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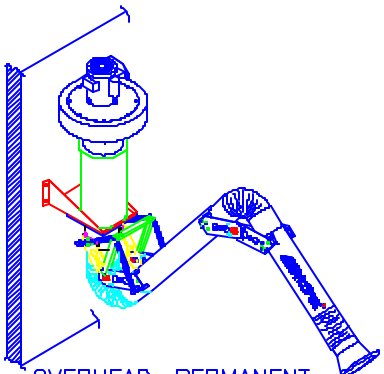
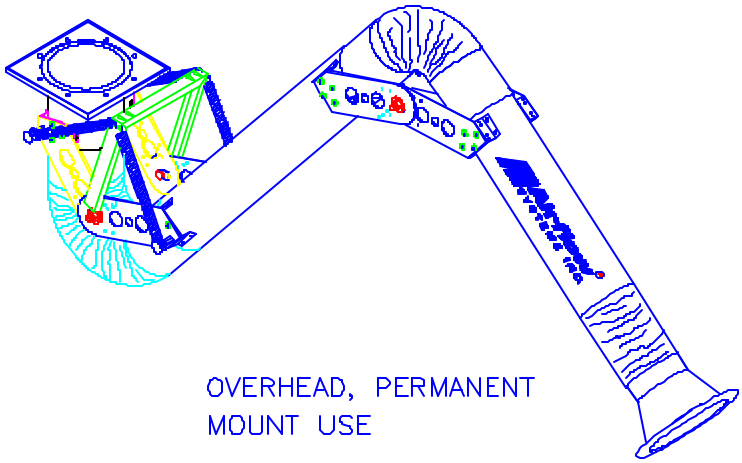
OWNERS MANUAL

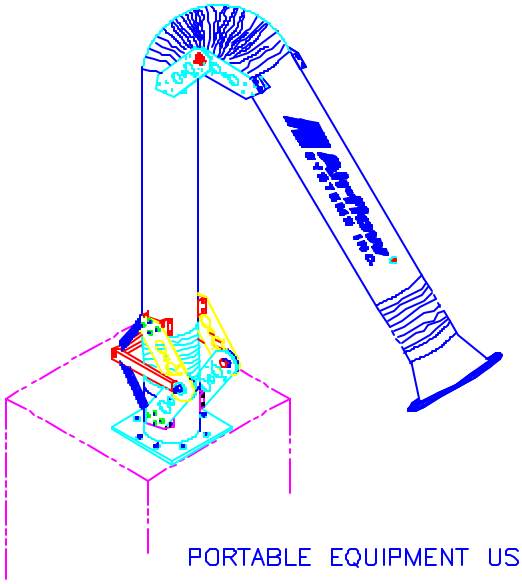
E-Z ARM ª High Flow Extraction Arms
- Stainless Steel -



OVERHEAD, PERMANENT MOUNT WITH OPTIONAL WALL BRACKET, SILENCER, AND MOTOR/BLOWER



OVERHEAD, PERMANENT MOUNT USE



PORTABLE EQUIPMENT USE

- INTRODUCTION
- SPECIFICATION
- UNPACKING
- INSTALLATION
- ELECTRICAL
- OPERATION
- MAINTENANCE
- REPLACEMENT PARTS
- TROUBLESHOOTING

***** IMPORTANT *****

THIS MANUAL CONTAINS PRECAUTIONARY STATEMENTS RELATING TO WORKER SAFETY. READ AND SAVE THIS MANUAL COMPLETELY AND COMPLY AS DIRECTED. ALL THE POTENTIAL HAZARDS OF DUST AND MIST CONTROL SYSTEMS AND EQUIPMENT ARE IMPOSSIBLE TO LIST; THEREFORE, OBTAIN THE SERVICES OF A PROFESSIONAL INSTALLER. A FIRE PROTECTION EXPERT SHOULD BE OBTAINED IN THE EVENT THE PRODUCT IS INTENDED FOR USES WHICH PRESENT A POTENTIAL RISK OF FIRE OR FIRE PROPAGATION. REFER TO APPROPRIATE AUTHORITIES, AND DISCUSS YOUR INTENDED USE WITH YOUR LOCAL DISTRIBUTOR OR AIRFLOW SYSTEMS, INC. WORKERS HANDLING EQUIPMENT OR SYSTEMS SHOULD BE INSTRUCTED TO CONDUCT THEMSELVES IN A SAFE MANNER.

ALWAYS USE AIRFLOW SYSTEMS, INC.â REPLACEMENT PARTS AND FILTERS TO MAINTAIN WARRANTY.

TO ORDER SPARE PARTS CONTACT:

The Local Exhaust & Ventilation Company Inc.
22–1050 Brock Rd, Pickering, Ontario L1W 3X4
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E-mail: sales@lev-co.com Web Site: www.lev-co.com

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READ THIS MANUAL CAREFULLY BEFORE INSTALLING OR USING YOUR EXTERNAL FUME EXHAUST ARM. RETAIN THESE INSTRUCTIONS FOR FUTURE REFERENCE.

SAFETY RULES

Follow all electrical and safety codes as well as the National Electrical Code (NEC), National Fire Protection Association (NFPA), and the Occupational Safety and Health Act (OSHA). All electrical connections and wiring should be performed by qualified personnel only.

National Fire Protection Association (NFPA) standards require specific duct design and dust collector configuration when collecting potentially reactive metal dusts, such as aluminum and magnesium, and other materials. NFPA also covers other dusts such as grain, plastics, etc. A guideline for determining the precautions to be taken can be found in NFPA 497. Other NFPA standards may apply to your specific application. Consult current NFPA standards, available from NFPA, 1 Batterymarch Park, Quincy, MA, 02269, 1-800-344-3555, for applicable safeguards which may be required for the Installation, Operation, and Service of this product. **Fire suppression equipment provided by others.**

Additional references are the Uniform Building Code and Uniform Mechanical Code.

WARNING

1. Avoid mixing combustible materials such as (but not limited to) buffing lint, paper/wood dust, aluminum and magnesium with dust generated from the grinding of ferrous metals. This creates a potential for fire due to the mixing of sparks and combustible materials.

2. Under no conditions should the machine operator be allowed to put lit cigarettes or any burning object into this or any dust/mist control system.

3. Installation of this unit in applications where the chance for heated and/or flammable materials to enter the unit should be evaluated to determine if a fire protection/extinguishing system should be installed. Such a system may be required by Federal, State, or Local codes, or as required by organizations as NFPA and Factory Mutual Insurance or your insurance carrier. Airflow Systems can offer basic guidelines for such an installation, however final installation design is the responsibility of the filtration unit Owner/User.

4. When exhaust arms are attached to a collector with hazard location requirements, explosion relief vents are required on some applications. Consult with an insurance underwriter or an NFPA manual to determine proper vent size ratio. Dust or mist collectors must be located outdoors unless otherwise indicated by NFPA standards. Dust and mist collectors DO NOT CONTAIN EXPLOSION RELIEF VENTS as shipped from the factory and must be field installed per NFPA standards.

5. Disconnect all power before installing or serving this equipment.

The Airflow Systems Inc.® (AFS) series of Externally Supported Fume Exhaust Arms,* (E-Z ARM ® High Flow Extractors), are simple, effective and highly reliable devices used to remove smoke, fumes, dust and dirt away from the work area. Because the exhaust arms are easy to maneuver, they can command a large work area allowing coverage anywhere within the range of motion. This feature accommodates a variable work station setup which would not be possible with a fixed or ducted system. The arms are designed to allow one hand operation.

The stainless steel E-Z ARM ® system is available in the 7' and 10' length only. The system consists of an externally supported arm assembly made with stainless steel tube, a friction release external center joint, and a white plastic bell hood with integral 360° handle. Options include integral blowers, silencers, and wall brackets. AFS blowers have steel housings and aluminum, self cleaning, non-sparking wheels. An optional inlet silencer is available when noise reduction at the hood is required.

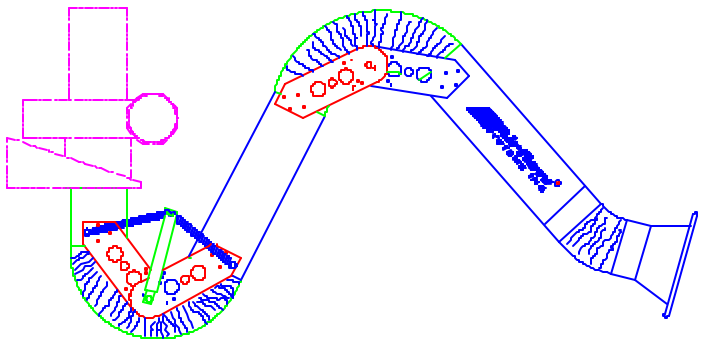


Figure 1.

SPECIFICATIONS(*): EXTERNAL ARM

CONSTRUCTION: Rigid stainless steel tubes, friction release external center joint, no maintenance swivel base joint/seal, and a high efficiency plastic bell hood with integral 360° handle.

7' Long
STD DIM : 6.75" O.D. x 96" L (from wall) [17.14 cm ID x 2.44 m L]
WEIGHT: 40 lb. [18.2 kg] SKID SHIPPED: 55 lb. [25 kg]

10' Long
STD DIM : 6.75" O.D. x 130" L (from wall) [17.14 cm ID x 3.30 m L]
WEIGHT: 44 lb. [20.0 kg] SKID SHIPPED: 78 lb. [35.5 kg]

*AFS has a policy of continuous research and improvement, and reserves the right to change design and specifications without notice.

INSPECTION AND UNPACKING

Inspect your AFS unit for shipping damage immediately upon receipt. Damaged carton(s), broken crate(s), etc. are indications that the unit may have been damaged in shipment. It is also possible shipping damage may be concealed and not noticed until the unit is installed and in operation. If any damage is found, notify your delivery carrier at once and enter a claim. Claims must be filed within 15 consecutive days of receipt of shipment. FREIGHT DAMAGE CLAIMS ARE THE RESPONSIBILITY OF THE PURCHASER, NOT AIRFLOW SYSTEMS, INC®.

PREPARATION AND INSTALLATION

All arm structures are shipped fully assembled.

The arms have been pre-assembled and tested at the factory and all joints have been adjusted. If further adjustment is required, refer to Figures 9 through 11 in the Maintenance Section for details.

Fire suppression equipment provided by others.

PERMANENT AND PORTABLE STYLES

The stainless steel E-Z ARM ® High Flow Extractor is available in either permanent (overhead) or portable style variants.

The permanent style arm is intended for use with an AFS wall mount bracket and provides for a suspended overhead installation (see Figure 1 on page 5). The flow of exhaust air is directed upward at the base. The wall bracket allows full 360 degree rotation of the arm about the base and retraction above base height when stowed. The wall mount receives the Airflow Systems, Inc.® 3/4, 1-1/2, 3, 5, or 7 HP motor/blower and options for tuned and reliable fume extraction.

An optional 10 foot fume exhaust arm stand with an adjustable mounting bracket is also available for a permanent installation.

The portable style arm is intended for use on portable machinery such as the Airflow Systems, Inc.® line of portable cartridge fume and dust collectors (see the illustration on the front cover). The exhaust air is directed down through the base into the cabinet of the collector.

Care must be taken when selecting the location for a permanently mounted unit or in the use of a portable system. Do not place the device in a position where other equipment must pass, such as overhead cranes, or where the normal range of the arm may come into contact with automatic equipment or electrical devices.

To install the wall bracket, select a location that will allow full travel of the arm assembly. Be careful not to place it near any equipment that may come into contact with or reduce the movement of the arm. Refer to Figure 3 and Chart A below for determining wall bracket height. **Do not mount at height exceeding Chart A. Arm is not designed for fully vertical use, as base extension springs will be over-extended and damaged.** Figure 2 shows the hole mounting pattern on the back of the bracket. The surface selected should be strong enough to support the arm and any force applied to it while being moved around. It is recommended that a piece of 1/2" all thread rod and a backing plate on the opposite side of the wall be used to secure the wall mount.

1. Mark the wall and drill (4) 1/2" - 9/16" diameter holes as shown in Figure 2.
2. Cut an appropriate length of 1/2" diameter all-thread rod to pass all the way through the wall, mounting bracket, and backing plate, see Figure 3.
3. Use a Nylon locking nut (or double nut) and washers to secure the bracket into place.

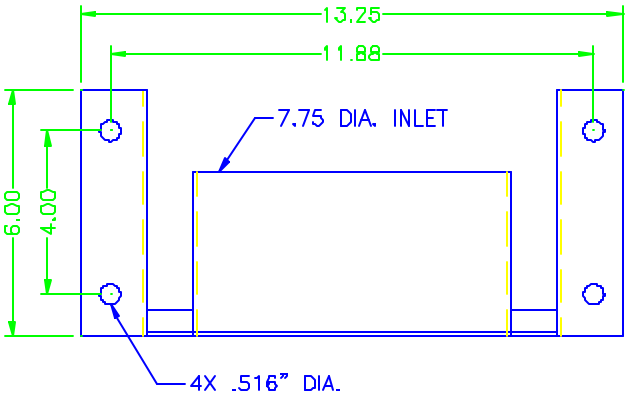


Figure 2.

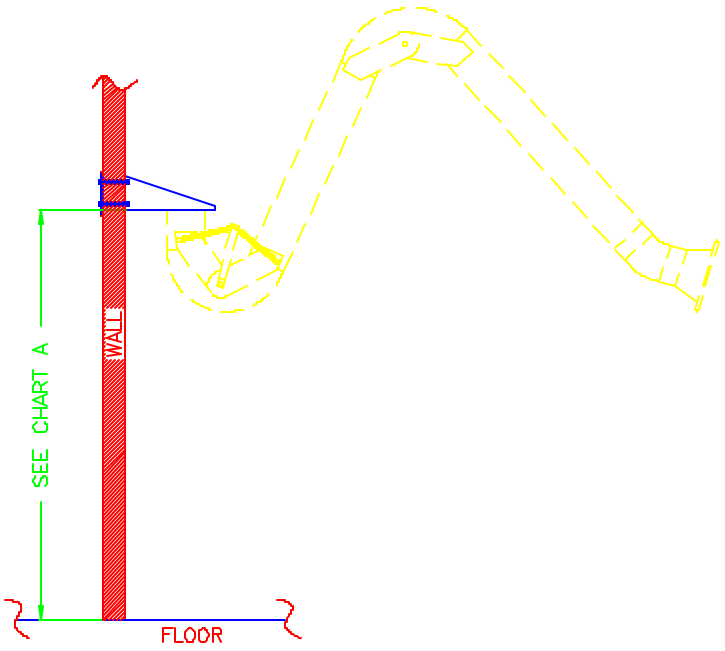


CHART A

E–Z ARM® LENGTH		7'	10'
HEIGHTH	MIN.	6.75'	6.75'
	MAX.*	10.25'	11'

*Note: Do not exceed maximum mounting height as shown in this table, as arm springs will be over–extended and damaged if arm is extended fully vertical.

Figure 3.

OPTIONAL ARM STAND

The optional arm stand is NOT constructed of stainless steel. Use suitable anchors to secure the arm stand in place. Four (5/8") diameter holes have been provided in the base plate for this purpose, see Figure 4.

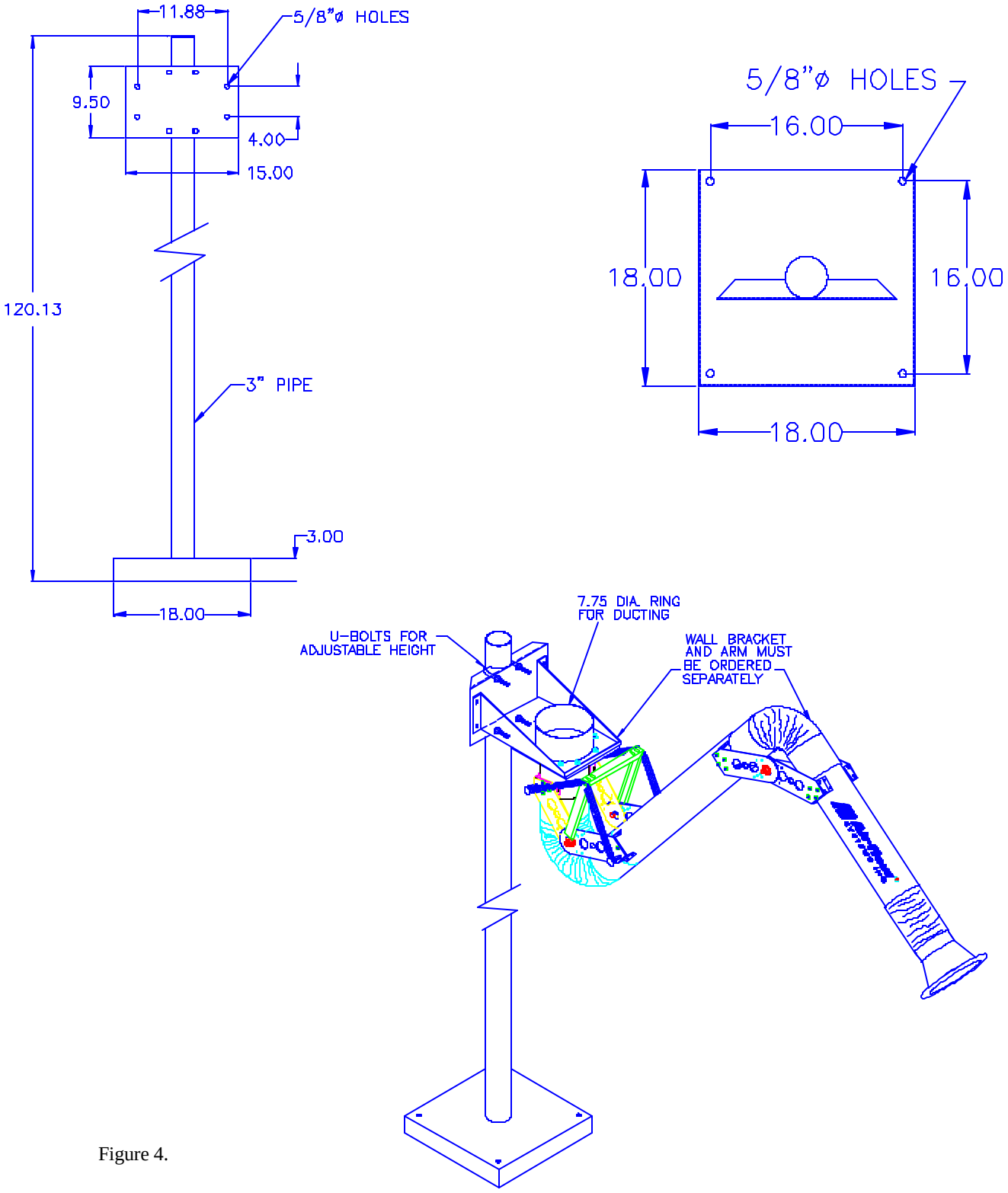

11.88
5/8"ø HOLES
9.50
4.00
15.00
120.13
3" PIPE
3.00
18.00
5/8"ø HOLES
16.00
18.00
16.00
18.00
7.75 DIA. RING
FOR DUCTING
U-BOLTS FOR
ADJUSTABLE HEIGHT
WALL BRACKET
AND ARM MUST
BE ORDERED
SEPARATELY

Figure 4.

The installation of the motor/blower assembly (on models so equipped) should conform to all local ordinances associated with building and electrical codes. Authorities having jurisdiction should be consulted before installation is made. If there are no local codes, the installation should conform to the National Electrical Code. Refer to the Electrical section for electrical tie in.

When an optional blower is used, **check the interior of the blower to be sure it is free of debris before installing**. Rotate the wheel by hand to insure that it is not rubbing or binding. If rubbing exists, loosen the set screw on the wheel, shift the wheel to obtain clearance, and re-tighten the set screw.

Figure 5 shows general details of the motor blower assembly onto the wall mounting bracket. Installation instructions are covered in the Inlet Silencer section below.

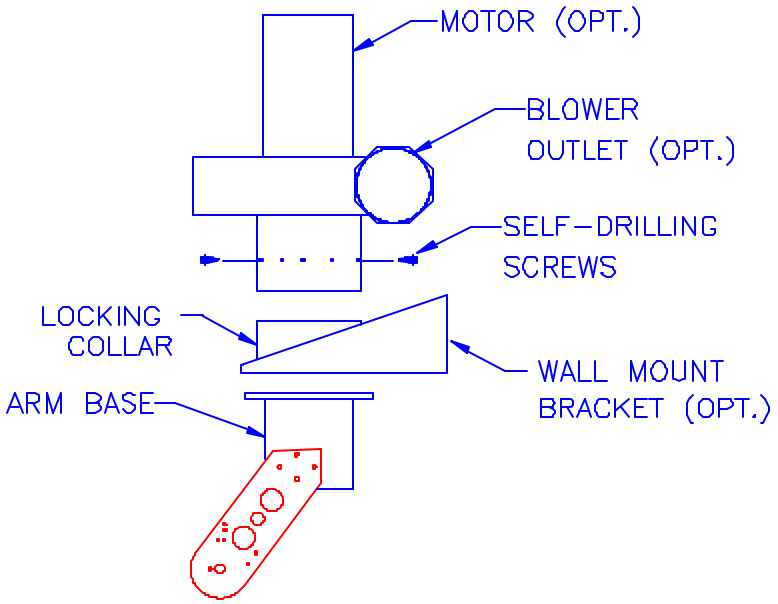


Figure 5.

INLET SILENCER (Optional)

The optional inlet silencer is designed to install in-between the wall bracket mount and the motor blower assembly. The inlet silencer will reduce the noise at the operator work zone by the amount shown in Table 1. *This option is not available on the 5 and 7.5 HP blowers.*

The silencer is designed to reduce noise without significantly decreasing the airflow available at the fume exhaust arm hood. A silencer can be added at any time if the need arises.

Table 1

BLOWER	STD dBA	W/SILENCER
3/4 HP	90	78
1-1/2 HP	88	78
3 HP	92	80

To install the inlet silencer, refer to Figure 6 and follow the steps listed below:

1. Place the bottom of the silencer (side without the collar) over the ring on top of the wall mounting bracket.
2. Using the eight bolts that secure the arm base to the wall mounting bracket, bolt through wall mount bracket into the weld nuts in the bottom of the silencer.
3. The motor/blower assembly should already be pre-assembled and tested at the factory. The blower has a blower inlet ring attached to the bottom. Slip the blower inlet ring over the silencer outlet ring. Rotate the blower assembly so that the outlet of the blower is pointing in the desired direction. Make sure to point it away from the work area to minimize any noise. Install the self-drilling screws through the inlet ring and into the ring on top of the silencer. **For safety, always mount a screen guard over the final outlet point.**
4. After the mechanical installation is com-plete, refer to the Electrical section for instructions on electrical tie in.
5. Installation for a motor/blower assembly without an inlet silencer is similar to the above procedure. Figure 5 on page 9 illustrates this configuration.

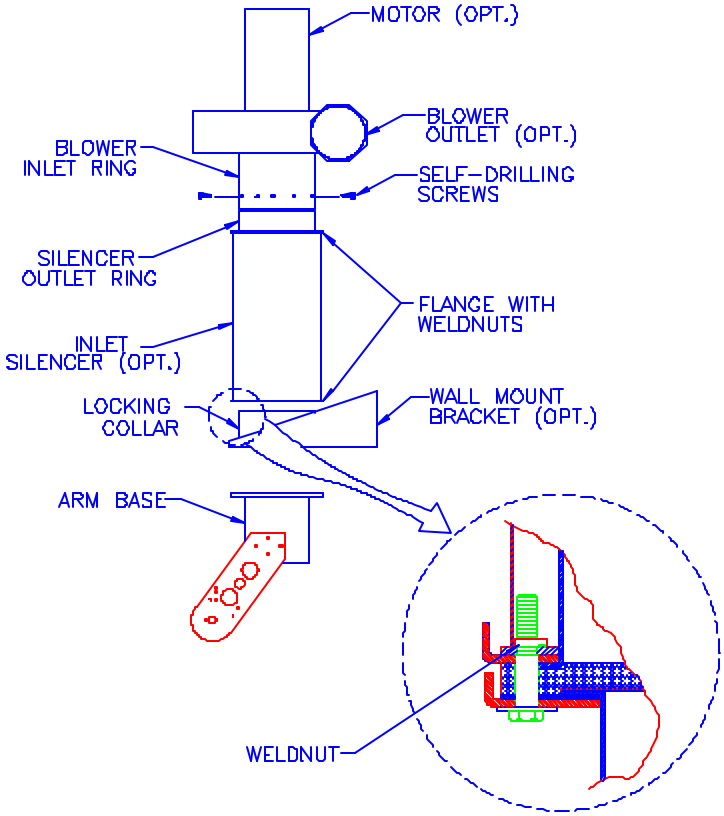


Figure 6.

CAUTION

DO NOT RUN BLOWER WITHOUT DUCT AND SCREEN (SUPPLIED BY OTHERS) ON BLOWER OUTLET.

WARNING

ALWAYS DISCONNECT POWER BEFORE INSTALLING OR SERVICING ANY ELECTRICAL EQUIPMENT. FAILURE TO DO SO MAY LEAD TO SERIOUS INJURY OR DEATH.

Motor starters and disconnects are not supplied with the unit, unless ordered as an option. If these are user supplied, they must meet local and National Electrical Code standards and recommendations. Motors are typically of the multiple voltage type (e.g. 115/230 or 208/230/480). Make sure connections in motor junction box correspond to the line voltage you plan to use. Motor starters (manual or magnetic type) must have properly sized thermal overloads for the voltage and current required for the motor.

Motor checkout should be performed with the unit running and **all arms and ducts in place. Running the motor without the arm and duct in place may cause the motor to overload and possible motor failure, voiding warranty**. Make sure the motor current readings are equal or below motor nameplate rating. These specifications can be found on the motor.

SINGLE PHASE MOTOR

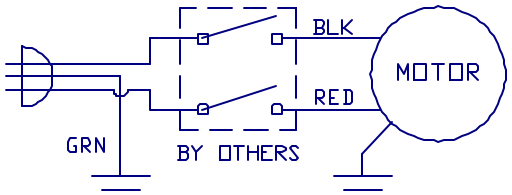


Figure 7.

The optional single phase motors available are 115/230 Volts AC. A typical wiring schematic is shown in Figure 7.

Normally motor rotation should not be changed, however, if it must be changed, reverse the two internal motor leads located under the wiring cover. The motor cover plate shows an internal schematic of the motor and should be consulted for this operation.

THREE PHASE MOTOR

The optional three phase motors available are 208-230/460 Volts AC. The motor does not have overload protection included in the standard configuration and must be supplied by the customer if not ordered from the factory. If these protective circuits are not ordered from the factory, use equipment as specified by the National Electric Code or other applicable authority.

The main power leads, L1, L2, L3 are not differentiated by color. If motor rotation must be changed, then reversing any two of the leads will produce this result (e.g. reverse L1 and L2 or L2 and L3). Figure 8 illustrates the line connections used and wiring configuration as reflected on the motor name plate of three phase motors. **Check the motor plate before changing voltage settings.**

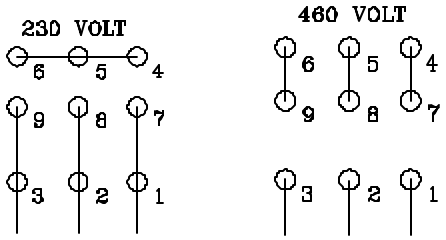


Figure 8.

UNIT OPERATION

When the electrical hookups are completed, "bump" the starter switch and check for correct motor rotation, see Figure 9. If the motor is operating backwards, switch two of the leads as shown for single phase motors. For three phase motors switch any two of the motor leads. See Figure 8 or diagram on motor.

After installation is completed, turn **ON** blower and take an amp reading on each motor lead. Check the motor amps against the nameplate FLA (Full Load Amps) to insure motor is operating correctly. If the motor is over-amping, shut it **OFF** immediately and see the Troubleshooting section or the Motor Wiring Guide located in the Appendix. Record this information in the Notes section for future reference.

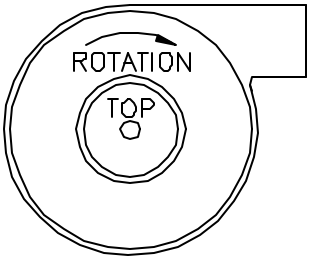


Figure 9.

Very little maintenance is required on the stainless steel E-Z ARM ® High Flow Extractor. The friction release mechanism should never need adjustment. However, if it fails to operate properly, check the pawl for free movement. If the pawl moves freely, be sure the pawl return spring has not been stretched too far. If the spring has been damaged, replace the spring. The following section discusses adjustments to the various joints.

WARNING

ALWAYS DISCONNECT THE UNIT FROM THE POWER SOURCE BEFORE WORKING ON OR NEAR THE MOTOR OR WIRING ASSEMBLIES. LOCK OUT DISCONNECTS TO PREVENT THE UNEXPECTED APPLICATION OF POWER

The following section discusses the procedure required to adjust the three sections of the stainless steel E-Z ARM ®.

BASE JOINT

The base joint on the fume extraction arm is a spring loaded counter balance system. Four springs are used to connect the base to a spring bridge and the spring bridge to the tube brackets. The spring bridge rotates about the joint center. The springs are selected to deliver the required force needed to counter-balance the weight of the arm and in normal use will require no maintenance. To adjust the friction disks within the joint, simply apply added torque to the two 1/2" Nyloc nuts on either side of the joint. Refer to Figure 10.

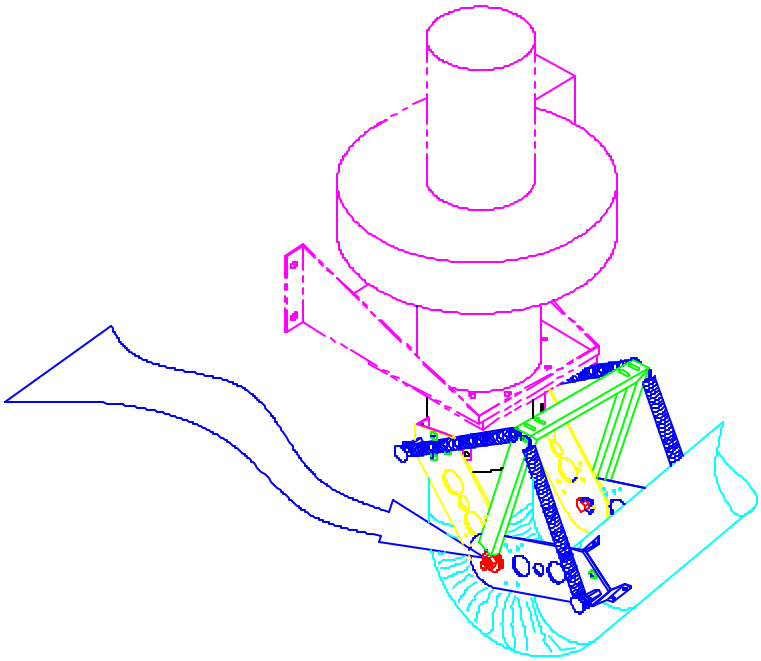


Figure 10.
Shown with optional wall bracket and blower assembly.

CENTER JOINT

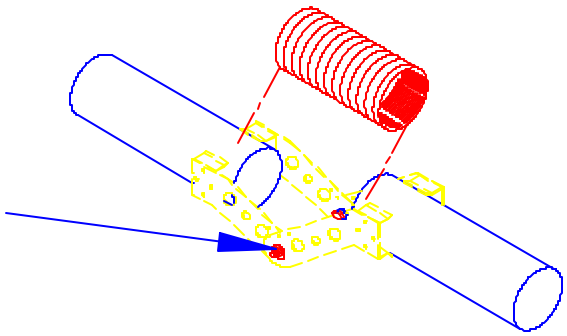
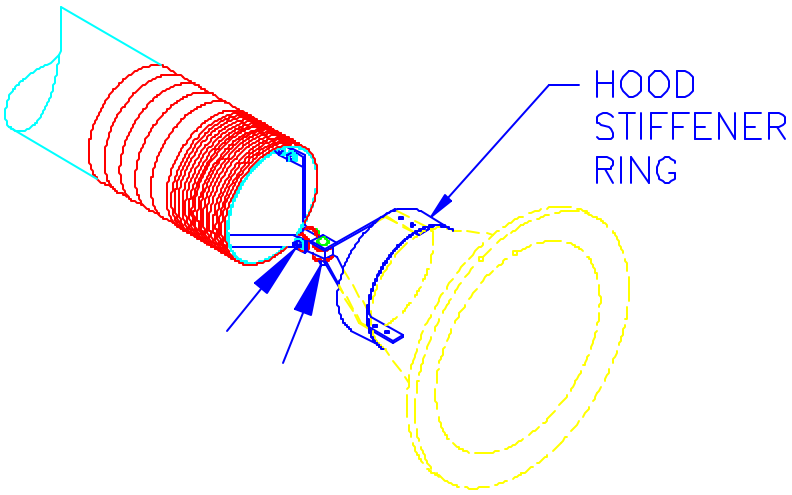


Figure 11.

To adjust the center joint, maneuver the arm to the desired working position. While holding the pivot bolt head with a wrench, tighten the Nyloc nut illustrated in Figure 11. **Always hold the pivot bolt head or the positioning tang on the anti-rotation lock will shear off causing the arm to lose its position**. Tighten the nut only enough to hold the arm in place. Excessive tightening will wear out the friction material prematurely.

HOOD JOINT



The hood is held in place by a swiveling U-joint. To tighten in either direction, loosen one of the hose clamps and slide the hose back. Tighten the through bolts enough so that the hood remains in the desired position, but can be easily moved. Do not over-tighten. When complete, re-attach the hose and hose clamp. Figure 12 shows the U-joint assembly.

Figure 12.

OTHER SERVICE

Most other components of the stainless steel E-Z ARM ® require little or no routine servicing. The base bearings should be checked twice a year under normal usage for any signs of deterioration or cracking. Also check all mounting bolts for tightness.

Replacement parts are available from your Airflow Systems' distributor. The following section lists replacement parts for the stainless steel E-Z ARM ®.

Listed below in Table 2 are common replacement parts for the stainless steel, 7' E-Z ARM ®. **Part numbers in braces ({}) are for the 10' E-Z ARM ª.** Use the following section and illustrations 13 through 16 for parts replacement.

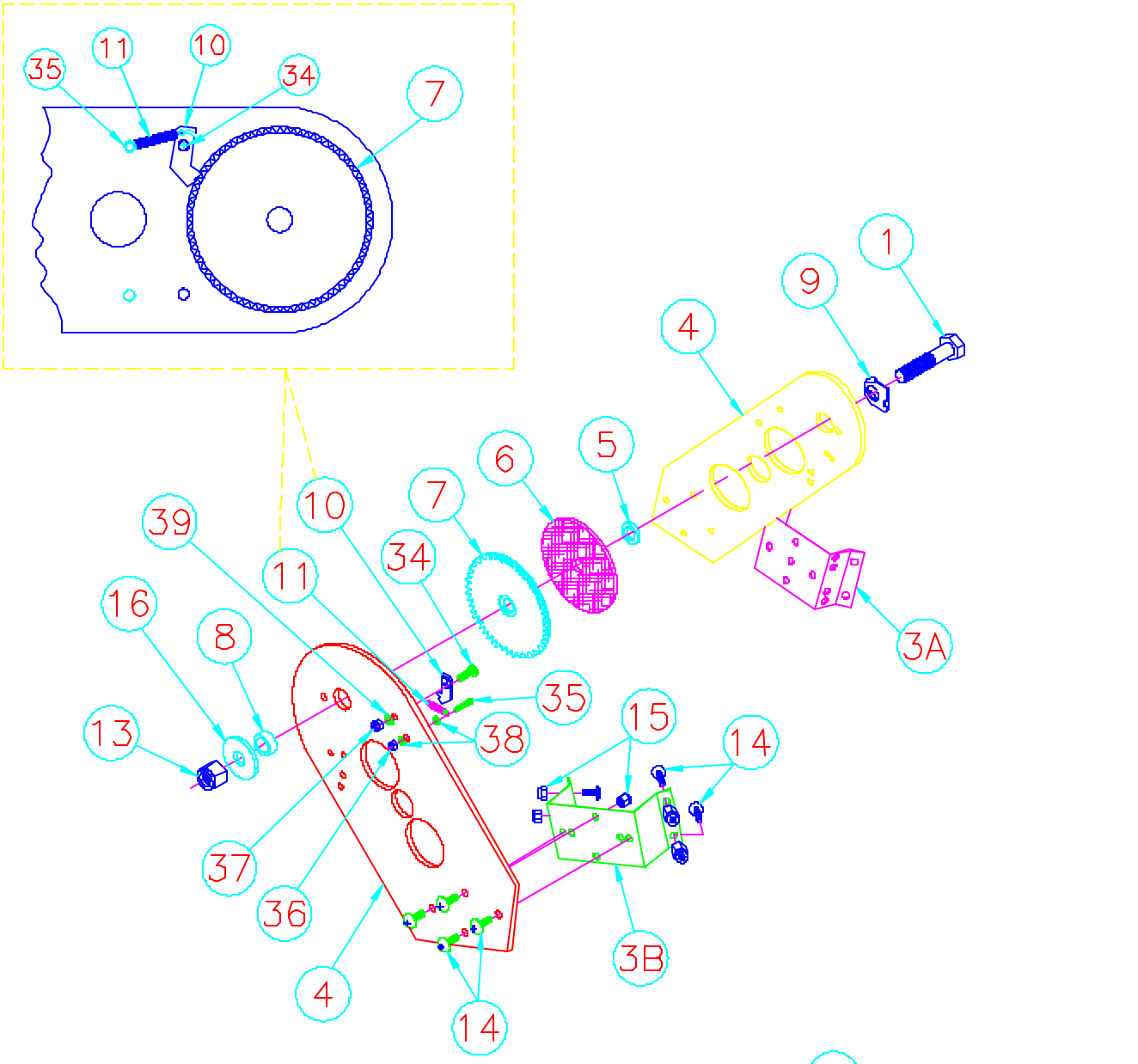
TABLE 2

ITEM	QTY	PART #	DESCRIPTION
1	4	7HF1-8019	Bolt, stainless steel, 1/2-20 x 1.75
2A	1	1TB0-9710	Inner arm tube, stainless steel {1TB0-9712}
2B	1	1TB0-9711	Outer arm tube, stainless steel {1TB0-9713}
3A	2	1PN0-9017	Base-joint to base attachment bracket, stainless steel
3A	2	1PN0-9017	Mid-joint to outer tube attachment bracket, stainless steel
3B	4	1PN0-9018	Mid-joint to inner tube attachment bracket, stainless steel
3C	4	1PN0-9019	Base-joint to inner tube attachment bracket, stainless steel
4	8	1PL0-9001	Joint plate
5	6	7PT0-7003	Short bushing
6	4	5MP5-8001*	Large friction disk
7	2	1AC8-7751	Sprocket plate assembly, stainless steel
8	4	7PT0-7004	Tall bushing
9	4	7HW0-9001	Tablock
10	2	1PL0-7007	Friction Release pawl
11	2	7PR1-2005	Pawl return spring, stainless steel
12	1	1PN0-9016	Mounting plate, stainless steel
13	4	7HN2-8007	Nut, 1/2-20, nylon lock, stainless steel
14	70	7HF1-4035	Button head socket bolt, 1/4-20 x 1/2, stainless steel
15	A/R	7HN2-4001	Nut, 1/4-20, nylon lock, stainless steel
16	6	7HW1-8005	Washer, 1/2", stainless steel
17	1	5MP2-6011	Hood, white plastic, Std.
17	1	5MP2-6010	Hood, black plastic, Opt.
18	4	1PN0-9002	Hood bracket, stainless steel
19	1	2AT0-9701	Hood shaft, plastic
20	4	5MP4-1754*	Small friction disk
21	2	7HF1-5016	Hood joint carriage bolt, 5/16-18 x 1.75, stainless steel
22	4	7PR1-9004	Spring, stainless steel {7PR1-9006}
23	4	7HF1-4015	Elevator bolt, stainless steel
24	4	7HN1-4011	Coupling nut, 1/4-20, stainless steel
25	1	1PN0-9015	Spring Bridge, stainless steel {1PN0-9020}
26	1	2AZ8-7702*	Thin base bearing
27	1	2AZ8-7701*	Thick base bearing
28	1	1PN0-9013	Wall mounting bracket, Opt.
29	10	7HW1-4003	Flat Washer, 1/4", stainless steel
30	2	7HN2-5002	Nut, nylon lock, 5/16-18, stainless steel
31	1	5MP2-6012	Arm base, stainless steel
32	8	7HF1-4029	Bolt, 1/4-20 x 1.75, stainless steel
33	8	7HF1-4030	Bolt, 1/4-20 x 1.25, stainless steel
34	2	7HF2-3010	Screw, #10-32, stainless steel

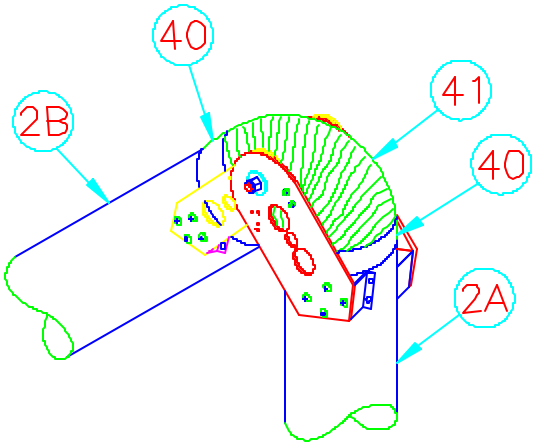
* - Denotes Normal Wear Items (Recommended Replacement Items)

ITEM	QTY	PART #	DESCRIPTION
35	2	7HF2-8004	Screw, #6-32, stainless steel
36	2	7HN1-0008	Nut, nylon lock, #6-32, stainless steel
37	2	7HN2-3002	Nut, nylon lock, #10-32, stainless steel
38	4	7HW4-2002	Washer, shoulder, nylon, black, #6
39	2	7HW4-3001	Washer, flat, #8, stainless steel
40	6	7PH5-1006	Band, rubber, white, Std.
40	6	7PH5-1002	Band, rubber, black, Opt.
41	A/R	7HD4-3028*	Hose, white, food grade, Std.
41	A/R	7HD4-3027*	Hose, black, Opt.
42	2	7HW1-6006	Washer, Belleville, 5/16" I.D., stainless steel
43	1	1RM8-7755	Stiffener ring, hood, outside, stainless steel
N/S	6	7HG3-6004	Hose clamp, stainless steel
N/S	1	9R751	3/4 HP Motor/blower, 115/230/1/60, Opt.
N/S	1	9R753	3/4 HP Motor/blower, 208-230/460, Opt.
N/S	1	10R751	1-1/2 HP Motor/blower, 115/230/1/60, Opt.
N/S	1	10R753	1-1/2 HP Motor/blower, 208-230/460, Opt.
N/S	1	BM12	3 HP High press. blower assembly, 208-230/460 or 575, Opt.
N/S	1	BM14	5 HP High press. blower assembly, 208-230/460 or 575, Opt.
N/S	1	BM02	5 HP BI blower, 208-230/460 or 575, Opt.
N/S	1	BM03	7.5 HP BI blower, 208-230/460 or 575, Opt.
N/S	1	2AU4-9008	Inlet Silencer 8", Opt.
N/S	1	2KT8-7710	Fume exhaust arm stand, Opt. (See Figure 4)

* - Denotes Normal Wear Items (Recommended Replacement Items)

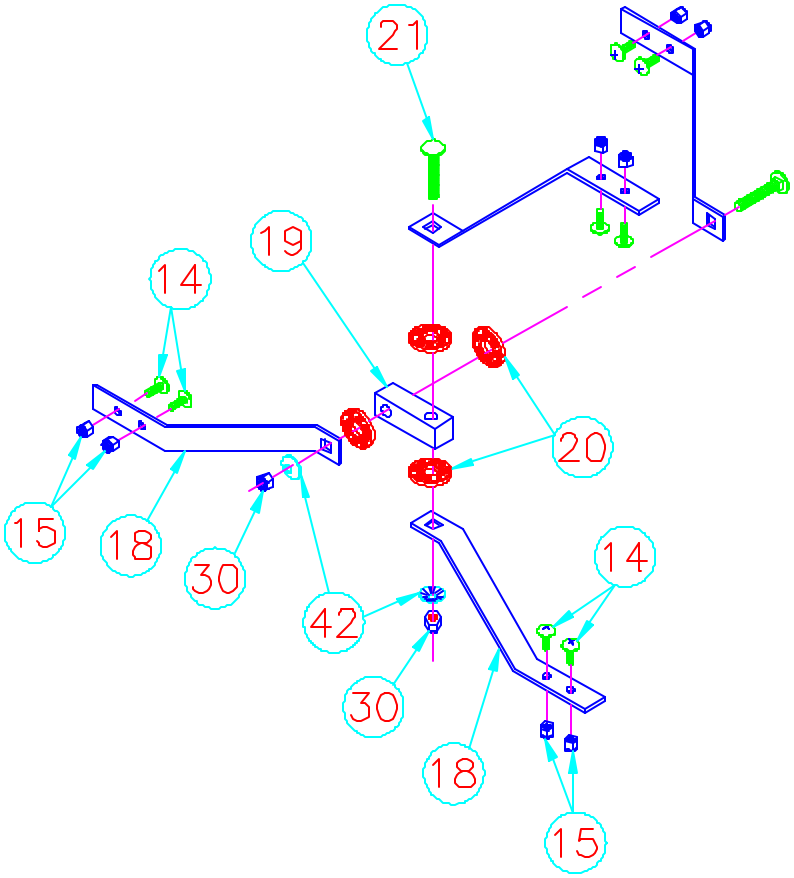


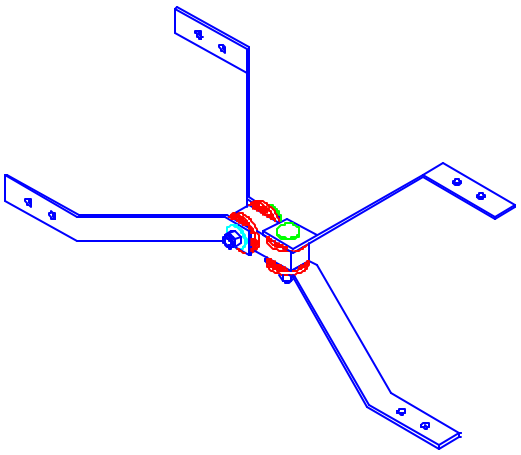
(Shown - Left side only.)



Assembled view.

Figure 13.
Center Joint Assembly





Assembled view

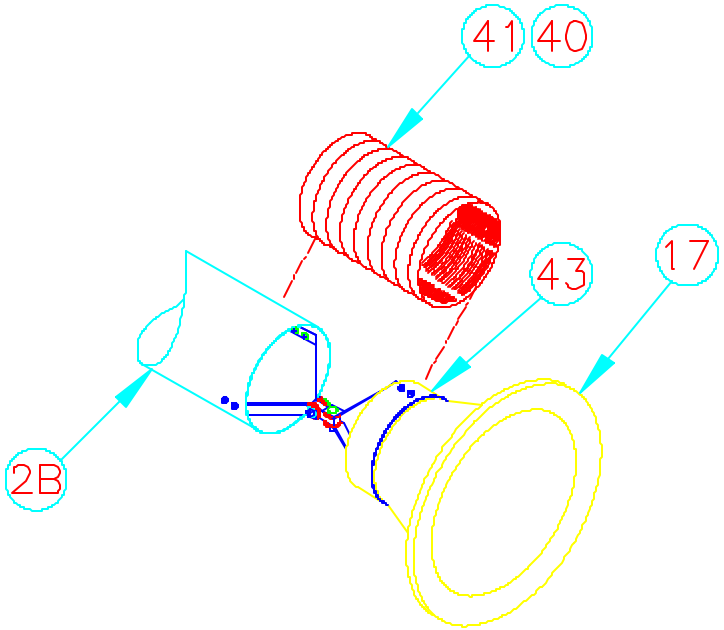


Figure 14.
Hood Joint Assembly

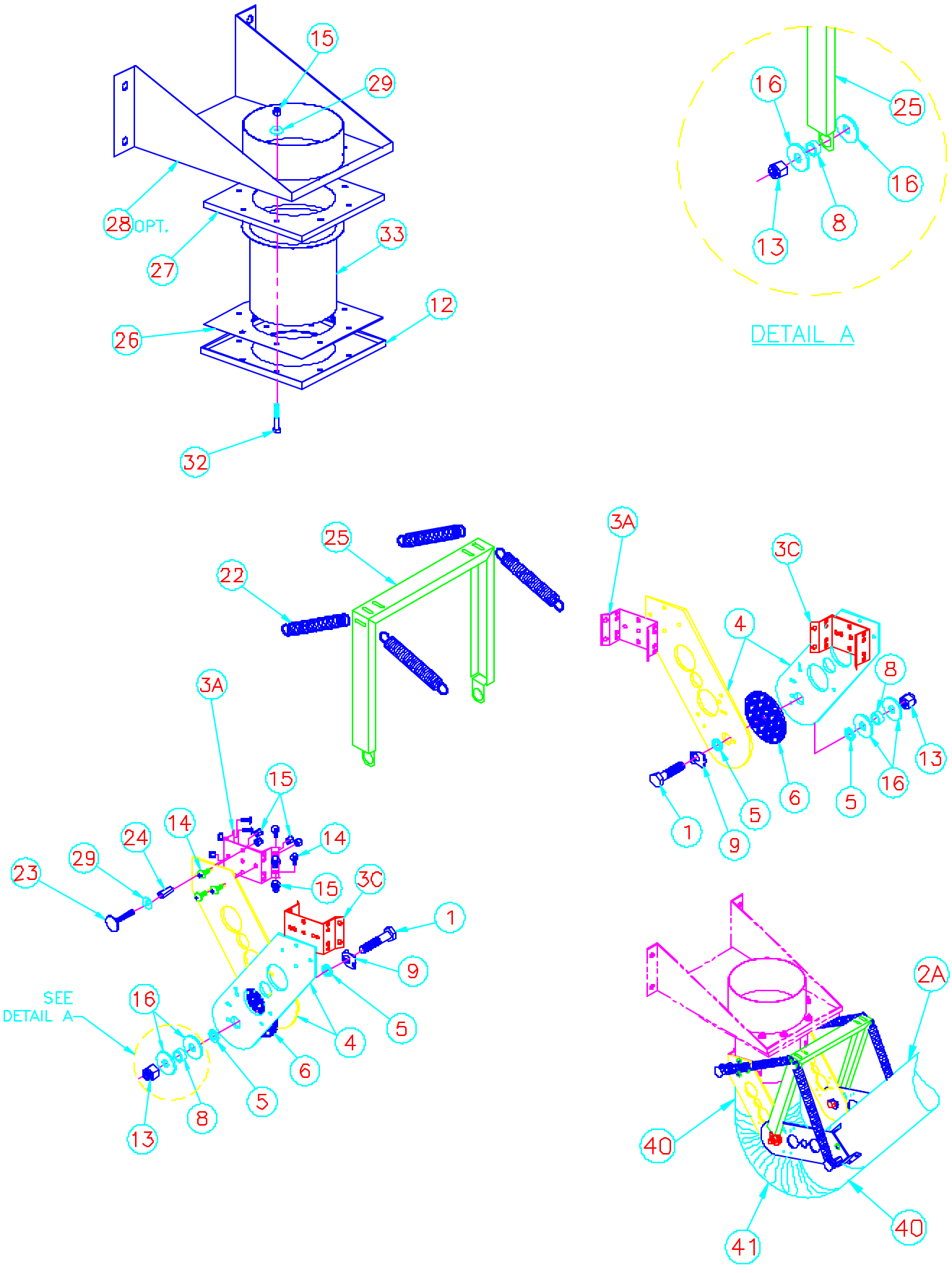


Figure 15
Overhead base assembly.

Assembled view.

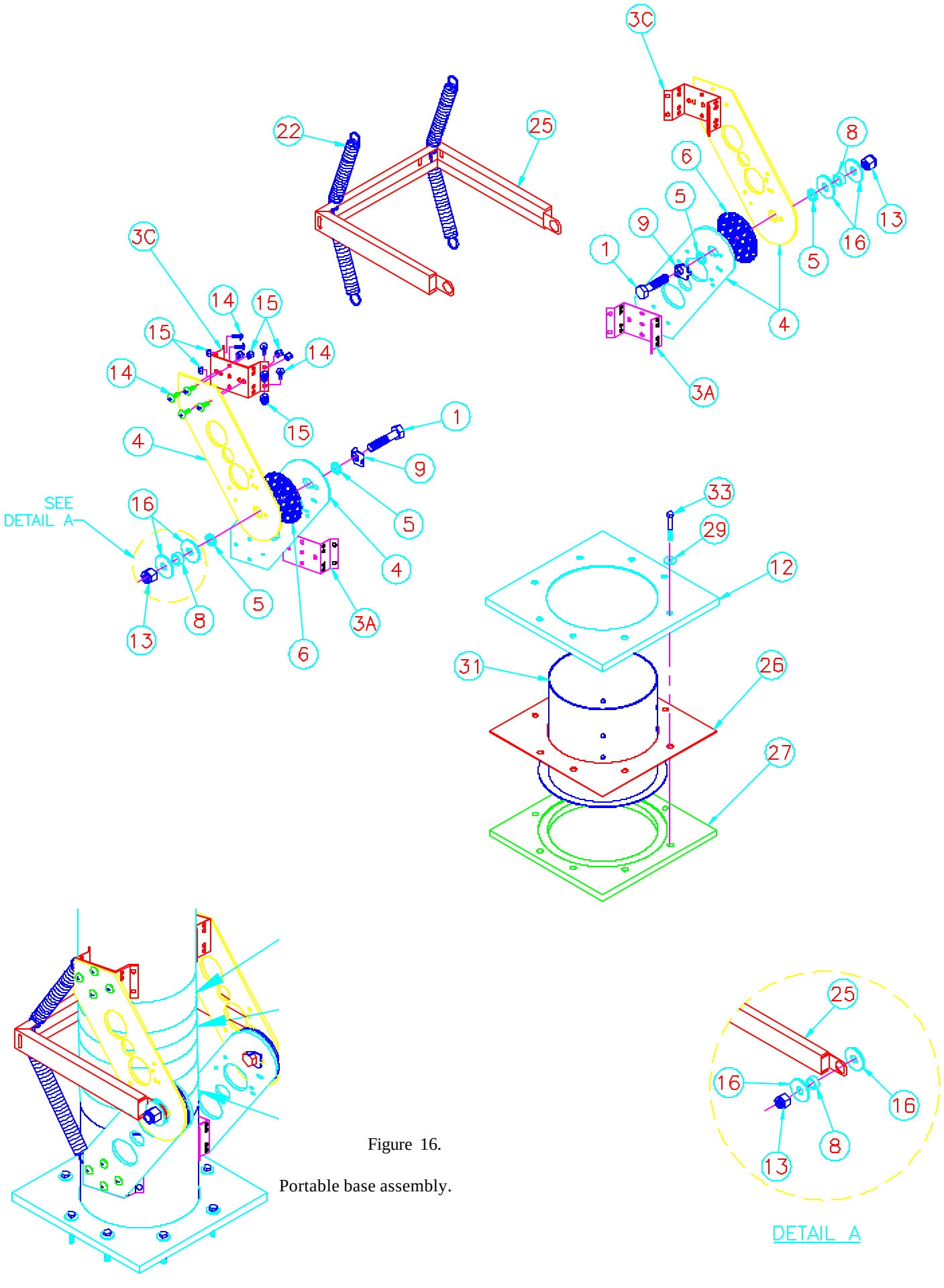


Figure 16.

Portable base assembly.

Assembled view.

The troubleshooting guide included in this manual is for qualified personnel only. If the unit does not function properly after following the guidelines in this manual, consult an Airflow Systems representative for further help.

WARNING

ALWAYS DISCONNECT POWER FROM UNIT BEFORE SERVICING.

PROBLEM	POSSIBLE CAUSE	CORRECTION
1. Motor won't operate.	Motor overload. Failed motor. Light not connected.	Too much air flow. Be sure arm and hose are hooked up before operating. Replace motor. Check amps to ensure proper operation. Check connection.
2. Motor trips.		Check overload indicator. Push reset on overload. Replace heaters.
3. Insufficient air flow.	Fan speed too slow. Motor turning backwards. Air-in leakage.	Check for proper voltage. Check for rotation. Check bearing, hose, and ducting.
4. Motor over-current.	Arm disconnected. Duct work faulty (if applicable).	Re-connect arm. Check and repair.

See also Motor Wiring Guide in the Appendix.

NOTES

RECORD START UP DATA HERE

MODEL: STAINLESS STEEL E-Z ARM® - 7', 10'
SERIAL NO.:
DATE PURCHASED:
DATE INSTALLED:
MOTOR VOLTAGE (MEASURED):
MOTOR CURRENT (MEASURED):
MOTOR FLA (FROM NAMEPLATE):
MOTOR VOLTAGE (FROM NAMEPLATE):

ALWAYS USE AIRFLOW SYSTEMS, INC.â REPLACEMENT PARTS AND FILTERS TO MAINTAIN WARRANTY

TO ORDER SPARE PARTS CONTACT:

The Local Exhaust & Ventilation Company Inc.
22–1050 Brock Rd, Pickering, Ontario L1W 3X4
Tel: 905.831.7001 Fax: 905.831.7443
Toll Free: 1.888.862.5356
E-mail: sales@lev-co.com Web Site: www.lev-co.com

1. BRANCH WIRING A1

2. MOTOR TROUBLE GUIDE..... A2

WIRING

To connect motor for proper voltage and rotation, refer to connection diagram on nameplate or inside terminal/conduit box. If power factor correction capacitors are used for individual motor power factor correction, do not exceed maximum recommended value.

All aspects of the installation must conform to the requirements of the NEC, including Article 430 (Motor Circuits and Controllers), and all local codes. Wherever possible, each motor should be powered from a separate circuit of adequate capacity to keep voltage drop to a minimum during starting and running. Increase wire size where motor is located a distance from the power source. Wire size must be adequate to minimize voltage drop during starting and running. Refer to Tables A and B for suggested wire sizes. Distances shown are one-way between source and load. Portable cords, if used, should be as short as possible to minimize voltage drop. Long or inadequately sized cords, especially on hard starting loads, can cause motor failure. Insulate and protect motor lead connections to prevent cut-through from sharp edges and vibration. Tape wire nuts to prevent loosening. All electrical connections in system must be secure to prevent voltage drop and localized heating.

Determine direction of rotation before connecting driven equipment to prevent damage. Remove shaft key if motor is to be operated at no-load. On three phase motors, interchange any two line leads (not motor leads) to reverse rotation. On air compressors, rotation of flywheel should direct air towards the cylinders. Look for rotational arrow on flywheel.

All motors must be securely and adequately grounded by wiring with a grounded, metal-clad raceway system, using a separate ground bond wire connected to bare metal on the motor frame, or other suitable means. Refer to NEC Article 250 (Grounding) for additional information.

Explosion-proof motors incorporating over temperature thermostats should be controlled with a magnetic starter. The thermostat circuit must be wired in series with the holding coil circuit, as shown on tag or nameplate on motor, to remove power from the starter coil if motor overheats.

TABLE A - MINIMUM WIRE SIZES FOR THREE-PHASE MOTORS

MOTOR HP	25 FT 200V	TO 230V	50 FT 460V	100 FEET 200V	230V	460V	150 FT 200V	TO 230V	200 FT 460V
1/8	14(18)*	14(18)*	14(18)*	14(18)*	14(18)*	14(18)*	14(16)*	14(18)*	14(18)*
1/6	14(18)*	14(18)*	14(18)*	14(18)*	14(18)*	14(18)*	14(16)*	14(16)*	14(18)*
1/4	14(18)*	14(18)*	14(18)*	14(16)*	14(18)*	14(18)*	14	14	14(18)*
1/3	14(18)*	14(18)*	14(18)*	14(16)*	14(16)*	14(18)*	12	14	14(18)*
1/2	14(16)*	14(18)*	14(18)*	14	14	14(18)*	10	12	14(18)*
3/4	14	14(16)*	14(18)*	12	14	14(18)*	8	10	14(16)*
1	14	14(16)*	14(18)*	10	12	14(18)*	8	10	14
1½	12	14	14(18)*	10	10	14(16)*	6	8	14
2	12	12	14(18)*	8	10	14(16)*	6	6	12
3	10	12	14(18)*	8	8	14	4	6	12

[*]Type S, SO, SJ, SJO, etc. flexible cable wire sizes. See NEC Article 400 for ampacity.
Note: Above wire sizes based on approximate 5% voltage drop during starting; copper conductors; and 75°C type TH, THW, RH, RHW, etc. insulation. For aluminum wire, increase two wire size steps minimum. See NEC Article 310 for ampacities of aluminum conductors and 60°C type RUW, T, etc. insulation.

TABLE B - MINIMUM WIRE SIZES FOR SINGLE-PHASE MOTORS

MOT0R HP	25 115V	FT 230V	50 115V	FT 230V	100 115V	FT 230V	150 115V	FT 230V	200 115 V	FT 230 V
1/8	14(16)*	14(18)*	14	14(18)*	10	14(16)*	10	14(16)*	8	14
1/6	14	14(18)*	12	14(18)*	10	14(16)*	8	14	6	12
1/4	14	14(18)*	12	14(18)*	8	14	6	12	6	12
1/3	14	14(18)*	10	14(16)*	8	14	6	12	4	10
1/2	14	14(18)*	10	14(16)*	8	14	6	12	4	10
3/4	12	14(18)*	8	14	6	12	4	10	3	8
1	10	14(16)*	8	14	4	10	4	8	2	8
1½	10	14(16)*	6	12	4	10	2	8	1	6
2	8	14	6	12	3	8	2	6	1/0	6
3	8	10	4	10	2	8	1/0	6	2/0	4

[*] Type S, SO, SJ, SJO, etc. flexible cable wire sizes. See NEC Article 400 for ampacity.
Note: Above wire sizes based on approximate 5% voltage drop during starting; copper conductors; and 75°C type TH, THW, RH, RHW, etc. insulation. For aluminum wire, increase two wire size steps minimum. See NEC Article 310 for ampacities of aluminum conductors and 60°C type RUW, T, etc. insulation.

MOTOR TROUBLE GUIDE

The purpose of this guide is to suggest common answers to electrical problems. The information is not all-inclusive and does not necessarily apply in all cases. When unusual operating conditions, repetitive failures, or other problems occur, consult an electric motor service firm for assistance.

TROUBLE	CAUSE	WHAT TO DO
MOTOR FAILS TO START	1. Blown Fuses.	1. Replace with time-delay fuses or circuit breakers. Check for grounded winding.
	2. Low voltage.	2. Use higher voltage tap on transformer terminals, increase wire size. Check for poor connections.
	3. Improper line connections.	3. Check connections against diagram supplied with motor.
	4.Overload (thermal protector) tripped.	4. Check and reset overload relay in starter. Check heater rating against motor nameplate current rating. Check motor load. If motor has manual reset thermal protector, check if tripped.
	5. Motor may be overloaded.	5. Reduce load. Increase motor size.
	6. If permanent split capacitor motor, capacitor may be open.	6. Indicated by humming sound. Replace run capacitor. See nameplate for correct value.
	7. Defective motor or starter.	7. Repair or replace.
MOTOR STALLS	1. Overloaded motor.	1. Reduce load or increase motor size.
	2. Low motor voltage.	2. See that nameplate voltage is maintained.
MOTOR DOES NOT COME UP TO SPEED	1. Not applied properly.	1. Consult motor service firm for proper type. Use larger motor.
	2. Voltage too low at motor terminals due to line drop.	2.Use higher voltage tap on transformer terminals, increase wire size. Check for poor connections.
	3.Load too high.	3.Check load motor is carrying at start-replace with larger motor.
MOTOR TAKES TOO LONG TO ACCELERATE	1. Excess Loading; high inertia load.	1. Reduce load. Increase motor size.
	2. Inadequate wiring.	2.Increase wire size. Check for poor connections.
	3. Applied voltage too low.	3.Reconnect to a higher transformer tap. Increase wire size. Check for poor connections.
	4. Defective motor.	4. Repair or replace.
	5. Inadequate starting torque.	5.Replace with higher horsepower motor.
MOTOR VIBRATES OR IS EXCESSIVELY NOISY	1. Motor mis-aligned.	1. Realign.
	2.High voltages.	2. Check wiring connections, transformer.
	3. Worn, damaged, dirty or overloaded bearings.	3. Replace, check loading and alignment.
	4. Loose or defective or out-of-balance air mover.	4.Tighten set screw(s); repair or replace.
INSUFFICIENT SPEED CHANGE	1. Insufficient motor load.	1. Use a lower horsepower motor. 2. Reduce system restrictions (blower). Increase system restriction (propeller fan).
MOTOR OVERHEATS WHILE RUNNING UNDER LOAD	1. Overload.	1. Reduce load; increase motor size.
	2. Dirt preventing ventilation.	2. Clean motor.
	3. Faulty connection.	3. Clean, tighten or replace.
	4. High or low voltage.	4. Check voltage at motor, should not be more than 10% above or below rated.
	5. Defective motor.	5. Repair or replace.