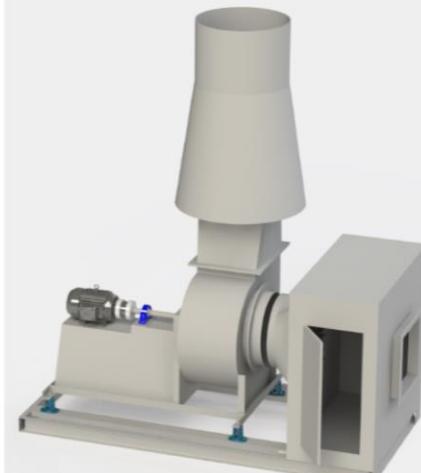


FAN INSTALLATION, MAINTENANCE & OPERATIONS GUIDE



SKYPLUME G1 EL SERIES

DIRECT-DRIVE, BELT-DRIVE CENTRIFUGAL EXHAUST FANS

MANUALS / SUBMITTAL DRAWINGS

***** Protecting the Drive and Motor *****

Input Line Reactors and Output Load Reactors may be required for proper installation of this fan motor. Installation with over 100 ft. of service wire must use a Line Reactor, and installations over 300 ft. of service wire must use both an Input Line Reactor and Output Load Reactor. No Parallel Line/Load Reactor shall be installed to service multiple motor drive combinations. With specific project power conditions known consult the project Electrical Consulting Engineer and review site power conditions to ensure motor service power is adequate.

CONDENSED PRODUCT TABLE

*** ATTENTION – PROTECTION OF MOTOR AND MOTOR DRIVE ***

Line and Load Reactors may be required for your electrical motor service conditions Consult SKYPLUME Technologies Product Manuals for Reference

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FAN INSTALLATION

All SKYPLUME Technologies fans are test run at operating speed to ensure that they pass our strict guidelines for vibration. The impeller and shaft assemblies are statically and dynamically balanced for the maximum recommended speed. For a safe and proper operation of the fan equipment requires a proper foundation that is level, rigid, and of sufficient structure and mass to support the equipment. It is always extremely important to consult a qualified structural engineer in order to design a proper foundation. A properly designed concrete base is the preferred foundation. The concrete base mass should be at least four times that of the fan equipment when the plan view area of the concrete base is no more than twice the plan view area of the fan equipment. Steel platforms or bases are common alternatives when properly designed. The steel platforms must be braced in all directions. Extra care should be taken to ensure that the natural frequency of all steel base components differs significantly from the rotating speed of the fan and driver.

SKYPLUME Technologies recommends using vibration isolators for the smoothest operation.

The following points should be considered prior to fan operation:

1. Avoid fan operation under conditions which would lead to the build-up of solids on the fan blades. This could lead to an unbalanced condition and cause a premature failure.
2. Fan equipment must be level prior to operation. Do not twist or distort during mounting. Shim fan support points before tightening foundation bolts make sure distortion does not occur.
3. Access door must be securely closed (if any) in order to avoid equipment damage and personal injury.
4. Owner/installer is solely responsible to make sure the fan is adequately secured to its supports.
5. Protection of Drive and Motor:

Input line reactors & output load reactors may be required for proper installation of this fan motor installation with over 100 ft. of service wire must use a line reactor, and installations over 300 ft. of service wire must use both an input Line reactor and output

load reactor. No parallel line / load reactor shall be installed to service multiple motor drive combinations. With specific project power conditions know consult the project electrical consulting Engineer and review site Power Conditions to ensure motor service power is adequate.

VIBRATION ISOLATORS

If the SKYPLUME Technologies fan is shipped with Type C vibration isolators the following procedures should be followed,

1. Supporting Surfaces must be flat and level under mounts. Relative elevation must be held to $\frac{1}{2}$ " from the highest to the lowest position. Grout to provide full size spacers to compensate for larger differences
2. When Equipment is mounted directly on Type "C" Mounts, place mountings under equipment bolt holes and install the mounting adjustment bolts.
3. When mounts are installed under steel base mounting brackets, block the base at the proper elevation as shown on the drawings before installing mounts.
4. Take 2 complete downward (clockwise) turns on adjustment bolt of all mounts. Repeat this procedure as many times as necessary until clearance between two parts of spring housing is minimum of $\frac{1}{4}$ " for direct mounting or equipment lifts off blocks
5. Level equipment by taking additional turns on low side or corner.
6. **TIGHTEN LOCK NUT AGAINST EQUIPMENT BASE** (See attached chard / diagram for location and size of mounts)

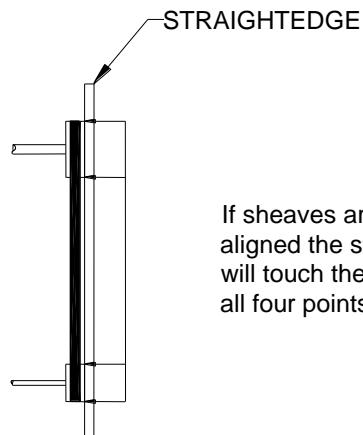
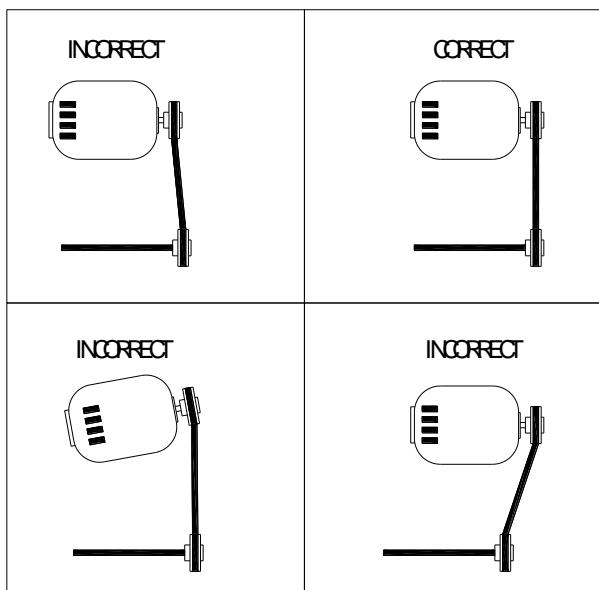
FAN SETUP

Do not place any loose items at fan inlet or outlet in order to avoid damage to the fan and personal injury

V-BELT DRIVE

Plasticair fans may be shipped with or without belt drives installed. In either case, the following Procedures should be followed:

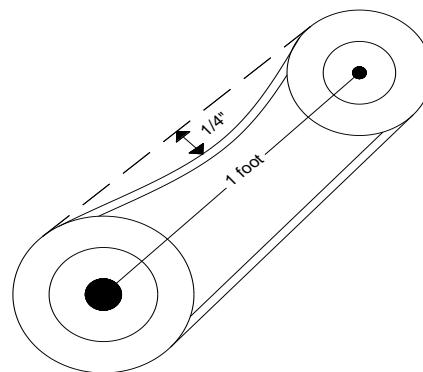
1. Check the pulley alignment on the fan and motor.
2. Make sure the string or straightedge is used properly for alignment inspection



If sheaves are straight and aligned the string or straightedge will touch them simultaneously at all four points shown by the arrows

3. Ensure that the proper sheaves are installed on the motor and fan (i.e. do not allow the fan to operate beyond its recommended maximum speed).

4. Belt tension should be checked with a proper belt tension gauge. Excessive tension will put undue stress on the bearing and shorten its life. Insufficient belt tension on the other hand will shorten belt life, reduce fan performance due to belt slippage, and may cause vibration. Consult the drive manufacturer's literature for recommended belt tension.



5. Proper alignment of the pulley is very important to long fan bearing, driver bearing, V-belt and sheave life. Ensure that driver and fan shafts are parallel to each other the most common causes of misalignment are non-parallel driver and driver shafts to be improperly located sheaves. When shafts are not parallel, V-belts on one side are drawn tighter and pull more than their share of the load. As a result, these V-belts wear out faster, requiring the entire set to be replaced before its maximum service. If the sheaves are misaligned, V-belts will enter and leave the groove at an angle, adding excessive V-belt and sheave wear. Shafts and sheaves alignment can be checked by measuring the distance between the shafts as shown in the above figures.

6. Ensure that the taper lock bushings are secure in place with the correct amount of torque on the fastening screws. If applicable, check that all setscrews are tightened. Use Loctite on all set screws

Recommended Torque for Set Screws / Bolts (In/lbs.)

Set screws				Hold Down Bolts	
Size	Key Hex Across Flats	Recommended Torque (Inch-lbs.)		Size	Wrench-Torque (inch-lbs.)
		Min.	Max.		
No. 10	3/32"	28	33	3/8" - 16	240
1/4"	1/8"	66	80	1/2" - 13	600
5/16"	5/32"	126	156	5/8" - 11	1200
3/8"	3/16"	228	275	3/4" - 10	2100
7/16"	7/32"	348	384	7/8" - 9	2040
1/2"	1/4"	504	600	1" - 8	3000
5/8"	5/16"	1104	1200	1-1/8" - 7	4200
3/4"	3/8"	1440	1800	1-1/4" - 7	6000

DUCT CONNECTIONS

All ducting attached to the fan should be independently supported. The fan case should not be placed under excessive loads. This may cause the case to distort and rub against the impeller and cause damage to the fan. SKYPLUME Technologies recommends using flexible connections to isolate the fan. All SKYPLUME Technologies fans equipped with drains should be plugged or connected to a P-trap.

STACKS

Unless the stack is short and light, do not support the stack by the fan outlet flange or case. Excessive loads may cause the fan case to distort and rub against the impeller and cause damage to the fan. Plasticair may supply fans with special stand and or case supports to accommodate stack installation. Consult Plasticair for fan stack support ratings for each fan.

ELECTRICAL CONNECTIONS

All fans should have an independent disconnect switch to isolate the fan motor from the electrical supply. Electrical disconnect should be near the fan. The maintenance personnel should be able to lock the disconnect switch in the off position while servicing the fan.

FAN STARTUP

- 1. Do not exceed the maximum recommended speed of fan.**
2. Ensure that the proper pulleys are installed. Use the following formula to estimate the approximate speed of the fan, divide the motor pulley diameter by the fan pulley diameter and then multiply by the motor speed.
3. Ensure that the fan is free of loose objects. The duct to the fan inlet should also be free from loose objects. Loose objects in the fan can become fast moving projectiles and may cause damage to equipment, or cause injury to personnel.
4. Check the impeller to inlet cone and impeller to fan housing clearance to ensure that there is no interference of any kind. Turn the impeller by hand (with the fan power off) to ensure that it rotates freely.
5. Check that all the bolts and fasteners are properly tightened.
6. Check the belt tension. Recheck the tension after the fan has been operating for 24 hours
7. Where applicable install the guards for belt drive & shaft. Close & secure all access doors.
8. Check motor wiring and voltage.
9. "Bump" start the fan to verify the correct impeller rotation. The proper rotation is clearly labeled on the fan. Rewire motor if necessary.
10. Turn on the fan and observe for unusual noises and vibration during this time. **Shut the fan down immediately if either of these conditions is observed.** If problems occur perform the start-up procedure again to ensure that all the steps were followed correctly.
11. Use extreme caution if the fan is operating while disconnected from the ductwork. The inlet should be screened to prevent objects from being sucked in. It should also be partially blocked off to avoid overloading the motor.

FAN MAINTENANCE

As with any piece of machinery, fans require regular maintenance and service to ensure trouble free service and long life. The fan should be turned off using disconnect on the motor and be locked in the off position. Allow the impeller to come to a complete stop before performing any maintenance on the fan. The following items should be checked as part of a regular maintenance program.

1. Check and record the vibration levels on the fan bearings regularly. This will usually give advance warning of trouble. Increased vibration over short periods of time can mean impeller imbalance. The impeller should be removed, cleaned, and rebalance if required. This will prevent permanent damage to fan components.
2. Check the impeller for damage and wear. **An impeller with visible signs of damage should be pulled from service immediately.** Detection of structural weakness is necessary in order to avoid catastrophic failure, which may result in significant damage to the fan, near-by equipment and personnel. The impeller should also be examined for build-up of material that may cause imbalance. Clean the wheel, being careful not to damage the laminated surface. Rebalance as required.
3. The Complete V-Belt Drive should be check. Ensure proper alignment of the pulleys. Check & adjust the belt tension as required. Examine the belts for visible damage & replace as required. Consult the manufacturer for recommended belt tension.
4. Lubricate the bearing according to instruction from the manufacturer. See republication section at the end of this manual.
5. Check the shaft seal for damage and replace as required.
6. Lubricate grease-packed seals at the same interval as the bearings. The re-lubrication period should be reduced if there is any evidence of gas leakage from the seal.
7. Check all bolts and fasteners. If required, tighten to the recommended torque.
8. For FRP (fibreglass reinforced plastic) components, check for visible damage and exposed glass. Damaged parts should be replaced or repaired immediately.

IMPELLER REMOVAL

For all 900, 800, and 700 Series & Direct Drive Fans:

1. Remove the impeller hub cover to expose the taper lock bushing. Be careful not to damage the gasketing so it can be re-used.
2. Remove the screws from the bushing and thread into alternate holes. Progressively tighten until bushing is free and slide impeller from the shaft.
3. Reinstall in reverse order and ensure that the impeller is not rubbing against anything.

For all SKYPLUME G1 EL (GIF) series,

1. Remove the inlet half of the fan case and the pulley from the shaft.
2. Unlock Shaft the shaft from the bearings.
3. Remove the impeller and shaft assembly. The impeller to inlet cone gap should be anywhere from $\frac{1}{4}$ " to $\frac{1}{2}$ " depending on the size of the fan. Consult Plasticair for recommended clearances

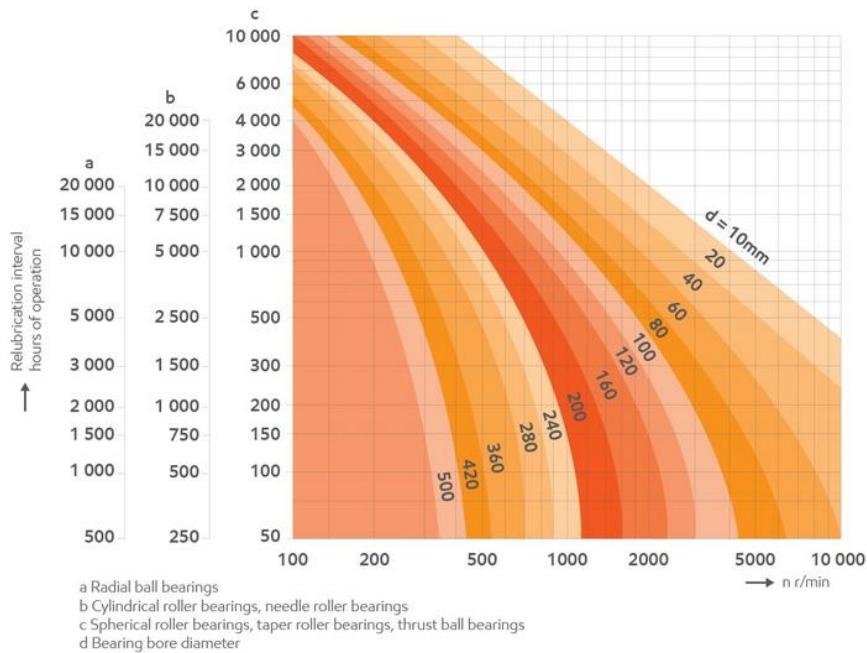
BEARING & RELUBRICATION INTERNAL

The period during which a grease-lubricated bearing will function satisfactorily without re-lubrication is dependent on the bearing type, size, speed, operating temperature and the grease used. The re-lubrication intervals obtained from the table below (Table 1.) are valid for bearings in stationary machines where loading conditions are normal. The intervals are based on the use of aging-resistant, average quality grease. It is valid for bearing temperatures of $+70^{\circ}\text{C}$ ($+158^{\circ}\text{F}$). The maximum permissible operating temperature for the grease should not be exceeded. Conversely, if operating temperatures are lower than $+70^{\circ}\text{C}$ ($+158^{\circ}\text{F}$), the intervals can be lengthened to about twice the values for operating temperatures of $+50^{\circ}\text{C}$ ($+122^{\circ}\text{F}$) and below. It should be noted, however, that re-lubrication intervals might vary significantly even where apparently similar greases are used. Where there is the risk of the grease becoming contaminated the re-lubrication intervals should be reduced. This reduction also applies to applications where the grease is required to seal against moisture, in which case once a week is required.

Table 1. Re-lubrication intervals (in months of operation) for solid pillow block bearings.

Shaft dia	0-20 mm (0"0.79")	21-40 mm (0.80"-1.57")	41-60 mm (1.58"-2.36")	61-80 mm (2.37"-3.15")	81-100 mm (3.16"-3.94")
RPM					
600	6	6	6	6	6
1000	6	6	6	4	4
1500	6	6	4	2	2
2000	6	4	4	2	1
2500	4	4	2	1	-
3000	4	4	2	1	-
4000	4	2	1	-	-
5000	2	1	-	-	-

Note: Information based on normal load conditions, using age resistant average quality grease, 70°C bearing temperature.

Figure 2. Re-lubrication interval for split pillow block bearings

bearing temperatures under 70°C (158°F), the Re-lubrication intervals can be doubled for temperatures below 50°C (122°F), provided that the bearing temperature is at least -30°C (-22°F).

Re-lubrication intervals: _____ rpm: _____ days

Grease quantity for Re-lubrication:

_____ oz. (Sheave-side bearing)

_____ oz. (Propeller Side bearing)

Note: Information based on normal load conditions, using age resistant average quality grease, +70°C (+158°F) bearing temperature.

For bearing temperatures over +70°C (+158°F), the Re-lubrication intervals should be halved for every 15°C (59°F) rise above 70°C (158°F), not exceeding 110°C (230°F).

Conversely, for

RECOMMENDED SPARE PART LIST

SKYPLUME Technologies highly recommends that end users keep spare parts for the fan. This is especially true for critical service that cannot afford a long down time. The following parts should be stocked:

1. A balanced impeller and shaft assembly
2. Spare bearings
3. Spare V-Belts & Pulleys
4. Shaft seals

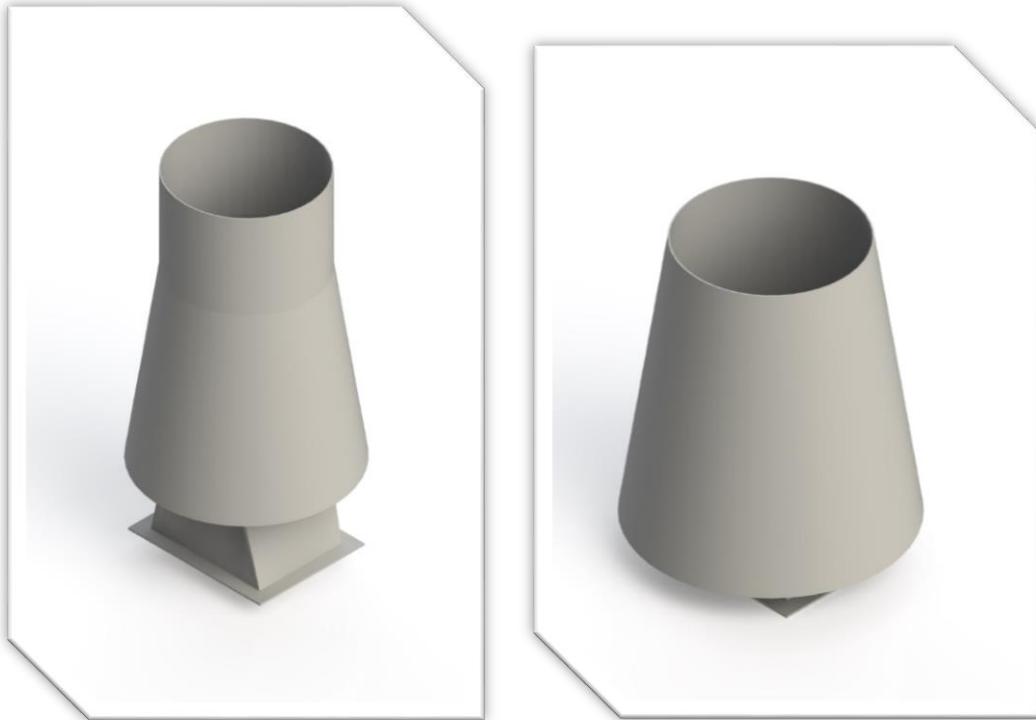
TROUBLE SHOOTING

PROBLEMS	POSSIBLE CAUSES
LOW AIR FLOW	<ul style="list-style-type: none"> • Duct elbow too close to fan inlet or outlet • Restricted fan inlet or outlet • Incorrect direction of rotation. Ensure the fan rotates in same direction as the rotation arrow on the fan housing. • Fan speed lower than design • Static pressure is higher than design • Dampers are shut • Filters or coils are clogged • Incorrect duct work • Inlet or outlet screens are clogged
HIGH AIR FLOW	<ul style="list-style-type: none"> • Static pressure is less than design • Fan RPM is too high • Dampers are not adjusted correctly • Filters are missing • Registers or grilles are not installed
HIGH VIBRATION & NOISE	<ul style="list-style-type: none"> • Accumulated material on wheel • Worn or corroded wheel • Wheel or sheaves are loose on shaft • Unbalanced motor • Unbalanced wheel • Loose bearing or fan mounting bolts • Weak, un-level or resonant foundation • Structure not secured correctly • Unstable operating conditions
INOPERATIVE FAN	<ul style="list-style-type: none"> • Blown fuse • Damaged or broken belts • Loose sheaves • Small motor HP • Wrong electrical wiring • Wrong voltage
OVER HEATED MOTOR	<ul style="list-style-type: none"> • Incorrect motor wiring • Wrong rotation • Diverted or blocked cooling air

SKYPLUME™ EXHAUST STACKS

US Patent No. 6,676,503 B2

Other Patents Pending



GENERAL

The SKYPLUME Technologies SKYPLUME™ Exhaust Stack is designed to safely exhaust laboratory effluent well above the roof line. This minimizes the risk of polluted air being drawn back into building make-up air intakes without the use of tall exhaust stacks the pollutants are diluted by the induction of ambient air into the exhaust stream through a conical windband. This addition of air also assists in generating the high plume effect. The stack is constructed of solid FRP. The entire inner surface exposed to the corrosive gas stream is complete with a resin-rich corrosion barrier consisting of C-Veil and a smooth finish. Exterior surfaces have a heavy UV stabilized gel coat finish.

INSTALLATION

The stack is designed to fit directly to the discharge flange of the exhaust fan. The stack flange should be match drilled to the fan discharge flange. Use stainless steel bolts to secure the stack to the fan.

WARRANTY

SKYPLUME Technologies Inc. warrants all their products against defects in workmanship and materials for 12 months from the original date of installation, but not greater than 15 months from the original date of shipping. If within this warranty period any items prove to be defective, the defective part or parts shall be repaired or replaced at SKYPLUME Technologies option. Parts not manufactured by SKYPLUME Technologies but installed by SKYPLUME Technologies in equipment sold to any customer shall carry the original manufacturer's warranty only.

Contact SKYPLUME Technologies for prior authorization (PS#) before sending back any part(s) or equipment. Defective part(s) must be shipped to SKYPLUME Technologies with a written explanation of the defect. All shipping, duties and tax charges for the defective part(s) shall be paid by the customer. SKYPLUME Technologies will not be responsible for any special, incidental or subsequent damage arising from these defective parts, including the removal and reinstallation of them. This warranty does not cover defects due to improper assembly, misuse, alterations, and normal wear and tear.