How to Use This Manual

This manual provides detailed instructions on installation and maintenance of Falk parallel shaft Type DH and right angle Type DB gear drives. Use the table of contents below to locate required information.

CAREFULLY FOLLOW THE INSTRUCTIONS IN THIS MANUAL FOR OPTIMUM PERFORMANCE AND TROUBLE FREE SERVICE OF YOUR FALK GEAR DRIVE.

Table of Contents

Introduction

Credit for long service and dependable operation of a gear drive is often given to the engineers who designed it, or the craftsmen who constructed it, or the sales engineer who recommended the type and size. Ultimate credit belongs to the mechanic on the job who worked to make the foundation rigid and level, who accurately aligned the shafts and carefully installed the accessories, and who made sure that the drive received regular lubrication. The details of this important job are the subject of this manual.

NAMEPLATE — Operate Falk gear drives only at power, speed and ratio shown on the nameplate. Before changing any one of these, submit complete nameplate data and new application conditions to the Factory for correct oil level, parts, and application approval.

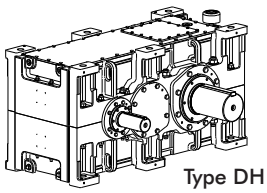
DISASSEMBLY AND ASSEMBLY — Disassembly & assembly instructions and parts guides are available from the Factory or Sale Representatives. When requesting information, please give complete data from the nameplate on the gear drive; Model, M.O. Number, Date, RPM, and Ratio.

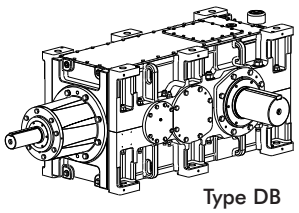
***WARNING**: Consult applicable local and national safety codes for proper guarding of rotating members. Lock out power source and remove all external loads from drive before servicing drive or accessories.*

Warranty

Rexnord Industries, LLC (the "Company") warrants that Drive One gear drives (I) conform to Company's published specifications, and (II) are free from defects of material for three years from the date of shipment.

Company does not warrant any non-Company branded products or components (manufacturer's warranty applies) or any defects in, damage to, or failure of products caused by: (I) dynamic vibrations imposed by the drive system in which such products are installed unless the nature of such vibrations has been defined and accepted in writing by Company as a condition of operation; (II) failure to provide suitable installation environment; (III) use for purposes other than those for which designed, or other abuse or misuse; (IV) unauthorized attachments, modifications or disassembly, or (V) mishandling during shipping.


Type DH


Type DB

Installation Instructions

The following instructions apply to standard Falk Type DH & DB drives. If a drive is furnished with special features, refer to the supplementary instructions shipped with the drive.

WELDING — Do not weld on the gear drive or accessories without prior approval from the Factory. Welding on the drive may cause distortion of the housing or damage to the bearings and gear teeth. Welding without prior approval could void the warranty.

NOTE: Drives equipped with cooling fans may require removal of shroud when installing foundation fasteners.

EFFECTS OF SOLAR ENERGY — If the gear drive operates in the sun at ambient temperatures over 38°C (100°F), then special measures should be taken to protect the drive from solar energy. This protection can consist of a canopy over the drive or reflective paint on the drive. If neither is possible, a heat exchanger or other cooling device may be required to prevent the sump temperature from exceeding the allowable maximum.

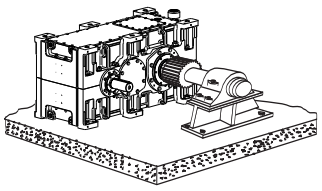
MOUNTING POSITION — Standard mounting positions for types DH & DB are with the input and output shafts horizontal. Allowable mounting angles for standard oil levels are;

	Bridge	Slope
DH & DB	0° Up & 4° Down	± 1.5°

Consult the Factory for other angles.

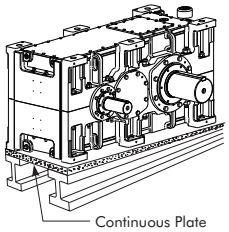
If a gear drive is ordered for non-standard mounting positions, refer to the instructions provided with the drive for oil levels and bearing lubrication. If it is necessary to mount the gear drive in a different position from which it was ordered, refer to the Factory for required changes to provide proper lubrication.

FOUNDATION, GENERAL — To facilitate oil drainage, elevate the gear drive foundation above the surrounding floor level. If desired, replace the drive oil drain plug with a valve, but provide a guard to protect the valve from accidental opening or breakage.

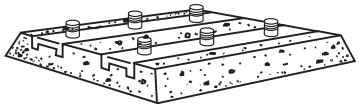


When an outboard bearing is used, mount drive and outboard bearing on a continuous foundation or bedplate, and dowel both in place.

FOUNDATION, STEEL — When mounting gear drive on structural steel, it is recommended that an engineered design be utilized for a pedestal, adapter base or bed to provide sufficient rigidity, to prevent induced loads from distorting the housing and causing gear misalignment. In the absence of an engineered design, it is recommended that a base plate, with thickness equal to or greater than the thickness of the drive feet, be securely bolted to steel supports and extend under the entire drive as illustrated.



FOUNDATION, CONCRETE — If a concrete foundation is used, allow the concrete to set firmly before bolting down the gear drive. For the best type of mounting, grout structural steel mounting pads into the mounting base, as illustrated, rather than grouting the drive directly into the concrete.

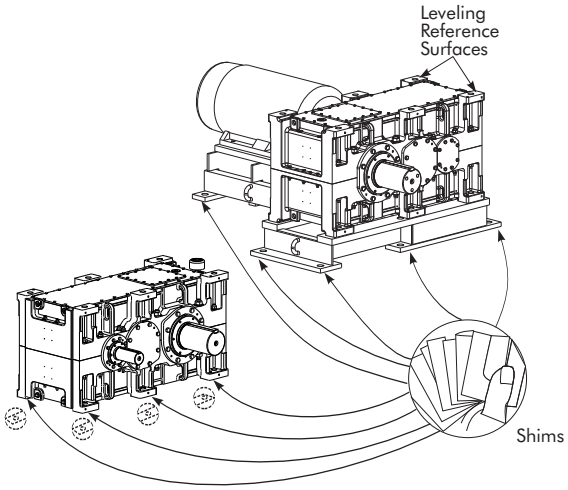


Motors and other components mounted on motor plates or motor brackets may become misaligned during shipment. ALWAYS check alignment after installation. Refer to Page 3 for coupling alignment instructions.

Gear Drive Alignment

FOOT MOUNTED DRIVES – Align drive with driven equipment by placing broad, flat shims under all mounting pads. Jack screw holes are provided by mounting feet to facilitate alignment. See Table 7, Page 6 for fastener and wrench sizes. Start at the low speed shaft end and level across the length and then the width of the drive. Check with a feeler gauge to make certain that all pads are supported to prevent distortion of housing when drive is bolted down. Fasten drive to foundation using Class 8.8 fasteners, see Table 7 for fastener size. Tighten fasteners to the torque specified in Table 1, Page 4. If the required torque is not attainable, the fasteners may be tightened with a pre-torque of 270 N-m (200 lb-ft), then tightened an additional 60° of rotation with a slugging wrench to achieve proper torque. After drive is aligned with driven equipment and bolted down, align prime mover to drive input shaft. Refer to Page 3 for coupling alignment.

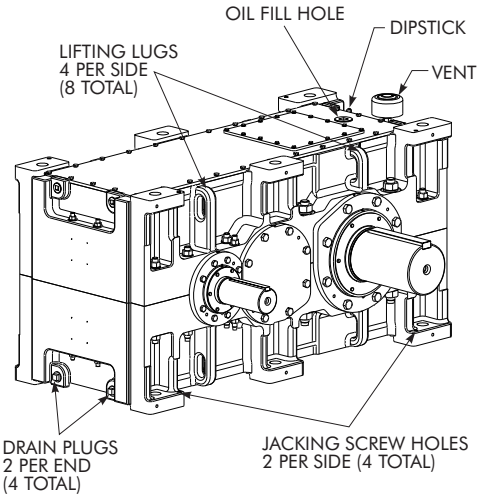
If equipment is received from the Factory mounted on a bedplate, the components were accurately aligned at the Factory with the bedplate mounted on a large, flat assembly plate. Shim under the bedplate foot pads until the gear drive is level and all feet are in the same plane.



Check high speed shaft coupling alignment. If the coupling is misaligned, the bedplate is shimmed incorrectly. Re-shim bedplate and recheck high speed coupling alignment. If necessary, realign motor.

Shaft Mounted Drives – General

Shaft mount drives should never be mounted in a manner that restricts the natural movement of the drive. They should be allowed to move freely with the shaft on which it is mounted. Shaft mounted drives should always be used in conjunction with a torque reaction arm. See Appendix A for instructions.



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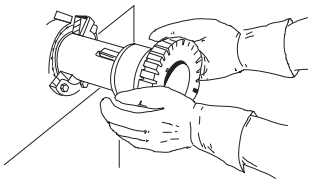
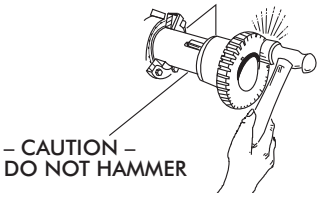
Shaft Connections

WARNING: *Provide suitable guards in accordance with local and national standards.*

COUPLING CONNECTIONS — The performance and life of any coupling depends largely upon how well the coupling is installed and serviced. Refer to the coupling manufacturer's manual for specific instructions.



CORRECT METHOD
Heat interference fitted hubs, pinions, sprockets or pulleys to a maximum of 135°C (275°F) and slide onto gear drive shaft.



– CAUTION –
DO NOT HAMMER

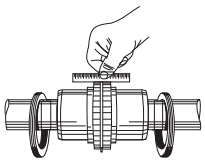
INCORRECT METHOD
DO NOT drive coupling hub, pinion, sprocket or pulley onto the shaft. An endwise blow on the shaft/coupling may damage gears and bearings.

COUPLINGS — (Except fluid type) Detailed installation manuals are available from the Factory, your local Representative or Distributor—just provide size and type designations stamped on the coupling. For lubricant requirements and a list of typical lubricants meeting the Factory specifications, refer to appropriate coupling service manual.

FLANGED TYPE RIGID COUPLINGS — These are typically used on drives with vertical output shafts. The low speed shaft extension ends of the solid vertical shaft drives are drilled and tapped to accommodate coupling keeper plates. Tightening torques for fasteners, including keeper plate fasteners are listed in Table 1, Page 4.

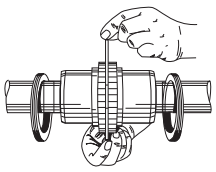
FLUID COUPLINGS — Refer to the installation manual furnished with the fluid coupling for installation and startup instructions. For Alignment Free Drives, refer to Appendix C.

GAP AND ANGULAR ALIGNMENT — If possible, after mounting coupling hubs, position the driving and driven equipment so that the distance between shaft ends is equal to the coupling gap. Align the shafts by placing a spacer block, equal in thickness to required gap, between hub faces, as shown at right, and also at 90° intervals around the hub. Check with feelers.



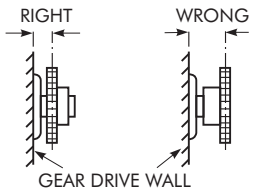
Steelflex Illustrated

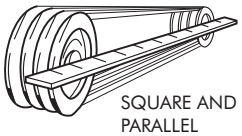
OFFSET ALIGNMENT — Align driving and driven shafts so that a straight edge will rest squarely on both couplings hubs as shown to the right and also at 90° intervals. Tighten foundation bolts of the connected equipment and recheck alignment and gap.



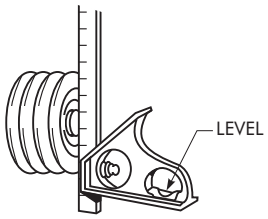
Steelflex® Illustrated

SPROCKETS, PULLEYS OR SHEAVES — Mount power take-offs as close to the gear drive housing as possible to avoid undue bearing load and shaft deflection.
Align the output shaft of the gear drive square and parallel with the driven shaft by placing a straightedge across the face of the sprockets or sheaves as illustrated.
Check horizontal shaft alignment by placing one leg of a square against the face of the sheave or sprocket with the spirit level on the horizontal leg of the square.





SQUARE AND PARALLEL



DO NOT over tighten belts or chains. Adjust chains to manufacturers' specifications. Adjust belts as follows:
The ideal tension is the lowest tension at which the belt will not slip under peak load conditions. Check the belt tension frequently during the first 24 to 48 hours of run-in operation. Over tightening belts shortens belt and bearing life. Keep belts free from foreign material which may cause slippage. Inspect the V–belt periodically; tighten the belts if they are slipping.

OUTBOARD BEARING — Mount the outboard bearing and gear drive on a common foundation so that they will shift as an assembly if settling should occur. Bring the outboard bearing to the correct horizontal position with broad flat shims under the mounting pad. Align accurately so that the load is equally divided between the two drive bearings and the outboard bearing. Mount a stop bar against the pillow block foot on the load side when large horizontal load components are exerted on the pillow block.

PINION MOUNTING — Mount pinion as close to the drive as possible to avoid undue bearing load and shaft deflection. Refer to the Factory for pinion alignment instructions.

NON FALK COUPLINGS — Refer to manufacturers' installation and maintenance instructions.

BACKSTOPS — To prevent damage to backstops due to incorrect motor shaft rotation at start up, couplings are NOT assembled when gear drives are furnished with backstops.
After completing electrical connections, check motor and gear drive shaft rotations. If rotations are correct, complete alignment and assembly of coupling.

Fastener Tightening Torques

Use the tightening torque values specified in Table 1 for fastening gear drives, motors and accessories to their mounting surfaces with un-lubricated fasteners. DO NOT use these values for "torque locking" fasteners or for fastening components with aluminum feet or soft gaskets or vibration dampeners on the mounting surface. If the tightening torque exceeds the capacity of the torque wrench, use a torque multiplier. Use ISO property class 8.8 for metric fasteners. See Table 7, Page 6 for fastener and wrench size.

TABLE 1 — Tightening Torques: ±5%

DO NOT Lubricate Fasteners

Metric Fasteners – Property Class 8.8				
Fastener Size	Metal to Metal		Metal to Concrete	
	Nm	lb-ft	Nm	lb-ft
M4 x .7	3	2	2	1.5
M5 x .8	6	5	5	3.5
M6 x 1.0	10	8	8	6
M8 x 1.25	24	18	19	14
M10 x 1.5	50	36	39	29
M12 x 1.75	84	62	68	50
M16 x 2	210	156	170	126
M20 x 2.5	415	305	330	246
M24 x 3	705	530	570	420
M30 x 3.5	1 440	1060	1 150	850
M36 x 4	2 520	1860	2 030	1500
M42 x 4.5	4 050	3000	3 250	2400
M48 x 5	6 100	4500	4 880	3600
M56 x 5.5	9 850	7300	7 860	5800

Water Cooling

WATER COOLED HEAT EXCHANGERS — Install a shut-off or control valve in the water line to the heat exchanger to regulate the water flow through the exchanger. Also install a water flow gauge between the control valve and the exchanger to determine actual flow rate. Discharge water to an OPEN DRAIN to prevent back pressure.

INTERNAL COOLING TUBES — Refer to Factory.

Lubrication Systems

SPLASH LUBRICATED DRIVES — Standard horizontal shaft type DH & DB drives are splash lubricated. The lubricant is picked up by the revolving elements and distributed to the bearings and gear meshes.

OIL PUMP LUBRICATED DRIVES (OPTIONAL) — Standard horizontal shaft type DH & DB drives can be equipped with an internal gear driven oil pump. The system consists of an automatic reversing pump, driving gears and internal distribution. The system can be used for improved thermal capacity and lubrications accessories, i.e. filters. The pump system is rotation independent.

Lubrication Requirements

Carefully follow lubrication instructions on the gear drive nameplate, warning tags, and installation manuals furnished with gear drive. Failure to follow instructions voids warranty.

Petroleum Based Lubricants

Industrial type (not automotive) petroleum based sulfur-phosphorous extreme pressure (EP) gear lubricants meeting specific requirements are required for ambient air temperatures of -9°C to +52°C (15°F to 125°F). An approved lubricant MUST be used. Approved lubricants meeting the specific requirements are listed in Table 4. Lubricants not listed may be used only after approval from Factory. Failure to use an approved lubricant voids warranty.

For drives operating outside the above temperature range refer to the "Synthetic EP Lubricants" section. Synthetic lubricants can also be used in normal climates.

WARNING: EP LUBRICANTS IN FOOD PROCESSING INDUSTRY — EP lubricants may contain toxic substances and should not be used in the food processing industry without the lubricant manufacturer's approval. Lubricants which meet USDA or NSF "H-1" classification are suitable for food processing applications. Consult Factory.

Viscosity

The proper grade for EP lubricants is found in Table 2. For cold and normal climate conditions refer to Table 3, and the "Synthetic EP Lubricant" section.

TABLE 2 — Viscosity Grade Requirements for Petroleum Based EP (Extreme Pressure) Lubricants

Ambient Air Temperature *	Viscosity Grade	
	ISO-VG	AGMA
10° to 52° C (50° to 125° F)	320	6 EP
-9° to 16° C (15° to 60° F)	220	5 EP

* See section on oil pumps.

OIL PUMPS — When selecting a lubricant for a gear drive equipped with an oil pump, cold temperature oil viscosity is very important. Lubricant viscosity at start-up generally should not exceed 2160 cSt (10,000 SSU). When exceeding this viscosity, pump cavitation is possible, reducing oil circulation to gear drive and possibly damaging the pump. A sump heater may be required or it may be possible to use a lower viscosity oil to minimize pump cavitation, refer to Factory.

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Synthetic EP Lubricants

Synthetic EP lubricants of the polyalphaolefin (PAO) type meeting specific requirements are recommended for cold climate operation, high temperature applications, extended temperature range (all season) operation, and/or extended lubricant change intervals. The proper viscosity grade of synthetic lubricants is given in Table 3. An approved lubricant MUST be used. Approved synthetic lubricants meeting the specific requirements are listed in Table 5. Synthetic lubricants not listed may be used only after approval from Factory. Failure to use an approved lubricant voids warranty.

WARNING: SYNTHETIC EP LUBRICANTS IN FOOD PROCESSING INDUSTRY — Synthetic lubricants may contain toxic substances and should not be used in the food processing industry without the lubricant manufacturers' approval. Lubricants which meet USDA or NSF "H-1" classification are suitable for food processing applications.

Bearing and Seal Greases

All drives and some backstops have grease lubricated seals. Some vertical shaft and specially mounted drives have grease lubricated bearings. Drives are shipped with NLGI #2 grease in the seal housing cavities unless otherwise specified. Refer to Table 6 for grease recommendations.

GREASE LUBRICATED BEARINGS — Vertical shaft drives with drywells have grease lubricated lower low speed bearings. These bearings are lubricated at the Factory with an NLGI Grade #2 grease. Refer to the preventative maintenance section for greasing instructions.

GREASE LUBRICATED SEALS — Drive One gear drives are furnished with grease purged seals which minimize the entry of contaminants into the drive. Drives are shipped with NLGI Grade #2 grease in the seal housing cavities unless otherwise specified. If grease could contaminate the product, as in the food and drug industries, it must be completely removed and replaced with grease that meets USDA or NSF "H-1" classification. Consult the Factory.

TABLE 3 — Viscosity Grade Requirements for Synthetic EP (Extreme Pressure) Lubricants ∗

Ambient Air Temperature	ISO Viscosity Grade	AGMA Viscosity Grade
-12° to +52°C (+10° to +125°F)	320	6 EP
-34° to +27°C (-30° to +80°F)	150	4 EP

∗ Refer to the Factory for viscosity recommendations when ambient temperatures are below -34°C (-30°F) or above 52°C (125°F).

TABLE 4 — Petroleum Based Extreme Pressure (EP) Lubricants †

Maximum operating temperature of lubricants 93°C (200°F)

ISO Viscosity Grade	220	320
AGMA Viscosity Grade	5 EP	6 EP
Viscosity, Centistokes (cSt) @ 40°C	198-242	288-352
Manufacturer	Lubricant	Lubricant
BP Lubricants	Energol GR-XP 220	Energol GR-XP 320
Castrol Industrial North America, Inc.	Castrol Alpha SP 220	Castrol Alpha SP 320
Chevron Products Company	Chevron Meropa 220	Chevron Meropa 320
Exxon Mobil Corporation	Mobilgear 600 XP 220	Mobilgear 600 XP 320
Shell Oil Company	Shell Omala 220	Shell Omala 320

† Minimum viscosity index of 90.

TABLE 5 — Synthetic Extreme Pressure (EP) Lubricants – Polyalphaolefin Type ★

ISO Viscosity Grade	150	220	320	460
AGMA Viscosity Grade	4 EP	5 EP	6 EP	7 EP
Viscosity, Centistokes (cSt) @ 40°C	135 - 165	198 - 242	288 - 352	414 - 506
Manufacturer	Lubricant	Lubricant	Lubricant	Lubricant
Castrol Industrial	Alphasyn EP 150	Alphasyn EP 220	Alphasyn EP 320	Alphasyn EP 460
Chevron Products Company	Tegra Synthetic Gear Oil 150	Tegra Synthetic Gear Oil 220	Tegra Synthetic Gear Oil 320	Tegra Synthetic Gear Oil 460
Exxon Mobil Corporation	Mobilgear SHC 150	Mobilgear SHC 220	Mobilgear SHC 320	Mobilgear SHC 460
Shell Oil Company	Omala Fluids HD 150	Omala Fluids HD 220	Omala Fluids HD 320	Omala Fluids HD 460

★ Minimum viscosity index of 140. Contains sulphur phorphorous.

TABLE 6 — Lithium Based Greases for Bearings and Seals

–18° to +93°C (0° to 200°F) ‡

Manufacturer	Lubricant
Amoco Oil Co.	Amolith Grease No.2
BP Oil Co.	Energrease LS EP2
Chevron U.S.A.	Industrial Grease Medium
Citgo Petroleum Corp.	Premium Lithium Grease No. 2
Conoco, Inc.	Multiplex Red
Mobil Oil Corp.	Mobilux EP2
Mobil Oil Corp.	Mobilith SHC 460 ★
Petro-Canada Products	Multipurpose EP2
Phillips 66 Co.	Multiplex Red
Shell Oil Co.	Alvania Grease 2
Shell Canada Ltd	Alvania Grease 2
Texaco Lubricants	Premium RB Grease

★ High performance synthetic alternate.

‡ For ambient or operating temperatures outside this range, review application with grease supplier or consult the Factory.

Oil Levels

TYPES DH & DB — Fill the drive with oil to the level indicated on the oil dipstick. Approximate oil capacities are given on the drive nameplate. Gear drive can be filled through oil fill plug or inspection cover. Clean area around fill location BEFORE removing plug or cover to reduce the risk of debris contaminating the drive. When filling with oil, pour a minimum of 20 liters (5 gallons) of oil into lubrication pan in the top of the drive, allow oil to drain from pan before checking level. Lubricant must be clean to maximize gear and bearing life. It is recommended to filter new oil when filling or adding oil to the gear drive.

The inspection cover is sealed with a non hardening chemical gasket eliminator. When replacing the inspection cover, run a bead of Loctite Gasket Sealant #2 (or equivalent) around the perimeter of the inspection opening, making sure to circle the fastener holes.

DRIVES WITH OIL PUMPS — Occasionally gear drives will be equipped with oil pumps for cooling or special lubrication considerations. If a drive is equipped with an oil pump, fill the drive to the level marked on the dipstick. Run the lubrication system for several minutes to fill the system components. Verify that the pump is circulating oil properly, then recheck oil level. If necessary, add oil to compensate for filter and/or cooler. Before starting the gear drive, rotate the input shaft to check for obstructions. Then start the drive and allow it to run without load for several minutes. Shut down and recheck oil level. If everything is satisfactory, the drive is ready for operation.

Preventive Maintenance

AFTER FIRST WEEK — Check alignment of total system and realign where necessary. Also tighten all external bolts and plugs where necessary. DO NOT readjust the internal gear or bearing settings in the drive, these were permanently set at the Factory. See Table 7 for fastener and wrench sizes.

TABLE 7 — Fastener & Wrench Sizes

Fastener		DRIVE SIZE			
		M1220	M1230	M1240	M1250
Foot Mounting	Screw Size	M42	M42	M48	M48
	Wrench Size	65mm	65mm	75mm	75mm
Housing Top Plate	Screw Size	M12	M12	M12	M12
	Wrench Size	18mm	18mm	18mm	18mm
Housing Bottom	Screw Size	M12	M12	M12	M12
	Wrench Size	18mm	18mm	18mm	18mm
Inspection Cover	Screw Size	M8	M8	M8	M8
	Wrench Size	13mm	13mm	13mm	13mm
Jackscrews	Screw Size	M16	M16	M16	M16
	Wrench Size	24mm	24mm	24mm	24mm
Magnetic Drain Plugs	Plug Size	1.250 NPT	1.250 NPT	1.250 NPT	1.250 NPT
	Wrench Size	15/16	15/16	15/16	15/16
Other Plugs	Plug Size	1.250 NPT	1.250 NPT	1.250 NPT	1.250 NPT
	Sq. Skt.	3/4	3/4	3/4	3/4
Shaft Fan Shroud	Screw Size	M12	M12	M12	M12
	Wrench Size	18mm	18mm	18mm	18mm
Shaft Fan Setscrew	Screw Size	M10	M10	M10	M10
	Hex Size	5mm	5mm	5mm	5mm

AFTER FIRST MONTH — Proceed as follows:

1. Operate drive until old sump oil reaches normal operating temperature. Shut down drive and drain immediately.
2. Immediately flush drive with an oil of the same type and viscosity grade as the original charge (warmed to approximately 38°C (100°F) in cold weather) by rapidly pouring or pumping a charge equal to 15 - 25% of the initial fill volume or until clean oil flows through the drain.
3. Close the drain and refill the drive to the correct level with new oil of the correct type and viscosity.

PERIODICALLY —

1. Check the oil level of the drive when it is stopped and at ambient temperature. Add oil if needed. If the oil level is ABOVE the high oil level mark on the dipstick, have the oil analyzed for water content. Moisture in the oil may indicate that a seal or the heat exchanger is leaking. If so, replace the defective part immediately and change the oil. DO NOT fill above the mark indicated as leakage or undue heating may result.
2. Check coupling alignment to make certain that foundation settling has not caused excessive misalignment.
3. If drive is equipped with a fan, periodically clean accumulated foreign matter from the fan, guard, and deflector.
4. If drive is equipped with a torque arm, check for free movement.

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Lubricant Changes

OIL ANALYSIS REPORT — Checking oil condition at regular intervals is recommended. Analyze oil samples approximately every 1000 hours for petroleum EP lubricants or every 3000 hours for synthetic EP lubricants. In the absence of more specific limits, the guidelines listed below may be used to indicate when to change oil:

1. Water content is greater than 500 ppm (parts per million) (0.05%).
2. Iron content exceeds 150 ppm.
3. Silicon (dust/dirt) exceeds 25 ppm, above reference sample from new oil container.
4. Copper content exceeds 75 ppm.
5. TAN (Total Acid Number) 50% increase above reference sample from new oil container.
6. Viscosity changes more than ±15%.

Laboratory analysis is recommended for optimum lubricant life and gear drive performance.

PETROLEUM EP LUBRICANTS — For normal operating conditions, change EP lubricant every 6 months or 2500 operating hours, whichever occurs first. Change oil more frequently when gear drives operate in extremely humid, chemical or dust laden atmospheres. In these cases, EP lubricants shall be analyzed to determine proper change interval. Refer to Table 2 for EP lubricant viscosity recommendations

SYNTHETIC EP LUBRICANTS — Synthetic EP lubricant change intervals can be extended to 8000 hours depending upon operating temperatures and lubricant contamination. Change oil more frequently when gear drives operate in extremely humid, chemical or dust laden atmospheres. In these cases, synthetic EP lubricants shall be analyzed to determine proper change interval. Refer to Table 3 for synthetic EP lubricant viscosity recommendations.

Grease Lubricated Seals — Depending on the frequency and degree of contamination (at least every six months or when changing oil in the drive), purge grease from seals by first cleaning grease fitting and then slowly pump fresh grease, WITH A HAND GREASE GUN, through the seal cavity until fresh grease flows out along the shaft. Wipe off purged grease. Refer to Table 10 for NLGI Grade #2 greases. Some greases are of the EP type and may contain toxic substances not allowed in the food processing industry. Grease that meets the USDA or NSF "H-1" classification is suitable for food processing applications. Consult Factory.

CAUTION: Rapid greasing with a power grease gun can force grease inward past the seals causing seal leaks.

GREASE LUBRICATED BEARINGS (Torque Arm) — Most shaft mounted drives have a grease lubricated bearings in the torque arm. Grease bearings during oil changes or at intervals of every 6 months or 2500 hours of operation whichever is less.

Stored & Inactive Gear Drives

Each gear drive is protected with a rust preventative that will protect parts against rust for a period of 4 months in an outdoor shelter or 12 months in a dry building after shipment from the Factory.

If a gear drive is to be stored, or is inactive after installation beyond the above periods, drain oil from housing and spray all internal parts with a rust preventative oil that is soluble in lubricating oil or add "Motorstor"™ vapor phase rust inhibitor at the rate of 1.05 liters per cubic meter (one ounce per cubic foot) of internal drive space (5% of sump capacity). Refer to Table 8 for Motorstor quantities. Rotate the shafts several times by hand. Before operating, drives which have been stored or inactive must be filled to the proper level with oil meeting the specifications given in this manual. Refer to Manual 128-014 for "Start-up after Storage" instructions.

Periodically inspect stored or inactive gear drives and spray or add rust inhibitor every six months, or more often if necessary. Indoor dry storage is recommended.

Gear drives ordered for extended storage can be treated at the Factory with a special preservative and sealed to rust-proof parts for periods longer than those cited previously.

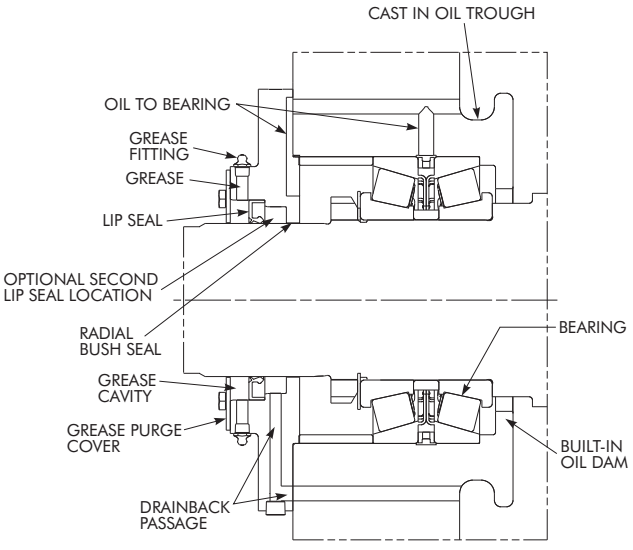
The vented dipstick should be replaced with a plug (vented dipstick should be attached to gear drive for future use) so that the protective rust inhibiting atmosphere is sealed inside the drive. Install vented dipstick when preparing drive for operation.

TABLE 8 — Motorstor/VCI–10 ★

(Add to stored or inactive drives)

DRIVE SIZE	Motorstor	
	Milliliters Per Drive	Ounces Per Drive
M1220 - M1230	440	15
M1240 - M1250	590	20

★ Product of Daubert Chemical Company, Chicago, IL.



Changing Hand of Drive

Right/Left Hand Spare — A Drive One Conveyor Drive can be used in a right hand or left hand application with a single low speed shaft extension and minimal change-over effort. The Conveyor Drive housing top and bottom halves are identical and therefore can be mounted on either end. Internal lubrication troughs and oil passage function in either position as well. Changing the drive from one hand to the other simply requires repositioning of the top and bottom plate, magnetic drain plugs, dipstick and breather.

To change hands of the drive, begin by cleaning the outside of the housing to prevent contamination of internal components and drain the oil. With inspection cover up, remove the AirMax breather and dipstick pipe fittings from the housing. Remove the top cover of the drive, threaded jacking holes are provide to break loose the sealant if required, (eyebolts threaded into jacking holes can be used for lifting). Remove internal oil distribution pan if present, (See additional instructions below if drive is equipped with an internal lubrication pump). Rotate the drive 180° so the bottom plate is now up. Remove the bottom plate, jacking holes are also provided.

Prepare top and bottom plate for reassembly by removing old sealant. Loctite Chisel Gasket Remover or equivalent can be used to aid in the removal of sealant. CAUTION: Gasket Remover can soften and remove paint. Prepare the housing surface in the same manner. Apply Loctite Activator 7649 or equivalent to the mating surfaces of the top plate and housing and allow to dry. Position the oil distribution pan in housing (if required) with large opening over the low speed gear. The tabs of the pan reside in the pockets of the housing and is secured by the cover plate. Apply a continuous bead of Loctite 515 Gasket Eliminator or equivalent to the housing mating surface to the inside of the bolt pattern. Assemble top plate to housing with the inspection cover over the low speed gear. Tighten fasteners to 85 N-m (62 lb-ft).

Remove pipe plugs from new dipstick and breather location. Rotate the drive 180° so the newly assembled top plate is down. Clean and prepare housing surface as previously mentioned for top plate. Apply a continuous bead of Loctite 515 Gasket Eliminator or equivalent to the housing mating surface to the inside of the bolt pattern. Assemble bottom plate to housing and tighten fasteners to 85 N-m (62 lb-ft). Install previously remove pipe plugs into old dipstick and breather location. Coat pipe threads with Loctite Pipe Joint Compound or equivalent prior to installation.

Position drive top side up. Install dipstick fitting in housing on side opposite the low speed gear. Assemble AirMax assembly fitting in housing on gear side. Reposition magnetic drain plugs such that they will be in the oil sump. Coat pipe threads with Loctite Pipe Joint Compound or equivalent prior to installation.

Drives with an Internal Lubrication Pump — When changing the hand of a drive with an internal lubrication pump, the pump must be moved to the cross-bar of what will be the bottom of the housing. All previous instructions for changing hands must be followed. In addition, to remove the oil pan, remove the fitting holding the fill tube into the oil pan. Remove the two fasteners mounting the pump bracket to the cross-bar and any shims that are used.

Prepare the pump for mounting on the opposite cross-bar by loosening the compression nut on the fittings securing the suction and output tubes to the pump. The tubes must remain in the same port on the pump. Rotate the output tube 180° and tighten compression nut. The suction tube should be rotated such that is will be approximately 10-20mm (0.375-0.750 inches) off the bottom of the drive sump. Position the pump in the housing. Align the pump gearset with a straight edge. The pump gearset back lash should be set between 0.15-0.56mm (0.006-0.022 inches) by adding or removing shim beneath the pump bracket.

After proper gear alignment and backlash is achieved, apply Loctite 242 threadlocker or equivalent to the threads of the pump mounting fasteners. Tighten fasteners to 85 Nm (62 lb-ft) and re-check alignment and backlash. When installing the oil pan, position pump output tube through coupling in pan. Install fitting to secure output tube. Continue with instructions as mentioned previously.

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Fixed Torque Arm Installation

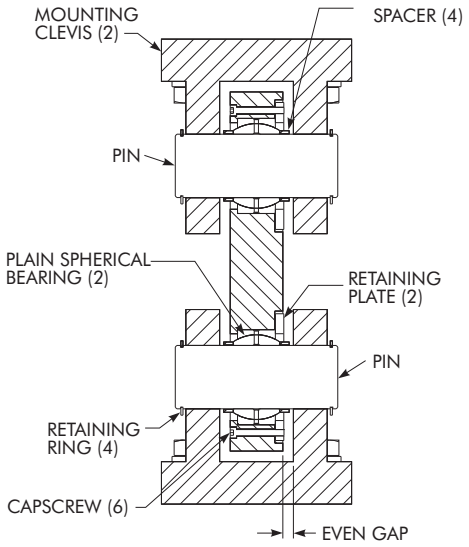
Introduction

The Drive One spherical bearing link style torque arm is available for all shaft mounted Drive One Large Conveyor Drive Sizes, both parallel shaft Type DH and right angle Type DB. It is used to support the drive when mounted in a standard horizontal position. The torque arm accessory is suitable for use on swing bases, bedplates, Alignment Free or mounted directly to the drive. The torque arm requires mounting holes in the driven equipment support structure to provide for attachment. The customer is responsible for determining the structural integrity of their support member.

Mounting

It is natural for the drive system to move during operation. This movement is due to runout from the driven equipment shaft and gear drive low speed shaft. Plain spherical bearings and a link are used to provide a resilient mounting support that accommodates the motion of the drive. To allow for maximum movement, the torque arm should be perpendicular to the supports and centered in the mounting clevis. Restricting the drive's motion will result in premature failure of the drive or driven equipment.

Figure 1



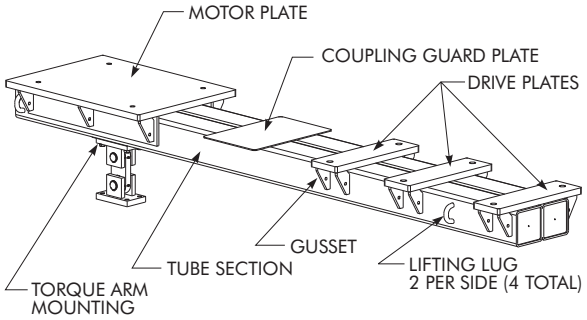
Installation

1. Position the drive on the driven equipment shaft such that the torque arm link is centered in the mounting clevis. Ideally, the clevis mounting holes should be added to the structure after the drive has been secured to the driven equipment.
   NOTE: Do not fasten the torque arm to the support structure at this time.
2. Secure the drive to the driven equipment via the rigid coupling connection.
3. Mount the clevis to the drive or drive system. Locate the position of the clevis to be mounted to the support structure. Match drill the mounting holes for M24 Cl. 8.8 or 1 inch Grade 5 fasteners or better.
4. **(IF REQUIRED)** Mount plain spherical bearings into link. Secure bearings with retainer plate and cap screws. Apply Loctite 242 Threadlocker or equivalent to fastener threads prior to installation.
5. Install pin through one lug of clevis mounted to drive. Position spacer, then link (with spherical bearings previously installed) and finally second spacer on pin. Finish positioning pin within clevis. Install retaining rings to each side of pin to retain pin. Refer to Figure 1.
6. Install pin in clevis mounted to supporting structure in a similar manner. The drive may need to be rotated about the low speed shaft to install second pin. If the drive has a backstop, it may be necessary to disconnect the backstop to rotate the drive. Refer to the backstop instructions for removal.
7 Verify the torque arm link is centered in the clevis and is not restricting motion of the drive.

Swing Base Installation

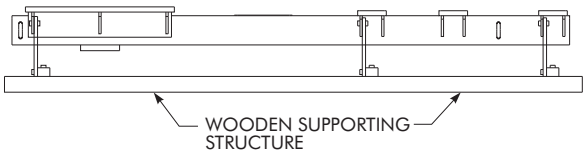
Introduction

The Drive One Swing Base is a welded steel structure designed to support a motor and a right angle Type DB, shaft mounted drive. The swing base itself is a length of square cross-sectional tubing with plates welded to it for the motor and drive. The motor and drive plates are machined and are supported by gussets for additional strength. A torque arm attaches to the tube section near the motor end of the swing base.



Supporting the Swing Base

The torque arm connection lug prevents the swing base from lying flat on the ground; therefore, a supporting structure is required for mounting the gear drive and motor to the swing base. This structure is typically built from wood and is unique to each swing base. All gussets have a 19 mm (0.75 inch) diameter hole for securing the swing base to the supporting structure.

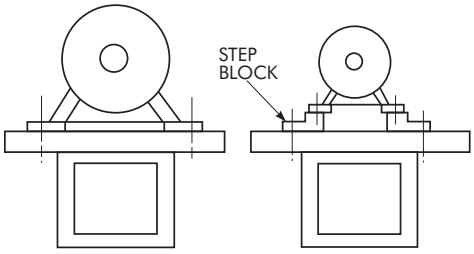


Mounting Gear Drive to Swing Base

It is standard procedure to mount the drive to the swing base at the Factory. These instructions are to be followed when field mounting of the drive to the swing base is required. Use of broad, flat shims between the gear drive and mounting plate are recommended to prevent distortion of the housing when the drive is bolted down. Jacking screw holes are provided in gear drive housing to aid in fixing the shims. Begin at the low speed shaft end and level across the length and then the width of the gear drive. Use a feeler gauge to insure that all pads are supported. Bolt down the drive to the torque specified in Table 1, Page 4.

Mounting Motor and Coupling Alignment

Shims are provided for motor mounting. Holes must be drilled into the swing base motor plate for mounting of the motor. Step blocks are also provided for some small frame motors. Use a feeler gauge to ensure that all motor pads are firmly seated. Motor mounting needs to be done in conjunction with coupling alignment to control angular and offset misalignment. Refer to the coupling manufacturer's manual for specific instructions. Bolt down the motor to the torque specified in Table 1, Page 4.

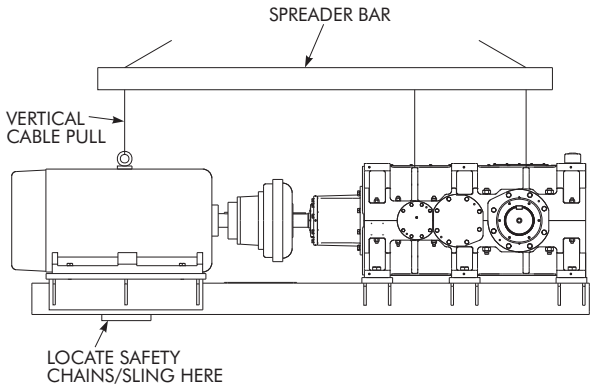


Coupling Guard

The coupling guard must be trimmed in order to fit the height and shaft extension requirements. Refer to the coupling guard installation manual for instructions on trimming the guard. After the guard has been trimmed holes can be drilled in the coupling guard plate on the swing base. The guard can then be bolted down to the plate.

Lifting the Swing Base Assembly

After the drive, motor, and coupling have been mounted to the swing base, the completed assembly can be lifted into position for installation on the driven shaft. The motor eyebolt and the lifting holes on the drive housing can be used as cable attachment points. The motor eyebolt is strongest when the cable pull is vertical. To insure that cable pull on the motor eyebolt is vertical, use of a spreader bar is recommended. See the sketch below. To ensure safety, chains or a sling should be placed behind the torque arm connection.



Mounting Swing Base Assembly to Driven Equipment

Mount the gear drive to the driven shaft (See Page 2). Secure the torque arm to the foundation per the instructions in Appendix A.

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Alignment Free Assembly and Installation - Welded Design

Introduction

The Alignment Free Drive design consists of a shaft mounted drive, bell housing, motor adapter plate, torque arm, motor and coupling. When assembled, the bell housing, motor adapter, and motor locate off registers, resulting in alignment of the motor and gear drive shafts. Therefore, no additional alignment is required for the high-speed coupling.

Assembly Instructions

The bell housing is fastened to the drive's high speed end using cap screws in tapped holes on that face, (see Table 1 for size and torque). The bell housing will locate on the bevel head of the drive. Read instructions provided with high speed coupling prior to assembly.

TABLE 1 — Tightening Torques

DRIVE SIZE	Bolt Size	Tightening Torque	
		N-m	lb-ft
M1220	M24	725	535
M1230	M24	725	535

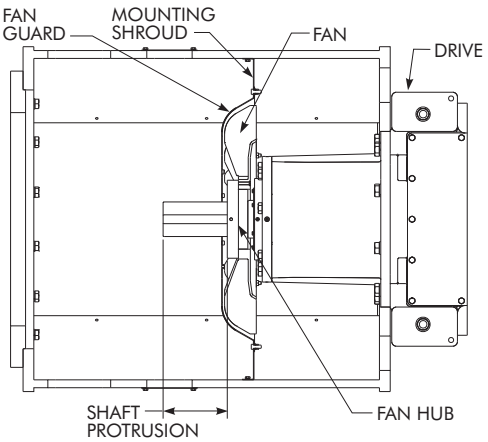
Shaft Fan (Optional)

A shaft fan is provided on the high speed shaft for drive requiring a shaft fan. The fan must be assembled to the drive prior to mounting any type of coupling. Assemble the fan to the hub, apply Loctite 242 threadlocker or equivalent to the fasteners and tighten. Caution: over-tightening can crack the fan. Position the fan on the high speed shaft to the position indicated in Table 2 (See Figure 1). Apply Loctite 242 threadlocker or equivalent to the set screw and tighten.

TABLE 2 — Fan Hub Location

DRIVE SIZE	Shaft Protrusion	
	mm	Inch
M1220	205	8.07
M1230	205	8.07

FIGURE 1



Assemble the mounting shroud and fan guard inside the bell housing. Mounting shroud and fan guard cannot be assembled outside the bell housing. Install all fasteners loosely to ensure all fastener holes are aligned. When all fasteners are loosely installed, tighten starting with the mounting shroud to bell housing fasteners and finish with the fan guard fasteners. Rotate the high speed shaft by hand to verify there is no interference between the fan and guard.

Fluid Coupling

Location of the fluid coupling on the high speed shaft of the drive is determined by the provided shaft spacer. Install the fluid coupling on the high-speed shaft of the gear drive per fluid coupling instructions.
Once the fluid coupling is installed, the motor adapter plate can be mounted to the bell housing, also being located by a register. Measurements must be taken to accurately position the motor half of the coupling hub on the motor shaft. First, measure the distance from the motor mounting face to the end of the motor shaft, (A). Then measure the distance from the motor adapter plate face to the hub on the fluid coupling, (B). Finally measure the distance from the hub flange to the hub end, (C). The desired gap can be found in Table 3, based on coupling size.

TABLE 3 — Coupling Gap

Fluid Coupling Size	Tschan Hub Size	Gap	
		mm	Inch
1480HFDD	**260**	7.5	0.295
1584HFDD	**300**	8.4	0.331
1660HFDD	**360**	9.0	0.354

Calculate the hub protrusion:
Protrusion = (A + Gap) – (B + C)
If the calculated protrusion is a negative value, the hub overhangs the shaft by that amount. (Figure 2)
Once the hub is correctly located on the motor shaft, the motor

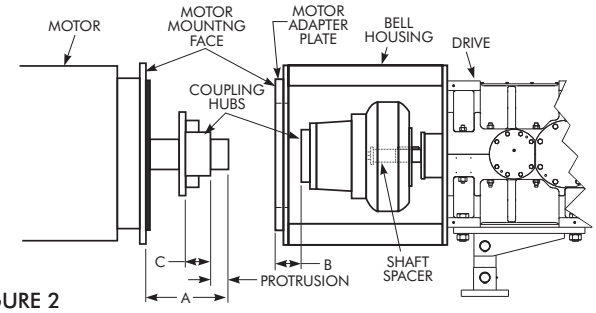


FIGURE 2

can be mounted to the motor adapter plate. The hubs will be aligned and come together to the proper gap. To fill the fluid coupling to the proper oil level, align the mark on the perimeter of the fluid coupling with the mark in the center of the inspection window on the bell housing on the side opposite the low speed shaft extension. To locate the correct mark on the fluid coupling, begin by aligning the fill hole of the fluid coupling with the mark in the inspection window. For fill angles less than 90°, rotate the fill plug upward until the marks line up. For fill angles greater than 90°, rotate the fill plug downward until the marks line up. When the proper marks are in-line, fill the fluid coupling with recommended fluid until fluid appears at the lip of the fill hole.

Close Coupling

If the drive requires a shaft fan, assemble prior to installing coupling.

Mount the motor to the motor adapter plate on the bell housing before installing the coupling. Once the motor is secured, measure the distance (D) between the end of the motor shaft and the high speed shaft of the drive, see Figure 3. Subtract the distance (D) from the length of the spacer coupling (BE). Then divide this value in half to find the overhang of each hub. [Overhang + (BE – D)/2] The overhang will be negative, this is the amount each hub overhangs the shaft. Once the overhang is determined, install the hubs according to the instructions provided with the coupling. Install the spacer sections and verify the gap is correct. If not, readjust the hub on the motor shaft. If the coupling is furnished with an interference fit, readjustment will not be possible, take extra care in making measurements. After the proper gap is set, finish installing the coupling per the instructions.

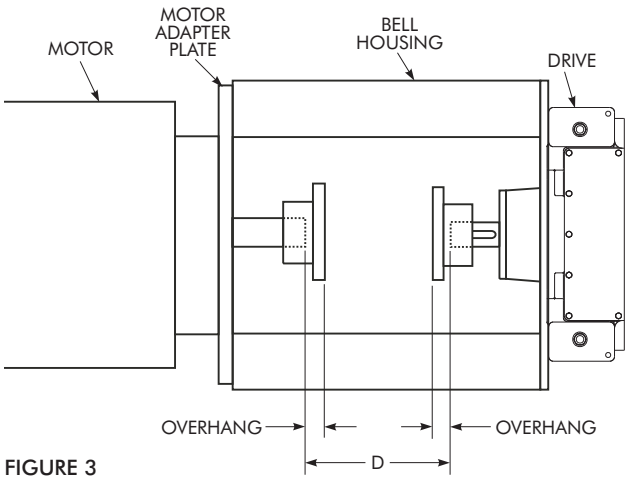


FIGURE 3

Lifting the Alignment Free Drive

Lifting points are provided on the corners of the motor side of the bell housing, see Figure 4. Lift by these and the provisions provided on the drive housing itself to maneuver the drive. DO NOT lift by the motor lifting eye.

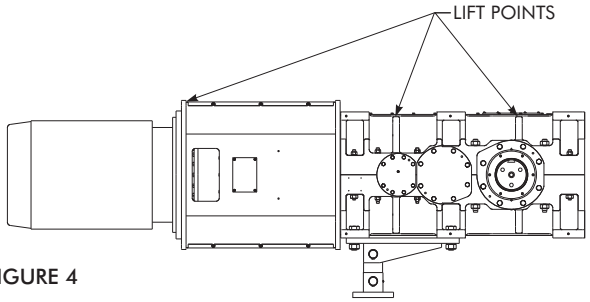


FIGURE 4

Mounting the Drive

Mount the Alignment Free Drive to the driven equipment per Page 2. The torque arm must be located on the extension side of the drive at the foot as shown in Figure 5. Connect the torque arm to the foundation per the torque arm installation instructions.

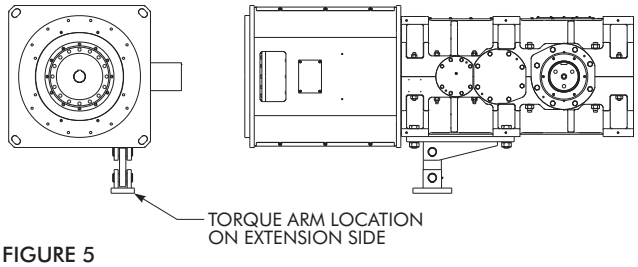


FIGURE 5

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Alignment Free Assembly and Installation – Cast Design

Introduction

The Alignment Free Drive design consists of a shaft mounted gear drive, bell housing, torque arm, motor and coupling. When assembled, the gear drive, bell housing and motor locate off registers, resulting in alignment of the shafts. Therefore, no additional alignment is required for the high-speed coupling.

Assembly Instructions

The Bell Housing is fastened to the gear drive's high-speed end using capscrews through the twelve mounting holes on that face with a lock washer, (see Table 1 for size and torque). Apply Loctite® #242 or equivalent to mounting fastener threads. The bell housing will locate on the bevel head of the gear drive. Read instructions provided with high speed coupling prior to assembly.

TABLE 1 — Tightening Torques

DRIVE SIZE	Bolt Size	Tightening Torque	
		N-m	lb-ft
M1220	M24	780	570
M1230	M24	780	570

High Speed Shaft Fan

High speed shaft fan is standard on all Drive One Alignment Free Drives. Fan size and position is independent of high speed coupling size or type. Assemble fan to fan hub, apply Loctite #242 or equivalent to fastener threads and tighten. ***CAUTION:*** *Do not over-tighten fasteners into plastic fan as fan may crack.* Mount the fan hub on the gear drive high speed shaft such that the set screw hole in the hub is towards the end of the shaft. Locate the hub axially at the values listed in Table 2. Dimensions listed are from the inside face of the bell housing to the far side of the hub, see Figure 1. Apply Loctite #242 or equivalent to threads of the set screw and tighten over key to secure hub in position. Fan hub must be installed prior to installing high speed coupling hub.

TABLE 2 — Fan Hub Location

DRIVE SIZE	Shaft Protrusion	
	mm	Inch
M1220	460	18.11
M1230	460	18.11

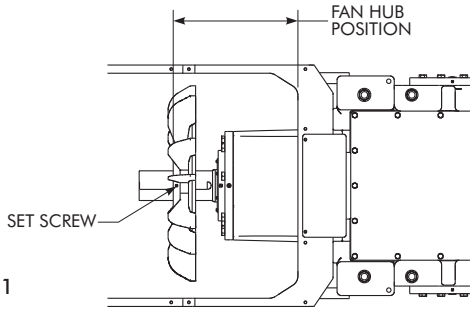

FIGURE 1

Assemble fan shroud mounting rails to bell housing. Assemble fan cowling with expanded metal guard to back of fan shroud/plates on same fasteners. Mount fan shroud assembly to mounting rails. The cowling may require to be notched to allow clearance for the bell housing to drive mounting fasteners. Rotate fan to ensure clearance, reposition fan hub if necessary. Split fan guard may be removed or installed without disrupting high speed coupling. See Figure 2.

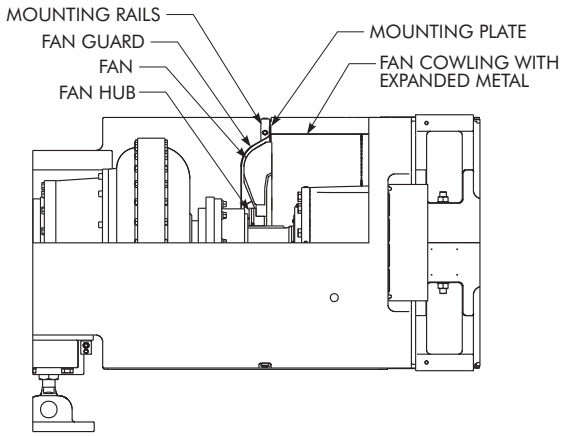

FIGURE 2

Fluid Coupling

The fluid coupling can be installed/removed without removing the motor, (see fluid coupling instructions for procedure). Mount the coupling hubs to the drive high speed shaft and the motor shaft. Hubs are to be mounted flush with the end of the shafts (coupling hubs may be furnished with an interference fit). Mount the motor to the bell housing, apply Loctite #242 or equivalent fastener threads and tighten to proper torque. Install fluid coupling per coupling instructions.

To fill the fluid coupling to the proper oil level, install the small top cover on the bell housing. Rotate the fluid coupling such that the fill hole is up and fill with the approximate quantity of oil (see coupling instructions for oil type and quantity). Rotate the coupling in either direction to align the mark on the perimeter of the fluid coupling with the mark in the center of the cover on the bell housing. A container should be placed to catch any excess oil that may spill from the fill hole. If oil drains from the fill hole, allow all excess to drain to achieve the proper fill level. If no oil drains when marks are aligned, rotate coupling back and add more oil. Repeat process until excess oil drains and proper fill level is achieved.

Close Coupling

Mount the coupling hubs to the drive high speed shaft and motor shaft. Hubs are to be mounted flush with the end of the shafts unless otherwise noted (coupling hubs may be furnished with an interference fit). Mount the motor to the bell housing, apply Loctite #242 or equivalent to fastener threads and tighten to proper torque. Install high speed coupling per coupling instructions.

Guards and Covers

Install bell housing covers, (top and bottom). Install air deflectors on the top, bottom and both sides of the gear drive. The bends of the deflectors are perforated to allow positioning of the deflectors. Air deflectors should be positioned approximately 25mm [1 inch] from the nearest housing surface by bending deflector towards or away from the drive.

Torque Arm

The carriage, adjusting rod, brackets and support bar are furnished pre-assembled from the Factory. Assemble the rod ends with heads perpendicular to each other (90°) as shown in Figure 3. Rod end threads must be engaged a minimum of 1 times thread diameter. Attach female rod end to carriage with pin. Place a spacer on each side of the rod end. Secure pin with locking plate. Carriage may be adjusted from center to either far end of the housing to facilitate installation of pin. Ensure that adjusting rod locking plate is NOT installed at this time as it will prevent adjustment of the torque arm assembly. Assemble anchor bracket to male rod end with a spacer on each side and secure with pin and retaining ring.

Lifting the Alignment Free Drive

Lifting points are provided on the corners of the motor end of the bell housing, see Figure 4. Lift by these and the provisions provided on the drive housing itself to maneuver the drive. DO NOT lift by the motor lifting eye.

Mounting the Drive

Mount the Alignment Free Drive to the driven equipment per Pages 1 and 2 of this manual. With Alignment Free drive assembly supported, rotate adjusting screw to move torque arm to desired position and to line up with foundation. Torque Arm must be perpendicular in both directions (± 1°), adjust screw if not. Install locking plate to lock the adjusting screw, (plate can be installed on either side). Remove support from drive and secure anchor bracket to foundation. Use M24 Class 8.8 [1 inch Grade 5] or better fasteners with lock and flat washers to mount anchor bracket. Slots are provided such that torque arm can be mounted perpendicular. ***CAUTION:*** *DO NOT adjust torque arm screw after support is removed and torque arm is under any load.*

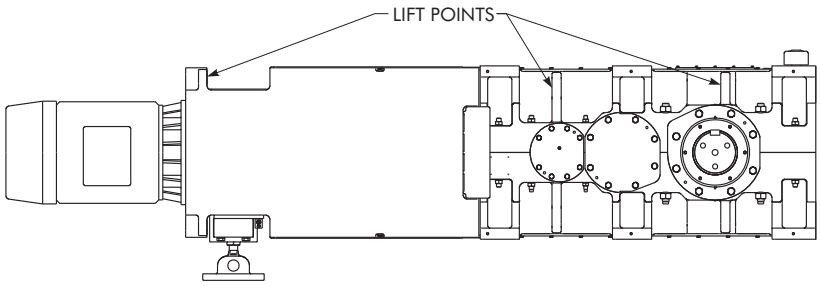

FIGURE 4

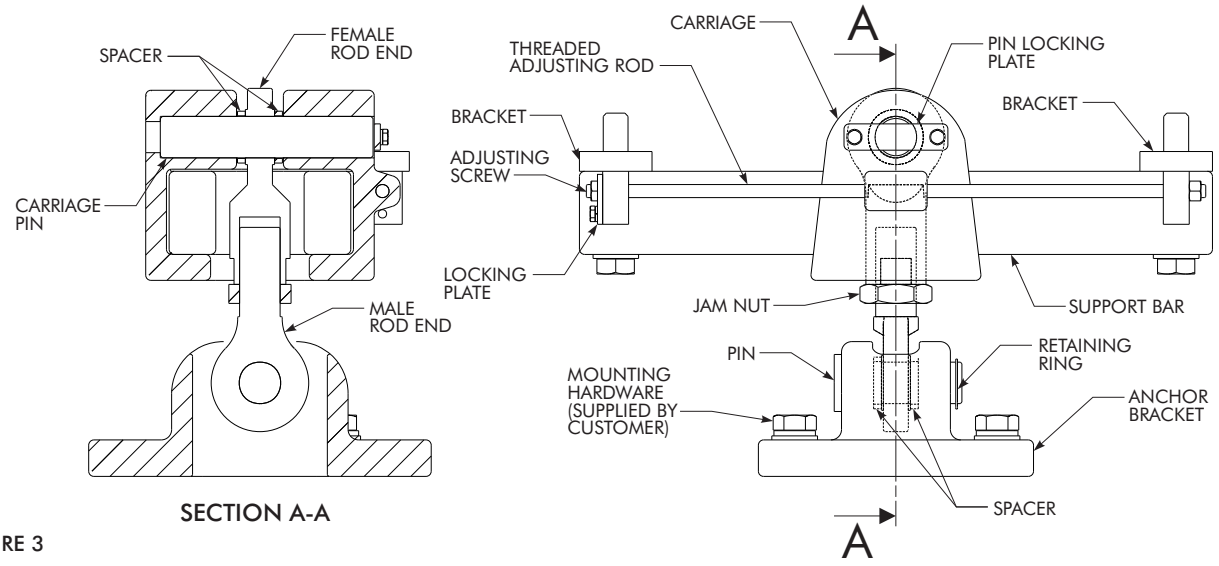

FIGURE 3

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Electric Fan Installation & Maintenance

Installation

The installation and troubleshooting of electric cooling fans are to be carried out by a qualified electrician according to the applicable local, state, province and federal codes. Inspect for any damage that may have occurred during transit. Check all bolts, screws, set screws, etc. Re-tighten as required. Before installing, rotate the blade to be sure it does not rub. Adjust if necessary. Before installation, read the entire manual carefully. This guide is pertinent only to electric fans furnished by the Factory and manufactured by Multifan Inc. (can be verified from nameplate on the electric fan). In the event the electric fan furnished by the Factory is of a special nature (manufactured by an alternate fan manufacturer), please contact the Factory for appropriate electric fan installation and maintenance instructions.

General Safety Information

Warning: *To reduce the risk of fire, electric shock, or personal injury, observe the following:*

1. Use this electric fan only in the manner intended by the manufacture. If you have any questions, contact the Factory.
2. Before servicing or cleaning the fan, switch the power off at the service panel and lock out to prevent the power from being switched on accidentally.
3. Follow all local electrical and safety codes, as well as the National Electrical Code (NEC) and Occupational Safety and Health Act (OSHA).
4. Fan motor must be securely and adequately grounded.
5. All working parts should be grounded.
6. When cleaning electrical equipment always use an approved cleaning agent. See CLEANING in NOTES section, Page 16.
7. For general ventilation and cooling use only. DO NOT use if hazardous or explosive materials and vapors are present.

Guidelines For Installation

Before connecting the electric fan, check if the information on the fan motor name plate is in accordance with the actual main supply voltage, phase and frequency.

Warning: *To reduce the risk of fire, electric shock, or personal injury, observe the following:*

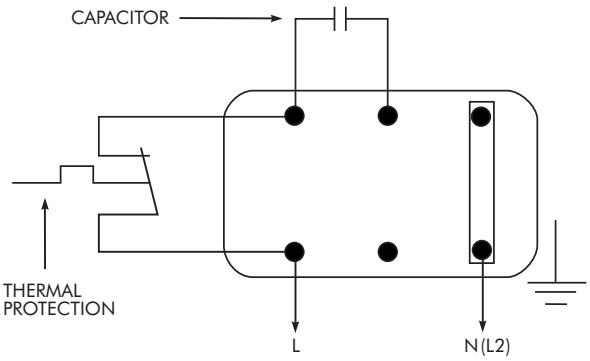
1. Switch off the main power supply and lock out before installing, servicing or making connections to the fan.
2. Installation work and electrical wiring must be done by a qualified person(s) in accordance with all applicable codes and standards, including fire-rated construction.
3. The fan should be securely mounted. Recheck the mounting hardware and tighten as necessary.
4. The fan motor must always be grounded. The installation of a motor protection switch is recommended. See Figure 1 for wiring diagrams.
5. Mount the motor guard if removed. The motor guard must be installed at all times during operation to prevent injury to personnel by rotating fan blade.
6. Use liquid tight electrical fittings and conduit.

FIGURE 1

SINGLE PHASE
TYPE - E

1 PHASE 220V - 50Hz
1 PHASE 240V - 50Hz

1 PHASE 110V - 60Hz
1 PHASE 220V - 60Hz
1 PHASE 240V - 60Hz

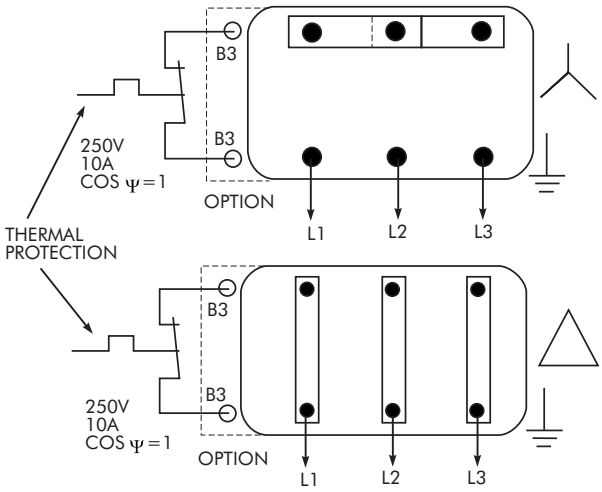


THREE PHASE
TYPE - D

3 PHASE

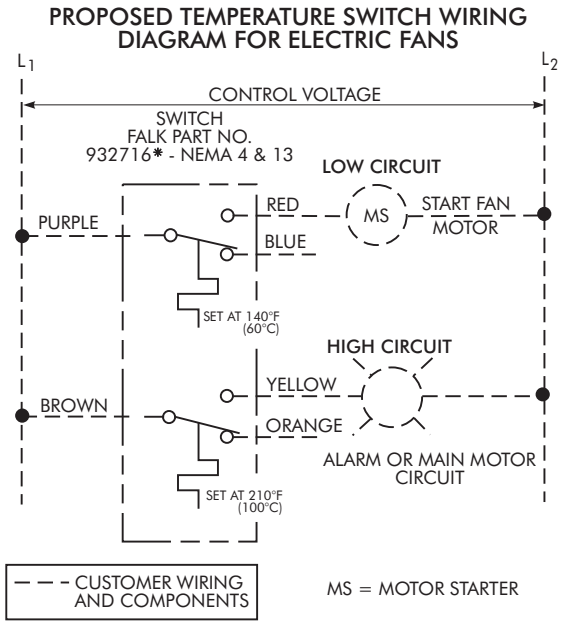
3 PHASE 220/380V - 50Hz
3 PHASE 230/400V - 50Hz
3 PHASE 240/415V - 50Hz

3 PHASE 220/380V - 60Hz
3 PHASE 208/360V - 60Hz
3 PHASE 265/460V - 60Hz



7. A temperature switch is provided to control oil sump temperature. See Figure 2 for proposed wiring. There are two separate circuits in the temperature switch. The low circuit is to operate the electric fan. It is recommended the fan motor be operated by the temperature switch through a motor starter relay (consult applicable local and national electrical codes). The high circuit is provided to operate either a high temperature alarm or main motor shutdown.

FIGURE 2



*AC RATING - INDUCTIVE LOAD - 50% PF
DC RATING - INDUCTIVE LOAD - L/R = 0.26

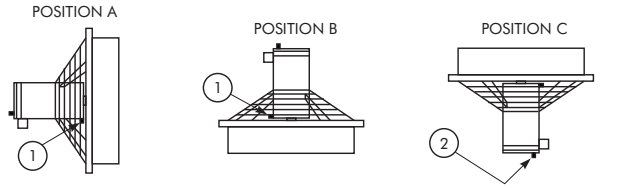
AC VOLTS	AMP	DC VOLTS	AMP
125	15	6-12**	15
250	15	24 **	5
480	15	125	0.05
		250	0.03

* MAXIMUM CONTINUOUS CURRENT
** Reference only.

8. Connect power to the motor using an approved wiring method. See Figure 1 for connection diagrams.
9. Before starting the fan, double-check to ensure there are no obstructions that could interfere with proper fan operation and airflow. Verify proper fan rotation, resulting in air flow directed at the adjacent face of the gear drive.
10. Remove proper condensation plug. See Figure 3 below. Do not discard. Plug is to be used during cleaning.

FIGURE 3

Mounting Positions		
For Position A & B Remove Plug 1	**For Position C Remove Plug 2**	**Note: Never use copper or brass fastening materials**



NOTES:

AIR SUPPLY AND TEMPERATURE — Sufficient air supply over the motor must be assured in all circumstances. Limits of operating ambient temperature are 14°F to 113°F (–10°C to 45°C).

RESTRICTION ON USE — Fan blade material is Polypropylene which is unsuitable and/or not recommended for certain chemicals. The following is a partial list of unsuitable chemicals for guideline purposes.

Chloro-Sulphonic Acid	Nitric Acid	Chloroform
Mixture of HNO3-HCL	Esters	1:2 Dichloroethylene
Mixture of HNO3-H2SO4	Benzene	Trichloroethylene
Sulfuric Acid, fuming	Gasoline	Diethyl Ether
Carbon Tetrachloride	Toluene	Chlorine, Liquid
Chlorobenzene	Xylene	

CLEANING — When cleaning fan, both condensation holes (Figure 3, Items 1 and 2) are to be temporarily plugged. If this is not done, guarantee is void. When cleaning electrical equipment, always use an approved cleaning agent.

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