. Any other location where a continuous wire cannot be run directly to a field device, such as at the end of a spool, must use terminal strips in a NEMA rated enclosure or junction box suitable for the environmental conditions where installed.
10. All electrical enclosures, junction boxes, and other devices that require grounding must have dedicated earth ground connections wired to an approved grounding bus or grid. Under no circumstances shall conduit be used as a grounding conductor.
11. All thermocouple wiring between the device and the electrical control enclosure must not have any splices and be compatible with the thermocouple type.

START-UP INSPECTION

A general purpose checklist of items that should be inspected prior to having qualified Dynamic Air personnel start-up your system is included in this manual (see Section 6.3). The inspection, incorporating any changes, is very critical to assure a smoother start-up, maximum safety and a correctly functioning system which will provide you with maximum trouble-free service.

Additionally, follow these basic guidelines:

1. Make sure that all equipment is installed according to the certified and approved drawings provided by Dynamic Air.
2. If the system is designed to operate above 15 psig (1.03 barg), make sure that all conveying line connections, such as couplings or flange connections, are designed and installed to meet a minimum operating pressure of 100 psig (6.89 barg).
3. Prior to connecting the air supply line to any components, make sure that all compressed air supply lines are blown clean of metal chips and foreign debris that might cause premature failure of any downstream equipment.

    3.1 Once the air header has been physically assembled, chase or clean the inside of the pipe of dirt, grease or any foreign matter.

    3.2 When the air header has been thoroughly cleaned, install all Magna™ flow control valves on the air header in the closed position. It is important to make sure the flow control valves are closed when they are in place.

    3.3 After all Magna flow control valves have been installed in the closed position, open the ball valve at the end of the air header to atmosphere. Blow the header line clean using clean compressed air pressure. It is important that when this procedure is implemented, the operators and/or installers are away from the open end of the air header, as the air coming out may be carrying foreign objects and/or particles. This can cause personal injury or damage to equipment that is close to the air header.

    3.4 When the air header has been blown clean, turn off the supply air and close the ball valve at the end of the air header.

    3.5 When the ball valve has been closed, pressurize the entire air header to 15-25 psig (1.03-1.72 barg) and check for leaks. While the air header is still under pressure, start with the Magna flow control valve closest to the transporter and working down the conveying line to the end, open each Magna flow control valve to the full open position for about 15 seconds or until the air in the header is clean and free of dust and foreign material. Be sure to only open one flow control valve at a time. Then close the flow control valve and continue to the next valve. Repeat this until all Magna flow control valves have been opened and closed and the air in the air header is clean.

    3.6 When all Magna flow control valves have been opened and closed under pressure, you are now ready to connect the Magna flow control valves to the DC-5® air saver controls on the convey line.

4. For operator safety, insure that all pressure relief valves and/or emergency bleed-off valves have been piped to prevent any bleed off air from injuring plant personnel.
5. All equipment that contains dusty material, such as receiving hoppers, transitions, chutes, end receivers, etc., must be installed air tight, without leaks, to prevent any possible dusting.

DO NOT attempt start-up of any equipment without having a qualified Dynamic Air service technician present to again review the Start-Up Checklist provided and to make other critical adjustments necessary for proper and safe operation.

For any items not included here or on the general purpose Start-Up Checklist (Section 6.3), consult with the Dynamic Air Service Department (see Section 11.1 for contact information).

⚠ WARNING

In an upset condition, reception bins may reach a pressure higher than their design pressure, therefore it is highly recommended that a pressure relief valve be placed on all receiving hoppers or silos.

NOTICE

Should any equipment fail prematurely, leak dust, vibrate, shake violently or perform in a manner different than is shown on Dynamic Air drawings, manuals, engineering documents, etc., shut down the system(s) immediately and call the Dynamic Air service department for assistance.

⚠ WARNING

Failure to follow the above instructions thoroughly may result in plant personnel injury or death and/or damage to equipment.

START-UP CHECKLIST

- ❑ Be sure that the material to be conveyed is the same as specified in the Dynamic Air proposal and/or test data relative to particle size, moisture, density, temperature, etc. Any changes in material to be conveyed will definitely affect system performance.
- ❑ All instruction manuals for every piece of equipment installed have been received and properly adhered to relative to proper installation.

ELECTRICAL COMPONENTS

- ❑ Observe and adhere to all engineering drawings provided.
- ❑ Proper power supply connected to electrical control panel.
- ❑ All terminations made correctly to electrical control panel.
- ❑ All electrical control panel and field terminations have wire number installed.
- ❑ All limit switches wired and set correctly.
- ❑ All level controls wired and calibrated correctly.
- ❑ Conveying line switches and diverters wired correctly.
- ❑ Air control stand wired correctly.
- ❑ All valve assemblies, etc., wired correctly.
- ❑ All pressure switches wired and set correctly.
- ❑ Timers properly adjusted (if applicable).
- ❑ Heaters installed and wired properly (if applicable).

MECHANICAL COMPONENTS

- ❑ Observe and adhere to all engineering drawings provided.
- ❑ Transporters located correctly.
- ❑ Transporters set correctly - straight and level.
- ❑ Transporters cleaned of debris from installation.
- ❑ Inlet valves aligned and all bolts have lock washers with nuts properly tightened.
- ❑ Conveyor line installed correctly.
- ❑ All pipes aligned.
- ❑ Pipe supports adequate.
- ❑ Couplings installed properly.
- ❑ Air saver controls installed (air inlets at top and flow direction correct).
- ❑ Receivers installed correctly.
- ❑ Dust filter is allowed to exhaust properly.
- ❑ Level controls installed correctly and undamaged.
- ❑ Level controls adjusted to correct level.
- ❑ Level controls adjusted for sensitivity to material.

COMPRESSED AIR SYSTEM

- ❑ Adequate compressed air volume available.
- ❑ Adequate compressed air pressure available 95-100 PSIG.
- ❑ All compressed air is dry and free of moisture.
- ❑ Supply lines adequately sized.
- ❑ All air cylinder ports piped correctly (if applicable).
- ❑ Compressed air dryers and filters correctly installed.
- ❑ Air receiver tank sized correctly to compensate for the maximum air surge which can occur.
- ❑ All compressed air dryers are located before, not after, an adequately sized compressed air receiver tank.
- ❑ No air leaks.
- ❑ Flow controls adjusted correctly.
- ❑ All compressed air piping installed correctly.
- ❑ All check valves installed with flow arrow pointing in the upstream direction of flow or according to any of the engineering drawings provided.
- ❑ All solenoid valves piped correctly.
- ❑ All hoses installed correctly - no kinks or restrictions.
- ❑ Air control panels located per print and operate correctly.
- ❑ Regulators, oilers and filters installed in proper sequence and operational.

LEVEL CONTROLS

1. All level controls used to indicate high level in silos, receiving bins, or hoppers (see Fig. 1) should be placed so that when actuated, there is still room for at least one full transporter batch above the highest level control actuation.
2. Full or high level controls in transporters (see Fig. 2 and Fig. 3) should be mounted low enough to allow the inlet valve sufficient time to close without overfilling vessel. This can be easily checked by removing the safety relief valve and/or opening the inspection port (if applicable) in the top of the vessel and then using a small probe to check the actual material level inside. The inlet valve should be allowed to close fully on a clean seat without material obstructions (see Fig. 2). It may be necessary to make a field adjustment of the level control since each material has a unique flow rate and pattern.

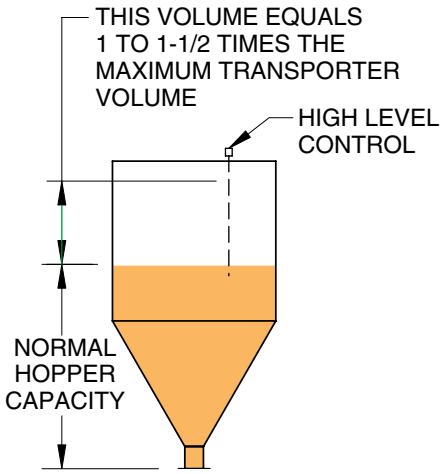


Fig. 1

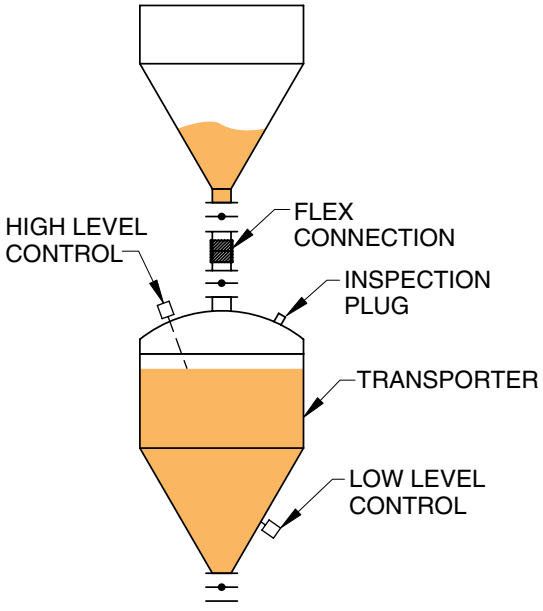


Fig. 2

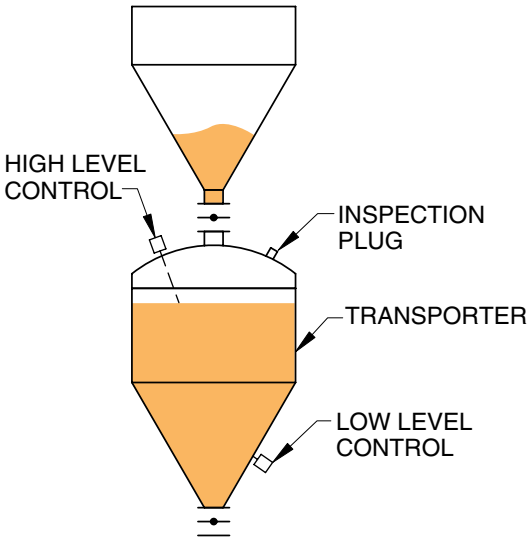


Fig. 3

ELECTRICAL CONTROL PANELS

Due to the wide range of design applications and components used, special considerations as to electrical control panel location may be required, keeping in mind the convenience and safety of operating personnel.

Fig. 1

1. Install panel according to all national, state and local codes applicable to the location in which the panel is installed.
2. Follow all safety requirements applicable to the material being handled or conveyed with regard to any dangerous attributes such as explosiveness, toxicity, etc.
3. Install cabinet in a location that is safe and convenient for plant personnel.
4. Take special care not to damage the control panel by tipping or dropping the cabinet.
5. Install cabinet away from traffic areas and areas where heavy equipment (fork lifts, etc.) is used.
6. Position so that the cabinet door(s) can fully open with a minimum clearance of three feet in front of the door(s).
7. Protect cabinet from weather, adjacent water lines, drains, etc., which may damage electrical components.
8. DO NOT install where excessive vibration exists.
9. Cabinet should be located where visual and audio alarms can be monitored.
10. Protect the cabinet from coming in contact with excessive dust or any other material. Accumulation in the cabinet will create maintenance problems.
11. DO NOT run any wire into or through the control cabinet that is not specifically shown on the design drawings.
12. All electrical cabinets should be permanently secured, taking special care not to damage upon installation by tipping or dropping.
13. All field wiring components utilized such as wire, connectors, junction boxes, etc., must be designed for the specific atmospheric environment in which they are used.

⚠ WARNING

Failure to follow the above guidelines thoroughly may result in plant personnel injury or death and/or damage to equipment.

FIELD MODIFICATIONS

After all equipment has been installed, a thorough inspection **MUST** be made of all components to assure that the system is installed exactly as shown on the drawings provided. Prior to making any field modifications that do not agree with the drawings provided, contact Dynamic Air for authority to change the design accordingly. Whenever a change is agreed upon, final drawings must be provided by Dynamic Air Inc. before any start-up is attempted.

If any field modifications have been made to facilitate installation on site, the appropriate drawings should be updated and returned to the Engineering Department for Dynamic Air's approval. The original tracings must be brought up to date for future reference.

Changes can be faxed or mailed to the attention of our Chief Mechanical/Electrical Engineering Managers. See section 11.1 for fax number and mailing address.

All back charges for re-work or changes will not be accepted without prior authorization from Dynamic Air Inc.

⚠ WARNING

Failure to follow the above guidelines thoroughly may result in plant personnel injury or death and/or damage to equipment.

Symptom	Problem	Correction
MATERIAL WILL NOT TRANSPORT	• System plugged.	• Contact Dynamic Air for recommendation.
		• Consult Maintenance section on removing system plug.
	• Electrical failure.	• Check main control panel and repair or replace any damaged parts.
LOADING CYCLE CANNOT BE INITIATED	• Pressure trapped in transporter from previous cycle causing plugged system.	• Contact Dynamic Air for recommendation.
		• Consult Maintenance section on removing system plug.
	• Inlet valve limit switch out of adjustment.	• Adjust inlet valve to proper setting.
	• Low compressed air supply pressure at inlet or vent valve.	• Check to make sure compressed air supply pressure at inlet and vent valves is between 95-100 psig (6.6-6.9 barg).
	• Compressed air supply line leaks.	• Correct compressed air supply line leaks.
	• Damaged transporter solenoid valve.	• Repair or replace transporter solenoid valve.
	• Mechanical binding of inlet or vent valve cylinder of actuator.	• Repair or replace inlet or vent valve cylinder or actuator.
	• Material build-up or foreign objects restricting Valve, switch, or diverter movement.	• Remove material build-up or foreign objects.
	• Transporter pressure switch out of adjustment.	• Adjust transport pressure switch to proper setting.
	• Electrical failure.	• Check main control panel and repair or replace any damaged parts.
	• Receiving station high or transporter full light illuminated.	• Wait for material to drop below probe.
	• Damaged receiving station or transporter level control.	• Check level control condition and function. Adjust, repair or replace as required.

Symptom	Problem	Correction
LOADING CYCLE CANNOT BE INITIATED	• Transport pressure switch PSI (low) or back pressure transducer actuated. Pressure trapped in transporter from prior cycle.	• Check for plug in convey or vent line.
	• Transport pressure switch PSI (low) out of adjustment or actuated.	• To clear system, take out of automatic mode. Then press and release manual transport push button. When the transport cycle is complete, try initiating another load cycle.
	• Transport pressure switch or back pressure transducer defective.	• Replace transport low pressure switch or back pressure transducer.
	• Pressure low timer defective.	• Replace and set as required. Refer to electrical schematic for proper setting (approximately 5 seconds).
	• Conveying line switch in proper position but lights on electrical panel do not indicate this.	• Check for burned out or defective lights and replace.
	• Limit switch out of adjustment or defective on inlet valve.	• Check limit switch adjustment and condition. Repair or replace as required.
	• Foreign material in solenoid valves: dirt, ice, pipe scale, etc.	• Manual overrides (if applicable) may be tripped to see if foreign material will pass through unit. Otherwise, disassemble unit, clean and replace as required.
	• Solenoid valve coil burned out.	• Replace coil and check for sticking, which is the probable cause of coil burnout.
EXCESSIVE LOADING CYCLE TIME	• Low compressed air supply pressure at inlet or vent valve.	• Check to make sure that compressed air supply pressure at inlet and vent butterfly valves is between 95-100 psig (6.6-6.9 barg).
	• Compressed air supply line leaks.	• Correct compressed air supply line leaks.

Symptom	Problem	Correction
EXCESSIVE LOADING CYCLE TIME	• Damaged transporter solenoid valve.	• Repair or replace transporter solenoid valve.
	• Mechanical binding of inlet or vent valve cylinder or actuator.	• Repair or replace inlet or vent valve cylinder or actuator.
	• Material build-up or foreign objects restricting valve, switch or diverter movement.	• Remove material build-up or foreign objects.
	• Damaged inlet or vent valve.	• Repair or replace inlet or vent valve.
	• Damaged transporter solenoid valve.	• Repair or replace transporter solenoid valve.
	• Damaged transporter level control.	• Repair or replace transporter level control.
	• Transporter level control out of adjustment.	• Adjust transporter level control to proper setting.
	• Electrical failure.	• Check main control panel and repair or replace any damaged parts.
	• Transporter inlet or vent valve will not open.	• Check for sufficient air supply at transporter inlet or vent valve solenoid(s).
	• Foreign material in solenoid valve: dirt, ice, pipe scaling, etc.	• Manual override (if applicable) may be tripped to see if foreign material will pass through unit. Otherwise, disassemble unit, clean and replace as required.
	• Solenoid valve coil burned out.	• Replace coil and check for sticking, which is the probable cause of coil burnout.
	• Mechanical binding of cylinder or actuator on valve(s).	• Check action and repair or replace as required.
	• Transporter inlet and vent valves open, but transporter fills slowly or not at all.	• Check bin, silo, etc. above transporter for material depletion.
	• Transporter inlet or vent valve restricted.	• Check for wet or lumpy material which may have bridged inlet valve. Clear any foreign objects between seat and disc of butterfly valve.

Symptom	Problem	Correction
EXCESSIVE LOADING CYCLE TIME	• Transporter inlet or vent valve bolts sheared on shaft.	• Check valve disc for travel and seating. Repair as required.
	• Transporter fills but loading indicator remains on and transporter full indicator turns on.	• Check for solenoid stuck in the “open” position.
TRANSPORT CYCLE CANNOT BE INITIATED	• Damaged inlet or vent valve limit switch.	• Repair or replace inlet or vent valve limit switch.
	• Low compressed air supply pressure at inlet or vent valve.	• Check to make sure compressed air supply pressure at inlet and vent valves is between 95-100 psig (6.6-6.9 barg)
	• Compressed air supply line leaks.	• Correct compressed air supply line leaks.
	• Damaged transporter solenoid valve.	• Repair or replace transporter solenoid valve.
	• Material build-up or foreign objects restricting valve, switch, or diverter.	• Remove material build-up or foreign objects.
	• Damaged inlet or vent valve.	• Repair or replace inlet or vent valve.
	• Receiving bin or transporter level control out of adjustment.	• Adjust receiving bin or transporter level control to proper setting.
	• Transporter overfilled.	• Remove excess material from transporter.
	• Inlet valve limit switch out of adjustment.	• Adjust inlet valve to proper setting.
	• Conveying line switch or diverter out of position.	• Place conveying line switch or diverter into its proper position.
	• Mechanical binding of inlet or vent valve cylinder or actuator.	• Repair or replace inlet or vent valve cylinder or actuator.
	• Electrical failure.	• Check main control panel and repair or replace any damaged parts.

Symptom	*Problem*	*Correction*
TRANSPORT CYCLE CANNOT BE INITIATED	• Transporter inlet or vent valve remain open with the transporter full indicator on.	• Check inlet valve limit switch for adjustment.
	• Insufficient air pressure.	• Check air supply for proper pressure.
	• Foreign material in solenoid valve: dirt, ice, pipe scale, etc.	• Manual overrides (if applicable) may be tripped to see if foreign material will pass through unit. Otherwise, disassemble unit, clean and replace as required.
	• Transporter overfilled.	• Take system out of automatic and cross-check level problem.
	• Level control malfunction.	• Press “Stop Automatic.” Remove excess material until the inlet and/or vent valves will close.
	• Receiving bin is full.	• Check receiving bin level control for build-up of material.
	• Receiving bin level control failure.	• Check level control for power, calibration, and mechanical function. Adjust, repair or replace as required.
	• Transporter inlet valve closed but has no indication of being closed.	• Limit switch defective or out of adjustment. Adjust, repair or replace as required.
	• Transporter inlet valve closed timer (if present) defective.	• Replace and set as required. Refer to electrical schematic for proper setting (approximately 3 to 5 seconds).
	• Conveying line switch or diverter in proper position but indicators do not report this.	• Check for burned out or defective bulbs and replace as required.
	• Inlet/vent valve is out of adjustment.	• Check for limit switch condition. Adjust, repair or replace as required.

Symptom	Problem	Correction
TRANSPORT CYCLE CANNOT BE INITIATED	• Solenoid valve coil burned out.	• Replace coil and check for sticking which is the probable cause of burnout.
TRANSPORT CYCLE TOO SHORT	• Mechanical binding of actuator.	• Check, repair or replace as required.
	• Low compressed air supply pressure.	• Check to make sure compressed air supply pressure at transporter is at the proper setting.
	• Compressed air supply line leaks.	• Correct compressed air supply line leaks.
	• Transporter pressure switch out of adjustment.	• Adjust transporter pressure switch to proper setting.
	• Damaged transporter pressure switch.	• Repair or replace transporter pressure switch.
	• Foreign object in transporter.	• Remove foreign object from transporter .
	• Damaged transporter solenoid valve.	• Repair or replace transporter solenoid valve.
	• Material specification are not the same as system design data.	• Contact Dynamic Air for design recommendation.
	• Damaged inlet or vent valve.	• Repair or replace inlet or vent valve.
	• Transporter manway improperly sealed.	• Repair or replace transporter manway seal.
	• Transporter outlet coupling improperly sealed.	• Repair or replace transporter outlet coupling seal.
	• Electrical failure.	• Check main control panel and repair or replace any damaged parts.
	• Transport cycle starts but does not remain on for the required 15 to 30 seconds needed to pressurize transporter.	• Check supply air for proper pressure.

Symptom	Problem	Correction
TRANSPORT CYCLE TOO SHORT	• Transport cycle start timer (pressure up time) out of adjustment or faulty (if applicable).	• Set timer to correct setting or replace (if applicable).
	• Transport cycle remains on for 15 to 30 seconds but ends before the transporter is empty.	• Check pressure switch #2 (or PS2 setting). Refer to electrical drawing for proper setting (approximately 15 psig (1.03 barg)).
	• Insufficient air to transporter or air saver controls.	• Check air supply pressure to air control module.
		• Check regulator setting and operation in air control module.
		• Check transporter and control solenoids for proper operation (if applicable).
		• Check operation and condition of check valve through which top air to transporter is supplied.
	• Material in transporter bridging or rat-holing.	• Inspect inside of transporter for foreign objects and remove, if any.
	• Material being conveyed is not to specification, i.e. excessive moisture, change in mesh size, change in temperature. (Refer to system design data).	• Check transporter tangential jets for proper function and settings (if applicable).
		• Check transporter outlet for foreign object.
		• Check heaters (if applicable) for proper setting.
		• Check oiler (if applicable) for proper function.
	• Large system air leak.	• Check system for air leaks and repair.
	• Material blowing out of flex connections on transporter (if applicable).	• Check transporter inlet and vent valves for proper sealing or damage. Repair or replace as required.
		• Check transporter manway for proper seal.

Symptom	Problem	Correction
TRANSPORT CYCLE TOO SHORT	• Transporter outlet coupling not sealed.	• Check coupling seal and adjust, repair or replace to insure a proper seal.
	• Transporter and air saver control supply line damage.	• Check supply lines for leaks.
	• Transport pressure switch PSI (high) out of adjustment (if applicable).	• Refer to air control module drawings for adjustment procedure.
	• Transport pressure switch defective (if applicable).	• Replace pressure switch.
TRANSPORT CYCLE TOO LONG	• Low compressed air supply pressure.	• Check to make sure compressed air supply pressure at transporter is at the proper setting.
	• Compressed air supply line leaks.	• Correct compressed air supply line leaks.
	• Damaged inlet or vent valve.	• Repair or replace inlet or vent valve.
	• Transporter manway improperly sealed.	• Repair or replace transporter manway seal.
	• Transporter outlet coupling improperly sealed.	• Check coupling seal and adjust, repair or replace to insure a proper seal.
	• Insufficient air supply to transporter.	• Check air supply to air control module.
		• Check module regulator for proper setting.
		• Check transporter and control solenoids for proper operation (if applicable).
		• Check operation and function of check valve through which transporter top air is supplied.
		• Check each air saver control and the air supply for proper functioning and proper setting.

Symptom	*Problem*	*Correction*
CONVEYING LINE IS PLUGGED	• Material characteristics such as particle size, shape, moisture content , etc. are different from the original design.	• Consult Dynamic air to review new design and adjust for new material characteristics.
	• Conveying line is misaligned.	• Check conveying line for alignment problems and correct accordingly.
	• Conveying pressure/air volume is too high or too low.	• Adjust conveying pressure/ air volume to its proper setting.
	• Convey line is irregular due to wear.	• Replace any worn conveying line components.
	• Main air supply pressure/ volume is inadequate.	• Provide adequate air supply pressure/volume.
	• Air supply line(s)/control valve(s) are too small.	• Increase air supply line(s)/ control valve(s) to proper size.
	• Air supply line(s)/control valve(s) frozen.	• Thaw out air supply line(s)/ control valve(s).
	• High moisture material is building up, condensing or freezing on the interior of the conveying line, thereby reducing the inside area.	• Insulate and/or heat trace the conveying line and remove material build-up.
	• Tubing is not consistent in size throughout the conveying line, i.e. schedule 10 pipe mating to schedule 80 pipe.	• Use the same size tubing throughout the conveying line or use Dynamic Air approved tapered transitions where different size pipelines mate.
	• Foreign object(s) inside the system are blocking material flow.	• Remove foreign object(s) from the system.
	• System power failure.	• Restore system power.
	• Convey line interior friction causes material to build up.	• Return convey line to its original condition or replace with new materials.

Symptom	*Problem*	*Correction*
SYSTEM IS CONSUMING EXCESSIVE AIR	• Material characteristics such as particle size, shape, moisture content, etc. are different from the original design.	• Consult Dynamic Air to review new design and adjust for new material characteristics.
	• Inlet and/or vent valves are leaking due to damage or wear.	• Repair or replace valve(s).
	• System air leaks in the conveying line, tubing bends, couplings, etc. due to misalignment, wear, etc.	• Repair or replace worn parts and fix system leaks.
	• Convey line distance is longer than what was originally designed.	• Consult Dynamic Air to review new system design.
	• Conveying pressure/air volume is too high or too low.	• Adjust conveying pressure/ air volume to its proper setting.
	• Insufficient air surge tank capacity is preventing the system from conveying at its design pressure.	• Increase air surge tank size to accommodate the proper system design pressure.
	• Air compressor is too small, preventing the system from operating at a higher design pressure.	• Install a larger air surge tank.
	• Transporter not completely filled up to inlet valve, causing air to fill void that material normally occupies.	• Ensure that transporter is properly filled.
CONVEYING LINE POUNDS OR SLUGS EXCESSIVELY	• Conveying pressure/air volume is too high or too low.	• Adjust conveying pressure/ air volume to its proper setting.
	• Main air supply pressure/volume is inadequate.	• Adjust main air supply to provide adequate pressure/ volume.
	• Conveying line is misaligned.	• Check conveying line for alignment problems and correct accordingly.
	• Foreign object(s) inside the system are hampering material flow.	• Remove foreign object(s) from the system.

Common Design Errors

1. Characteristics of the material to be conveyed have changed from the original design and may be heavier, coarser, higher in moisture, more friable, higher in temperature or a totally different material.
2. The conveying line has a mixture of schedule 40 and schedule 10 size tubing, resulting in conveying line obstructions with adverse ledges at the joints adding additional resistance to flow.
3. Rubber hose was substituted for the steel conveying line adding significant resistance to the conveying line flow.
4. The conveying line is dented or smashed reducing the conveying line area which adds additional resistance to the conveying line.
5. Short radius elbows were substituted for long radius type adding to the conveying line resistance.
6. Additional tubing bends added to the original system or added length increasing conveying line resistance and overall pressure drop.
7. Conveying line is misaligned at joints due to poor installation and/or improper conveying line couplings.
8. Leaking conveying line joints or worn spots in the conveying line and/or tubing bends.
9. Build-up of material inside the conveying line due to condensing of warm, moist material through a cold section of the conveying line.
10. Static electrical charge emits from the conveying line due to improper grounding or the use of non-conductive convey line components.
11. Conveying line moves or shakes violently due to improper conveying line supports or excessive conveying line velocity.
12. Solenoid valves do not operate due to a poor and/or dirty compressed air supply system.
13. System is not able to maintain a consistent air pressure due to improperly sized or poorly located air surge tanks, and/or system is conveying faster than designed.
14. Dust collector is not adequately sized to handle the instantaneous air flow of the system.
15. System plugs due to inadequate air flow, valves leaking, improper flow settings, kinked air hoses, frozen air lines, etc.

Daily, Weekly, Monthly and Yearly Maintenance

⚠ WARNING

The parts and/or equipment purchased from Dynamic Air Inc. have a limited life that depends on the user's specific application and the conditions under which the user operates the equipment. Over time, parts and equipment may suffer deterioration, wear and tear, corrosion, or other failure. Therefore, the user must follow all instructions contained in this notice and in the operating manuals provided by Dynamic Air Inc. for each piece of equipment.

REQUIRED PREVENTATIVE MAINTENANCE SCHEDULES

The user of the Dynamic Air Inc. supplied parts and equipment must take adequate preventative maintenance precautions to safeguard persons, equipment and property against all conditions that may occur during operation of the equipment. The user must establish and follow a daily, weekly, monthly and yearly maintenance schedule that coincides with the actual and intended use of the equipment. The proper maintenance schedule for each situation depends on the specific type of application and materials handled. If the user has any questions about maintenance, contact the Dynamic Air Service Department at (see Section 11.1 for contact information).

HAZARD AND OPERABILITY STUDY (HAZOP)

Dynamic Air Inc. has not performed a HAZOP evaluation involving the material and/or process for which this equipment was sold and/or will be used. It is the customer's sole responsibility to perform any HAZOP should it be required, in order to identify and evaluate all operating conditions and environments which represent a possible risk to any people or persons whatsoever.

REQUIRED INSPECTIONS

The user of the Dynamic Air Inc. supplied parts and equipment should visually inspect the entire system, parts or equipment at least once daily in order to detect potential problems such as leaks, stress cracks, loosening of bolts and part failures, etc.

In addition, during the first start-up of the parts or equipment, specific data and settings must be recorded in writing and be provided to all appropriate operating personnel for their safe use in operating the system. This includes, but is not limited to, the following operating data:

- **Recommended air supply pressure**
- **Air volume settings**
- **Recommended air regulator settings**
- **Electrical interlocks**
- **Recommended procedures**
- **Weight limitations**
- **Temperature limitations**
- **Convey times**
- **Specific control settings**
- **Valve settings**
- **Other applicable measurements**
- **Motor amperage, etc.**
- **Timing sequences**
- **Batch sizes**
- **Weighments**

The operating data should be reviewed and, if necessary, adjusted accordingly on a daily, weekly and monthly basis to insure that the parts or equipment is operating safely and properly according to all the recommendations provided by Dynamic Air Inc.

Daily, Weekly, Monthly and Yearly Maintenance

WARNING

SYSTEMS THAT REQUIRE IMMEDIATE SHUTDOWN AND INSPECTION

Whenever any unusual operating conditions or system functions or sudden changes in such conditions or functions is noticed, the parts or equipment should be shut down immediately and all air and electrical power should be shut off. Then, the equipment should be thoroughly inspected to determine the cause of such conditions or symptoms in order to protect personnel from potential injury and to protect the equipment from potential damage or unsafe operating conditions. Conditions that require immediate shutdown and inspection include but are not limited to excessive vibration, unusual equipment movement, abnormal noise, excessive heat build-up, leaks, sudden loss of air pressure, or sudden and unusual changes in temperature, noise, or an unusual amount of material handled, etc.

SERVICE REQUIREMENTS

A Dynamic Air service technician must perform a thorough service inspection and maintenance check of all Dynamic Air supplied parts or equipment at least once annually in order to maximize equipment life and performance, minimize system downtime, protect plant personnel, and minimize liability. It will be the user's responsibility to schedule these services as required. Failure to follow this requirement could cause damage to equipment and endanger plant personnel. Should the user fail to operate the system according to all instructions in the operating manuals, the warranty will be invalidated.

CHANGES TO DYNAMIC AIR SUPPLIED EQUIPMENT

Any proposed changes or repairs to the equipment furnished by Dynamic Air must be submitted in writing to the Dynamic Air engineering department for advance written approval. Should the user fail to obtain written approval before making any changes or repairs, it will invalidate the warranty and may create unsafe or dangerous operating conditions and put operating personnel at risk. The user assumes all liability for the changes made to the systems and/or equipment without Dynamic Air Inc.'s written approval.

DANGEROUS OR EXPLOSIVE MATERIALS:

The parts or equipment furnished by Dynamic Air Inc. may handle materials that may be dangerous or explosive. It is the customer's total responsibility to insure that all plant personnel are properly trained to handle dangerous/explosive materials and to follow recommended procedures provided by material suppliers and/or state and local guidelines for handling such materials. Dynamic Air Inc. assumes no responsibility or liability with regard to potential hazards in handling such material.

Troubleshooting a Stalled Conveying Line

⚠ WARNING

Disconnect and lockout/tagout all energy sources before performing any maintenance.

Note: When a conveying line becomes plugged, the reason for it most likely is because something has changed from the system's original design. This could be a change in material conveyed or the air pressure or air volume could have been reduced or modified from the original design. Therefore, whenever a plugged line occurs, it is highly recommended that Dynamic Air be notified in order to obtain recommendations and hopefully find the cause.

1. The exact location of where a plug has occurred within the conveying line, or a system which has stalled, may or may not be apparent. To locate the position of the plug in a system utilizing Dynamic Air air saver controls, observe each air pressure gauge at each air saver control.

   If the system is operating under proper and normal conditions, the air saver control pressure gauge readings will decrease from the beginning to the end of the conveying line. For example, if the transporter air pressure was set to 60 psig (4.14 barg), then the first air saver control gauge at the transporter would indicate nearly 60 psig (4.14 barg). Each successive air saver control will read slightly less and the last air saver control gauge will read approximately 1 psig (.07 barg) (see Fig. 1, Section 9.5). The air pressure at each individual air saver control is very near to the exact conveying line pressure at those points.

   When a conveying line plug occurs, the air saver control air pressure readings up until the position of the plug will all normally read the same pressure unless a gauge is faulty, etc. All air saver control air pressure readings beyond the position of the plug will normally read zero on the gauges, even though air may be flowing through the air saver control.

2. When locating plugs on systems without Dynamic Air's exclusive air saver controls, take a hard metal object and lightly tap on the conveying line until there is a high pitched ringing or hollow sound comparable to a dull, low pitched ringing sound.

⚠ WARNING

Whenever a plugged conveying line is diagnosed do not take the conveying line apart to mechanically dislodge the obstruction. Any sudden movement could dislodge the obstruction and its velocity could injure plant personnel or cause death.

3. To dislodge the system plug, first try to increase the conveying line pressure in 5 psig (0.34 barg) increments, waiting five minutes before changing to a higher conveying pressure. In any event, DO NOT exceed the normal conveying pressure by more than 50 percent of its maximum pressure.

Troubleshooting a Stalled Conveying Line

4. If this maneuver fails to dislodge the plug, then depressurize the complete system and shut off all the volume control valves on the system including, but not limited to, all transporter control valves including top air supply, transporter jets and each individual air saver control volume control valve.

   Adjust the main air regulator to the Dynamic Air system to a maximum of 50 percent of the normal conveying line pressure and turn on the air saver control just before and after the plug to full open (see Fig. 2, Section 9.6). This increase in pressure should easily clear the plug at that point in the conveying line. If the plug does clear, proceed backward with each air saver control from the position of the plug to the transporter to clear the section of the conveying line in front of the plug (see Fig. 3 and Fig. 4, Sections 9.7 and 9.8).

5. If the conveying line remains plugged after the above maneuvers are implemented, it may be necessary to completely depressurize the system, dismantle the conveying line and mechanically dislodge the plug.

⚠ WARNING

It is extremely important when dismantling the system where a plugged line has occurred to take extreme care, since pockets of air pressure could suddenly become dislodged and injure plant personnel or cause death. Never look down the inside of a conveying line, due to the possibility of trapped high pressure pockets of compressed air suddenly exploding through and out the end of the conveying line.

6. A top air bleed-off valve is provided to manually depressurize the transporter vessel before troubleshooting is attempted.

⚠ WARNING

Even though the transporter may be depressurized, the conveying line could still have high pressure compressed air trapped and thus extreme care should be taken to avoid personal injury. It is highly recommended to completely depressurize the system before any dismantling is attempted.

7. Close the maintenance lockout valve and depressurize the system by opening the manual drain valve. Open the bleed-off valve in the top air supply line to insure the transporter is depressurized. When all system pressures are at zero, work on the conveying line or its components can begin.

8. Disassemble conveying line at system plug and clear plug from it.

9. Reassemble conveying line, closely following procedures listed in the installation guide section.

Troubleshooting a Stalled Conveying Line

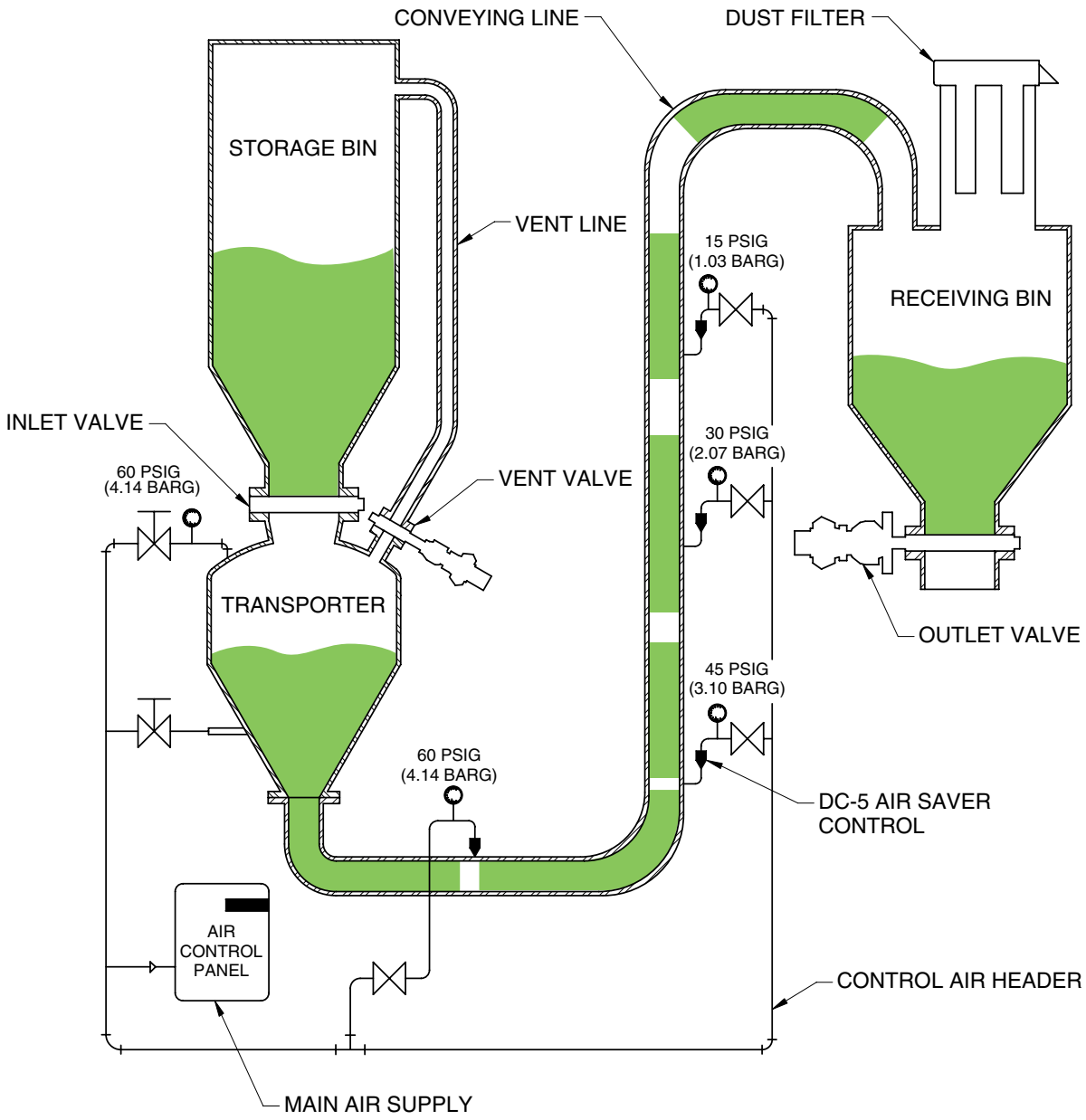


Fig. 1
Normal System Characteristics

Troubleshooting a Stalled Conveying Line

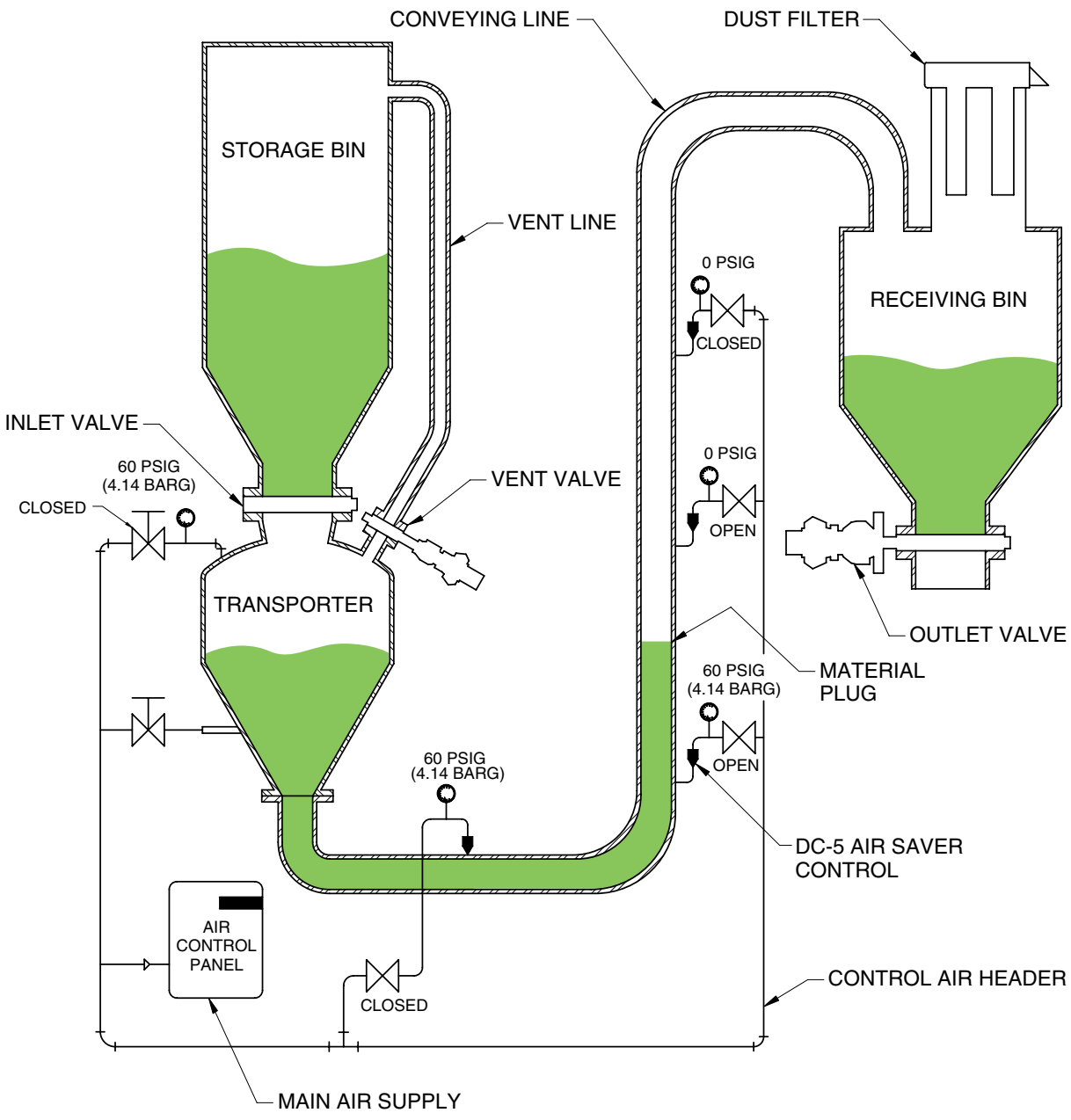


Fig. 2
Plugged System Characteristics, Step 1

Troubleshooting a Stalled Conveying Line

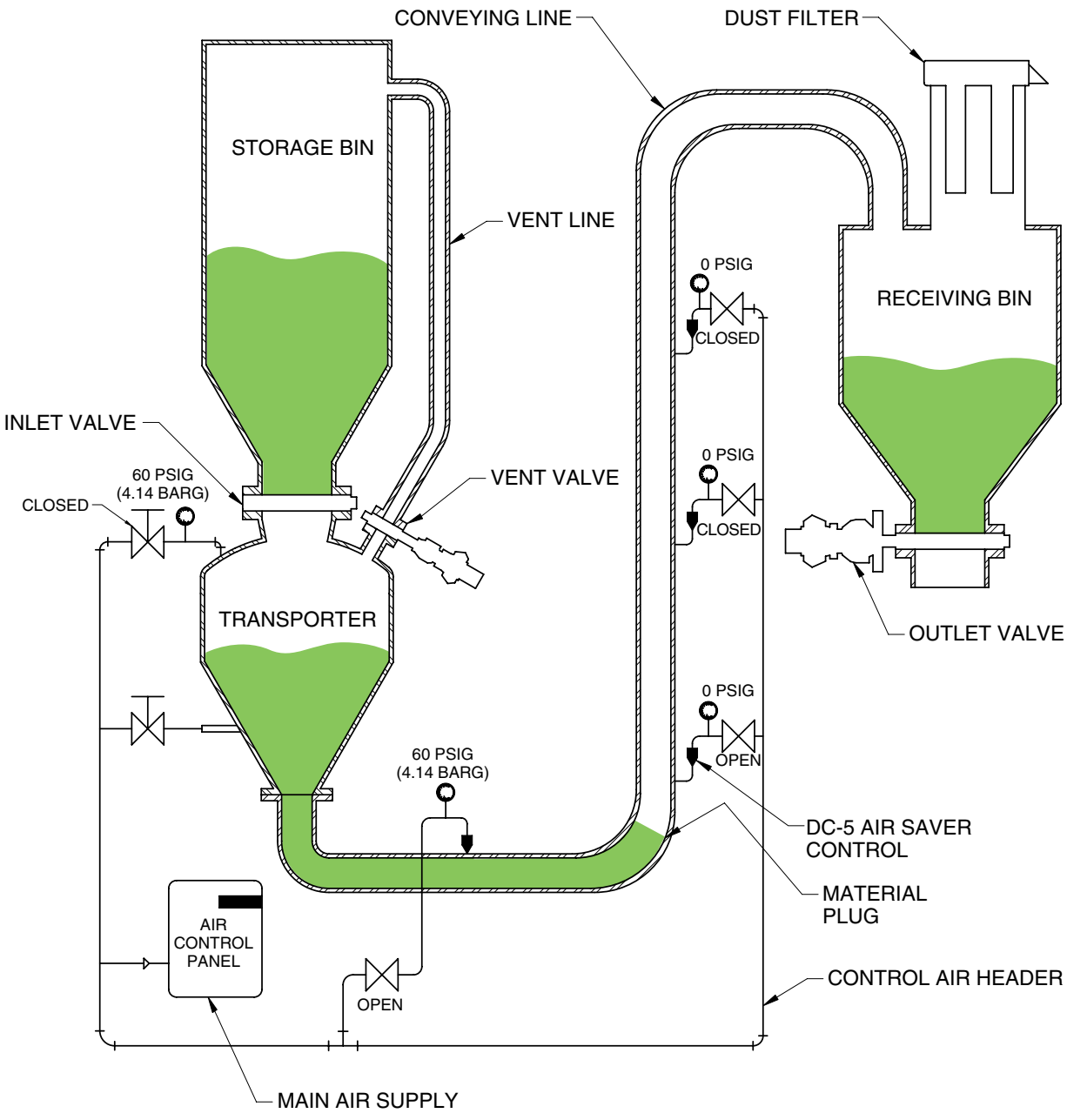


Fig. 3
Plugged System Characteristics, Step 2

Troubleshooting a Stalled Conveying Line

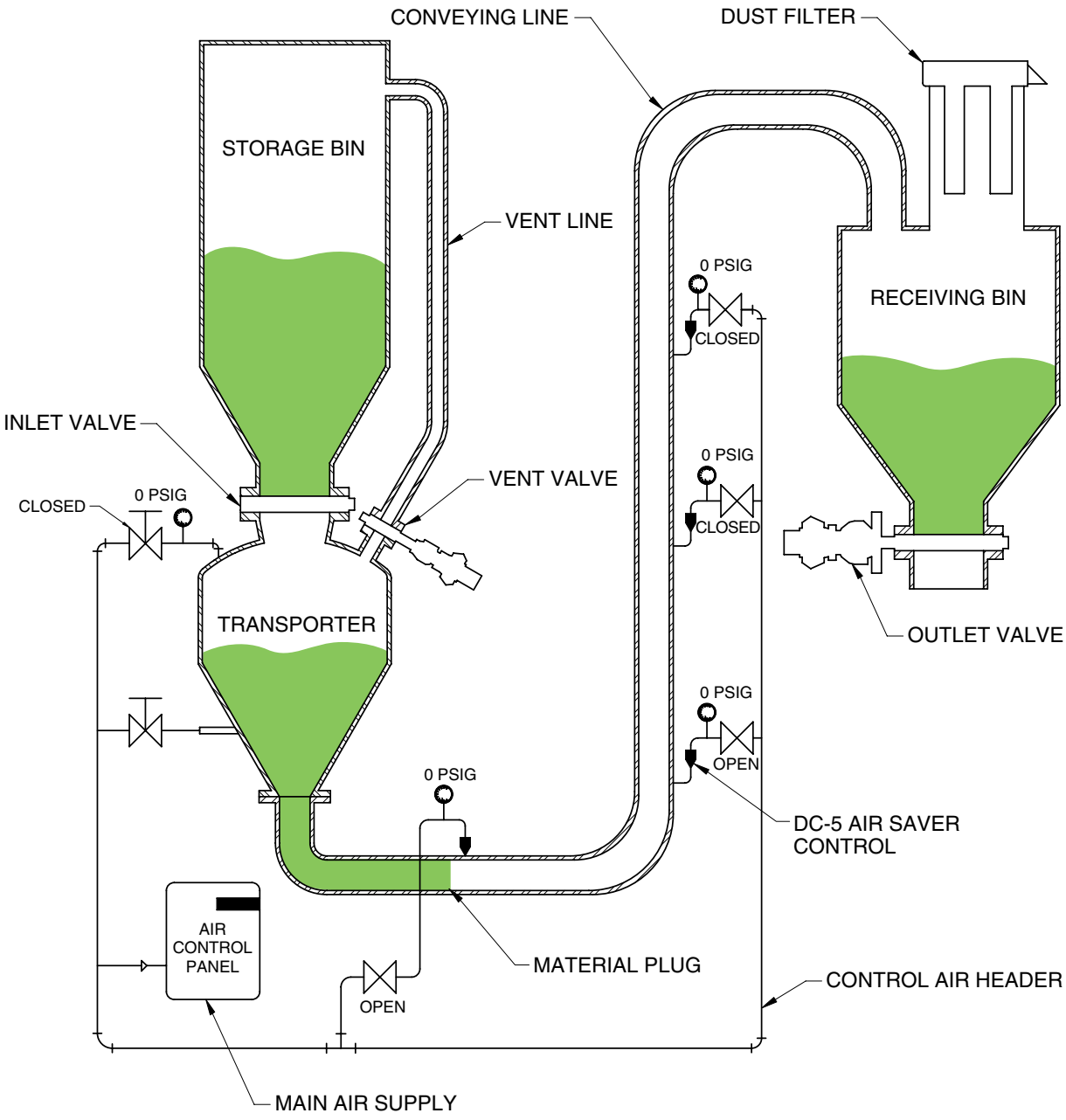


Fig. 4
Plugged System Characteristics, Step 3

Equipment List

The following is a typical equipment list of all items which are provided by Dynamic Air. The reference numbers shown on this printout relate to reference numbers which will appear on its corresponding job tubing details and piping diagram. Only the items shown on this equipment list will be provided by Dynamic Air, and all other items required for the installation of the system must be supplied by the customer.

EQUIPMENT LIST

PAGE NUMBER: (5)

ORDER NUMBER: (3) (4)

CUSTOMER: (1)
(2)

ITEM NUMBER	DESCRIPTION	QUANTITY	UNIT OF MEASURE
(6)	(7)	(8)	(9)

KEY TO REFERENCE NUMBERS

1. Customer Name.
2. System Location.
3. Dynamic Air engineering job number for customer.
4. System Number.
5. Equipment list page number.
6. Dynamic Air item number of individual part.
7. Abbreviated item description.
8. Quantity of item provided by Dynamic Air.
9. Unit of measure.

Material List

The following is a typical material list of all items which are provided by Dynamic Air. The bubble numbers shown on this printout relate to bubble numbers which will appear on its corresponding engineering drawing. Only the items shown on this material list will be provided by Dynamic Air, and all other items required for the installation of the individual part must be supplied by the customer.

BILL OF MATERIAL

PAGE NUMBER: (4)

ASSEMBLY ITEM NUMBER: (1)
ASSEMBLY DESCRIPTION: (2)
ENGINEERING DRAWING NUMBER: (3)

BUBBLE NUMBER	QUANTITY	UNIT OF MEASURE	ITEM NUMBER	DESCRIPTION	DRAWING NUMBER
(5)	(6)	(7)	(8)	(9)	(10)

KEY TO REFERENCE NUMBERS

1 Dynamic Air item assembly number.

2 Item description for the assembly.

3 Engineering drawing number to be referenced for item number listed.

4 Bill of Material page number.

5 Bubble number, to be used with the assembly's corresponding engineering drawing.

6 Quantity of item provided by Dynamic Air.

7 Unit of measure.

8 Dynamic Air item number of individual part.

9 Abbreviated item description.

10 Drawing number for internal reference only.

Packing Slip

The following is a typical packing slip of all items which are provided by Dynamic Air. The line numbers shown on this printout relate to line numbers which will appear on its corresponding customer order. Only the items shown on this packing slip will be provided by Dynamic Air, and all other items required for the installation of the system must be supplied by the customer.

PACKING SLIP

PAGE NUMBER: (3)
PACKING SLIP: (4)

FROM:
DYNAMIC AIR INC.
1125 WILLOW LAKE BLVD.
ST. PAUL, MN 55110
651-484-2900

BILL TO: (1)
(2)

SHIP TO: (5)

ORDER CONTACT: (6)

PACK DATE (7)	ORDER NUMBER (8)	CUSTOMER PO (9)	

LINE/REL (10)	ITEM (11)		QUANTITY ORDERED (12)	QUANTITY TO PACK (13)

KEY TO REFERENCE NUMBERS

1 Customer number assigned by Dynamic Air.

2 Customer bill to address.

3 Page number of packing slip.

4 Packing slip reference number.

5 Customer ship to address, carrier name, and shipping terms.

6 Customer order contact for system.

7 Packing slip date.

8 Customer order number assigned by Dynamic Air.

9 Customer's purchase order number.

10 Line/Release number corresponding to the customer order.

11. Item/Description taken from the customer order.

12. Quantity of the item ordered by the customer.

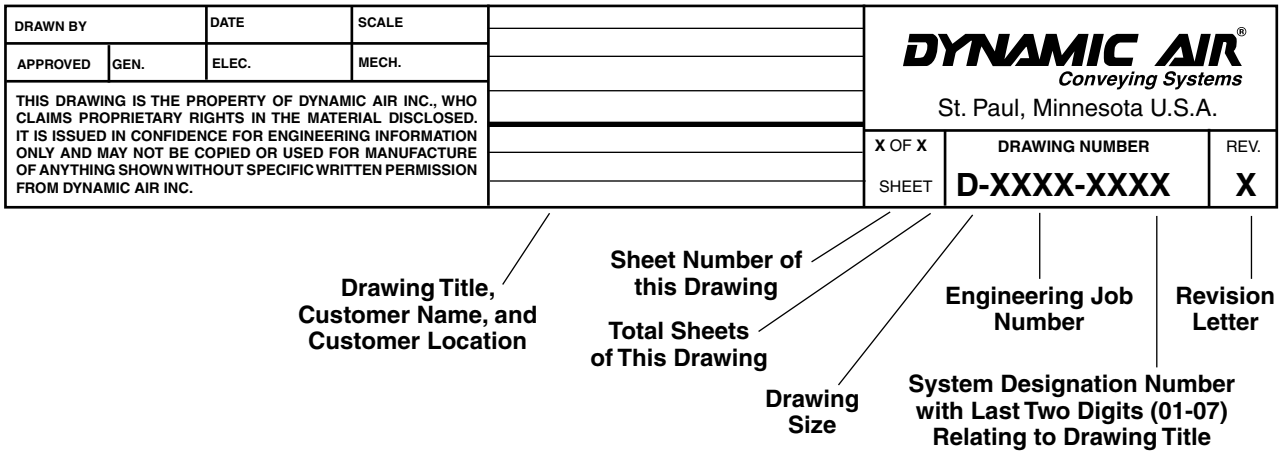
13. Quantity of the item shipped by Dynamic Air. *NOTE:* This **does not** correspond to the total number of pallets or boxes shipped. Frequently, smaller items are combined or packed in larger boxes for protection and efficiency.

Drawing Description

The letter preceding every drawing number refers to the physical size of the drawing. A guide to each size follows:

A: 8.5" x 11"
B: 12" x 18"
C: 17" x 22"
D: 22" x 34"

A typical example of a Dynamic Air drawing is shown below for reference.



The first set of numbers immediately following the drawing size letter may be either three-digit or four-digit numbers. A three-digit number indicates that it is a standard Dynamic Air drawing. A four-digit number indicates that the document is meant for a specific customer at a specific location. The four-digit number will represent the customer's individual job number.

The second set of numbers following the drawing size letter is the System Number, with the first digit(s) representing the System Number one through ninety-nine, and the last two digits representing a particular drawing for that system. A key of the last two digits follows.

01: Tubing Details
02: Electrical and Input/Output Schematics
03: Control Enclosures
04: Piping Diagrams
05: Equipment List
06: Wiring Diagrams
07 and larger: Additional drawings intended solely for individual customer

The drawings that must be in the customer's possession prior to the start of installation are as follows:

Tubing Details (01)
A mechanical drawing showing the details required for installing the components which come in contact with and convey the material. These components range from transporter, butterfly valves, and air saver controls to silos, chutes, and feeders. Tubing Detail Drawings will contain dimensions, field erection notes, and details pertaining to the mechanical portion of each individual system.

Electrical Schematics (02)
An electrical ladder-type drawing showing a schematic of the entire system including the internal wiring of the main control enclosure. Electrical Schematics will show interlocks with other related equipment and takes precedence over the Wiring Diagrams.

Input/Output Schematics (02)
An electrical ladder-type drawing showing connections between input/output modules and field equipment, if a programmable logic controller is used. Input/Output Schematics will take precedence over the Wiring Diagrams.

Control Enclosures (03)
An electrical drawing showing a physical layout of internal components as well as pushbuttons, selector switches, and pilot lights on the enclosure face. A separate material list will accompany this drawing.

Piping Diagrams (04)
A drawing showing a schematic diagram of the control air piping. It is very important to note that this diagram is **not to scale** and that only the tubing detail drawings will show the actual system layout. This drawing is intended for use by both mechanical and electrical contractors.

Equipment List (05)
This is a computer printout of all items provided by Dynamic Air. The reference numbers on this printout will relate to reference numbers which appear on the Tubing Detail (01) drawings, Piping Diagrams (04), and Wiring Diagrams (06).

Wiring Diagrams (06)
A drawing showing wire connections required to various components of the system. It is very important to note that this diagram is **not to scale** and that only the tubing detail drawings will show the actual system layout. This drawing is intended for use by both mechanical and electrical contractors.

Other drawings (07 and larger)
Any drawing that contains information specifically for an individual customer, such as custom equipment, special electrical controls, or additional information not normally included in the standard drawings.

Information Drawings (Series 395)
A drawing that contains additional instructions for installation that are particular to customer's individual system and that are not included in the Tubing Details (01), Piping Diagrams (04), and Wiring Diagrams (06).

The preceding described drawings are provided to aid in the proper installation and operation of each system. Any changes in layout and/or design must be reported, documented, and approved by Dynamic Air's Engineering department or all guarantees and warranties will be nullified.

Customer Assistance

We highly encourage the use of our service department for a safe and successful application of the equipment you have purchased and to provide maximum service life.

Should any questions arise with regard to installation and/or operation that is not covered in this manual, please call Dynamic Air's customer service department for further recommendations or visit our website at **www.dynamicair.com**.

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Customer Satisfaction Survey

Dynamic Air Pneumatic Conveying Systems

Dynamic Air is interested in feedback from our customers. Please help us serve you better by going to www.dynamicair.com/customer.html and completing our Customer Satisfaction Survey or complete the survey below and fax or e-mail it to us.

1. Are you satisfied with the delivery of your Dynamic Air product? ☐ Yes ☐ No
2. Are you satisfied with the performance of your Dynamic Air product? ☐ Yes ☐ No
3. Are you satisfied with the customer service you received? ☐ Yes ☐ No
4. Are you satisfied with the technical support? ☐ Yes ☐ No
5. Are you satisfied with the price? ☐ Yes ☐ No
6. Are you likely to buy more Dynamic Air products? ☐ Yes ☐ No
7. Do you have any suggestions to improve the Dynamic Air product quality or service? ☐ Yes ☐ No

Comments:

_____

_____

_____

_____

_____

Thank for your help. Please tell us about yourself:

Name: _____

Company: _____

Country: _____

Phone Number: _____

E-mail Address: _____

Would you like someone from Dynamic Air to contact you? ☐ Yes ☐ No
(If Yes, be sure to include your contact information above.)

*Please fax this page to Dynamic Air at **+1 651-484-7015** or email to **info@dynamicair.com**.*