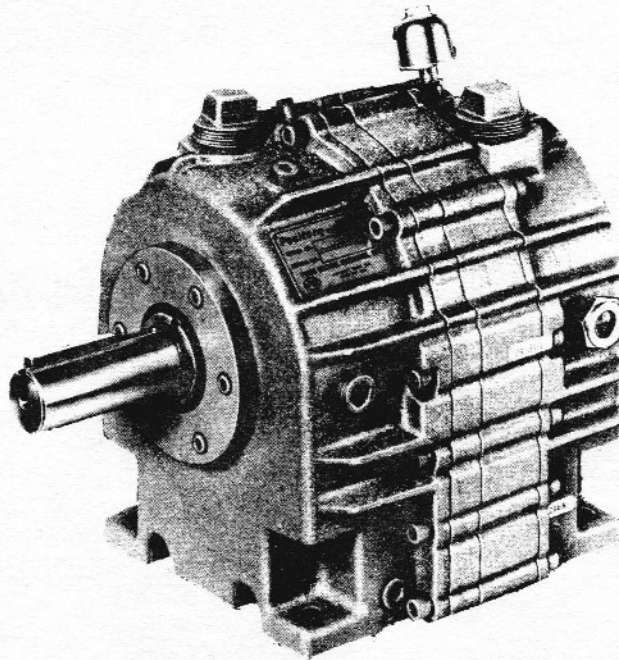


Instruction and Parts List

Positorq

Size 03,05,10,11 & 20 Brakes



WARNING

READ THIS INSTRUCTION BOOK BEFORE
INSTALLATION, OPERATION, OR MAINTENANCE

POSITORQ

TABLE OF CONTENTS

	Page
A. Definition & Operation	1
B. Troubleshooting	4
C. Receiving The Drive	6
D. Mounting The Drive	6
E. Oil Spec's.	7
F. Unit repair instructions	8
G. Cleaning & Inspection	8
H. Repair & Replacement	9
I. Reassembly	10
J. Ordering Replacement Parts	12
K. Factory Rebuild Service	13
Parts List & Drawings	

POSITORQ DEFINITION & OPERATION

The Positorq is a brake only product. It employs the alternating plate and friction disc design as the working or friction producing elements. The plates are prevented from rotating by drive keys in the housing engaging in slots in the plates perimeter. Gear teeth cut into the I.D. of the friction disc engage into splines cut on the hub of the output shaft. When no clamping pressure is applied to the stack there is no appreciable friction developed between the working surfaces. As a result the output shaft is free to rotate except for shaft seal and bearing friction.

A friction build up in the plate and disc pack is accomplished by a clamping pressure being applied to the pack. Since the plates are prevented from rotating by the keys in the housing the friction buildup between the working surfaces causes a holding or braking action on the disc. This braking action is transferred to the output shaft via the gear teeth in the disc and the splines on the output shaft. By controlling or adjusting the clamping pressure on the plate and disc stack the braking action or brake torque seen at the output shaft can be controlled.

The clamping pressure is applied to the plate and disc stack by an annular shaped piston contained inside the Positorq piston housing. The logic of the piston or actuator may be one of two types. Pressure applied/multiple spring release (Models SB & TB) or multiple spring applied/pressure release (FB Model). The control pressure may be pneumatic or hydraulic and is contained by Teflon seals backed up with o-rings.

- 2 - Positorq Definition

This type of seal combination is of major importance in that the Teflon allows for a low sliding friction on the piston moving surfaces reducing hysteresis. Furthermore, the o-rings are in static positions as they should be and are not subjected to sliding and wear resulting in premature leaks.

The piston in the pressure applied/multiple spring releases (SB & TB Models) Positorq is shifted away from the brake pack by multiple springs when the control pressure approaches zero. As the control pressure is applied to the piston chamber the return spring force is overcome at approximately 3 to 7 PSIG. The total friction surface areas of the disc, their effective mean radius and coefficient of friction remain constant; therefore the torque buildup in the brake stack is controlled by the clamping pressure induced by the piston.

The clamping force produced by the piston is controlled by the actuation pressure available over the fixed surface area of the piston. Once the return spring force is overcome the relationship between the torque buildup and the actuation pressure is linear.

The multiple spring set/pressure release (FB Model) type Positorq has just the opposite logic. The multiple springs shift the piston toward the brake pack setting the brake. When sufficient actuation pressure is applied it overcomes the multiple spring force and shifts the piston away from the pack, releasing the brake. In this type, torque is inversely proportional to actuation pressure.

Above we have discussed design methods of control of the Positorq. Let us now turn to how the work i.e. energy absorption is accomplished. During a dynamic and clamped condition the sliding friction between the friction disc & plates result in heat buildup at the working surfaces.

- 3 - Positorq Definition

The basic models employ the patented "Posidyne" integral centrifugal oil pumping system in the barrel of the output shaft.

The forced lubrication models employ a closed loop fluid circulation and cooling system. In both types, fluid is circulated from inside the barrel of the output shaft and through the friction disc and plate stack. As the thin film of fluid passes across the friction surfaces the heat of sliding friction is transferred to the fluid. The fluid then carries the heat to the sump or reservoir. The basic models dissipate the heat stored in the fluid through the finned housing. The forced lubrication models circulating systems pump the fluid through an external heat exchanger to cool the fluid. Oil to water (shell & tube) or oil to air (fan type) may be used.

The same fluid that is absorbing the heat of friction is also lubricating the working surfaces. Therefore, the normal wear that occurs in friction type devices is not present in the "Positorq". The normally expected service is only a simple flushing and replacing the fluid in the "Positorq". This eliminates the frequent replacing of friction facing or lining common to most other brakes.

TROUBLESHOOTING

TROUBLE	POSSIBLE CAUSE	REMEDY
Stops load too quickly	Too high air pressure	Reduce air pressure
	Low oil level	Check oil level
Noise & vibration	Mounted on poor foundation	Improve installation tighten foot bolts
	Misaligned couplings	Recheck alignment
	Damaged bearings	Disassemble to extent necessary to inspect.
Brake fails to engage properly	Electrical control circuit	Check control circuit
	Valve not functioning properly	Check valve operation replace, if necessary.
	Air set only { Low air pressure	Increase air pressure (max. 80 PSI)
		Internal air leakage
	Spring set only — Weak or broken springs	Check and replace "O" rings and Teflon liners if necessary.
		Disassemble to extent necessary and inspect for damaged parts.
Brake fails to dis-engage properly	Electrical control circuit	Check control circuit
	Valve not functioning properly	Check valve operation. Replace, if necessary.
	Air set only — Piston sticking	Disassemble to extent necessary & inspect for damaged parts.
	Spring set only — Low air pressure	Increase air pressure (see table 1 & 2).
Drive overheats	Brake fails to engage or dis-engage properly causing excessive slippage.	Refer to these troubles.
	Inertia or load changed	Check with Force Control Engineering.
	Improper oil level	Check oil level, add or drain as necessary.

TROUBLESHOOTING (Con't.)

TROUBLE	POSSIBLE CAUSE	REMEDY
Oil leakage	Lip seals	Check to see if oil is leaking around shaft.
	Gaskets	Tighten all external bolts.
	Poor ventilation	Remove breather and clean
	Seal retainers	Tighten if loose
Oil leakage out breather	Damaged seal around piston	Dis-assemble and repair
	Oil level too high	Drain excess oil
Shaft end play excessive (.020 max.)	Bad bearings	Dis-assemble and replace

Receiving The Drive

Check the drive for shortage or damage immediately after arrival. Prompt reporting to the carrier's agent, with notations made on the freight bill, will expedite satisfactory adjustment by the carrier. When unloading or handling the drive, keep it upright. All drives are filled with oil, ready to run, when shipped except for forced lube drives. However, before placing the unit in service or storage, check the oil level to make sure none has spilled out in transit, add oil if necessary. If the drive is not to be installed and operated soon after arrival, store it in a clean, dry place having slow, moderate change in ambient temperature.

Mounting The Drive

IMPORTANT SAFETY PRECAUTIONS

The Positorq units described in this manual must not be installed in any manner except as specified herein, and must not be operated at speeds, horsepower loads or temperatures other than these specified for new units. Failure to limit operation of the brakes to the conditions specified could damage the units and may cause malfunction or damage of interconnected equipment.

Suitable guards for rotating shafts and couplings must be used at all times when operating equipment.

Installation of the drive should be made in the same manner and receive the same care as for a precision gear reducer. Standard drives are designed for horizontal operation only. Note the following precautions when mounting the drive:

1. The drive should be mounted on a firm, level base or foundation.

2. Use socket head cap screws or grade 5 bolts to bolt the drive securely in place before tightening down the bolts, check alignment, then recheck after tightening.
3. If the shaft is to be directly coupled use only a flexible coupling (with horsepower service factor 3 to 1) to take care of maximum torque requirements. Make sure that the shafts to be coupled are concentric with 0.005 in. tir. Check for horizontal, vertical or angular misalignment and use shims as necessary to correct.

CAUTION

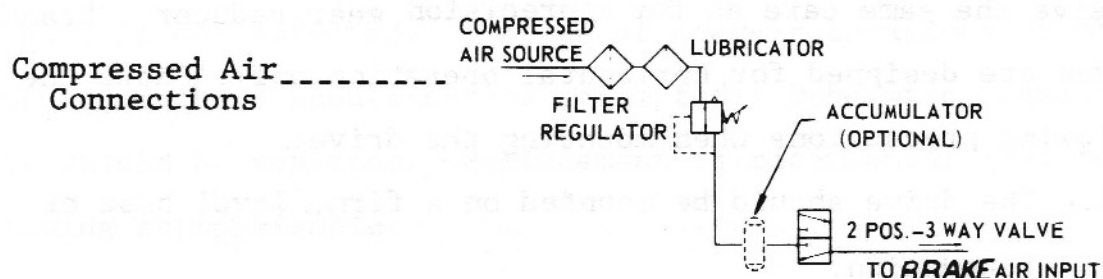
Do not drive couplings or bushings on shaft.

4. If the drive is to be connected through a belt, chain or gear drive locate as close as possible to the housing to minimize overhung loads. Make sure that the sheaves, sprockets or gears are in line and that the shafts are parallel.
5. After the machinery has been in operation for a few hours, make sure that all mounting bolts are tight and recheck the alignment of all components.
6. After machinery has been in operation for 40 hours check the mounting bolts and tighten if necessary.

OIL SPEC'S

SB & FB brakes use Mobil automatic transmission fluid ATF 210.

TB brakes use oil F.C.I.I. #710-02-005.



UNIT REPAIR INSTRUCTIONS

CAUTION

Before attempting repairs to the brake, open the disconnect switch to electric motor to avoid possibility of personal injury.

General

In most cases unless the drive is to be completely overhauled the unit should be dis-assembled only to the extent necessary to gain access to worn or damaged parts. Re-assembly is the reverse of dis-assembly.

NOTE: Refer to the parts list included.

1. Removal of socket type nuts (#152) will allow access to first brake stack. Removal of socket head cap screws (#69) will allow access to second brake stack. Jack-screw holes are provided.
2. Removal of socket head cap screws (#63) on the shaft end will allow bearing retainer (#7) and shaft (#1) removal. The bearings (#26 & 28) and seal (#31) can now be replaced if necessary.
3. The piston housing assemblies (#245, 11 & 3) and (#10, 11 & 3) can be separated into two sub-assemblies by separating at gasket at center. Removal of socket head cap screws (#61) will allow removal of the piston (#3) and gain access to seals (#43 & 40) and (#42 & 39) and springs (#36).

Clearing And Inspection

CAUTION

Petroleum - base cleaning solvents are flammable, and open flames or smoking by personnel in the vicinity of these solvents is extremely hazardous

- 9 - Positorq Definition

Clean metal parts in a suitable solvent and dry out in a stream of low pressure compressed air. Clean the brake drive plates and friction discs one at a time, keeping parts in the same order as they were removed, after cleaning, inspect parts for cracks, distortion, scoring, nicks, burrs or other damage which would affect serviceability. Pay particular attention to the following:

1. Check the friction disc wear surfaces for scoring, galling, or evidence of uneven wear.
2. Check the drive plates for scoring or galling, make sure they are flat. If a perceptible ridge is worn in the plate where it mates with the friction disc, the plates should be replaced.
3. Carefully check the piston and bore surfaces for nicks, scratches, scoring or other damage which would affect operation or cause leakage.
4. Pay particular attention to the mating rings, checking for nicks, scratches or other damage which would cause leakage.
5. It is not necessary to remove the ball bearings to check their operation. Slowly rotate the free race of each bearing, checking that it turns freely without rough or flat spots.

Repair or Replacement

A fine stone or crocus cloth may be used to remove minor surface defects from parts so long as the operation or sealing action of the part is not affected. The use of coarser abrasives or other machining methods should not be attempted. Otherwise, damaged parts should be replaced. Replacement is recommended also for the following as applicable:

- 10 - Positorq Definition

1. Replace all "O"-rings, liners, gaskets and oil seals removed during the course of dis-assembly.
2. Replace friction discs in complete sets.

Reassembly

Note the following general re-assembly instructions, as applicable:

1. Lubricate "O-rings and the lips of oil seals with oil (the same as used in the assembled unit) immediately before assembly and installation of mating parts.
2. "O-rings liners will be easier to install if heated in an oven to 200° F. max.

CAUTION

Wear suitable gloves when handling heated parts.

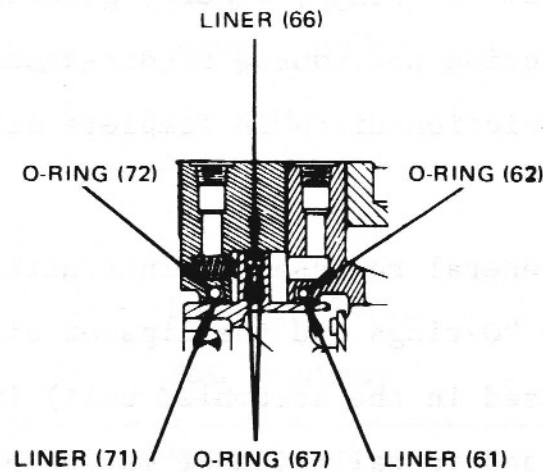
3. The installation of press fitted parts can be eased by heating the outside parts in an oven, heat bearings to 250° F max.
4. Apply capscrew adhesive (Loctite No. 59241, or equivalent) to the threads of screws and locknuts immediately before assembly. Use adhesive sparingly and wipe up any excess. Use cleaner No. 74771.
5. Apply gasket sealant (Permatex No. 30 or equivalent) to all flat gasket immediately before assembly of mating parts. Use sealant sparingly and wipe up any excess.

Reassembly

Refer to parts list.

1. Piston housing sub-assembly (#11 & 246) and (#10 & 11)
 - a. Use care not to cut or otherwise damage liners (#42 & 43) when installing mating parts, proper position of "O-rings, liners, and mating parts are shown below.

- 11 - Positorq Definition



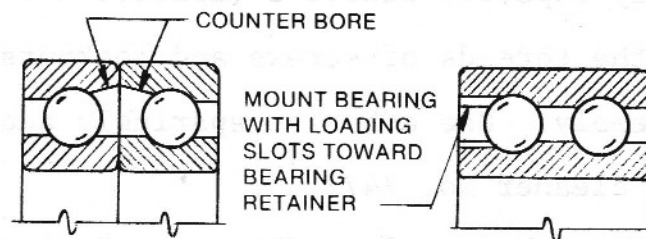
Check parts list for "O-rings used and location.

2. End housing assembly (#9) .

a. A double row bearing (26) is used on sizes 03 & 05.

Two separate bearings are used on sizes 10,11 and 20.

When installing the separate bearings make sure that they are positioned as shown below with the larger race gaps facing each other.



b. Install bearings (#26 & 28) before installing shaft #1.

c. When installing bearing retainer (#7) note that a gasket is used on 05, 05 and some 10, the other sizes use an "O-ring.

3. Final assembly.

a. Set housing (#9) and shaft (#1) assembly with shaft extension down. Position the brake drive plates (#13), friction disc (#12) and springs (when required). Install the plates so that the notches on the O.D. are all lined up.

NOTE

When building up the stack (drive plates & friction disc) always begin end and the stack with a drive plate.

Assemble first piston housing assembly (#10, 11 & 3) over shaft slipping the lugs on piston retainer (#11) through the slots in O.D. of the plates (#13). Assemble second piston housing assembly (#246, 11 & 3).

Assemble second brake stack as the first was done. Assemble end housing assembly (#9 & 16).

Completion of Repair

4. After complete re-assembly, re-install drive in the drive train, make proper hook-ups and check oil level.

Ordering Replacement Parts

When ordering replacement parts, please specify all of the following:

1. Drive model number (on the nameplate).
2. Drive serial number (on the nameplate).
3. Part reference number (from the parts list).
4. Part name (from the parts list).
5. Quantity.
6. Complete shipping information.

Failure to include information for items 1 thru 5 will only delay your parts order, unless another method is specified for Item 6, parts less than 50 pounds will be shipped United Parcel Service, parts over 50 pounds will be shipped Motor Freight, Air Freight and other transportation services are available but only if specified on your order.

Factory Rebuild Service

Reconditioning service is offered by Force Control Industries at the factory. Unless major parts (such as housings) are damaged, the cost of a complete factory rebuild will generally not exceed 40% the cost of a new unit. Before returning a unit for this service, however, be sure to first contact the Force Control Industries Service Sales Department for authorization and shipping instructions. Force Control Industries cannot be responsible for units returned to the factory without prior notice and authorization.

Care must be given to the packaging of return drives. Always protect mounting feet by attaching to a skid. Shipment-damaged drives always delay repairs. It is usually impossible to recover damage costs from the carrier. When possible describe the problem experienced on your shipping papers.

Return to: Force Control Industries, Inc.
3660 Dixie Highway
Fairfield (Hamilton), Ohio 45014
Telephone: 513-868-0900

TABLE I

L	Brake Torque (LB.-FT.)		Brake Set By	Pressure Required To Release	Maximum R.P.M.	Thermal Horsepower Horizontal Mounting		Overhung Load Capacity (LBS.)/R.P.M.				Inertia of Rotating Elements	Piston Chamber Volume
	Static	Dynamic				Basic @ 1800 RPM	With Forced Lubrication	900	1200	1800	3600		
	130	78	Springs Pressure	60 PSIG	3600	.40	7.5 Maximum	424	385	336	267	0.10 lb.ft. ²	7.6 cu.in.
	260	156	Springs Pressure	60 PSIG	3600	1.0	15.0 Maximum	483	439	384	304	0.16 lb.ft. ²	7.6 cu.in.
	700	420	Springs Pressure	60 PSIG	3600	1.25	30.0 Maximum	1545	1392	1222	979	0.5 lb.ft. ²	12.0 cu.in.
	1000	600	Springs Pressure	80 PSIG	3600	1.20	40.0 Maximum	1795	1630	1424	N/A	1.0 lb.ft. ²	12.0 cu.in.
	2000	1200	Springs Pressure	80 PSIG	1800	1.50	75.0 Maximum	3054	2753	2416	N/A	2.0 lb.ft. ²	23.0 cu.in.

TABLE II

L	Brake Torque (LB. IN.)		Brake Set By	Maximum Actuation Pressure	Maximum R.P.M.	Thermal Horsepower Horizontal Mounting		Overhung Load Capacity (LBS.)/R.P.M.				Inertia of Rotating Elements	Piston Chamber Volume
	Static	Dynamic				Basic @ 1800 RPM	With Forced Lubrication	900	1200	1800	3600		
	1000	1000	Pressure	35 PSIG	3600	.40	7.5 Maximum	424	385	336	267	0.10 lb.ft. ²	7.6 cu.in.
	1700	1700	Pressure	35 PSIG	3600	1.0	15.0 Maximum	483	439	384	304	0.16 lb.ft. ²	7.6 cu. ir
	4080	4080	Pressure	35 PSIG	3600	1.25	30.0 Maximum	1545	1392	1222	979	0.5 lb.ft. ²	12.0 cu.ir
	6240	6240	Pressure	42 PSIG	3600	1.20	40.0 Maximum	1795	1630	1424	N/A	1.0 lb.ft. ²	12.0 cu.ir
	9300	9300	Pressure	35 PSIG	1800	1.50	75.0 Maximum	3054	2753	2416	N/A	2.0 lb.ft. ²	23.0 cu.ir

For thermal horsepower above the basic ratings a Force lube cooling unit is supplied. See F.L.C.U. manual.

3. For tandem brakes torque ratings are for each of the two stacks.

Overhung load ratings are pounds of pull concentrated at mid-point of shaft extension. Note: Pillow block mounted brakes must be direct coupled.

4. For tandem brakes piston volume is for each of the two stacks.



FORCE CONTROL INDUSTRIES, INC., 3660 DIXIE HIGHWAY • FAIRFIELD, OHIO, 45014
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