KOBELT

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Leaders in Propulsion Controls, Steering and Disc Brakes.

KOBELT MANUFACTURING

COMPANY LIMITED

MAINTENANCE & INSTALLATION

INSTRUCTIONS

FOR

ALL KOBELT DISC BRAKES

"LEADERS IN QUALITY MARINE CONTROLS AND DISC BRAKES"

BASIC PRINCIPLE OF OPERATION FOR KOBELT DISC BRAKES

Low pressure actuators with large areas are used to apply the force against a mechanical lever, multiplying the brake application forces with a lever ratio of approximately 3.6:1 and up to 5:1. The application force of the actuator is therefore directly related to the brake force. Varying the pressure results in an absolute proportional brake torque reduction or increase. This results in very high torque capabilities. Kobelt manufactures basically two different types of calipers. The box shoe type and the open shoe type. The box shoe type caliper is mainly used for high torque applications with relatively low energy input. This is due to the area of square inches of lining available. The open shoe type calipers have enormous lining surfaces and lend themselves extremely well for continuous high energy absorption. Both caliper types are available in either air or hydraulic applied version or in the spring applied configuration. Some of the brake calipers are also manufactured with a combination actuator which will provide both air applied and spring applied functions.

DISC BRAKE LININGS

Kobelt engineers have developed a unique disc brake lining material. Available only from Kobelt, it offers a combination of advantages over most other materials. In situations where the brake disc is operating in relatively high temperatures, or where the P.V.* ratio will exceed normal allowable levels, localized plastic deformation in the disc will occur. Brake discs that are subject to high energy input, which goes beyond the thermal conductivity of the disc brake material, will result in plastic deformation of the disc. This results in uneven energy distribution which in turn causes disc failure. Kobelt lining material, with its slight abrasive characteristics, will minimize the uneven energy distribution. Unless Kobelt disc brake lining material is used, guarantees on the brake disc may be void.

DISCS

Kobelt brake discs are available in a variety of diameters and thicknesses to accommodate nearly unlimited combinations of torque and energy input requirements. Kobelt provides four different types of standard discs.

(1) Medium energy input - solid steel discs. These discs are used for infrequent stopping applications. The energy in these discs is absorbed rapidly in the disc mass, but the disc requires a long cooling time.

(2) Medium energy input - ductile iron, internal aircooled discs. These discs are designed for general purposes and will perform much better than a solid disc at higher speeds and continuous or intermittent brake applications, since the fan action of the disc will increase the heat transfer by drawing air over the internal cooling fin design.

*P.V. - Pressure velocity - pounds per square inch x feet per minute.

DISCS (cont'd)

(3) High energy input - ductile iron, internal aircooled discs. These patented discs provide the most refined internal cooling fin design and are ideally suited for continuous high energy input at higher speeds.

(4) Very high energy input - ductile iron, internal water cooled discs. These patented discs, designed for high torque, low speed applications, have internal water passages which permit a high rate of energy dissipation.

(5) Some Kobelt brake discs are available segmented (half or quartered). The purpose of these segmented discs is to facilitate disc installation or removal on disc adaptor flanges located between machinery parts which do not allow for a one piece disc installation without the removal of other components.

AIR COOLED BRAKE DISCS

Air cooled brake discs are designed to pump air efficiently when rotating quickly. In most cases a guard or some protective cover is needed to shield the brake disc. An improper design of covers may cause air recirculation through the disc or radiant heat reflection, which may result in the disc overheating. The cooling air pumped through the disc must be exhausted away from the disc to allow fresh, cool air to enter the inner vent openings of the disc. No back pressure should be generated on the exhaust side of the disc.

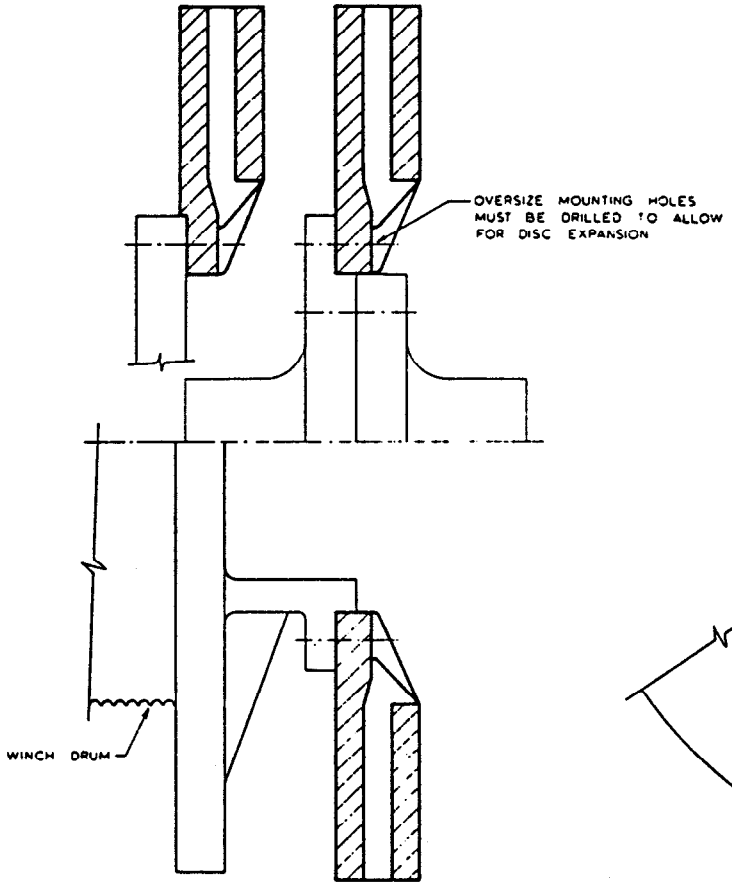
CAUTION: UNDER NO CIRCUMSTANCES SHOULD THE DISC COOLING FINS BE PAINTED.

INSTALLATION AND ADJUSTMENT INSTRUCTIONS FOR KOBELT DISC BRAKE CALIPERS

BRAKE DISC INSTALLATION

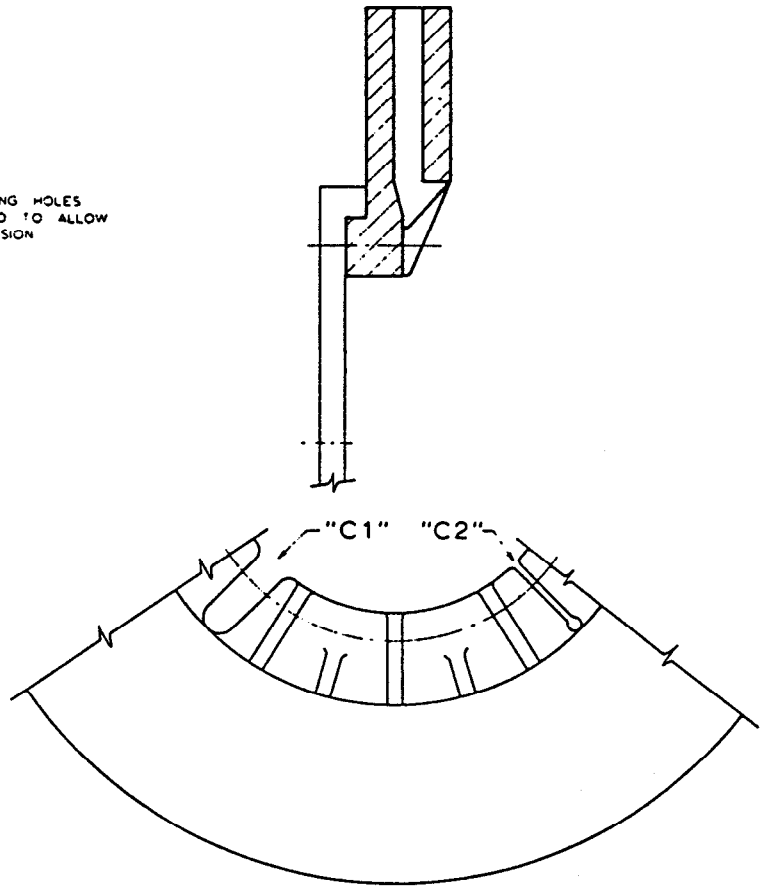
It is important to remember that the brake disc itself must be installed onto the rotating element before installing the caliper. This will then allow proper alignment of the brake caliper to the disc. The disc mounting bolts must be suitable to absorb the brake torque plus any shock load in the system. For high temperature disc applications, the holes for the mounting bolts must be oversize to allow the disc to expand and contract during operation.

DISC INSTALLATION "A"
TYPICAL DISC INSTALLATIONS RECOMMENDED FOR HIGH TEMPERATURE APPLICATIONS



DISC INSTALLATION FOR WINCH

DISC INSTALLATION "B"
THIS TYPE OF SPIGOT DETAIL IS NOT SATISFACTORY FOR HIGH TEMPERATURE APPLICATIONS



DISC MACHINING DETAIL "C1" & "C2"

BOLT MOUNTING HOLE DIAMETER OVER SIZING, IN.

Disc Bolt Circle, in.	Maximum Disc Temperature, F			
	400	500	600	700
10	.013	.016	.020	.023
15	.020	.024	.029	.034
20	.026	.033	.039	.046
25	.033	.041	.049	.057
30	.039	.049	.059	.068
35	.046	.057	.068	.080
40	.052	.065	.078	.091
45	.059	.073	.088	.102
50	.065	.081	.098	.114
55	.072	.089	.107	.125
60	.078	.097	.117	.137
65	.085	.106	.127	.148
70	.091	.114	.137	.159
75	.098	.122	.147	.171
80	.104	.130	.156	.182

The brake disc must be installed onto a rotating element that is machined flat and clean for the disc mounting surface. The rotating element should have bearings sufficient to carry the weight of the disc and also absorb the additional stress when the disc brake is applied. The bearings should be of sufficient quality to make the shaft run through without wobbling. Any excess runout of the disc (wobble) could cause premature lining wear and also cause the lever arm bearings to wear out prematurely. For special applications, some end float in the shaft can be tolerated.

Consult Kobelt for maximum float in shaft bearings.

It is important to remember that the brake disc itself must be installed onto the rotating element before installing the caliper. This will then allow proper alignment of the brake caliper to the disc. The disc mounting bolts must be suitable to absorb the brake torque plus any shock load in the system.

Since a brake disc is absorbing energy during operation, it will, in this process, become hot and consequently, expand. The hotter a brake disc becomes, the more it will expand because of the coefficient of expansion pertaining to a specific material. It is therefore very important that the mounting holes are oversized to let the disc expand and contract during normal operation. Depending on the type of material used, a disc will also shrink during initial start-up and could become considerably smaller depending on the maximum operating temperature. Therefore the spigot diameter between the

male and female bore must be machined to allow for the shrinkage of disc. We would highly recommend that you contact Kobelt with all the operating criteria for assistance.

The disc must never be machined with a male spigot for high temperature applications since such a spigot (see detail "B") will prevent the disc from expanding due to heat.

The caliper brake unit should also be mounted to allow for disc expansion without causing contact between the outer circumference of disc and the inner caliper frame.

The heat transfer from the disc to the mounting flange is relatively low, therefore fitted bolts cannot be used. If the maximum operating temperature of the disc is known, the clearance allowance can easily be calculated after the bolt circle is established.

In order to prevent disc deflection, the mounting flange of the disc can be machined or cast with relief cut-outs as indicated under disc machining details "C1" and "C2".

It is also very important to obtain a fine grain casting disc material which should be machined to a fine finish (32 micro preferably). This will eliminate excessive lining wear.

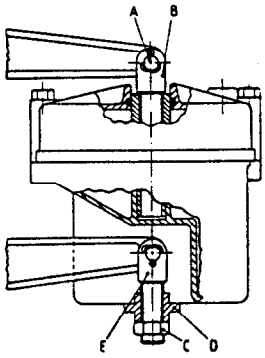
DISC BRAKE CALIPER INSTALLATION

A foundation plate to support the brake caliper must be strong enough to withstand the maximum torque generated by the brake caliper. The foundation must also be flat and square to the brake disc. The caliper must be installed with the proper size bolts (grade 5 or better) as specified in our drawing and under no circumstances must there be a bolt missing. It is also important that these bolts be properly and evenly torqued. Failing to do so could cause the foot of the brake to fail. It is also very important that the assembly bolts, (studs and nuts), are tightened before placing a brake caliper into operation. Again, loose bolts will cause the brake to fail. With the 5000 series brakes, it is possible to undo the assembly bolts, (nuts), and raise the whole caliper arrangement away from the foot to allow installation of the mounting bolts into the brake foot. After the bolts are in place the brake can be re-assembled. The clearance between the brake and disc shoe should be equally divided on both sides of the brake disc and the shoe should be parallel to the disc. The rugged design of Kobelt brake calipers allows for some inaccuracy without affecting the performance.

On the die-cast bronze 5000 series brake calipers shims can be placed between the shoe bearing and the shoe to allow the calipers to be adapted to various sizes of disc thickness. The actuator themselves also have an adjustable clevis to allow for brake lining wear or to adapt to various sizes of disc. It is important that the clearance between the shoe and the disc be maintained at a minimum for fast response, and also minimum air consumption in air applied calipers. The spring applied actuators are equipped with a single pipe port at the actuator piston housing, either 1/4" or 3/8" N.P.T. The air applied actuators from the bronze die-cast series have two supply ports per actuator. These ports are common internally, and normally only one port is connected to the control circuit. Only in cases of extremely fast response will it become necessary to connect both ports.

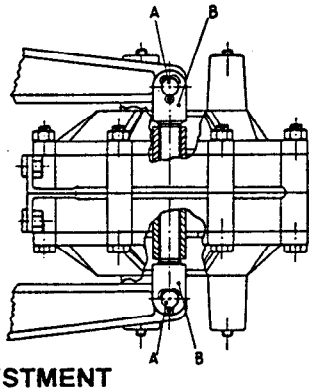
CLEARANCE ADJUSTMENT

Before making any adjustment ensure that the brake is released



SPRING APPLIED ACTUATOR

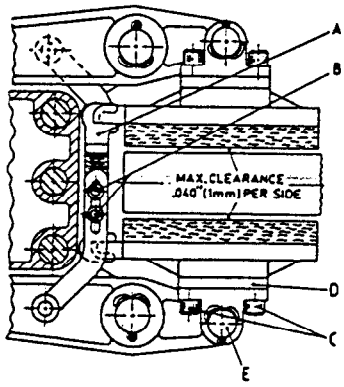
The clearance can be adjusted by removing pin "A" and by turning clevis "B". It can further be adjusted by loosening jam nut "C". Then removing bolts in bracket "D" and rotating same.



FLUID APPLIED ACTUATOR

Remove both pins "A" and turn both clevises an equal amount. Turn counter clockwise to decrease clearance and clockwise to increase clearance.

BALANCING LINK ADJUSTMENT



All calipers are equipped with balancing links to ensure even lining wear. To adjust, loosen screws "B" and adjust link "A" to align the shoe parallel with the disc.

SHIM KITS

In order to adapt a caliper for a thinner disc shim kits are available. These shims "D" fit between the brake shoe and the bearing. See product sheets for ordering information.

LINING REPLACEMENT

It is important to replace the lining before the rivets make contact with the disc. By removing screws "C" or pin "E" the shoes can be taken off the caliper assembly. Drill out rivets and install new lining with the proper rivets. When re-installing shoes into the caliper assembly be sure to re-engage the balancing link "A".

ACTUATOR MAINTENANCE

Kobelt actuators require very little maintenance. However, should it become necessary to replace seals, proceed as follows:

Spring Applied Actuators
In order to remove the actuator pressure must be applied to the actuator to release the brake (or use manual release screw). After removal, place actuator into a press to retain the two housings before removing assembly bolts. Once dismantled, clean and replace parts as needed. When re-assembling, lubricate all moving parts.

Fluid Applied Actuators
These actuators are in most cases diaphragm operated. There are two diaphragms per actuator and one "O" ring between the centre housings. To replace seals remove the actuator and dismantle same. Clean all parts and install new seals (diaphragms).

SPRING APPLIED ACTUATORS WITH MANUAL RELEASE SCREWS

All Kobelt spring applied actuators can be supplied with manual release screws. This manual release screw serves to release the brake upon failure of the fluid pressure. It is very important that the fluid supply line is open to tank or atmosphere when winding the manual release screw inward, since the piston cavity requires a fluid supply source when doing this. This holds especially true in hydraulic systems, where a vacuum plus the spring tension is generated. The manual release screw mechanism will fail if no source of fluid supply is available.

BRAKE SHOE CLEARANCE ADJUSTMENT FOR SPRING APPLIED ACTUATORS

On the spring applied calipers it is extremely important that the proper clearance is maintained between shoe and disc. On the manual adjust actuators the clevis pin can be removed and the clevis can be manually rotated to maintain a minimum clearance between disc and shoe. When the new lining is inserted it will be necessary to turn the clevis inward to allow for the extra thickness of the new lining. Our automatic adjust spring applied brake actuators will take up the excess clearance between brake lining and disc during normal use automatically. When new lining is installed again the clevis pin must be removed from the actuator rod and turned 90^0. This will allow the actuator rod to be pushed in completely to allow for the extra lining thickness. Re-insert clevis pin after adjustment.

It is important that the clearance between the shoes and disc is kept at a minimum without causing drag. The clearance should not exceed .040" (1.0mm) per side. This will allow for fast response and a minimum for fluid consumption with fluid applied actuator. On spring applied calipers a minimum of clearance is necessary to maintain maximum brake torque.

ACTUATOR MAINTENANCE

Air applied actuators in most cases are diaphragm operated and consist of two opposite diaphragms spring returned. If diaphragm failure occurs, remove actuator, dismantle same, clean and re-install new diaphragms.

SPRING APPLIED ACTUATORS

If maintenance is required on our spring applied actuator it must be first removed from the brake assembly. After removal it must be retained in a press strong enough to retain the spring tension of the actuator. It is also important that this holding device maintains the actuator in a square position to the press. The assembly bolts holding the piston housing to the spring housing can now be removed and the pressure of the press can be slowly released allowing the actuator to separate. Clean actuator, replace seals, inspect springs and change same if necessary.
Re-assemble and reinstall actuator in reverse order.

All Kobelt piston type actuators, which are air actuated, must have a filter and lubricator in the air line which is filled with a light hydraulic oil to lubricate the seals and piston as well as the piston rod.

INITIAL BRAKE START UP

In order to achieve maximum brake torque it is of the utmost importance that the brake line is burnished. This can only be accomplished if the brake is applied with the engine or motor driving the brake disc on the relatively low pressure. This should be done approximately three times. The maximum disc temperature that should be achieved is approximately 600^0 F and each run should take approximately 10-15 minutes. Our normal brake lining will provide a coefficient of friction of 0.45 at approximately 200^0 F and can go as high as .6 at approximately 400 - 450^0 F.
If the lining is not properly burnished a coefficient of 0.3 is all that can be obtained. Care must be taken not to overheat the disc during this process. If the brake system is running in an environment where maximum brake torque is required, burnishing has to be done all over again after lining replacement. On large brake shoes it becomes necessary to cut grooves into the lining to allow lining vapour to escape between the lining and the disc. On water cooled discs it is extremely difficult to burnish the lining unless a limited amount of water is fed into the disc during the burnishing operation. Again, extreme care must be taken no to overheat the disc.

CHECK LIST: BEFORE STARTING DISC BRAKES

(1) Ensure that all bolts are of good quality and installed properly (no bolts missing).

(2) Make sure that brake lining does not make contact with the disc when the brake is released. Also ensure the brake is reasonably square to the disc.

(3) Brake levers must have no obstruction and allow actuator rod to come out completely, without interfering with other obstructions.

(4) Check the brake disc surface for foreign matter and grease. Remove all lubricants from the disc with a cleaning solvent. If the disc was damaged during installation with nicks or welding marks, remove same.

(5) Check the source of fluid supplied that it complies with the specified pressure range from Kobelt and that it is also properly interlocked with other machinery, such as clutches, electric motors, etc.

(6) Check that bolts are tight and cotter keys are in place.

In order to calculate the brake torque, the clamping force of the caliper must be multiplied by the coefficient of friction and the acting radius of the disc.

(Clamping force x coefficient of friction x acting radius of disc = brake torque).

Note: When selecting a disc brake, the coupling flange to which the brake disc is attached must fit within the inner adaptor flange of the disc (dimension B).

LINING REPLACEMENT FOR OPEN SHOE TYPE BRAKE CALIPERS

On these calipers the brake shoes are attached with pins to the brake open lever. These pins must be removed in order to detach the brake shoe from the caliper. New lining can be installed and the brake re-assembled. With brake shoes it is important that the balancing link be connected to the back of the brake shoe.

LINING REPLACEMENT FOR BOX SHOE TYPE BRAKE CALIPERS

The shoe is retained within the framework of the caliper by the upper retainer plate. In order to remove the brake shoe, this plate has to be removed. The pin attaching the clevis to the brake lever must also be removed. This will allow the clevis to be moved, to clear the lever and the brake shoe can now be removed. New lining can be installed and the brake re-assembled.

MAINTENANCE

Over the years it has been proven that very little goes wrong with Kobelt disc brake calipers and discs. It is important that periodic brake lining wear inspection takes place. The lining must be replaced before the shoe lining bolts or rivets start making contact with the brake disc.