NORMAN WRIGHT
MECHANICAL EQUIPMENT CO. – PACIFIC
1714 KAHAI STREET • HONOLULU, HI 96819-3133 • (808) 841-2811 • FAX (808) 847-7742

Dept. of Health Lab Facility Fan Schedule

Mark	Model #	cfm	static	rpm	hp	Electrical
SF-6	BSQ-160-15	3560	1.25	1562	1.50	460/3/60
SF-7	BSQ-200-30	5150	1.25	1241	3.00	460/3/60
SF-8	BSQ-140-7	1500	1.25	1447	0.75	460/3/60
SF-9	BSQ-140-7	1450	1.25	1439	0.75	460/3/60
SF-10	BSQ-90	380	0.75	1467	0.25	115/1/60
SF-11	BSQ-200	4900	1.25	1208	3.00	460/3/60
SF-15	SPFS-24-10	400	0.40	1089	1.00	460/3/60
EF-1,2,3	44-BISW	37500	6.00	1026	60.00	460/3/60
EF-4,5,6	44-BISW	40000	6.00	1057	60.00	460/3/60
EF-7	GB-180-15	4500	0.50	1260	1.50	460/3/60
EF-8	GB-120-4	1000	0.75	1285	0.25	115/1/60
EF-9	GB-120-4	800	0.50	1042	0.25	115/1/60
EF-10	BSQ-200-30	5300	1.00	1209	3.00	460/3/60
EF-11	GB-180-20	4850	1.00	1441	2.00	460/3/60
EF-12	GB-80-4	200	0.40	988	0.25	115/1/60
EF-13	SWB-15-10	2580	1.00	1582	1.00	460/3/60
EF-14	BSQ-420-75	20000	0.50	544	7.50	460/3/60
EF-16	BSQ-130-7	2000	0.50	1688	0.75	460/3/60
EF-17, 18	SPFE-24-7	2800	0.40	971	0.75	460/3/60

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FAN SCHEDULE

Job Name : Dept. of Health Lab
Job Location : Honolulu, HI
Prepared by : Dwight
Elevation : 0 (Ft)

Mark	Qty	Vol (CFM)	SP (In WC)	Air Temp (F)	Model	Rot/ Pitch	Arr	Dis	FRPM	TS (Ft/m)	OV (Ft/m)	Pwr (BHp)	-- Motor Information -- Hp	V/C/P	Encl	Spd	Wt
EF-1	1	1800	0.375	70	SFB-12-5	CW	10	UB	692	2287	2104	0.42	1/2	115/60/1	ODP	1	147
Octave Bands :		86	78	72	66	63	59	55	51	LwA :	70	dBA :	59	Sones :	10.7		

LwA calculations based on ANSI standard S1.4.
dBA values based on 11.5 dB attenuation per octave band at 5 feet.
Sones calculated using AMCA standard 301 at 5 feet.

READ AND SAVE THESE INSTRUCTIONS

GREENHECK
P.O. BOX 410 SCHOFIELD, WISCONSIN 54476-0410
PH. 715-359-6171

Model BSQ Belt Drive Centrifugal Inline Fan

Installation Operating and Maintenance Manual

Upon receiving unit, check for any damage and report it immediately to the shipper. Also check to see that all accessory items are accounted for.

Move fan to desired location and determine position of access panels and motor. Attach the fan to a suitable framework as specified (hanging or base vibration isolators are recommended). See chart below for dimensions of vibration isolator centerlines (Fig.1). See Fig.2 for physical dimensions.

The motor's amperage and voltage ratings must be checked for compatibility to supply voltage prior to final electrical connection. Electrical lead in wires are then connected to the factory supplied safety disconnect switch. All wiring must conform to local and national codes.

Vibration Isolator Dimensional Data

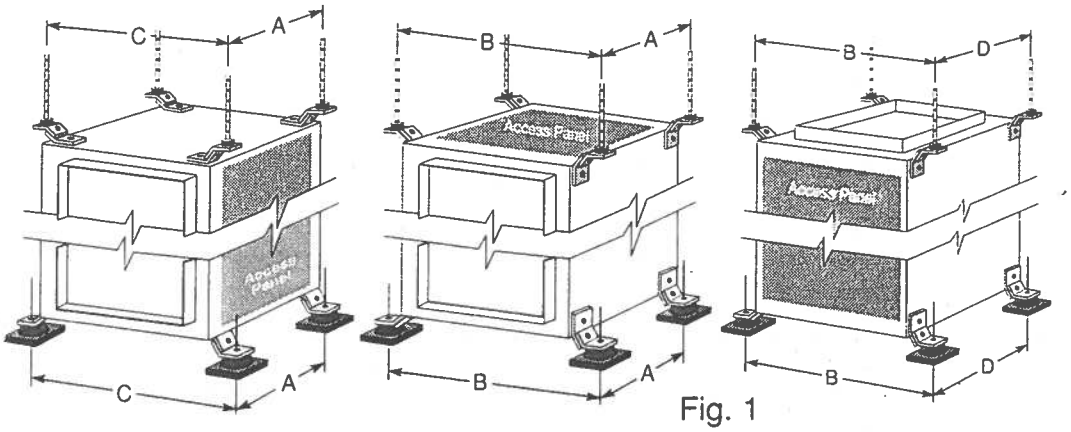
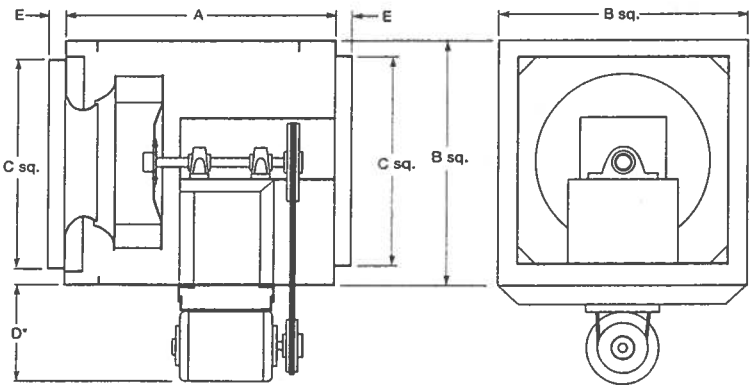


Fig. 1

Unit Size	A	B	C	D
BSQ 70-90	18 5/8	19 3/4	17 1/2	11 7/8
BSQ 100	18 5/8	21 3/4	17 1/2	13 7/8
BSQ 120	18 5/8	23 3/4	17 1/2	15 7/8
BSQ 130	18 5/8	25 3/4	17 1/2	17 7/8
BSQ 140	18 5/8	27 3/4	17 1/2	19 7/8
BSQ 160	23 1/2	31	17 1/2	22 7/8
BSQ 180	25 1/2	34	28 3/8	22 7/8
BSQ 200	29 1/4	37	32 3/8	26 7/8
BSQ 240	31 5/8	44	39 3/8	33 7/8
BSQ 300	35	51	46 3/8	40 7/8
BSQ 360	39 1/4	57	52 3/8	46 7/8
BSQ 420	47 1/4	63	58 3/8	52 3/4

BSQ Dimensional Data



Unit Size	A	B	C	D	E	Material Thickness	Approx. Weight (lbs.)
70-80-90	21	15	11 7/8	9	1	20	75
100	21	17	13 7/8	9	1	20	85
120	21	19	15 7/8	9	1	20	95
130-130HP	21	21	17 7/8	9	1	20	110
140-140HP	22	23	19 7/8	9	1	18	140
160-160HP	26	26	22 7/8	11	1	18	160
180-180HP	28	28	23 7/8	13	1 1/2	18	190
200-200HP	32	32	27 7/8	13	1 1/2	18	220
240-240HP	34	39	34 7/8	13	1 1/2	18	320
300-300HP	38	46	41 7/8	13	1 1/2	16	420
360-360HP	42	52	47 7/8	13	1 1/2	16	600
420	50	58	53 7/8	13	1 1/2	14	720

Pre Start-up Checks

Check all fasteners for tightness. The wheel should rotate freely and be aligned as shown in Fig. 3. Wheel position is preset and the unit is test run at the factory. Movement may occur during shipment, and realignment may be necessary. Centering can be accomplished by loosening the bolts holding the drive frame to the shock mounts and repositioning the drive frame. Wheel and inlet cone overlap can be adjusted by loosening the set screws in the wheel and moving the wheel to the desired position.

WHEEL OVERLAP DIMENSIONS

Model	G
70-160	1/4"
180-240	3/8"
300-420	1/2"

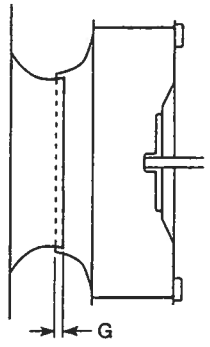


Fig. 3

WHEEL ROTATION

All BSQ fans have CW wheel rotation when viewed from top of fan.

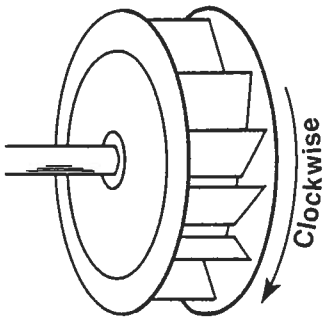
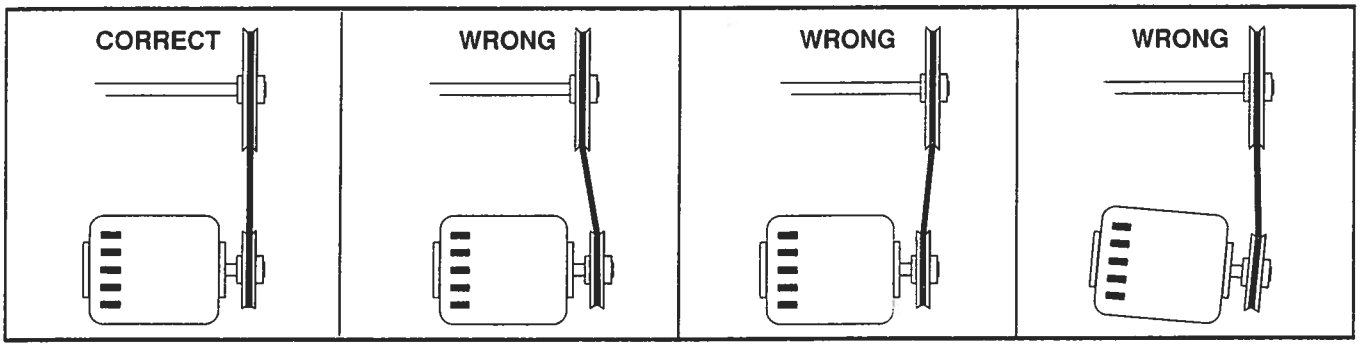


Fig. 4

Direction of wheel rotation is critical. Reversed rotation will result in poor air performance, motor overloading and possible burnout. Check wheel rotation (viewing from the shaft side) by momentarily energizing the unit. Rotation should be clockwise as shown in Fig. 4 and correspond to the rotation decal on the unit.

Fig. 5



If adjustments are made, it is very important to check the pulleys for proper alignment. Misaligned pulleys lead to excessive belt wear, vibration, noise and power loss. (See Fig. 5)

Belt tension can be adjusted by loosening four fasteners (marked "R") on the drive frame. For all BSQ units, the motor plate slides on the slotted adjusting arms (see Fig. 6). Belt tension should be adjusted to allow 1/64" of deflection per inch of belt span. For example, a 15" belt span should have 15/64" (or about 1/4") of deflection with mo derate thumb pressure at mid-point between pulleys (See Fig. 7). Overtightening will cause excessive bearing wear and noise. Too little tension will cause slippage at startup and uneven wear.

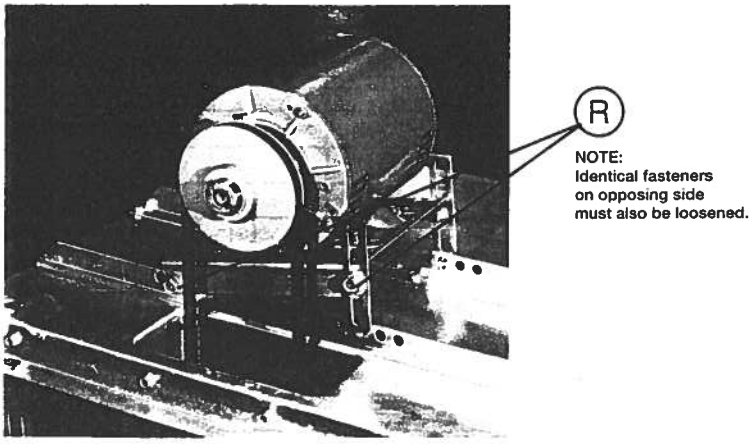


Fig. 6

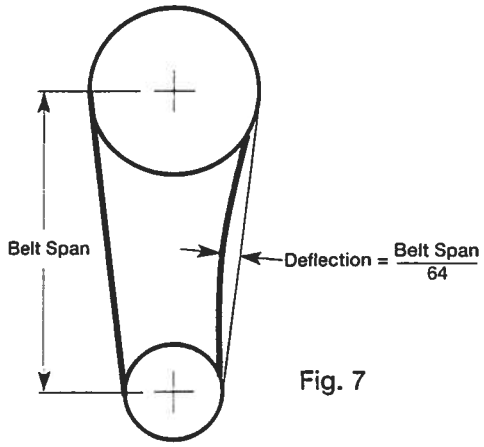


Fig. 7

The adjustable motor pulley is factory set for the RPM specified. Speed can be increased by closing or decreased by opening the adjustable motor sheave. Two groove variable pitch pulleys must be adjusted an equal number of turns open or closed. Any increase in speed represents a substantial increase in the horsepower required by a unit. Motor amperage should always be checked to avoid serious damage to the motor when speed is varied.

MAINTENANCE

Belts tend to stretch after a period of time. They should be checked periodically for wear and tightness. When replacing belts, use the same type as supplied with the unit. Matched belts should always be used on units with multigroove pulleys. For belt replacement, loosen the tensioning device far enough to allow removal of the belt by hand. Do not force belts on or off. This may cause cords to break, leading to premature belt failure. Once installed, adjust belts as shown in "Pre-Startup Checks".

Shaft bearings can be classified in two groups: relubricating and non-relubricating. All bearings on standard Model BSQ fans are factory lubricated and require no further lubrication under normal use (between -20°F and 180°F in a relatively clean environment). Units installed in hot, humid or dirty locations should be equipped with special bearings. These bearings will require frequent lubrication. Caution should be employed to prevent overpacking or contamination. Grease fittings should be wiped clean. The unit should be in operation while lubricating. Extreme care should be used around moving parts. Grease should be pumped in very slowly until a slight bead forms around the seal. A high grade lithium base grease is recommended.

Motor maintenance is generally limited to cleaning and lubrication (where applicable). Cleaning should be limited to exterior surfaces only. Removing dust buildup on motor housing ensures proper motor cooling. Greasing of motors is only intended when fittings are provided. Many fractional motors are permanently lubricated and should not be lubricated further. Motors supplied with grease fittings should be greased in accordance with manufacturers' recommendations. Where motor temperatures do not exceed 104°F (40°C), the grease should be replaced after 2000 hours of running time as a general rule.

Wheels require very little attention when moving clean air. Occasionally, oil and dust may accumulate causing imbalance. When this occurs, the wheel and housing should be cleaned to ensure smooth and safe operation.

The unit should be made non functional when cleaning the wheel or housing (fuses removed, disconnect locked off, etc.).

All fasteners should be checked for tightness each time maintenance checks are performed prior to restarting unit.

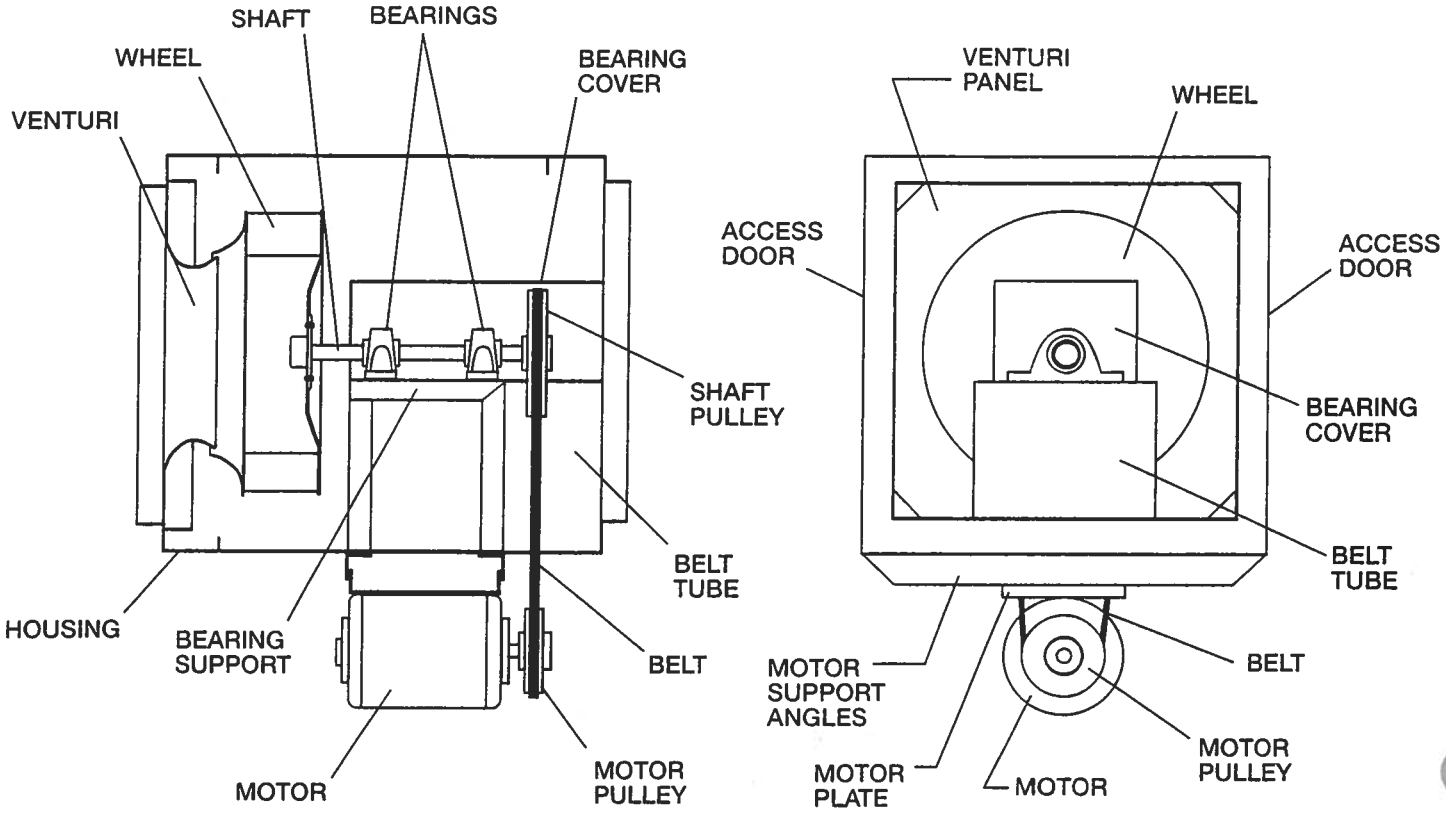
A proper maintenance program will help these units deliver years of dependable service.

TROUBLESHOOTING

PROBLEM	CAUSE	CORRECTIVE ACTION
REDUCED AIRFLOW	System resistance too high	Check system: Proper operation of backdraft or control dampers, obstruction in ductwork, etc.
	Unit running backwards	Correct as shown in Fig. 4.
	Excessive dirt buildup on wheels	Clean wheel.
	Improper wheel alignment	Center wheel on inlets.
EXCESSIVE NOISE	Bad bearings	Replace.
	Belts too tight or too loose	Refer to Fig.8 and adjust tension.
	Wheel improperly aligned and rubbing	Center wheel on inlets. See Fig. 3
	Loose drive or motor pulleys	Align and tighten. See "Pre-Starting Checks".
	Foreign objects in wheel or housing	Remove objects, check for damage or unbalance.
	Unbalance of wheel caused by excessive dirt and grease buildup	Remove buildup.

NOTE: Before taking any corrective action, make certain unit is not capable of operation during repairs.

PARTS LIST



NOTE: Each fan bears a manufacturer's nameplate with model number and serial number embossed. This information will assist the local Greeheck representative and the factory in providing service and replacement parts.

WARRANTY

Greenheck warrants this equipment to be free from defects in material and workmanship for a period of one year from the purchase date. Any units or parts which prove to be defective during the warranty period will be repaired at our option when returned to our factory, transportation prepaid.

The motor is warranted by the motor manufacturer for a period of one year. Should the motor prove defective during this period, it should be returned to the nearest authorized motor service station.

Greenheck will not be responsible for any installation or removal costs.

GREENHECK
P.O. BOX 410 SCHOFIELD, WISCONSIN 54476-0410
PH. 715-359-6171

GREENHECK
P.O. BOX 410 SCHOFIELD, WISCONSIN 54476-0410
PH. 715-359-6171

BELT DRIVE SIDEWALL PROPELLER FANS

INSTALLATION, OPERATING AND MAINTENANCE MANUAL

INSTALLATION

Upon receiving the unit, check for any damage and report it immediately to the shipper. Also assure all accessory items are accounted for.

Move fan to the desired location and determine the method by which the fan is to be mounted as shown below in figures 1, 2 and 3. Optional wall mount housings (Fig. 2) and wall mount collars (Fig. 3) provide a convenient means of mounting sidewall fans while maintaining the proper distance between propeller and damper.

Attach the fan by inserting a suitable fastener through each of the pre-punched mounting holes in the fan panel. Care should be taken not to bend or distort the fan panel or drive components during installation.

The motor voltage and amperage rating must be checked for compatibility with the electrical supply. Supply wiring to the fan must be properly fused and conform to local and national electrical codes.

TYPICAL INSTALLATIONS

Wall opening size and propeller-to-damper distance are two important dimensions for fan installation. Fans mounted to the wall require a different opening (W.O.) size than those mounted in collars or wall housings. Propeller-to-damper distance (M) is important to reduce turbulence and damper flutter which may lead to premature damper failure.

Fig. #1 shows the recommended wall opening (W.O.) and the minimum distance suggested between the fan and damper for direct installations.

Figs. #2 and 3 show the wall opening (W.O.) required for installations with either a wall housing or collar.

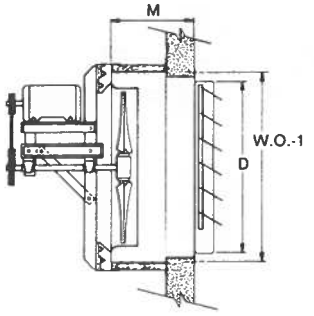


Fig. #1

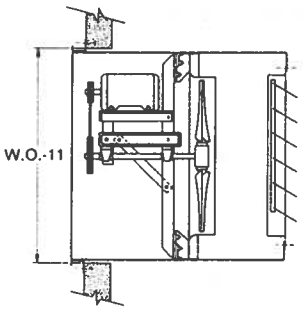


Fig. #2

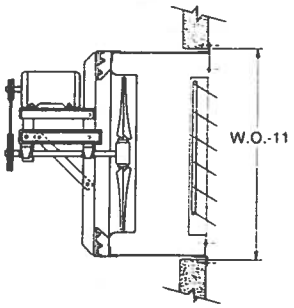


Fig. #3

Fan Size	D Damper Size	M Min.	WO-I Sq.	WO-II Sq.
24	26 x 26	13	26½	33¾
30	32 x 32	13	32½	39¾
36	38 x 38	14	38½	45¾
42	44 x 44	15	45½	51¾
48	50 x 50	16	50½	57¾
54	56 x 56	17	56½	63¾
60	62 x 62	18	62½	69¾
72	74 x 74	19	74½	—

PRE-STARTING CHECKS

Check all fasteners and set screws for tightness. This is especially important for bearing set screws.

The propeller should rotate freely and not rub on the fan panel venturi. Rotation direction of the propeller should be checked by momentarily turning the unit on. Rotation should be in the same direction as the rotation decal affixed to the unit or as shown in Fig. 4. For 3-phase installations, fan rotation can be reversed by simply interchanging any two of the three electrical leads. For single phase installations follow the wiring diagram located on the motor.

The adjustable motor pulley is preset at the factory for the specified fan RPM. Fan speed can be increased by closing or decreased by opening the adjustable pulley. Two or three groove variable pitch pulleys must be adjusted an equal number of turns open. Any increase in fan speed represents a substantial increase in horsepower required from the motor. Always check motor load amperage and compare to name plate rating when changing fan speed.

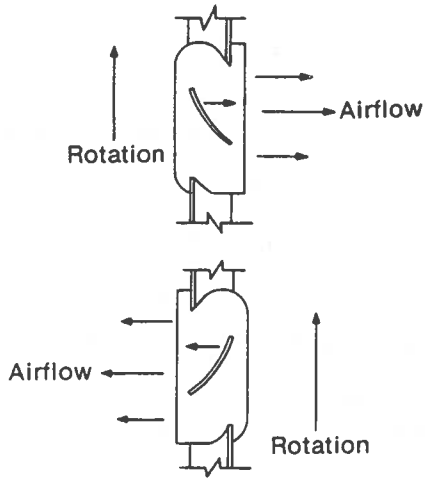


Fig. #4

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WARNING

DISCONNECT AND SECURE TO THE "OFF" POSITION ALL ELECTRICAL POWER TO THE FAN PRIOR TO INSPECTION OR SERVICING. FAILURE TO COMPLY WITH THIS SAFETY PRECAUTION COULD RESULT IN SERIOUS INJURY OR DEATH.

****

Once the fan has been put into operation, a periodic maintenance program should be set up to preserve the reliability and performance of the fan. Items to be included in this program are:

—BELTS
—BEARINGS
—FASTENERS
—SET SCREWS
—LUBRICATION
—REMOVAL OF DUST/DIRT

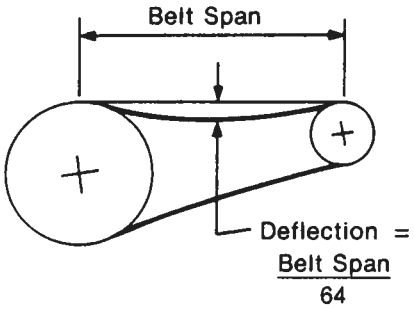


Fig. #5

BELTS

Premature belt failures are frequently caused by improper belt tension (either too tight or too loose) or misaligned pulleys. The proper tension for operating a V-belt is the lowest tension at which the belts will not slip at peak load conditions. For initial tensioning, the proper belt deflection half way between pulley centers is 1/64" for each inch of belt span. For example, if the belt span is 64 inches, the belt deflection should be one inch using moderate thumb pressure at midpoint of the drive (Fig. 5).

Check belt tension two times during the first 24 hours of operation and periodically thereafter. To adjust belt tension, simply loosen four fasteners (two on each side of the motor plate) and slide the motor plate away from the fan shaft until proper belt tension is attained. On some fans, fasteners attaching the motor to the motor plate must be loosened in order to adjust the belt.

It is very important that the drive pulleys remain in proper alignment after adjustments are made. Misalignment of pulleys will result in premature belt wear, noise, vibration and power loss. See diagrams below.

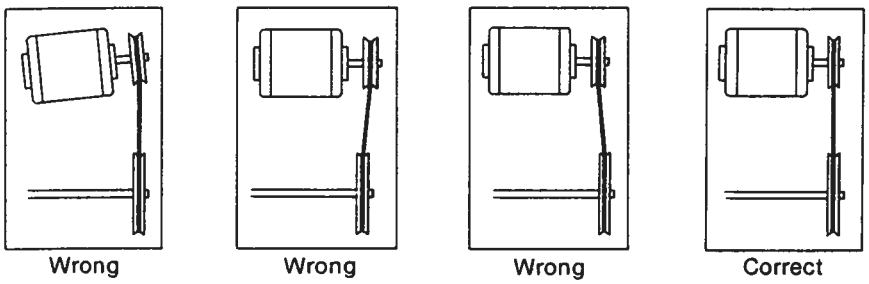
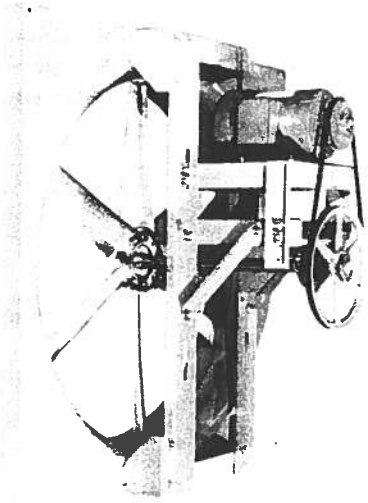


Fig. #6



BEARINGS

Bearings are the most critical moving part of the fan and should be inspected at periodic intervals. Locking collars and set screws, in addition to fasteners attaching the bearings to the bearing plate, must be checked for tightness. In a clean environment and temperatures above 32 degrees F./below 200 degrees F., fan shaft bearings with grease fittings should be lubricated semi-annually using a high quality lithium based grease. If unusual environmental conditions exist.....temperatures below 32 degrees F./above 200 degrees F., moisture or contaminants.....more frequent lubrication is required. With the unit running, add grease very slowly with a manual grease gun until a slight bead of grease forms at the seal. Be careful not to unseat the seal by over lubricating or using excessive pressure. Bearings without grease fittings are lubricated for life.

FASTENERS AND SET SCREWS

Any fan vibration has a tendency to loosen mechanical fasteners. A periodic inspection should include checking all fasteners and set screws for tightness. Particular attention should be paid to set screws attaching the propeller to the shaft and the shaft to the bearings. Loose bearing set screws will lead to premature failure of the fan shaft.

LUBRICATION

Refer to the paragraph on bearings for bearing lubrication.
Many fractional horsepower motors installed on the smaller fans are lubricated for life and require no further attention. Motors equipped with oil holes should be oiled in accordance with the manufacturers instructions printed on the motor. Use a high grade SAE 20 machine oil and use caution not to over lubricate. Motors supplied with grease fittings should be greased according to directions printed on the motor.

REMOVAL OF DUST AND DIRT

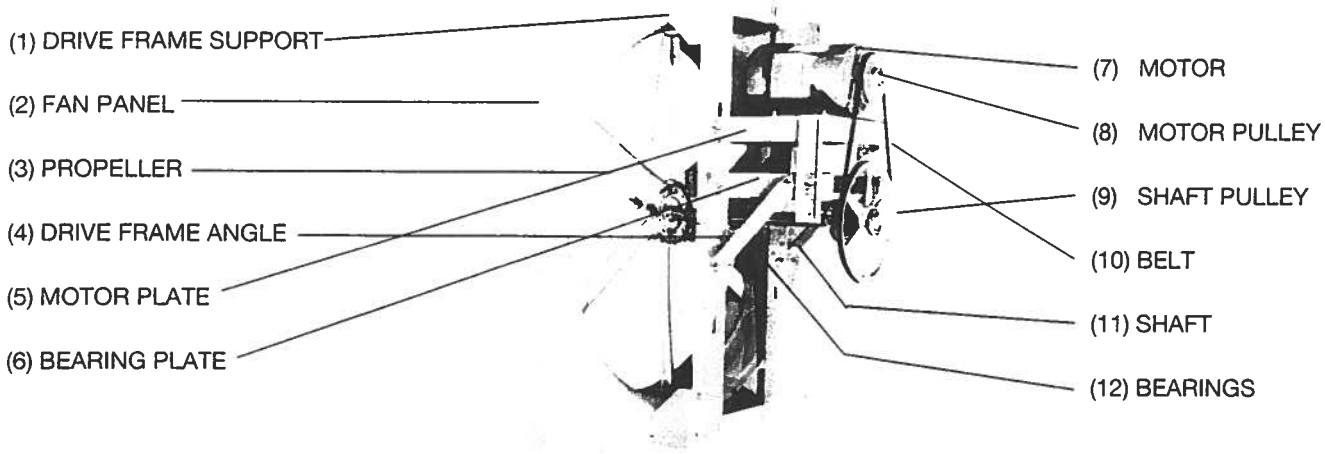
Dirt clogs cooling openings on the motor housing, contaminates bearing lubricant and collects on propeller blades causing severe imbalance if left unchecked. The exterior surface of the motor, fan panel and entire propeller should be thoroughly cleaned periodically. Use caution and do not allow water or solvents to enter the motor or bearings. Under no circumstances should motors or bearings be sprayed with steam or water.

TROUBLESHOOTING

PROBLEM	CAUSE	CORRECTIVE ACTION
Reduced airflow	System resistance is too high.	Check backdraft dampers for proper operation. Remove obstructions in ductwork. Clean dirty filters. Check for adequate supply air for exhaust fans or exhaust air for supply fans.
	Fan too close to damper.	Increase distance between fan and damper.
	Unit running backwards.	See pre-starting checks.
	Fan speed too low.	Increase fan speed.*
	Excessive dirt on propeller.	Clean propeller.
Excessive Noise	Bearings	Tighten bearing collars and set screws. Lubricate bearings. Replace defective bearings.
	V-Belt drive	Tighten pulleys on motor and fan shaft. Adjust belt tension. Align pulleys. Replace worn belts or pulleys. See "Routine maintenance".
	Excessive vibration	Clean dirt build-up from propeller. Check all set screws and fasteners for tightness. Check for worn bearing. Correct propeller imbalance. Check for loose dampers, guards or ductwork.

* Motor load amperage must be checked and compared to nameplate rating to avoid serious damage to motor when speed is increased.

PARTS LIST



SIDEWALL PROPELLER FAN (Typical)

REPLACEMENT PARTS

Always provide the unit serial number when requesting parts or information.

JOB _____

MODEL _____ SERIAL NO. _____

GREENHECK PRODUCTION ORDER NO. _____

SALES OFFICE _____ CITY _____

PART DESCRIPTION	QUANTITY
(1) Drive Frame Support	
(2) Fan Panel	
(3) Propeller	
(4) Drive Frame Angle	
(5) Motor Plate	
(6) Bearing Plate	
(7) Motor	
(8) Motor Pulley	

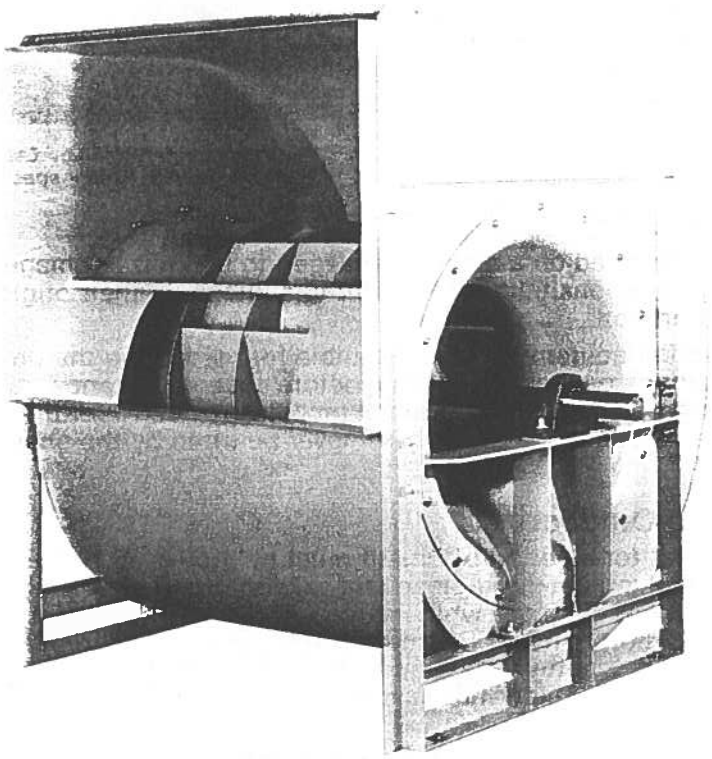
PART DESCRIPTION	QUANTITY
(9) Shaft Pulley	
(10) Belt	
(11) Shaft	
(12) Bearings (2)	

READ AND SAVE THESE INSTRUCTIONS

GREENHECK
P.O. BOX 410 SCHOFIELD, WISCONSIN 54476-0410
PH. 715-359-6171

CENTRIFUGAL FAN

Installation Operating and Maintenance Manual



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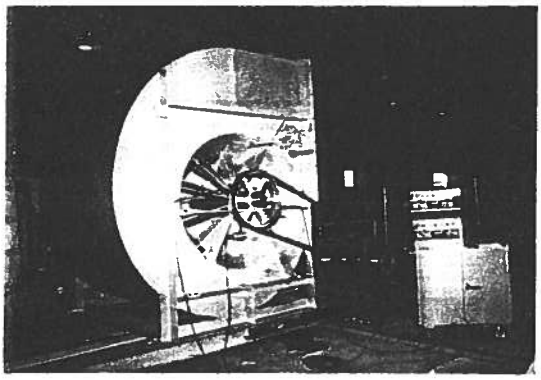
GENERAL INFORMATION

Greenheck Centrifugal Fans are thoroughly inspected and tested before leaving the factory. Items such as proper wheel alignment, balance, vibration and workmanship are analyzed by quality control personnel using state-of-the-art equipment. Every unit must pass a recorded vibration analysis while being run at a fan RPM specified by the customer. Any vibration resulting from unbalance is corrected by use of modern in-place balancing equipment. However, obvious or hidden damage can occur due to mishandling or installation. To insure a successful installation, the instructions in this manual should be read and adhered to. Failure to comply with proper installation procedures may void the warranty.



Designed and built by Greenheck's Machine Developement Centre, final inspection is done on this vibration test stand.

RECEIVING AND HANDLING

All Centrifugal Fans are shipped on a skid or packaged to minimize damage during shipment. The transporting carrier has the responsibility for delivering all items in their original condition as received from Greenheck Fan Corporation.

The individual receiving the equipment is responsible for inspecting the unit for obvious or hidden damage, recording any damage on the bill of lading before acceptance and filing a claim (if required) with the final carrier. Fans are to be rigged by the lifting brackets provided, identified by "Lift Here" decals, or by the skid when a forklift is used. The fan should never be lifted by the shaft, housing, motor, belt guard or accessories.

STORAGE · Indoor and Outdoor

When a fan is to be stored for a period of time it must be protected from dirt and moisture. Use of a tarp to cover the unit will aid in keeping it clean and dry. Do not use a black plastic tarp as it will promote condensation. Improper storage which results in damage to the fan will void the warranty. Additionally, the wheel and motor should be rotated periodically and the bearings purged with new grease if the storage period is lengthy. In a humid, dusty or corrosive atmosphere, rotate the fan and purge the bearings once a month. Under normal conditions, once every three months is recommended.

INSTALLATION

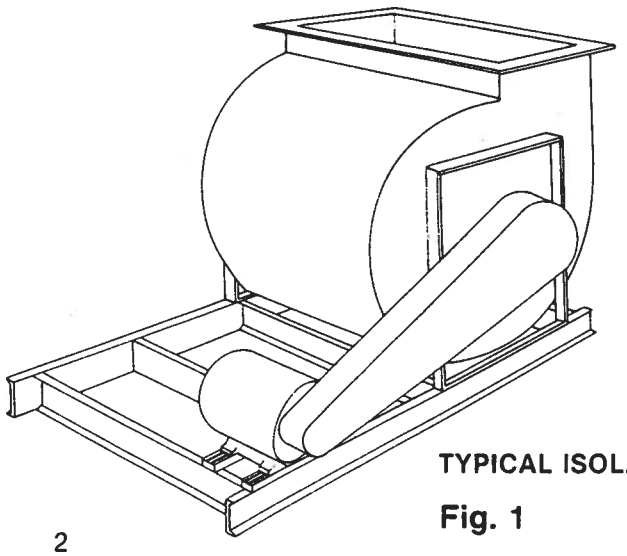
FOUNDATION AND ISOLATION

Critical to every fan installation is a strong, level foundation. Reinforced poured concrete provides an excellent foundation and is used in most installations. Steel beams are also acceptable, but must be sturdy enough, with welded construction, to prevent flexing and vibration.

To eliminate vibration and noise from being transfered to the building, vibration isolators should be used. The types of vibration isolators currently available are: Elastomer, Shearmount, compression mount, ribbed neoprene and cork, natural cork and metal springs. Consult the appropriate isolator catalog for specific applications.

The isolators are installed between the isolation base and the concrete or steel foundation. The fan is mounted directly on the isolation base and must be supported the entire length of the fan base angle. (See Fig. 1)

After the fan, isolator base and isolators are installed, the entire assembly must be leveled. Position the level on the isolation base, not the fan shaft, for proper leveling. Additionally, the motor and fan shafts must be level and parallel relative to each other for proper alignment.



TYPICAL ISOLATOR BASE

Fig. 1

ROTATABLE HOUSINGS — WHEEL ALIGNMENT

On fan sizes Arr 1, 9, 10 only the discharge can be changed, if desired, by removing the housing bolts and rotating the housing to a new discharge position and then replacing the bolts. Insure the clearances between the wheel and inlet cone are as preset at the factory. (Fig. 2)

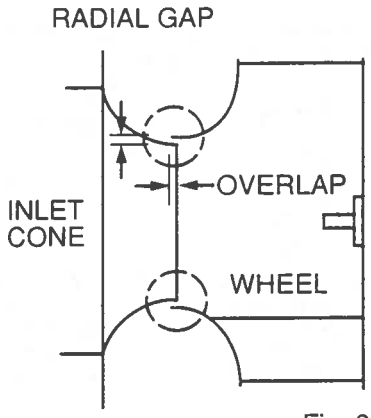


Fig. 2

Radial gap is adjusted by loosening the bearing bolts and centering wheel and/or loosening inlet cone bolts and repositioning the inlet cone.

Overlap is adjusted by loosening the wheel hub and moving wheel to the desired position along the shaft.

CENTRIFUGAL FAN WHEEL OVERLAP AND RADIAL GAP (INCHES)

	*Overlap			Radial Gap		
Unit Size	Min.	Max.	Nominal	Min.	Max.	Nominal
12	1/4	1/2	3/8	1/8	3/16	5/32
13	5/16	9/16	7/16	1/8	3/16	5/32
15	3/8	5/8	1/2	1/8	3/16	5/32
16	3/8	5/8	1/2	1/8	3/16	5/32
18	1/2	3/4	5/8	1/8	3/16	5/32
20	7/16	13/16	5/8	1/8	7/32	5/32
22	1/2	7/8	11/16	1/8	7/32	5/32
24	1/2	1	3/4	1/8	7/32	5/32
27	5/8	1-1/8	7/8	5/32	1/4	3/16
30	9/16	1-5/16	15/16	5/32	5/16	3/16
33	11/16	1-7/16	1-1/16	5/32	5/16	3/16
36	13/16	1-9/16	1-3/16	5/32	5/16	3/16
40	3/4	1-1/2	1-1/4	7/32	3/8	1/4
44	1-1/16	1-13/16	1-7/16	7/32	3/8	5/16
49	1-1/16	2-1/16	1-9/16	7/32	7/16	5/16
54	1-1/4	2-1/4	1-3/4	5/16	7/16	3/8
60	1-1/2	2-1/2	2	5/16	1/2	3/8
66	1-11/16	2-11/16	2-3/16	5/16	9/16	7/16
73	1-7/8	2-7/8	2-3/8	3/8	5/8	1/2

*NOTE: Doublewidth fans must have equal overlap on each side of the wheel.

V-BELT DRIVES

The V-belt drive components, when supplied by Greenheck Fan Corporation, have been carefully selected for this unit's specific operating condition. Caution: changing V-belt drive components could result in unsafe operating conditions which may cause personal injury or failure of the following components: 1. Fan Shaft, 2. Fan Wheel, 3. Bearings, 4. V-belt, 5. Motor.

V-BELT DRIVE INSTALLATION

1. Remove the protective coating from the fan shaft and assure that it is free of nicks and burrs.
2. Check fan and motor shafts for parallel alignment (Fig. 3)
3. Slide sheaves on shafts - do not drive sheaves on as this may result in bearing damage.
4. Align fan and motor sheaves with a straight-edge or string, and tighten (Fig. 4)

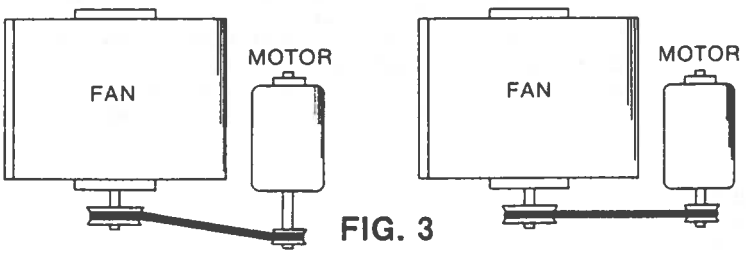


FIG. 3

IMPROPER SHEAVE ALIGNMENT PROPER SHEAVE ALIGNMENT

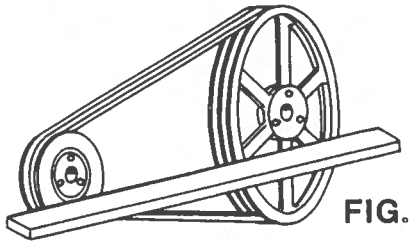


FIG. 4

ALIGNING SHEAVES WITH A STRAIGHT EDGE

5. Place belts over sheaves. Do not pry or force belts as this could result in damage to the cords in the belts.
6. Adjust the tension until the belts appear snug. Run the unit for a few minutes (see section on unit start-up) and allow the belts to "Set" properly.
7. With the fan off, adjust the belt tension by moving the motor base. (See belt tensioning procedures in the maintenance section of this manual). When in operation, the tight side of the belts should be in a straight line from sheave to sheave with a slight bow on the slack side.

DUCT INSTALLATION AND EFFECTS ON PERFORMANCE

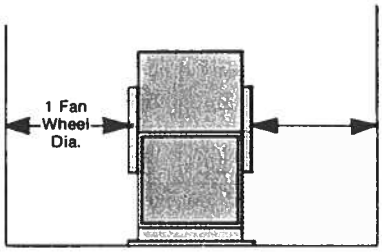
Ratings presented in Greenheck performance tables and curves were derived from tests made in accordance with AMCA Standard 210 — "Test Code for Air Moving Devices". The AMCA test procedure utilizes an open inlet and a straight outlet duct to assure maximum static regain.

Any installation with inlet or discharge configurations that deviate from this standard may result in reduced fan performance. Restricted or unstable flow at the fan inlet can cause pre-rotation of incoming air or uneven loading of the fan wheel yielding large system losses and increased sound levels. Free discharge or turbulent flow in the discharge ductwork will also result in system effect losses.

Static pressure losses due to inlet and discharge conditions can be expressed in terms of system effect factors. The static pressure for selection of the fans equals the system static pressure plus the system effect factor.

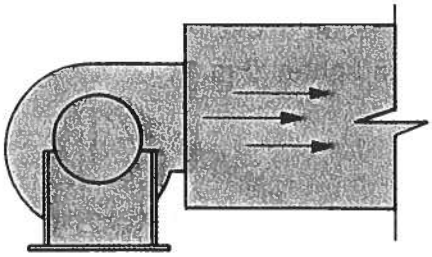
The most common inlet and discharge conditions which affect fan performance are:

NON-DUCTED INLET CLEARANCE



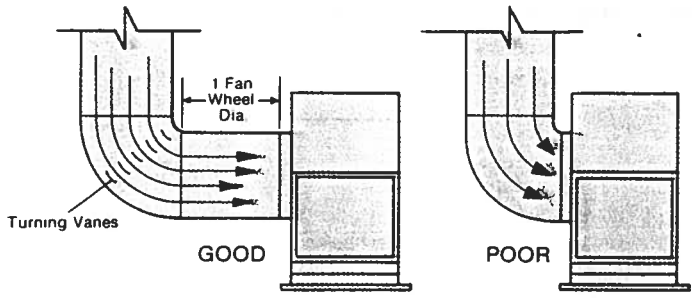
Installation of a fan with an open inlet too close to a wall or bulkhead will cause reduced fan performance. It is desirable to have one fan wheel diameter if possible and a minimum of three fourths of a wheel diameter between the fan inlet and the wall. System effect curve #3 depicts the pressure loss for one-half wheel diameter clearance.

FREE DISCHARGE



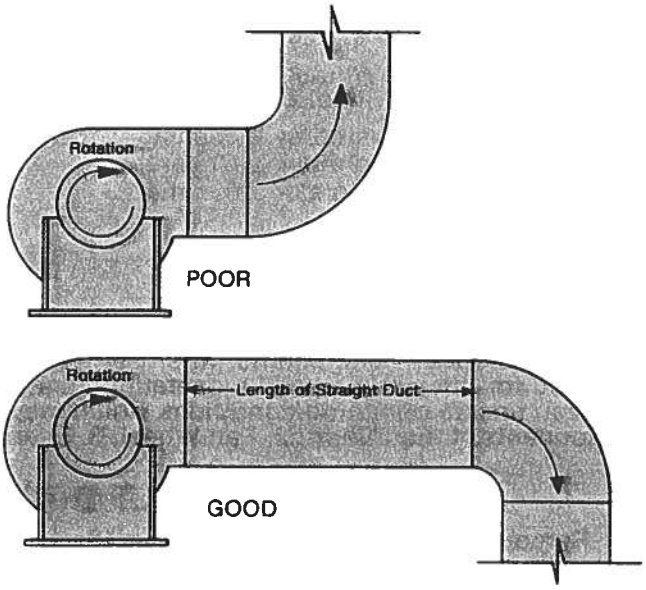
Free or abrupt discharge into a plenum results in a reduction in fan performance. The effect of static regain in discharge is not realized. System effect curve #2 depicts the pressure loss for free or abrupt discharge.

INLET DUCT TURNS



Installation of a duct turn or elbow too close to the fan inlet reduces fan performance because air is loaded unevenly into the fan wheel. To achieve full fan perfomance there should be at least one fan wheel diameter between the turn or elbow and the fan inlet. Curve #1 shows the system effect factor when less than one diameter is provided.

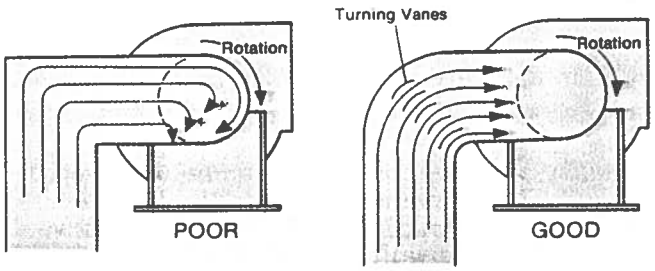
DISCHARGE DUCT TURNS



Duct turns located near the fan discharge should always be in the direction of the fan rotation.

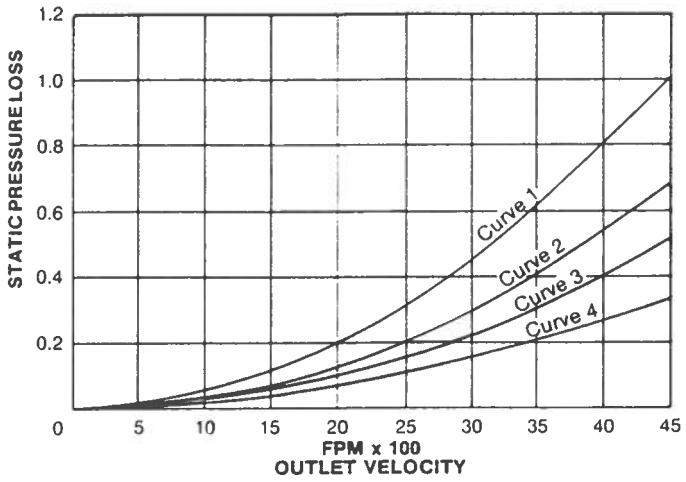
Fan performance is reduced when duct turns are made immediately off the fan discharge. To achieve cataloged fan performance there should be at least three equivalent duct diameters of straight ductwork between the fan discharge and any duct turns. Curve #4 shows the system effect factor for two diameters of straight ductwork and curve #2 for one diameter.

INLET SPIN



Inlet spin is a frequent cause of reduced fan performance. The change in fan performance is a function of the intensity of spin and not easily defined. The best solution is proper duct design and airflow patterns.

SYSTEM EFFECT FACTOR CURVES



Generally, fan vibration and noise is transmitted to other parts of the building by the ductwork. To eliminate this undesireable effect, the use of heavy canvas connecters is recommended. If fireproof material is required, flexweave 1000 - type FN-30 can be used.

WARNING

Disconnect and secure to the "Off" position all electrical power to the fan prior to inspection or servicing. Failure to comply with this safety precaution could result in serious injury or death.

UNIT START-UP

1. Open all power switches to fan and tag. See warning above.
2. Check all fasteners, set screws and locking collars on the fan, bearings, drive, motor base and accessories for tightness.
3. Rotate the fan wheel by hand and assure no parts are rubbing.
4. Check for bearing alignment and lubrication.
5. Check the V-belt drive for proper alignment and tension.
6. Check the belt guard (if supplied) for being securely attached.
7. Check operation of variable inlet vanes or discharge dampers (if supplied) for freedom of movement.
8. Check all electrical connections for proper attachment.
9. Check housing and ductwork, if accessible, for obstructions and foreign material that may damage the fan wheel.

ADDITIONAL STEPS FOR INITIAL START-UP

1. Check for proper wheel rotation by momentarily energizing the fan. Rotation is always determined by viewing the wheel from the drive side and should correspond to the rotation decal affixed to the unit. (Fig. 5). One of the most frequently encountered problems with Centrifugal Fans is motors which are wired to run in the wrong direction. This is especially true with 3-phase installations where the motor will run in either direction, depending on how it has been wired. To reverse rotation of a 3-phase motor, interchange any two of the three electrical leads. Single phase motors can be reversed by changing internal connections as described on the motor label or wiring diagram.
2. If the fan has inlet vanes, they should be partially closed to reduce power requirements. This is especially important if the fan is designed for a high temperature application and is being started at room temperature.

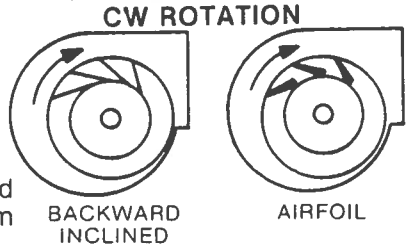


Fig. 5

2. Fans with multi-speed motors should be checked on low speed during initial start-up.
3. Check for unusual noise, vibration or overheating of bearings. Refer to the "Troubleshooting" section of this manual if a problem develops.
4. Grease may be forced out of the bearing seals during initial start-up. This is a normal self-purging feature of this type bearing.

VIBRATION

Excessive vibration is the most frequent problem experienced during initial start-up. *Left unchecked, excessive vibration can cause a multitude of problems, including structural and/or component failure. The most common sources of vibration are listed below.

1. Wheel Imbalance
2. Drive Pulley Misalignment
3. Incorrect Belt Tension
4. Bearing Misalignment
5. Mechanical Looseness
6. Faulty Belts
7. Drive Component Imbalance

Many of these conditions can be discovered by careful observation. Refer to the trouble-shooting section of this manual for corrective actions. If observation cannot locate the source of vibration, a qualified technician using vibration analysis equipment should be consulted. If the problem is wheel imbalance, in-place balancing can be done providing there is access to the fan wheel. Any correction weights added to the wheel should be welded to either the wheel back (single plane balance) or to the wheel back and wheel cone (two-plane balance).

***Allowable vibration of fans (measured at bearings)**

Fan RPM	Vert. and Horiz. Planes	Axial Plane
0-300	5 mils	5 mils
300-500	4 mils	5 mils
500-1000	3 mils	5 mils
1000 & up	2 mils	5 mils

ROUTINE MAINTENANCE

Once the unit has been put into operation, a routine maintenance schedule should be set up to accomplish the following:

1. Lubrication of bearings and motor.
2. Variable inlet vanes should be checked for freedom of operation and wear.
3. Wheel, housing, bolts and set screws on the entire fan should be checked for tightness.
4. Any dirt accumulation on the wheel or in the housing should be removed to prevent imbalance and possible damage.
5. Isolation bases should be checked for freedom of movement and the bolts for tightness. Springs should be checked for breaks and fatigue. Rubber isolators should be checked for deterioration.

CAUTION:
When operating conditions of the fan are to be changed (speed, pressure, temperature, etc.), consult Greenheck Fan Corporation to determine if the unit can operate safely at the new conditions.

BEARINGS

The bearings for Greenheck Centrifugal Fans are carefully selected to match the maximum load and operating conditions of the specific class, arrangement, and fan size. Following the instructions provided in this manual, and those provided by the bearing manufacturer, will minimize any bearing problems. Bearings are the most critical moving part of the fan, therefore special care is required when mounting them on the unit. Refer to the following chart for grease types and intervals for various operating conditions.

RECOMMENDED BEARING LUBRICATION SCHEDULE FOR GREENHECK CENTRIFUGAL FANS

Recommended Relubrication Schedule in Months

FAN RPM	Bearing Bore Diameter in Inches					
	1/2 to 1	1 1/8 to 1 1/2	1 5/8 to 1 15/16	2 to 2 1/2	2 11/16 to 3 3/16	3 7/16 to 3 15/16
To 500	6	6	6	6	5	4
500-1000	6	6	6	5	4	3
1000-1500	5	5	5	4	3	2
1500-2000	5	4	4	3	2	-
2000-2500	4	4	3	2	1	-
2500-3000	4	3	2	1	2	-
3000-3500	3	2	2	2	-	-
3500-4000	3	2	1	-	-	-
4000-4500	2	1	1	-	-	-
4500-5000	2	1	-	-	-	-

If unusual environmental conditions exist — temperatures below 32°F or above 200°F, moisture or contaminants — more frequent lubrication is required. Consult Greenheck for recommendations on special intervals.

Add grease slowly with a handgun until a slight bead of grease forms at the seal. Be careful not to unseat the seal by overlubricating.

A high quality lithium base grease conforming to NLGI Grade 2 consistency, such as those listed below, should be used:

Mobil 532
Mobilux #2
B Shell Alvania #2
Texaco Multifak #2
Texaco Premium RB
Unirex N2

WARNING: Centrifugal fans which are stored for extended periods of time prior to operation should have the shaft rotated monthly. If the fan is stored for more than three months, the bearings should be purged with new grease prior to start-up.

V-BELT DRIVES

V-belt drives must be checked on a regular basis for wear, tension, alignment, and dirt accumulation. Premature or frequent belt failures are frequently caused by improper belt tension, (either too loose or too tight) or misaligned sheaves. Abnormally high belt tension or drive misalignment will cause excessive bearing loads and may result in failure of the fan and/or motor bearings. Conversely, loose belts will cause squealing on start-up, excessive belt flutter, slippage, and overheated sheaves. Either excessively loose or tight belts may cause fan vibration.

When replacing V-belts on multiple groove drives all belts should be changed to provide uniform drive loading. Do not pry belts on or off the sheave. Loosen belt tension until belts can be removed by simply lifting the belts off the sheaves. After replacing belts, insure that slack in each belt is on the same side of the drive. Belt dressing should never be used.

Do not install new belts on worn sheaves. If the sheaves have grooves worn in them, they must be replaced before new belts are installed.

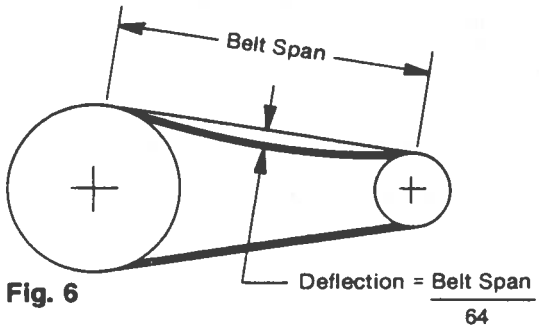


Fig. 6

The proper tension for operating a V-belt drive is the lowest tension at which the belts will not slip at peak load conditions. For initial tensioning, the proper belt deflection half-way between sheave centers is 1/64" for each inch of belt span. For example, if the belt span is 64 inches, the belt deflection should be 1 inch using moderate thumb pressure at mid-point of the drive (Fig. 6). Check belt tension two times during the first 24 hours of operation and periodically thereafter.

MOTORS

Motor maintenance is generally limited to cleaning and lubrication. Cleaning should be limited to exterior surfaces only. Removing dust and grease buildup on the motor housing assists proper motor cooling. Greasing of motors is only intended when fittings are provided. Many fractional motors are permanently lubricated for life and require no further lubrication. Motors supplied with grease fittings should be greased in accordance with the manufacturer's recommendations. When motor temperature does not exceed 104°F (40°C), the grease should be replaced after 2000 hours of running time.

TROUBLESHOOTING

Problem	Cause	Corrective Action
Excessive Noise	Wheel Rubbing Inlet	Adjust wheel and/or inlet cone. Tighten wheel hub or bearing collars on shaft.
	V-Belt Drive	Tighten sheaves on motor/fan shaft. Adjust belt tension. Align sheaves properly (see page 7). Replace worn belts or sheaves.
	Bearings	Replace defective bearing(s). Lubricate bearings. Tighten collars & fasteners.
	Wheel Unbalance	Clean all dirt off wheel. Check wheel balance, rebalance inplace if necessary.
Low CFM	Fan	Check wheel for correct rotation. Increase fan speed.*
	Duct System	See page 4.
High CFM	Fan	Decrease fan speed.
	Duct system	Resize ductwork. Access door, filters, grills not installed.
Static, Pressure Wrong	Duct system has more or less restriction than anticipated	Change obstructions in system. Use correction factor to adjust for temperature/altitude. Resize ductwork. Clean filters/coils. Change fan speed.*
High Horsepower	Fan	Check rotation of wheel. Reduce fan speed.
	Duct System	Resize duct work. Check proper operation of face and bypass dampers. Check filters and access doors.
Fan Doesn't Operate	Electrical Supply	Check fuses/circut breakers. Check for switches off. Check for correct supply voltage.
	Drive	Check for broken belts. Tighten loose pulleys.
	Motor	Assure motor is correct horsepower and not tripping overload protector.
Overheated Bearing	Lubrication	Check for excessive or insufficient grease in the bearing.
	Mechanical	Replace damaged bearing. Relieve excessive belt tension. Align bearings. Check for bent shaft.

NOTE: Always provide the unit model and serial numbers when requesting parts or service information.

*Always check motor amps and compare to nameplate rating. Excessive fan speed may overload the motor and result in burnout.

WARRANTY

The Greenheck Fan Corporation warrants this equipment to be free from defects in material and workmanship for period of one year from the purchase date. This warranty limits our responsibility to repairing or replacing, to the original purchaser, any part or parts of said equipment found to be defective upon examination by representatives of Greenheck Fan Corporation. Additionally, said part or parts will be returned to and received by the factory only after prior authorization, with transportation charges prepaid.

Greenheck Fan Corporation shall not be obligated under this warranty, for payment of any delivery, removal or installation charges with regard to repair or replacement of any defective part or parts.

Motors are warranted by the motor manufacturer for a period of one year. Should motors furnished by Greenheck Fan Corporation prove defective during this period, they should be returned to the nearest authorized motor service station.

GREENHECK

READ AND SAVE THESE INSTRUCTIONS

PN 453005

GREENHECK
P.O. BOX 410 SCHOFIELD, WISCONSIN 54476-0410
PH. 715-359-6171

Model GB Belt Drive Centrifugal Roof Exhauster

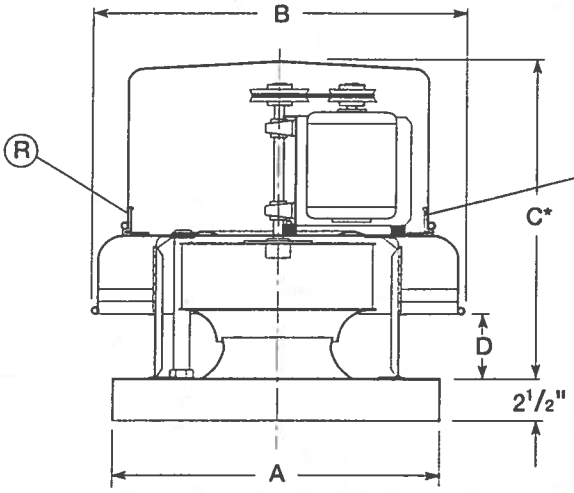
Installation Operating and Maintenance Manual

Upon receiving unit, check for any damage and report it immediately to the shipper. Also check to see that all accessory items are accounted for.

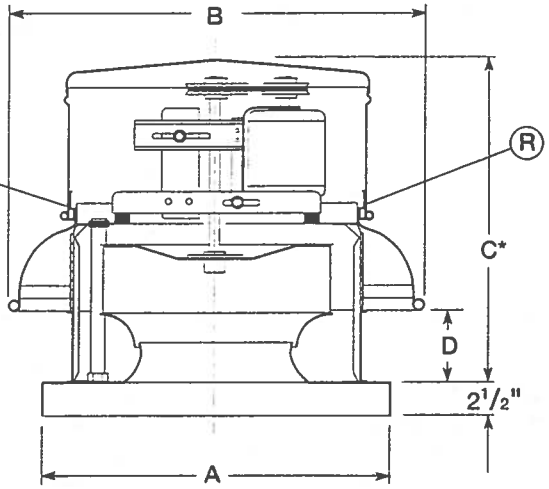
Move fan to desired location and fasten securely through mounting holes in base. Shims may be necessary depending upon roofing material thickness. The diagram below shows dimensions for Model GB.

Access to the motor compartment is accomplished by removing the screws designated "R" in Fig. 1 and 2. The cover can then be removed and placed on a flat surface in an area protected from strong winds.

The motor's amperage and voltage ratings must be checked for compatibility to supply voltage prior to final electrical connection. For GB installations, the electrical supply should be routed through the conduit chase provided between the curb cap and the bottom of the motor compartment. Wiring must conform to local and national codes.



GB Sizes 70-300
Fig. 1



GB Sizes 330-540
Fig. 2

MODEL	A sq.	B	C*	D	DAMPER	ROOF OPENING	APPROX. WEIGHT
GB-70, 80, 90	19	21 3/4	20 3/4	4	10x10	12 1/2 x 12 1/2	30
GB-100, 120	22	24 3/8	23 3/4	4 3/8	12x12	14 1/2 x 14 1/2	50
GB-130	22	28 3/8	23 3/4	4	12x12	14 1/2 x 14 1/2	60
GB-140, 160	26	28 3/8	23 3/4	4	16x16	18 1/2 x 18 1/2	90
GB-180, 200	30	35 1/2	28	5 1/2	18x18	20 1/2 x 20 1/2	101
GB-220, 240	34	42 3/4	31 1/2	5 3/4	24x24	26 1/2 x 26 1/2	123
GB-260, 300	40	50	36	8 1/4	30x30	32 1/2 x 32 1/2	208
GB-330, 360	46	58 3/4	38 1/2	8 7/8	36x36	38 1/2 x 38 1/2	275
GB-420	52	65 1/4	44	9 3/4	42x42	44 1/2 x 44 1/2	331
GB-480	58	73 3/4	47 1/4	11 1/4	48x48	50 1/2 x 50 1/2	396
GB-540	64	83	50 3/4	14 1/2	54x54	56 1/2 x 56 1/2	558

Dimension "A" is the inside dimension of the curb cap. The roof curb should be 1 1/2" less than the curb cap to allow for roofing and flashing.

*May vary depending on motor size.

Pre Starting Checks

Check all fasteners for tightness. The wheel should rotate freely and be aligned as shown in Fig. 3. (see pg. 2) Wheel position is preset and the unit is test run at the factory. Movement may occur during shipment, and realignment may be necessary. Centering can be accomplished by loosening the bolts holding the drive frame to the shock mounts and repositioning the drive frame. Wheel and inlet cone overlap can be adjusted by loosening the set screws in the wheel and moving the wheel to the desired position.

WHEEL OVERLAP DIMENSIONS

MODEL	G
70-160	1/4"
180-240	3/8"
260-540	1/2"

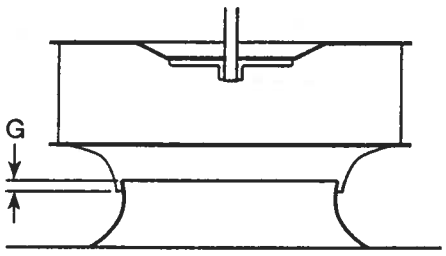


Fig. 3

WHEEL ROTATION

All GB fans have CW wheel rotation when viewed from top of fan.

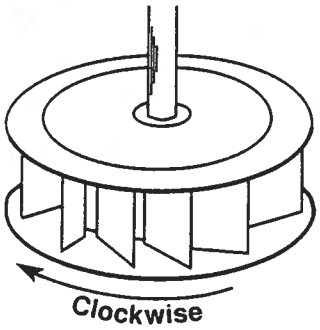


Fig. 4

Direction of wheel rotation is critical. Reversed rotation will result in poor air performance, motor overloading and possible burnout. Check wheel rotation (viewing from the shaft side) by momentarily energizing the unit. Rotation should be clockwise as shown in Fig. 4 and correspond to the rotation decal on the unit.

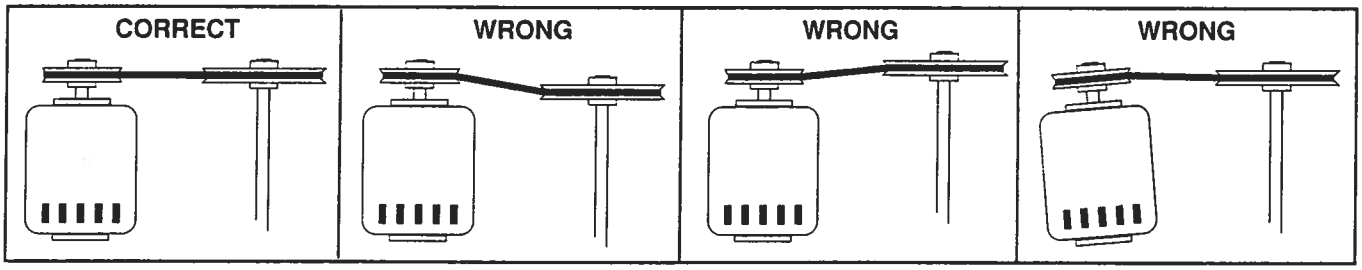


Fig. 5

If adjustments are made, it is very important to check the pulleys for proper alignment. Misaligned pulleys lead to excessive belt wear, vibration, noise and power loss. (See Fig. 5)

Belt tension can be adjusted by loosening four fasteners (marked "R") on the drive frame. For GB 70-200 units, pull motor until desired tension is achieved and retighen bolts (see Fig. 6). For GB 220-540 units, the motor plate slides on the slotted adjusting arms and drive frame angles in the same manner (see Fig. 7). Belt tension should be adjusted to allow 1/64" of deflection per inch of belt span. For example, a 15" belt span should have 15/64" (or about 1/4") of deflection with moderate thumb pressure at mid-point between pulleys. (See Fig. 8). Overtightening will cause excessive bearing wear and noise. Too little tension will cause slippage at startup and uneven wear.

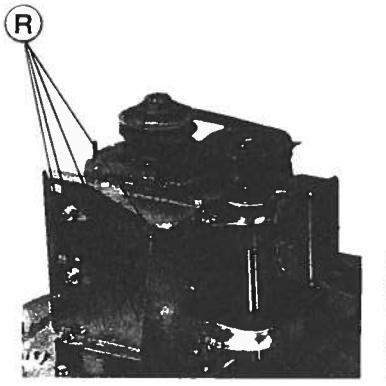


Fig. 6
GB 70-130

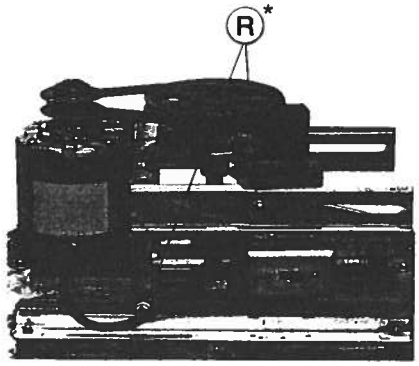
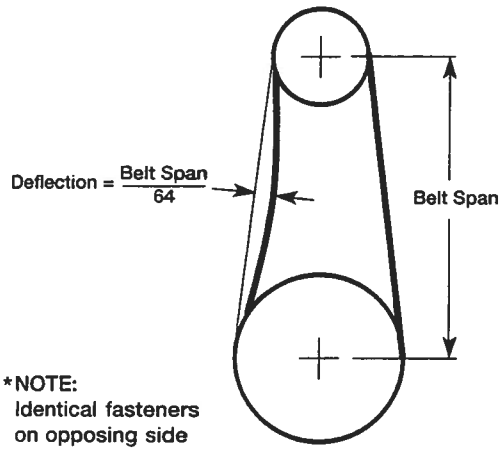


Fig. 7
GB 140-540



*NOTE:
Identical fasteners on opposing side must also be loosened.

Fig. 8

The adjustable motor pulley is factory set for the RPM specified. Speed can be increased by closing or decreased by opening the adjustable motor sheave. Two groove variable pitch pulleys must be adjusted an equal number of turns open or closed. Any increase in speed represents a substantial increase in the horsepower required by a unit. Motor amperage should always be checked to avoid serious damage to the motor when speed is varied.

MAINTENANCE

Belts tend to stretch after a period of time. They should be checked periodically for wear and tightness. When replacing belts, use the same type as supplied with the unit. Matched belts should always be used on units with multigroove pulleys. For belt replacement, loosen the tensioning device far enough to allow removal of the belt by hand. Do not force belts on or off. This may cause cords to break, leading to premature belt failure. Once installed, adjust belts as shown in "Pre-Startup Checks".

Shaft bearings can be classified in two groups: relubricating and non-relubricating. All bearings on standard Model GB fans are factory lubricated and require no further lubrication under normal use (between -20°F and 180°F in a relatively clean environment). Units installed in hot, humid or dirty locations should be equipped with special bearings. These bearings will require frequent lubrication. Caution should be employed to prevent overpacking or contamination. Grease fittings should be wiped clean. The unit should be in operation while lubricating. Extreme care should be used around moving parts. Grease should be pumped in very slowly until a slight bead forms around the seal. A high grade lithium base grease is recommended.

Motor maintenance is generally limited to cleaning and lubrication (where applicable). Cleaning should be limited to exterior surfaces only. Removing dust buildup on motor housing ensures proper motor cooling. Greasing of motors is only intended when fittings are provided. Many fractional hp motors are permanently lubricated and should not be lubricated further. Motors supplied with grease fittings should be greased in accordance with manufacturers' recommendations. Where motor temperatures do not exceed 104°F (40°C), the grease should be replaced after 2000 hours of running time as a general rule.

Wheels require very little attention when moving clean air. Occasionally, oil and dust may accumulate causing imbalance. When this occurs, the wheel and housing should be cleaned to ensure smooth and safe operation.

The unit should be made non functional when cleaning the wheel or housing (fuses removed, disconnect locked off, etc.).

All fasteners should be checked for tightness each time maintenance checks are performed prior to restarting unit.

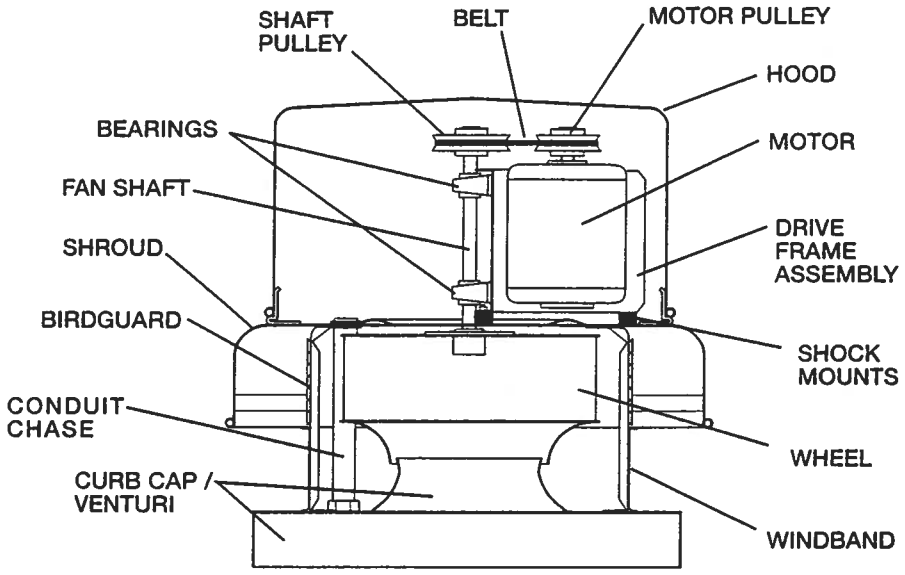
A proper maintenance program will help these units deliver years of dependable service.

TROUBLESHOOTING

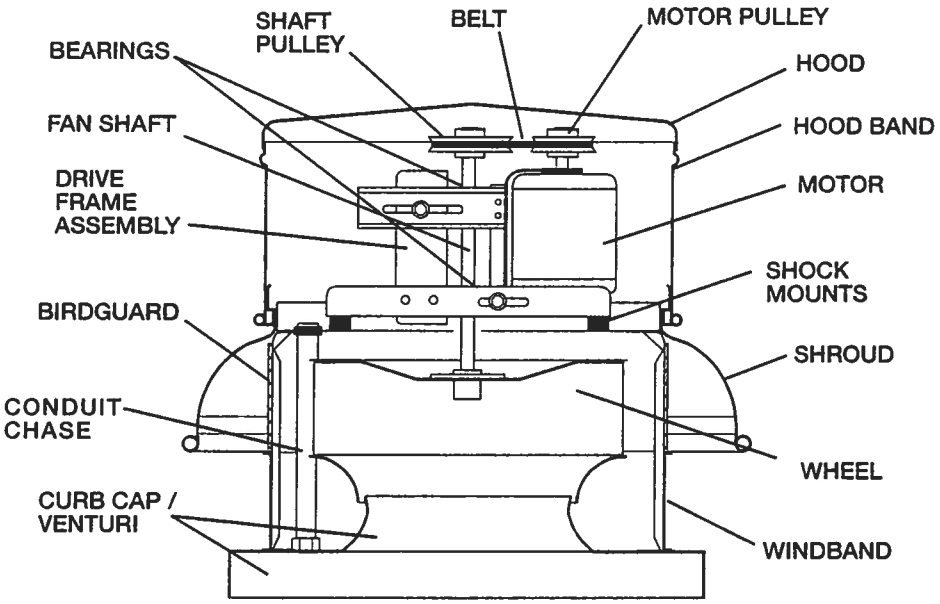
PROBLEM	CAUSE	CORRECTIVE ACTION
REDUCED AIRFLOW	System resistance too high	Check system: Proper operation of backdraft or control dampers, obstruction in ductwork, etc.
	Unit running backwards	Correct as shown in Fig. 4.
	Excessive dirt buildup on wheels	Clean wheel.
	Improper wheel alignment	Center wheel on inlets.
EXCESSIVE NOISE	Bad bearings	Replace.
	Belts too tight or too loose	Refer to Fig.8 and adjust tension.
	Wheel improperly aligned and rubbing	Center wheel on inlets. See Fig. 3
	Loose drive or motor pulleys	Align and tighten. See "Pre-Starting Checks".
	Foreign objects in wheel or housing	Remove objects, check for damage or unbalance.
	Unbalance of wheel caused by excessive dirt and grease buildup	Remove buildup.

NOTE: Before taking any corrective action, make certain unit is not capable of operation during repairs.

PARTS LIST



GB SIZES 70-300



GB SIZES 330-540

NOTE: Each fan bears a manufacturer's nameplate with model number and serial number embossed. This information will assist the local Greeheck representative and the factory in providing service and replacement parts.

WARRANTY

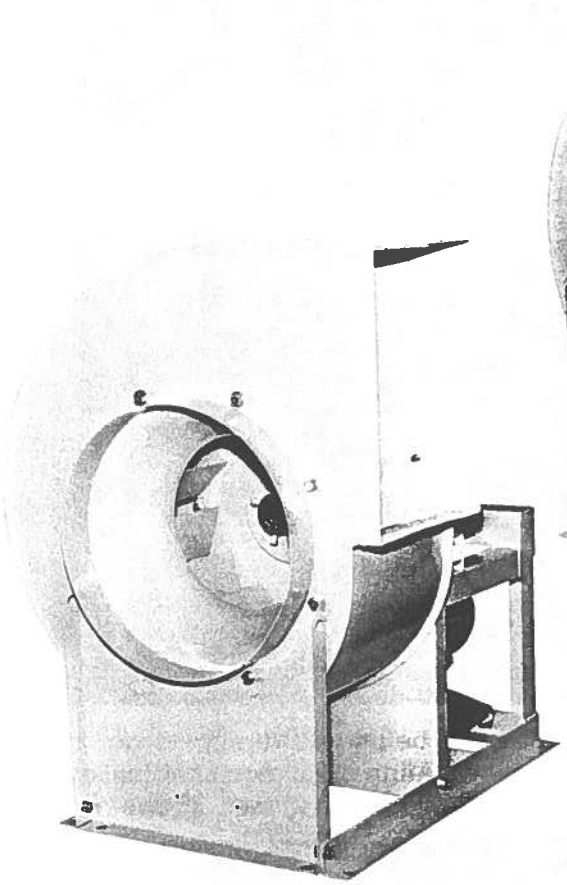
Greenheck warrants this equipment to be free from defects in material and workmanship for a period of one year from the purchase date. Any units or parts which prove to be defective during the warranty period will be repaired at our option when returned to our factory, transportation prepaid. The motor is warranted by the motor manufacturer for a period of one year. Should the motor prove defective during this period, it should be returned to the nearest authorized motor service station. Greenheck will not be responsible for any installation or removal costs.

GREENHECK

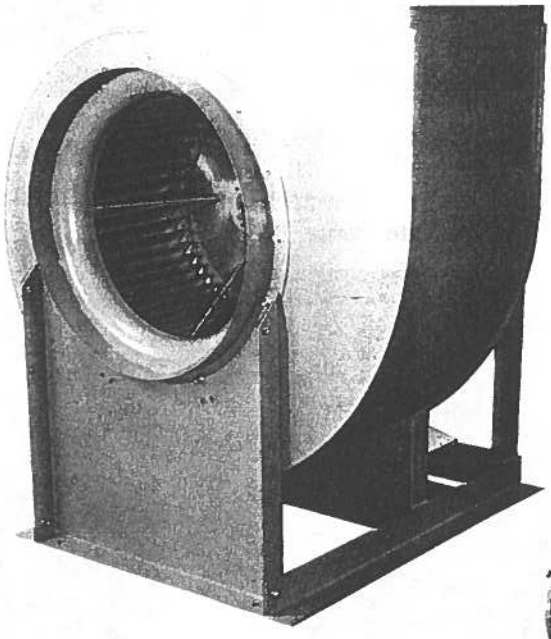
GREENHECK
P.O. BOX 410 SCHOFIELD, WISCONSIN 54476-0410
PH. 715-359-6171

CENTRIFUGAL UTILITY FANS MODELS SWB, SFB AND SFD

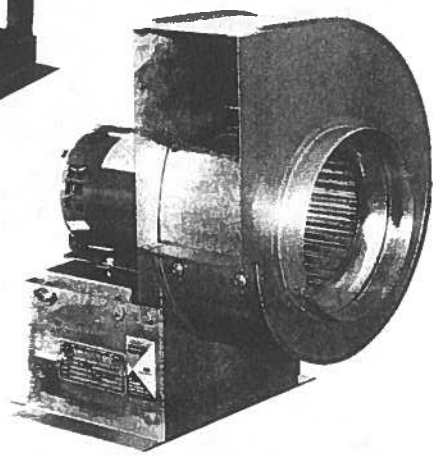
INSTALLATION, OPERATING AND MAINTENANCE MANUAL



MODEL SWB



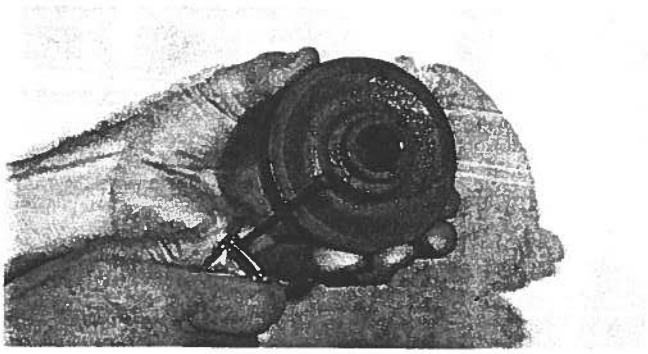
MODEL SFB



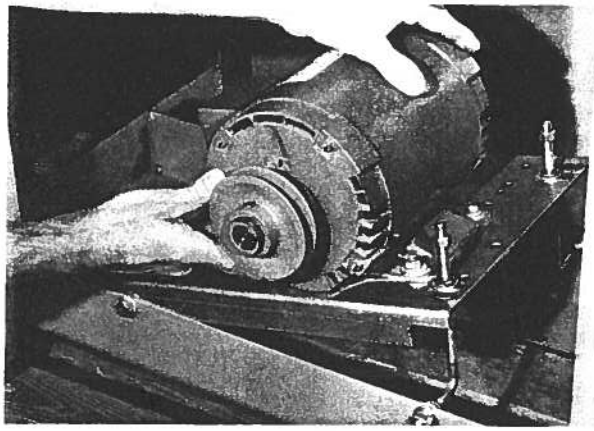
MODEL SFD

TABLE OF CONTENTS

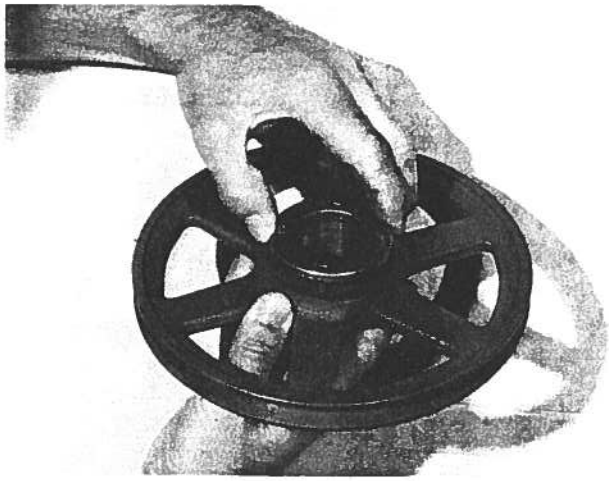
MOTOR AND DRIVE INSTALLATION INSTRUCTIONS
(For Model SWB units shipped from stock without motors or drives)



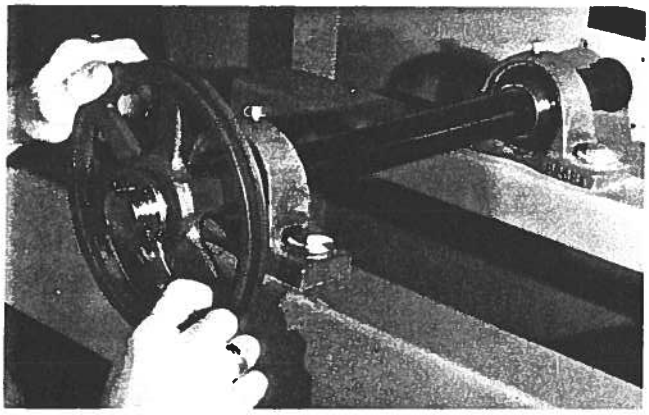
[ ] 1. Adjust motor pulley to it's closed position for maximum fan speed or increments of 1/2 turn open (maximum of 5 turns open) for reduced fan speed. Tighten set screw on flat area only.



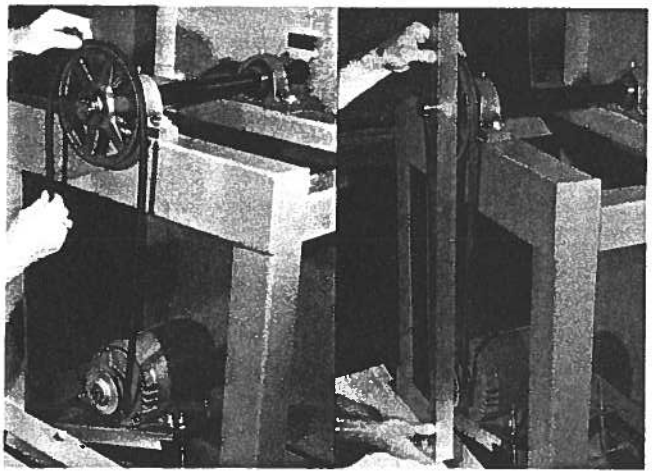
[ ] 2. Install motor pulley to the motor shaft and install motor to the motor plate. Prepunched holes are provided for most common motor frame sizes.



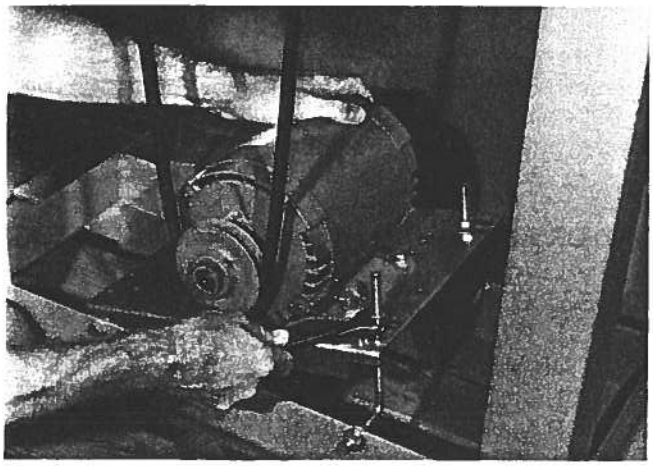
[ ] 3. If supplied, install taperlock bushing into shaft pulley.



[ ] 4. Install shaft pulley to fan shaft.



[ ] 5. Install drive belt(s). Belts should not be forced over pulleys. Align motor and shaft pulleys with a straight edge. Tighten all set screws.



[ ] 6. Adjust belt tension. See page 5 for belt tensioning instructions.

INSTALLATION

Inspect the unit for any damage and report it to the shipper immediately. Also, check to see that all accessory items are accounted for.

Move the fan to the desired location and fasten securely through mounting holes provided in the base angles. The unit must be set level (Shimming may be necessary). Flexible duct connections and vibration isolators should be used where noise is a factor.

The motor voltage and ampere rating must be checked for compatibility with the electrical supply prior to final electrical connection. Supply wiring to the fan must be properly fused and conform to local and national electrical codes.

The discharge is factory set as specified by customer order, however, it can be rotated to other discharge positions in the field if necessary. Removal of the housing bolts allows the discharge to be rotated to the clockwise positions below (Fig. 1). For TAD, BD and BAD discharge positions a portion of the frame angle must be removed.

VIEWED FROM DRIVE SIDE OF THE FAN

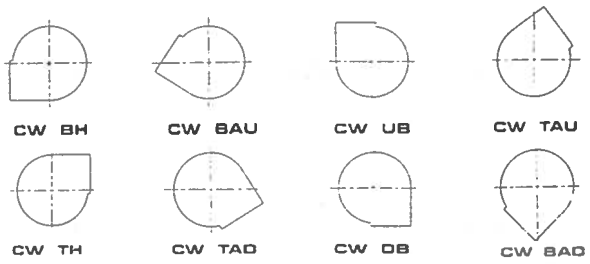


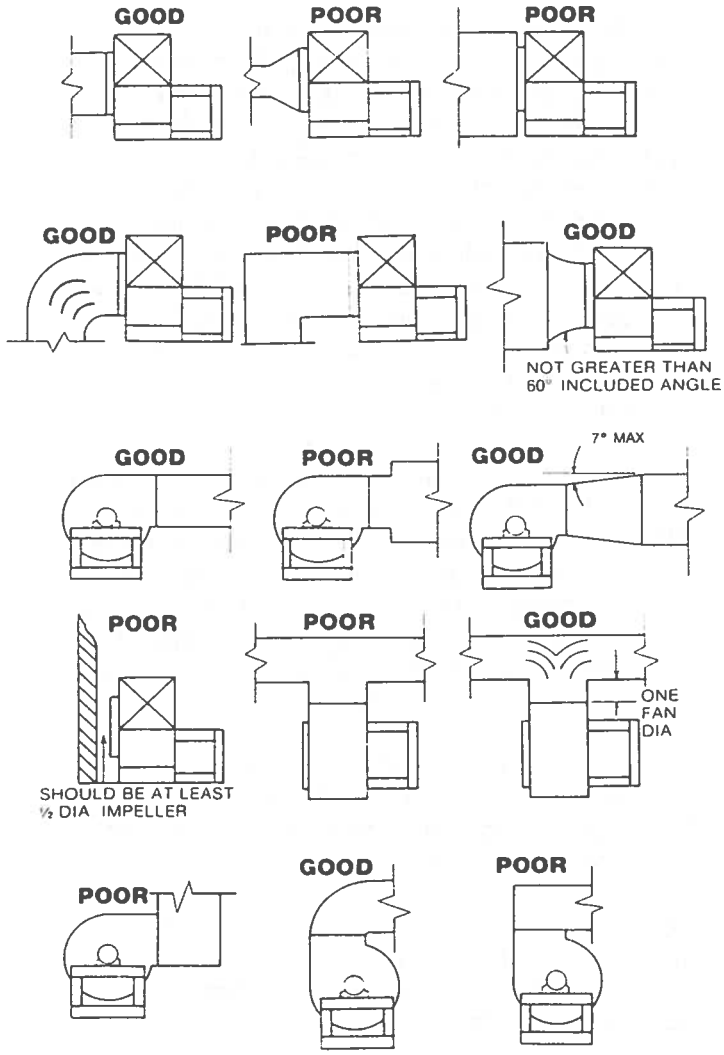
Fig. 1

Clockwise rotation shown. Counterclockwise discharge positions are a mirror image of those shown. Fan rotation is always viewed from the drive side of the housing.

EFFECT OF INSTALLATION ON PERFORMANCE

Restricted or unstable flow at the fan inlet can cause pre-rotation of incoming air or uneven loading of the fan wheel, yielding large system losses, increased sound levels and structural failure of the fan wheel. Free discharge or turbulent flow in the discharge ductwork will also result in system effect losses.

The examples below show the system layout and inlet and discharge configurations which can affect fan performance.



PRE-STARTING CHECKS

Wheels must rotate freely and not rub on the inlet venturi. Model SWB wheels overlap the inlet venturi as shown in figure 2. Refer to the SWB fan wheel overlap and radial gap chart for proper dimensions.

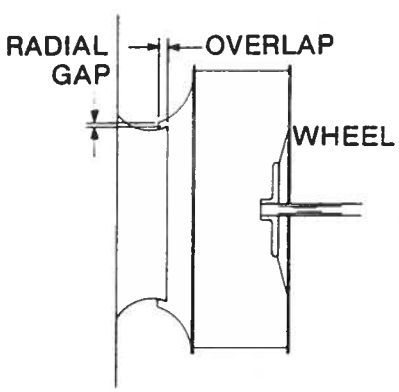
Models SFD and SFB wheels do not overlap the venturi, but have a gap between the inlet venturi and the wheel (Fig. 3). Wheel position is preset at the factory and the unit is test run. Wheel movement may occur during shipment or installation and wheel alignment may be necessary.

On belt drive units, centering can be accomplished by (1) loosening the inlet cone bolts to move the inlet cone or by (2) loosening the bearings in order to move the shaft. Wheel and inlet cone overlap can be adjusted by loosening the wheel hub set screw and moving the wheel to the desired position. Tighten all fasteners and set screws securely and realign drive pulleys after adjustment. Check pulleys and belts for proper alignment to avoid unnecessary belt wear, noise, vibration and power loss. Motor and drive shafts must be parallel and pulleys in line (Fig. 4).

The adjustable motor pulley is set at the factory for the fan RPM specified by the customer. Fan RPM can be increased by closing or decreased by opening the adjustable motor pulley. Multi-groove variable pitch pulleys must be adjusted an equal number of turns open or closed. Any increase in fan speed represents a substantial increase in load on the motor.

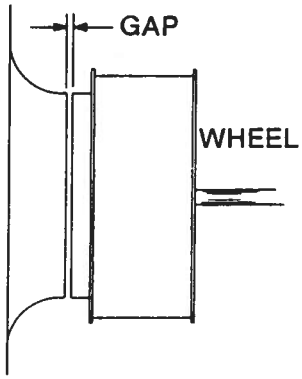
To avoid motor overheating and possible burnout, motor load amperes should always be check and compared to nameplate rating when fan speed is increased.

Rotation direction of the wheel is critical and incorrect rotation will result in reduced air performance, increased motor loading and possible motor burnout.



MODEL SWB

Fig. 2

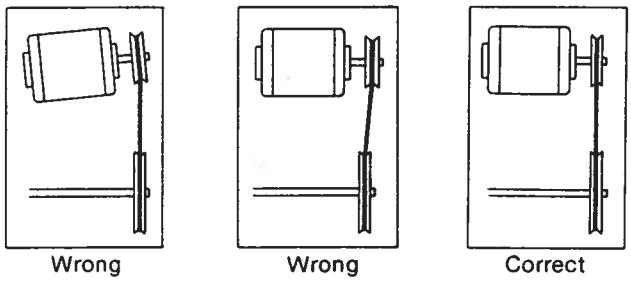


MODEL SFD OR SFB

Fig. 3

APPROXIMATE WHEEL CLEARANCE DIMENSIONS

Unit Size	SWB Overlap (Inches)	SWB Radial Gap (Inches)	SFD GAP (In.)	SFB GAP (In.)
6	-	-	3/8	-
7	-	-	3/8	-
9	-	-	1/2	1/2
10	3/8	5/32	1/2	1/2
12	3/8	5/32	-	1/2
13	7/16	5/32	-	1/2
15	1/2	5/32	-	1/2
16	1/2	5/32	-	-
18	5/8	5/32	-	1/2
20	5/8	5/32	-	5/8
22	11/16	5/32	-	5/8
24	3/4	5/32	-	-
25	-	-	-	3/4
27	7/8	3/16	-	3/4
30	15/16	3/16	-	3/4
33	1-1/16	3/16	-	-
36	1-3/16	3/16	-	-



Wrong Wrong Correct

Fig. 4

Check wheel rotation by momentarily energizing the unit and noting if rotation is in the same direction as the airflow at the outlet and conforms to the rotation decal affixed to the unit (Fig. 5). NOTE: Models SFD and SFB units should be operated only when attached to the system for which they were designed. Without proper system static pressure the motor could be seriously overloaded.

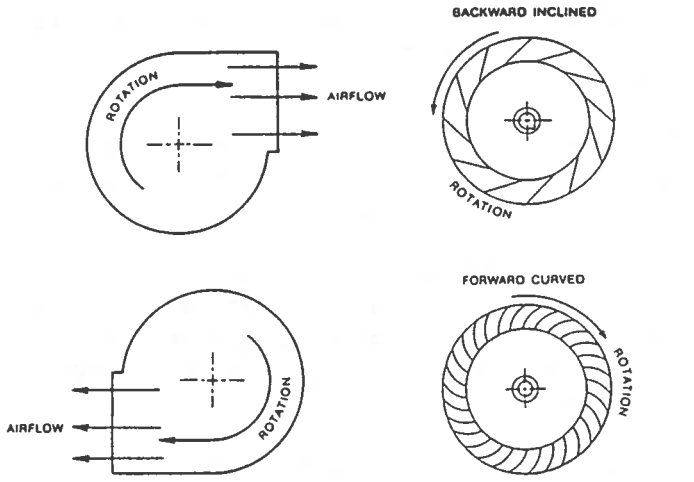


Fig. 5

WHEELS VIEWED FROM THE DRIVE SIDE

****

WARNING

DISCONNECT AND SECURE TO THE "OFF" POSITION ALL ELECTRICAL POWER TO THE FAN PRIOR TO INSPECTION OR SERVICING. FAILURE TO COMPLY WITH THIS SAFETY PRECAUTION COULD RESULT IN SERIOUS INJURY OR DEATH.

****

BLOWER MAINTENANCE (BELT DRIVE)

Belts tend to stretch after a period of time. They should be periodically checked for tension and wear. When replacing belts, use the same type as supplied with the unit. Replacement of belts should be accomplished by loosening the tensioning "L-bolts" so the belts may be removed by hand. Do not force belts on or off as this may cause breakage of cords and lead to premature belt failure.

Belt tension should be adjusted to allow 1/64" of belt deflection per 1" of belt span. For example, a 16" belt span should have 16/64" or 1/4" of deflection with moderate thumb pressure at mid-point between the pulleys. (Fig. 6).

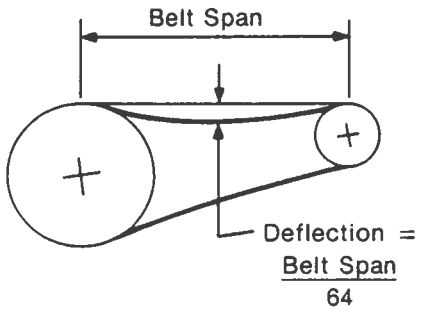


Fig. 6

Shaft bearings are the most critical moving part of a fan. Therefore, special attention should be given to keeping the bearings clean and well lubricated. Proper lubrication provides for reduction in friction and wear, transmission and dissipation of heat, extended bearing life and prevention of rust.

In order for a lubricant to fulfill these tasks, the proper grease applied at regular intervals is required. See the recommended bearing lubrication schedule.

BEARING LUBRICATION SCHEDULE FOR GREENHECK UTILITY FANS

(Relubrication schedule in months)

FAN RPM	Shaft Diameter in inches	
	1 to 1 1/2	1 3/4 to 2
To 500	6	6
500-1000	6	5
1000-1500	5	4
1500-2000	4	3
2000-2500	4	2
2500-3000	3	1
3000-3500	2	1

If unusual conditions exist - temperatures below 32°F or above 200°F, moisture or contaminants - more frequent lubrication is required.

With the unit running add grease very slowly with a manual grease gun until a slight bead of grease forms at the seal.

Be careful not to unseat the seal by over lubricating or using excessive pressure. A guide to the amount of grease to be used is to fill 30% to 60% of available space in the bearing and housing.

A high quality lithium based grease conforming to NLGI Grade 2 consistency, such as those listed below, should be used.

Mobil 532
Mobilux #2
B Shell Alvania #2
Texaco Multifak #2
Texaco Premium #2
Unirex N2

In addition to lubricating the bearings at specified intervals, set screws in the bearing collars should be checked for tightness. *A bearing collar which has loosened will cause premature failure of the fan shaft.* Fasteners attaching the bearings to the drive frame should also be checked.

MOTOR MAINTENANCE (BELT AND DIRECT DRIVE)

Motor maintenance is generally limited to cleaning and lubrication (where applicable). Cleaning should be limited to exterior surfaces only. Removing dust and grease build-up on the motor housing assures proper motor cooling. Use caution and do not allow water or solvents to enter the motor or bearings. Under no circumstances should motors or bearings be sprayed with steam, water or solvents.

Greasing of motors is intended only when fittings are provided. Many fractional horsepower motors are permanently lubricated for life and require no further lubrication. Motors supplied with grease fittings should be greased in accordance with the manufacturer's recommendations.

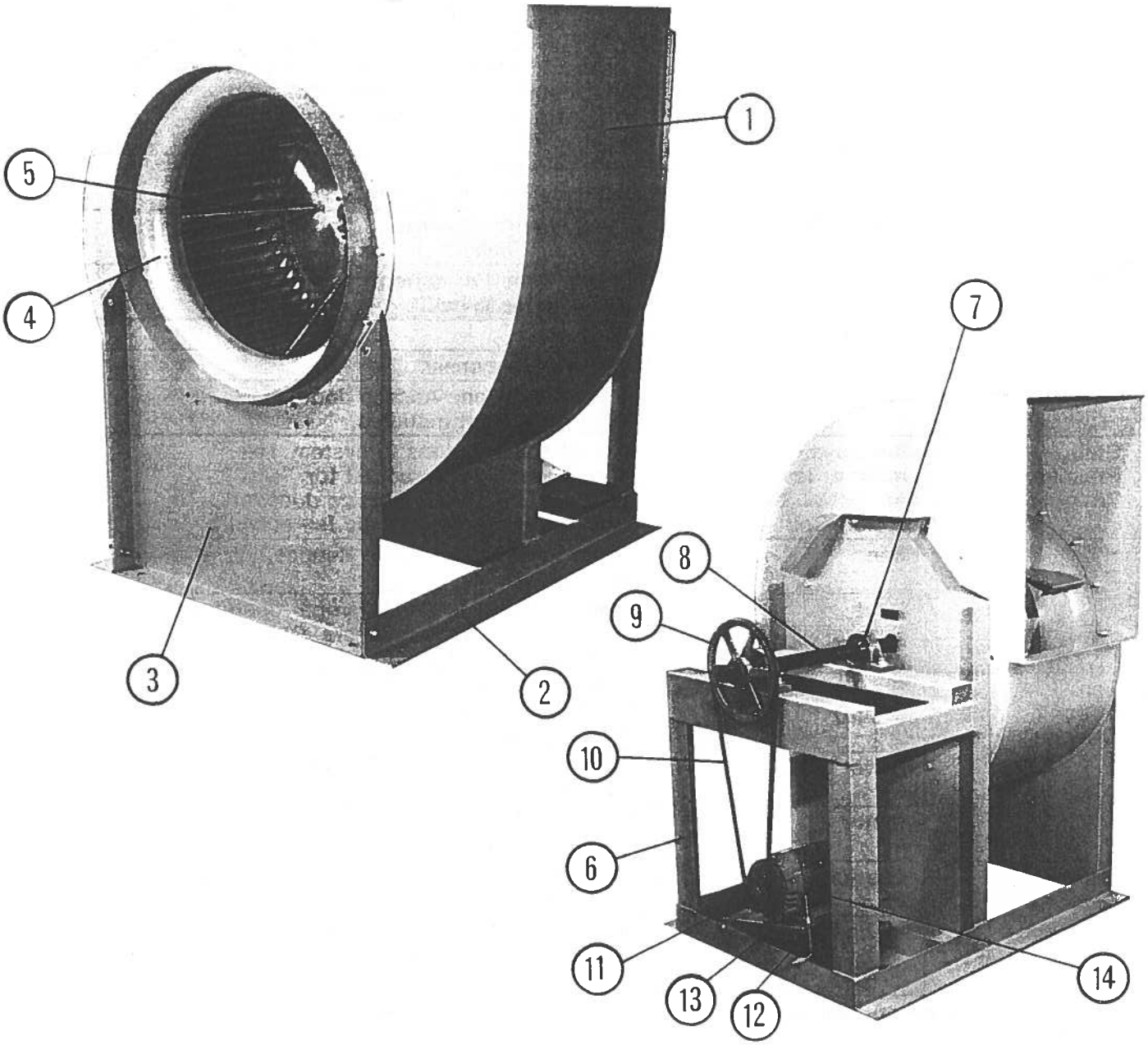
WHEEL AND FASTENER MAINTENANCE

Wheels require very little attention when exhausting clean air, however air heavily laden with grease or dirt will tend to accumulate on the wheel causing unbalance. Wheels exhausting dirty or grease laden air require frequent cleaning to assure smooth and safe operation.

All fasteners, including set screws in the bearing collars, should be checked for tightness each time maintenance checks are performed.

A proper maintenance program will help preserve the performance and reliability designed into the fan.

PARTS LIST



Always provide the unit model and serial number when requesting parts or information.

REPLACEMENT PARTS		
1. Scroll housing	6. Drive frame assembly	11. Motor pulley
2. Drive frame - Base angle	7. Pillow block bearings	12. Belt tensioning bolts
3. Intake support panel	8. Fan shaft	13. Motor plate
4. Inlet ring and cone	9. Shaft pulley	14. Motor
5. Wheel (Specify rotation)	10. Belt	

TROUBLESHOOTING

Problem	Cause	Corrective Action
Excessive Noise	Wheel Rubbing Inlet	Adjust wheel and/or inlet cone. Tighten wheel hub or bearing collars on shaft.
	V-Belt Drive	Tighten sheaves on motor/fan shaft. Adjust belt tension. Align sheaves properly (see page 4). Replace worn belts or sheaves.
	Bearings	Replace defective bearing(s). Lubricate bearings. Tighten collars & fasteners.
	Wheel Unbalance	Clean all dirt off wheel. Check wheel balance, rebalance inplace if necessary.
Low CFM	Fan	Check wheel for correct rotation. Increase fan speed.*
	Duct System	See page 3.
High CFM	Fan	Decrease fan speed.
	Duct System	Resize ductwork. Access door, filters, grills not installed.
Static Pressure Wrong	Duct system has more or less restriction than anticipated	Change obstructions in system. Use correction factor to adjust for temperature/altitude. Resize ductwork. Clean filters/coils. Change fan speed.*
High Horsepower	Fan	Check rotation of wheel. Reduce fan speed.
	Duct System	Resize ductwork. Check proper operation of face and bypass dampers. Check filters and access doors.
Fan Doesn't Operate	Electrical Supply	Check fuses/circuit breakers. Check for switches off. Check for correct supply voltage.
	Drive	Check for broken belts. Tighten loose pulleys.
	Motor	Assure motor is correct horsepower and not tripping overload protector.
Overheated Bearing	Lubrication	Check for excessive or insufficient grease in the bearing.
	Mechanical	Replace damaged bearing. Relieve excessive belt tension. Align bearings. Check for bent shaft.

NOTE: Always provide the unit model and serial numbers when requesting parts or service information.

*Always check motor amps and compare to nameplate rating. Excessive fan speed may overload the motor and result in burnout.

WARRANTY

The Greenheck Fan Corporation warrants this equipment to be free from defects in material and workmanship for a period of one year from the purchase date. This warranty limits our responsibility to repairing or replacing, to the original purchaser, any part or parts of said equipment found to be defective upon examination by representatives of Greenheck Fan Corporation. Additionally, said part or parts will be returned to and received by the factory only after prior authorization, with transportation charges prepaid.

Greenheck Fan Corporation shall not be obligated under this warranty, for payment of any delivery, removal or installation charges with regard to repair or replacement of any defective part or parts.

Motors are warranted by the motor manufacturer for a period of one year. Should motors furnished by Greenheck Fan Corporation prove defective during this period, they should be returned to the nearest authorized motor service station.

RUSKIN®

3900 Dr. Greaves Rd. • Kansas City, MO 64030 • (816) 761-7476 • FAX (816) 765-8955

INSTALLATION INSTRUCTIONS
1½ HOUR UL CLASSIFIED CURTAIN TYPE FIRE DAMPERS MODELS (D-)IBD2, IBDT, IBDT1, and IBDT2

APPLICATION

The fire damper models shown on this sheet are marked with a 1½ hour fire damper label and are approved for use in fire walls or floors with ratings of less than 3 hours. Fire Dampers require a field-or factory-installed sleeve. Select a sleeve of sufficient length to permit attachment, with perimeter mounting angles, to duct work on each side of wall or floor opening.

(All sizes apply to galvanized and stainless steel construction unless indicated otherwise)

DYNAMIC FIRE DAMPERS – DIBD and DIBDX models

See label on damper for maximum air flow and pressure.

MODEL D-IBD2 MAXIMUM SIZE

Single Section
Vertical or Horizontal Installation – 33"w x 36"h (838 x 914).
Multiple Section Assembly
Vertical Installation, galvanized steel construction – 120"w x 72"h (3048 x 1829).
Vertical Installation, stainless steel construction – 99"w x 72"h (2515 x 1829).
Horizontal Installation – 114"w x 38"h or 90"w x 91"h (2896 x 965 or 2286 x 2301).

MODELS DIBDT, DIBDT1, AND DIBDT2 MAXIMUM SIZE

Single Section
Vertical Installation – 40"w x 48"h (1016 x 1219).

INSTALLATION SUPPLEMENTS

Refer to the appropriate Ruskin installation operation instructions supplements for special requirements:

- S-and-Drivemate No. 14880
- Ductmate
- Sealing of Dampers in Fire Rated Walls or Floors
- Picture Frame Mounting Angles
- Metal Stud Framing for Fire Dampers in Drywall Partitions
- Metal Stud Framing for Fire Dampers in Drywall Design No. U438
- Wood Stud Framing for Fire Dampers in Drywall Partitions

STATIC FIRE DAMPERS – IBD models

Not for use in dynamic (fans on) systems.

MODEL IBD2 MAXIMUM SIZE

Single Section
Vertical Installation – 48"w x 30"h or 33"w x 72"h (1215 x 762 or 838 x 1829).
Horizontal Installation – 33"w x 38"h or 30"w x 45½"h (838 x 965 or 762 x 1156).
Multiple Section Assembly
Vertical Installation, galvanized steel construction – 120"w x 72"h (3048 x 1829).
Vertical Installation, stainless steel construction – 99"w x 72"h (2515 x 1829).
Horizontal Installation – 114"w x 38"h or 90"w x 91"h (2896 x 965 or 2286 x 2301).

MODELS IBDT, IBDT1, AND IBDT2 MAXIMUM SIZE

Single Section
Vertical Installation – 40"w x 48"h (1016 x 1219).
Horizontal Installation – 60"w x 12"h (1524 x 305).

These instructions comply with Underwriters Laboratories Safety Standard 555. UL File No. R5531.

SEE DETAILS ON UL CLASSIFICATION MARKING ON ENCLOSED PRODUCT

California State Fire Marshal Listing No. 3225-245:005 (Vert. only)

Note:
Dimensions shown in parentheses ( ) indicate millimeters.

1. Expansion Clearance

Expansion clearance is required for all fire damper/sleeve assemblies. The opening in the wall or floor must be a minimum of 1/8" per foot (3 per 305) larger than the overall damper/sleeve assembly size for galvanized steel dampers and a minimum 3/16" per foot (5 per 305) for stainless steel dampers. The maximum opening size is 1" (25) larger than the minimum clearance dimensions above. Example: Opening for a 36" x 24" damper/sleeve assembly can be 36 3/8" x 24 1/4" minimum up to 37 3/8" x 25 1/4" maximum. All openings must be at least 1/4" (6) larger than the damper/sleeve assembly.

2. Fasteners and Multiple Section Assembly

Use No. 10 (M5) bolts or screws, 3/16" (5) rivets, tack welds or spot welds as depicted in figures 2 and 4 and spaced as follows when joining individual dampers to make multiple section damper assemblies or when fastening damper to the sleeve:

Vertical Mount (In wall)	
Galvanized steel dampers	12" (305) spacing
Stainless steel dampers	6" (152) spacing
Horizontal Mount (In floor)	
All dampers	6" (152) spacing

Multiple section horizontal mount dampers require a 14 gage thick x 4 1/2" (2 x 114) wide steel mullion plate sandwiched between the damper frames with 1/2" (13) long welds staggered intermittently and spaced on maximum 6" (152) centers. The mullion plate must be the same material as the dampers. The mullion length must be equal to the damper width of two or more adjoining damper sections. Mullions are not required for assemblies consisting of two dampers attached end-to-end or three dampers attached side-to-side as depicted in figure 5.

3. Damper Sleeve

Damper sleeve must be minimum 26 gage (.6) up to a maximum 10 gage (3.5) steel. Sleeve thickness must be equal to or thicker than the duct connected to it. Sleeve gage requirements are listed in the SMACNA Fire, Smoke and Radiation Damper Installation Guide For HVAC Systems and in NFPA90A. If a break-away style duct/sleeve connection is not used, sleeve must be 16 gage (1.6) minimum for dampers up to 36" wide or 24" height and 14 gage (2) minimum when damper exceeds 36" wide or 24" high. Sleeve must be fastened to damper as described in (note 2). Sleeve must not extend more than 6" (152) out of the wall or floor. Exception – Dampers equipped with factory installed access door may extend 16" (406) out of the wall or floor on the access door side. Sleeves must terminate on both sides of the wall or floor within the dimension shown in figures 1 and 3.

4. Damper Orientation

Damper must be installed with the blades within the wall or floor when they are in the closed position. Use "Air Flow" and "Mount With Arrow Up" labels on Dynamic DIBD and DIBDX models for proper damper orientation. For Static IBD models use only "Mount With Arrow Up" label on damper for proper damper orientation.

5. Mounting Angles

Ruskin Picture Frame Mounting Angles can be used as shown in the supplemental installation instructions in lieu of the following conventional mounting angles.

Galvanized dampers 50" x 60" or 60" x 50" (1270 x 1524 or 1524 x 1270) or smaller require minimum of 1 1/2" x 1 1/2" x 16 gage (38 x 38 x 1.6) conventional mounting angles fastened to the damper sleeve with No. 10 (M5) bolts or screws, 3/16" (5) rivets, tack welds or spot welds as depicted in figures 1 and 3, spaced a maximum of 6" (152) on center.

Larger dampers require minimum 1 1/2" x 1 1/2" x 14 gage (38 x 38 x 2) conventional mounting angles fastened to damper sleeve with No. 10 (M5) bolts or screws, 3/16" (5) rivets, tack welds or spot welds as depicted in figures 1 and 3 and spaced as follows:

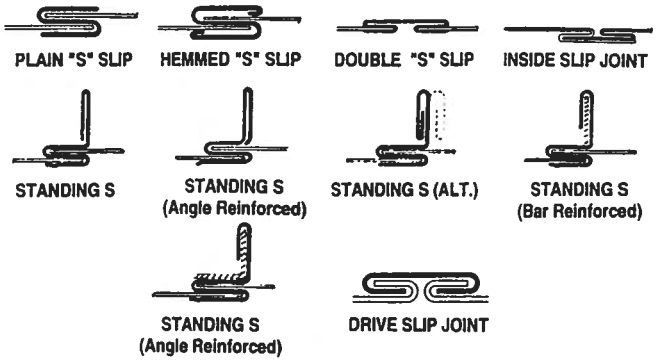
Galvanized steel dampers	12" (305) spacing
Stainless steel dampers	6" (152) spacing

Mounting angles must overlap the wall or floor a minimum of 1" (25). Do not fasten angles together at corners of the damper/sleeve assembly.

6. Duct/Sleeve Connections

Break-away Duct/Sleeve Connections

Rectangular ducts must use one or more of the connections depicted below:



A maximum of two #10 sheet metal screws on each side and the bottom, located in the center of the slip pocket and penetrating both sides of the slip pocket may be used. Connections using these slip joints on the top and bottom with flat drive slips up to 20" (508) long on the sides may also be used.

Round and Oval Break-away Connections

Round and flat oval break-away connections must use either a 4" (102) wide drawband or #10 sheet metal screws spaced equally around the circumference of the duct as follows:

- Duct diameters 22" (559) and smaller – 3 screws.
- Duct diameters over 22" (559) and including 36" (914) – 5 screws. For flat oval ducts, the diameter is considered the largest (major) dimension of the duct.

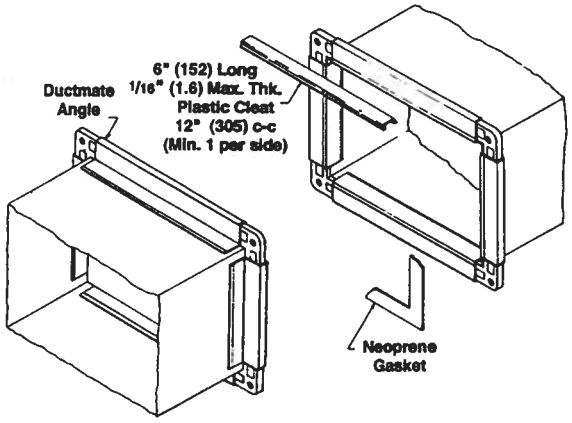
Note: When optional sealing of these joints is desired, the following sealants may be applied in accordance with the sealant manufacturer's instructions:

Hardcast, Inc. – Iron Grip 601

Precision – PA2084T

Flanged Break-away Style Duct Sleeve Connections.

Flanged connection systems manufactured by Ductmate, Nexus or Ward are approved break-away when installed as depicted.



TDC (by Lockformer) and TDF (by Engle) flanged connections are approved break-away when installed as described in the TDC or TDF addendum to the SMACNA Duct Construction Standards except the corners may not be bolted. The standard 6" (152) metal clip may be used with spacing as depicted in the addendum.

Non-Break-away Duct/Sleeve Connections

If other duct sleeve connections are used, the sleeve shall be a minimum of 16 gage (1.6) for dampers up to 36" (914) wide x 24" (610) high and 14 gage (2.0) for dampers exceeding 36" (914) wide x 24" (610) high.

VERTICAL INSTALLATION

FIGURE 1

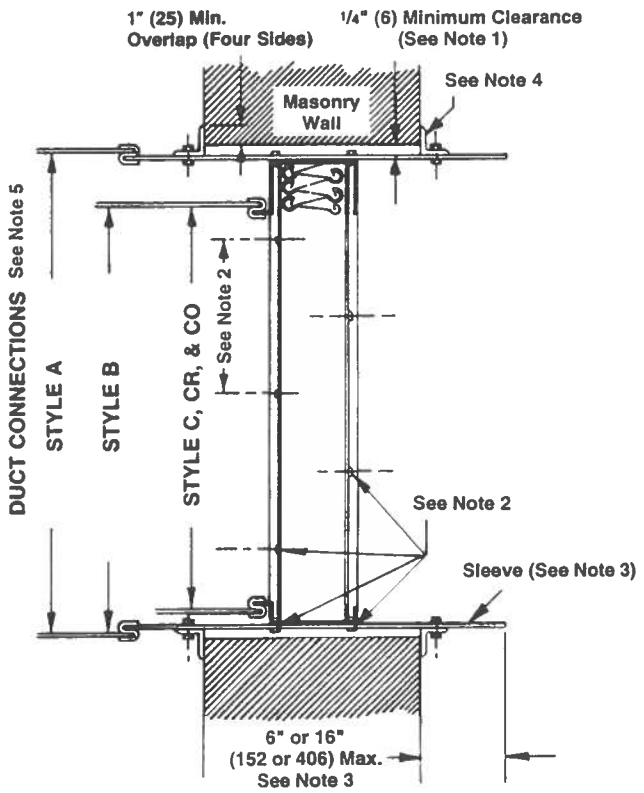
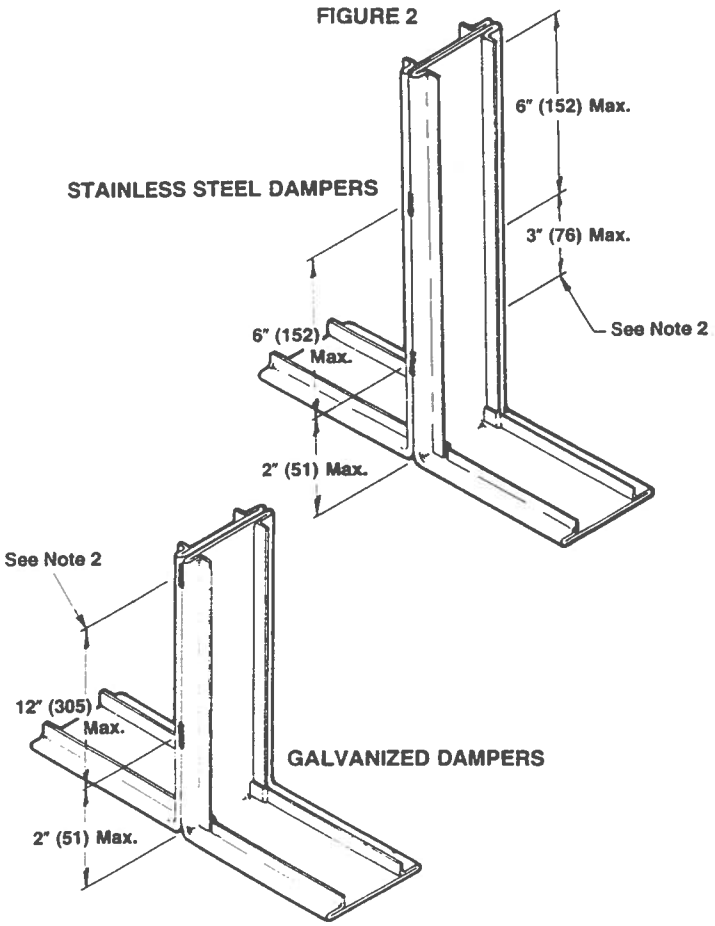


FIGURE 2



HORIZONTAL INSTALLATION

FIGURE 3

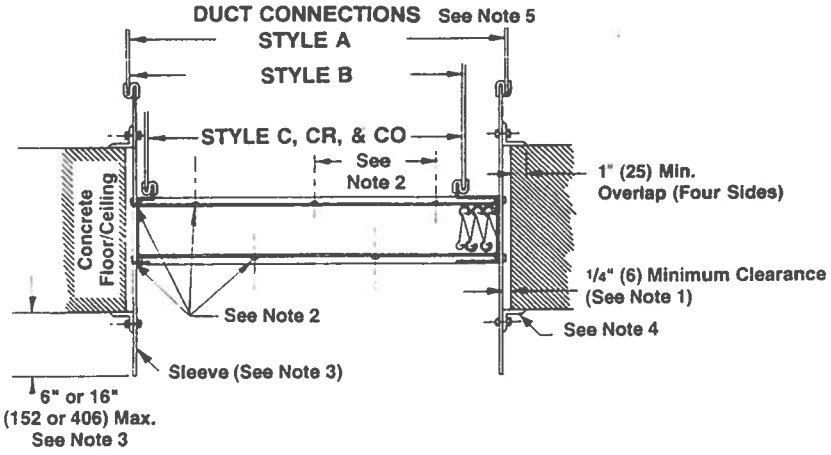


FIGURE 4

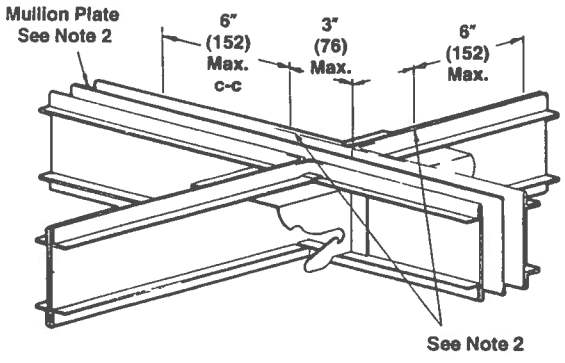
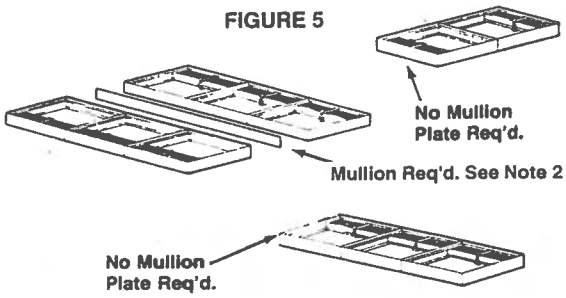


FIGURE 5



RUSKIN®

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(816) 761-7476
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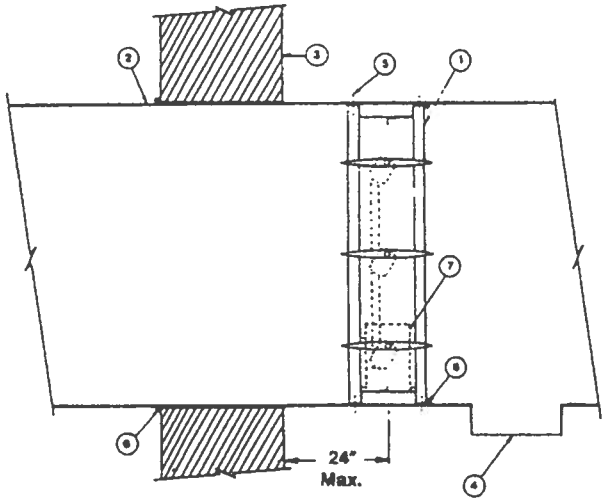
RUSKIN®

PO BOX 129 Grandview, Mo. 64030

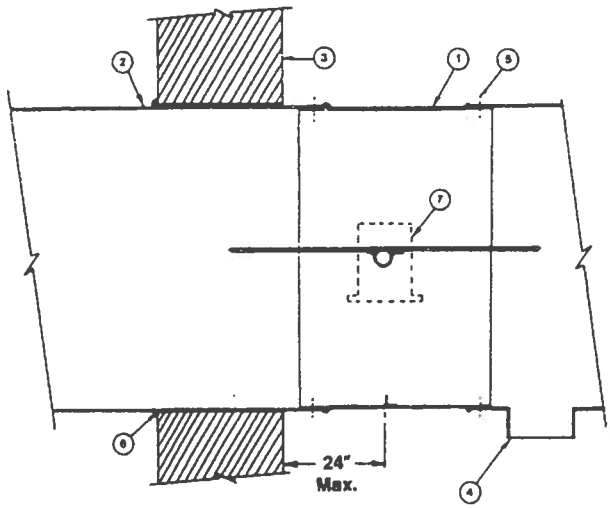
INSTALLATION INSTRUCTIONS

LEAKAGE RATED DAMPERS

MODELS SD34, SD35, SD36, SD37, SD50, SD60, SDS25, and SDRS25



SD34, SD35, SD36, SD37, SD50, or SD60 Multiple Blade Leakage Rated Damper Installed Within a Duct or Sleeve (SD50/SD60 Shown)



SDS25 or SDRS25 Single Blade Leakage Rated Damper Installed Within a Duct or Sleeve

APPLICATION

Leakage rated dampers are designed to operate with blades running horizontally. Dampers can be vertically or horizontally installed, in accordance with NFPA-90A, at or adjacent to the point where the duct passes through the smoke barrier. In no case shall the damper be installed more than 24" from the smoke barrier or after the first duct or outlet.

GENERAL INSTALLATION

To ensure optimum operation and performance, install damper squarely and free from racking. Do not compress or stretch the damper frame into the duct or opening.

When dampers are joined and installed as a multiple damper assembly, dampers fasten together at adjoining mullions with No. 8 bolts or screws, ½" long welds, or 3/16" tubular steel rivets. Dampers more than one section wide and one section high require bracing at every horizontal mullion, as well as vertical bracing, a minimum of 8' apart on center.

The damper fastens to the duct, sleeve, or wall opening with No. 8 bolts or screws, ½" long welds, or 3/16" tubular steel rivets.

All fastenings must be spaced a maximum of 12" apart, center to center with a minimum of two fastenings per side.

A ⅛" bead of the appropriate sealant — Dow-Corning 999, Dow-Corning Silastic 732 RTV, or GE RTV 108 — shall be applied to the entire mullion joint. The surface of the sealant shall be pressed into place to dispel any air. Apply sealant in the same manner between the damper and sleeve or duct around one side of the damper's downstream face.

These Instructions comply with Underwriters Laboratories Safety Standard 555SS.

II-SD1289/Replaces II-SD587

ITEM	DESCRIPTION
1.	Damper
2.	Duct (Sleeve)
3.	Smoke Barrier
4.	Duct Outlet
5.	No. 8 (Minimum) Fastener
6.	Caulking Material
7.	Operator/Actuator

Damper may be supplied without operator/actuator installed. Ruskin's U.L. listed Fire Damper Operators specified on damper marking may be field installed. See Operator/Actuator Installation instructions for field mounting of damper operators.

SEE DETAILS ON UL CLASSIFICATION MARKING ON ENCLOSED PRODUCT

3900 Dr. Greaves Rd.
Grandview, MO 64030
(816) 761-7476
FAX (816) 765-8955

INSTALLATION OF BARBER-COLMAN MA-418 ACTUATOR

SPECIFICATIONS

MOTOR TYPE

Two-position, spring return.

ELECTICAL REQUIREMENTS

Voltage: 120 volts a.c. 60 hz.
Current: Running-.9 amp
Holding-.35 amp

RATED TORQUE

60 in-lb

SPEED

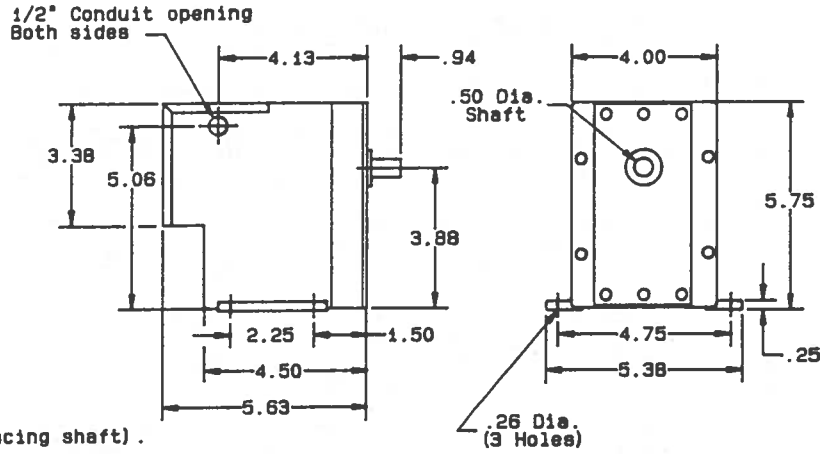
20 sec./180° (No Load)

SHAFT ROTATION

Energized clockwise 180° (as viewed facing shaft).

OPERATING TEMPERATURES

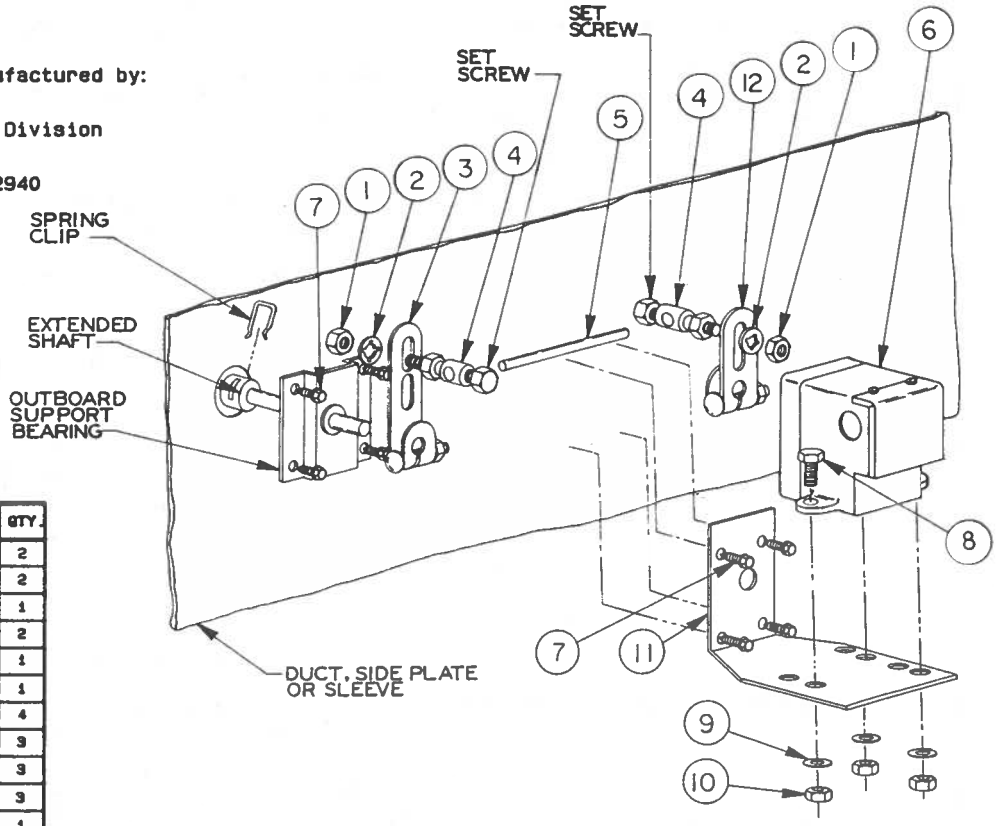
Ambient temperature limitations: -40°F to 136°F.



NOTE: Actuator must be mounted with output shaft horizontal.
Allow 6" clearance above the actuator wiring compartment.

These actuators are manufactured by:

Barber-Colman Company
Enviromental Controls Division
1354 Clifford Avenue
P.O. Box 2940
Loves Park, IL 61132-2940



ITEM NO.	DESCRIPTION	QTY.
1.	HEX NUT: 1/4-28	2
2.	LOCKWASHER: INTERNAL TOOTH, 1/4"	2
3.	DAMPER CRANK ARM #2637	1
4.	BALL JOINT: 1/4-28 x 5/16 x 5/16	2
5.	STEEL ROD: 5/16" DIA.	1
6.	ACTUATOR	1
7.	TEK 3 SCREW: #10-16 x 1/2" HWH	4
8.	HEX HEAD BOLT: 1/4-20 x 3/4"	3
9.	LOCKWASHER: HELICAL SPRING, 1/4"	3
10.	HEX NUT: 1/4-20	3
11.	MOTOR MOUNT #2702	1
12.	ACTUATOR CRANK ARM #4354	1

PRELIMINARY: Determine whether your damper is normally closed or normally open. The actuator shaft rotates 180° counter-clockwise (as viewed from back of actuator) and pushes on steel rod for normally closed applications or pulls on steel rod for normally open applications when energized. Internal spring returns the shaft to normal position when actuator is de-energized. Actuator must be mounted with shaft horizontal. The actuator must travel its full 180° stroke and be stopped by its limit switch. (Not stopped by the damper or linkage).

1. If necessary, place socket end of extended shaft on hex end of power axle on linkage side of damper and lock it into place with spring clip. Make sure that extended shaft does not bind in hole of duct (or side plate, or damper sleeve). Extended shaft and spring clip were originally supplied with your damper.

2. Install extended shaft/outboard support bearing. Slide bearing on extended shaft and fasten bracket to duct with TEK screws.

3. Install damper crankarm on extended shaft loosely. Finger tighten nut only.

4. Install a ball joint into slot of damper crankarm using lockwasher and hex nut. Locate ball joint 2 13/16 inches from center of extended shaft. Tighten hex nut on ball joint to secure it on damper crankarm.

5. Install the other ball joint into slot of actuator crankarm as in (4) above. Locate ball joint 2 inches from center of actuator shaft. Tighten hex nut on ball joint to secure it to actuator crankarm.

6. Place one end of steel rod through hole in ball joint on damper crankarm and the other end through hole in ball joint on actuator crankarm with equal length of each end extending past ball joints. Tighten setcrews on ball joints against steel rod.

7. Determine location of actuator on duct (or side plate, or damper sleeve). Mark off mounting hole locations corresponding to holes on actuator mounting bracket and fasten it with TEK screws. CAUTION: Make sure that mounting screws do not interfere with damper linkage operation. If interference occurs, move actuator to a different location.

8. Set parts relationship for proper linkage operation according to Fig. 2 or Fig. 3, whichever is applicable. Actuator shaft rotation is viewed from back of actuator.

   a. For normally closed damper, close blades and hold them closed tightly; OR for normally open damper, open blades manually and hold them fuuly open.

   b. With crankarms installed on the actuator and damper shafts, (nuts loose), rotate the actuator crankarm to the normally open or closed position as determined in (8a). See Fig. 2 or Fig. 3.

   c. Tighten nut on damper crankarm.

CAUTION: NEVER ATTEMPT TO TURN ACTUATOR SHAFT WITH WRENCH, CRANKARM OR SIMILAR TOOL. THIS MAY CAUSE DAMAGE TO ACTUATOR GEARS.

   d. Rotate actuator crankarm 180° clockwise. Damper should now be in opposite position.

   ADJUSTMENTS: If damper blades do not travel the full distance from closed to open positions, or travel too far, adjust linkage as follows:

      1. Loosen setscrew on ball joint on actuator crankarm that holds steel rod.

      2. Loosen nut on ball joint on actuator crankarm and move ball joint 1/16 inch away from actuator shaft for more damper travel or closer to actuator shaft for less damper travel.

      3. Tighten nut and setscrew on ball joint on actuator crankarm.

      4. Repeat (8d).

      5. Repeat above procedure if necessary.

   e. After linkage is properly adjusted, rotate crankarm back to the normal position as determined in (8a). Tighten actuator crankarm nut.

9. Connect electrical wiring to actuator as shown in Fig. 4. All wiring must comply with applicable codes. CAUTION: First disconnect power supply before connecting wiring to actuator to prevent electrical shock.

10. Check linkage setting for proper operation by running actuator between travel limits of damper blades.

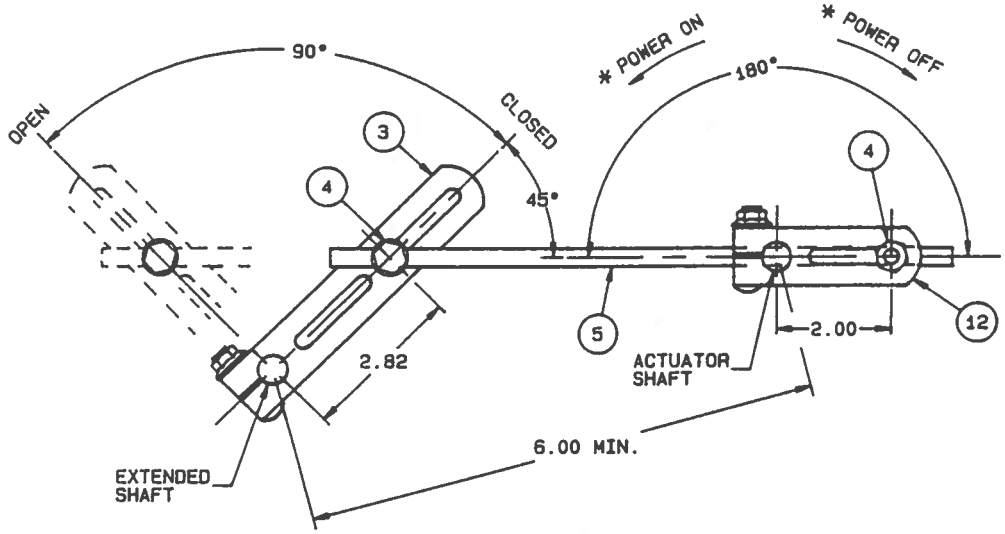


FIG. 2 - NORMALLY CLOSED DAMPER

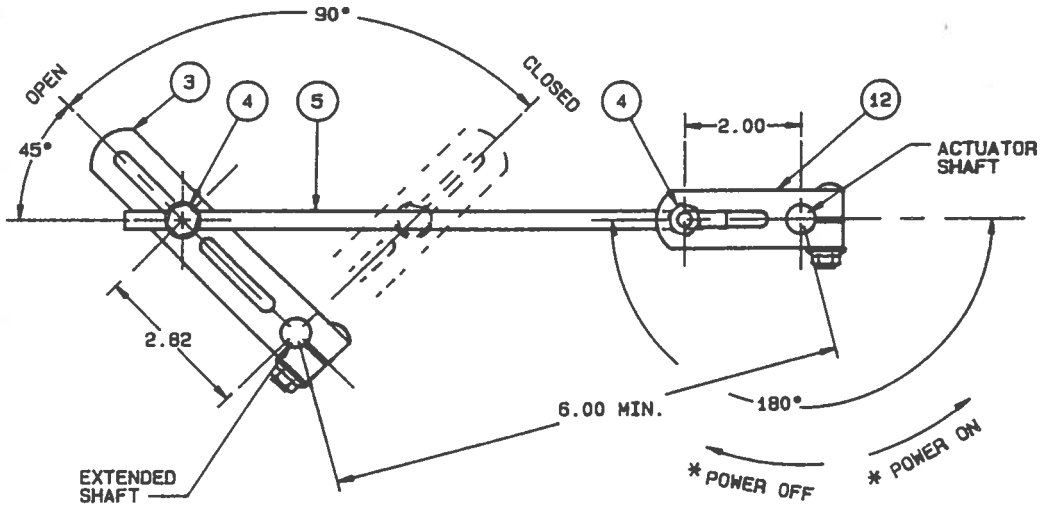
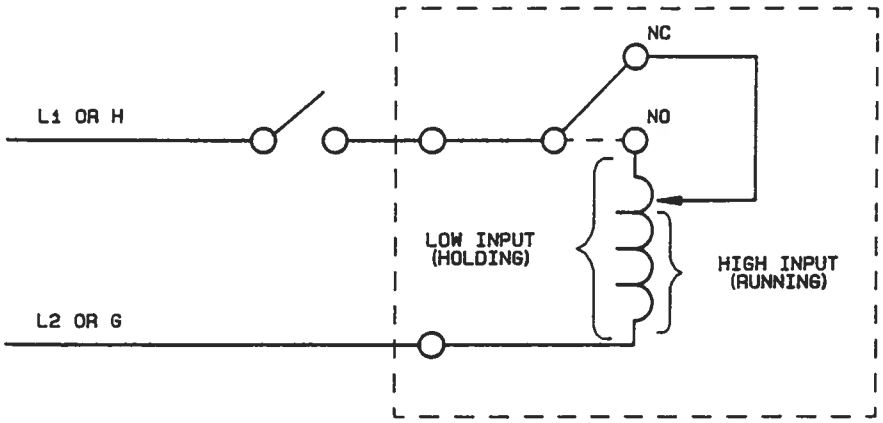


FIG. 3 - NORMALLY OPEN DAMPER

* As viewed from back of actuator.



TYPICAL WIRING

FIG. 4

OPERATION:

The MA418 has an end of travel switch that reduces the running input from 70 watts to 25 watts at the end of the clockwise rotation (as viewed facing shaft). Actuator must be linked to the damper to allow it to power to the full end of travel movement.

Spring returns the shaft to the starting position when actuator is de-energized.