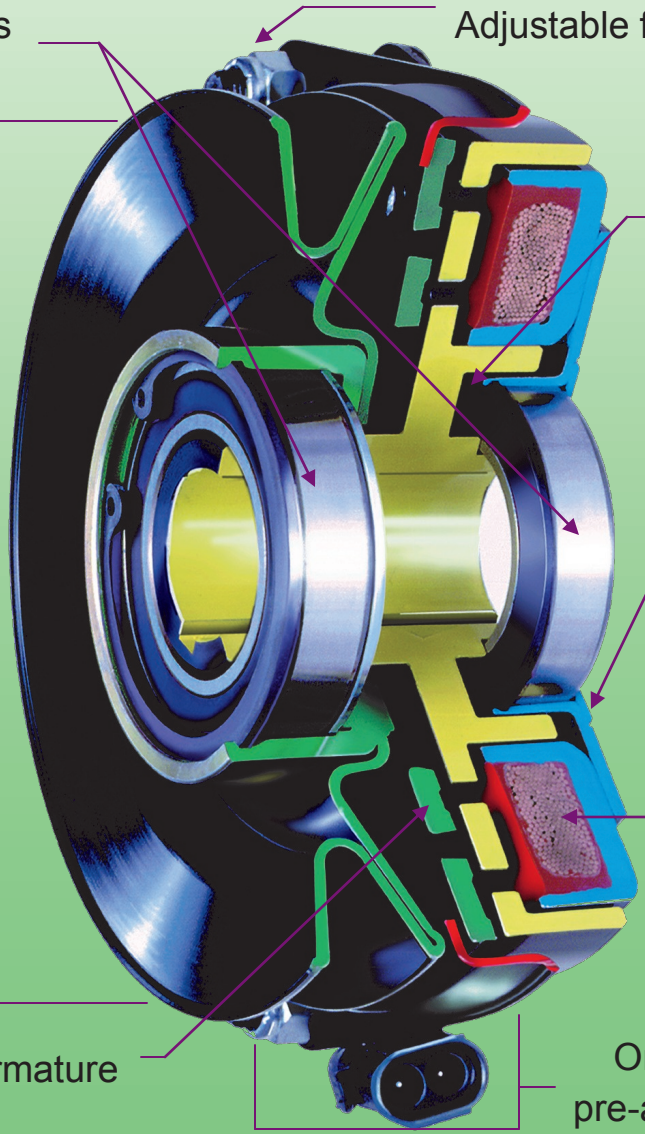
OGURA INDUSTRIAL CORP.

"What you need in a clutch"™

PTO Clutch/Brakes for Outdoor Power Equipment



Introduction

PTO Clutch/Brakes

The Ogura Clutch Company was founded in 1938. Since that time, it has grown to be the largest manufacturer of electromagnetic clutches in the world. Ogura has technical and manufacturing representation worldwide.

Ogura's numerous quality awards reflect a desire for continuous improvement which we apply not only to our products; but, also to our personnel. We believe the cornerstone of quality begins with people. This is why our personnel are continually trained on the latest manufacturing techniques and design principles. Our plants currently conform to ISO9001 and some to QS9000 guidelines.

We welcome the opportunity to put our manufacturing and engineering skills to work for you. If for some reason, your requirement does not fit within the product lines shown in this catalog, please contact us directly. We may have other products available to meet your requirements.

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Products In This Catalog

There are two basic models of clutches described in this catalog.

PTO Clutch/Brakes:

These are used to engage and to also help stop cutting blades that are used on tractors and commercial cutting machines. They can be either flange or bearing mounted. They are typically used on gas and diesel engines which can be up to 31 horsepower. (Sometimes higher, depending upon how much horsepower can go through the clutch.)

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IV PTO Clutch / Brake Principle Of Operation

PTO clutch/brakes are primarily made up of three major sub-assemblies. They are:

1. Field/rotor assembly: This is the coil, backing plate and rotor. The coil provides the magnetic flux that allows the clutch to pull in. The rotor provides the input rotation and is mounted on the input shaft.
2. Pulley/armature assembly: This includes the armature disk, springs, hub and pulley. This is the output of the clutch. In some instances, a mounting flange is used instead of a pulley.
3. Brake assembly: This includes the brake shroud, adjustment nuts and springs. By controlling the force against this brake shroud, the stopping time in the application can be controlled.

Engagement of the armature to the rotor is caused by the magnetic attraction between the rotor and the armature. The magnetic flux is transferred from the field into the rotor and then into the armature. The slots in the rotor and the armature are called banana slots. These slots allow the flux to contact the rotor and the armature in more than just two places. (A normal magnet only has a north and a south point of attraction.) By making multiple points of flux connection, the torque can be increased in this type of clutch.

When the power is cut, the armature is released and pulled back against the brake shroud via the leaf springs. As the armature drags against the brake shroud, the blade is helped to slow to meet the manufacturer's stop time requirements. The shroud is attached to the backing plate via the studs. The backing plate is connected to a portion of the machine so that it can withstand the braking force. Depending upon the inertia of the system, the leaf springs can be adjusted in thickness to create a stronger torque to help meet the stop time requirements.

This unit also has the advantage of being able to be adjusted as it wears. This can be a considerable cost advantage to the end user over the life of the clutch/brake.

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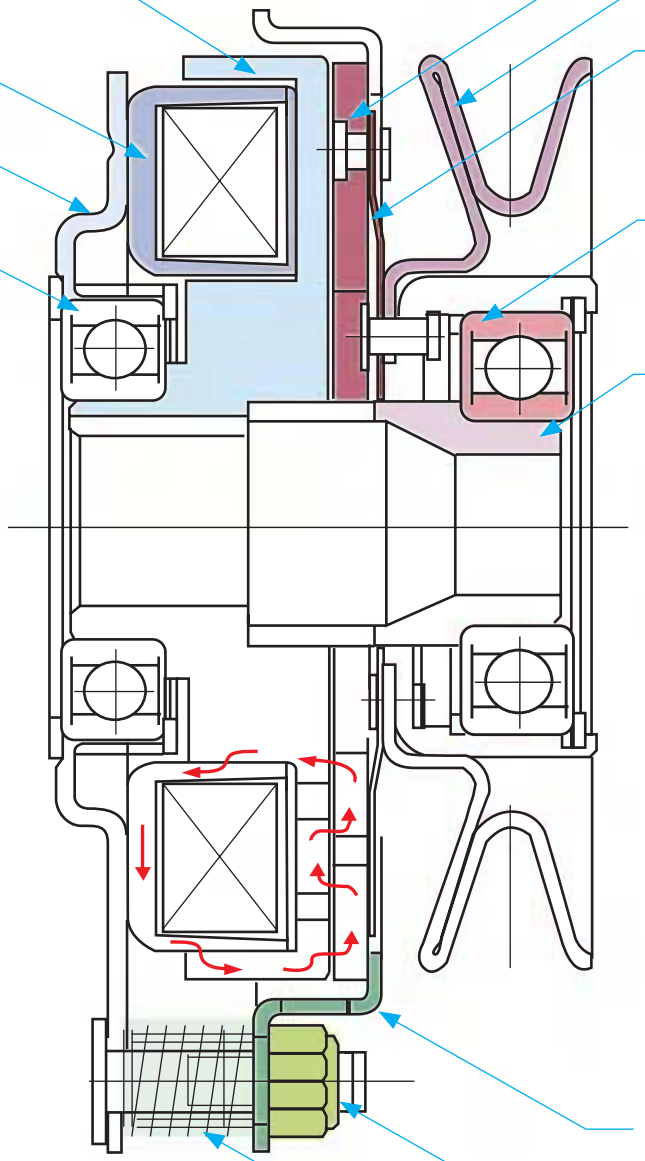
PTO Clutch/Brake Components



ROTOR

FIELD COIL

BACKING PLATE

BEARING

FIELD/ROTOR ASSEMBLY

ARMATURE

PULLEY

ARM. SPRING

BEARING

BEARING

COLLAR

ARMATURE/ PULLEY ASSEMBLY

BRAKE ASSEMBLY

BRAKE COVER

GAP ADJUSTMENT NUT

COIL SPRING

← Magnetic Flux Path

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Reasons
For Using An Electromechanical PTO Clutch/Brake

1. Compact unit:

Both the clutch and the brake functions are contained in one single unit taking up a relatively small amount of space.

2. Simple control set up:

Since the clutches run directly off the battery, all that is required is a switch. This allows the clutch to be placed into tight locations since wires can be easily routed to a simple switch on the control panel versus linkages that would be required with mechanical units.

3. Operator convenience:

Rather than an operator trying to fight against a mechanical linkage or a belt idler, a simple flip of a switch will engage the clutch, resulting in less operator fatigue.

4. Industry Compliance:

PTO clutch/brakes help to meet industry stop times by assisting the blades to a stop.

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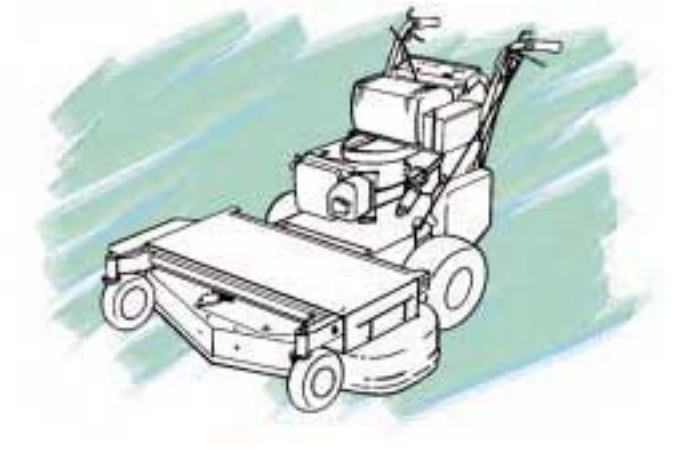
Typical Applications for PTO Clutch/Brakes

In almost all lawn and garden applications, the objective of the PTO clutch/brake is to start the cutting rotation of the blades and assist in stopping. Most applications require the addition of the brake to meet industry stop time recommendations; however, depending upon the size of the machine and the internal friction, some machines may only require a PTO clutch. We have provided PTO clutches and/or brakes for the following applications:

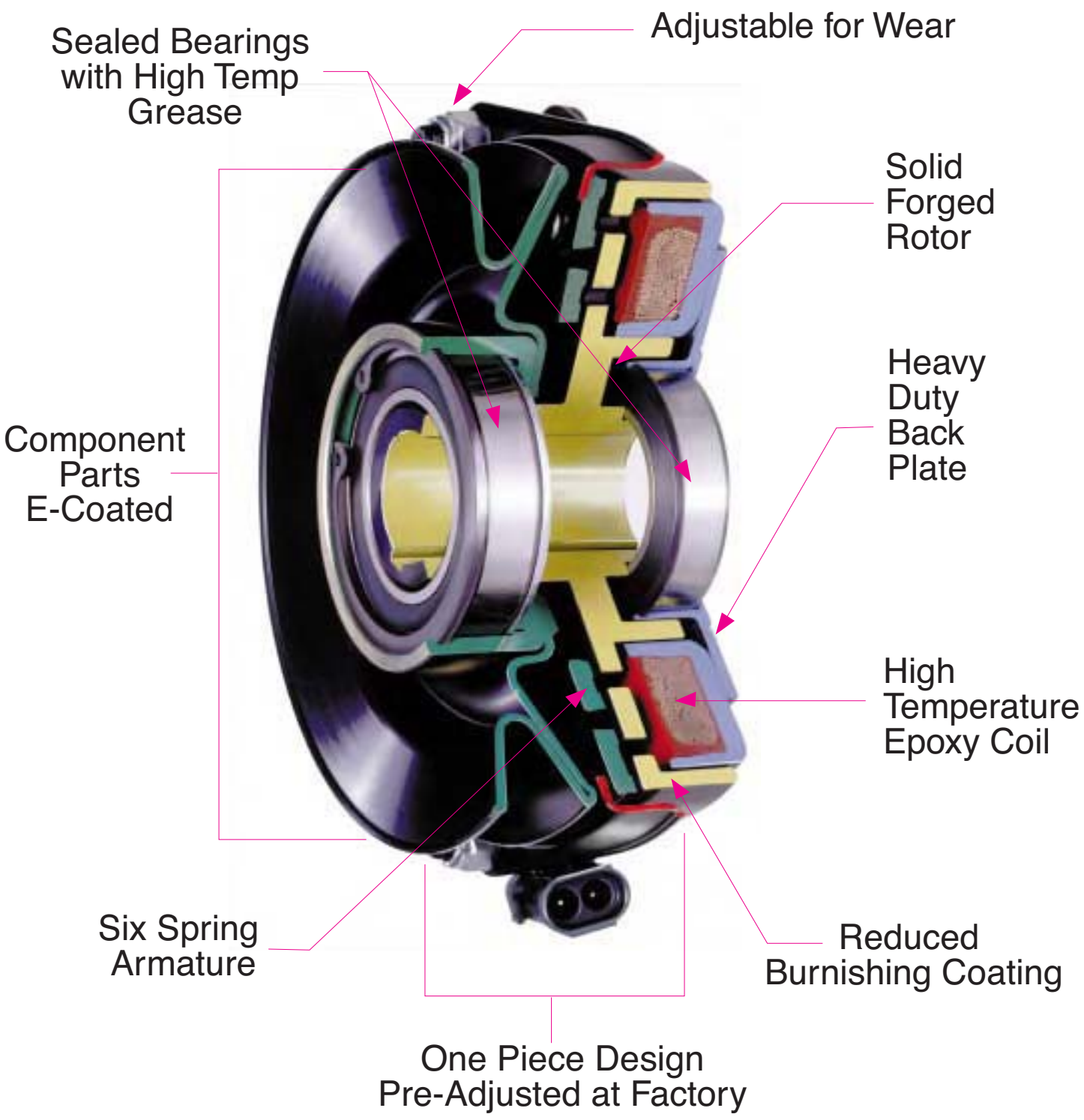
CONSUMER RIDE-ON TRACTORS

ZERO TURN RADIUS MACHINE



COMMERCIAL WALK BEHIND MOWERS

OUT FRONT MOWERS


Sealed Bearings with High Temp Grease
Adjustable for Wear
Solid Forged Rotor
Heavy Duty Back Plate
Component Parts E-Coated
High Temperature Epoxy Coil
Six Spring Armature
Reduced Burnishing Coating
One Piece Design Pre-Adjusted at Factory

Typical Ogura PTO Clutch/Brake Design Advantages

1. **Simple installation:**
Since the majority of Ogura clutches are one piece designs that come in pre-set, there are no adjustments to make either at the mower manufacturer or with the end user.

2. **Solid forged rotor:**
A one-piece solid forged rotor means no chance of internal parts separation. Our rotors also have an even wall thickness around the coil which gives optimum flux distribution, maximizing torque.

3. **Different coil voltages available:**
Although 12 volt is the most common, 24 volts can also be made available. Depending upon the quantity, other specialty voltages can be made.

4. **High temperature longer life grease:**
All models include our special longer life grease that has shown a significant improvement in life over other standard high temperature greases.

5. **E-coating:**
Where possible, all parts in the clutch are e-coated to give maximum corrosion protection.

6. **High temperature epoxy coil:**
To help prevent failure from both vibration and outside contaminants, all coils are sealed in the coil shell with a high temperature epoxy coating.

7. **Reduced burnishing time:**
Ogura uses a coating on the clutch face that significantly reduces burnishing time. This is a standard feature on all units.

8. **Adjustable for wear:**
All Ogura PTO clutch/brakes in this section have the ability to be adjusted for wear. This is both a cost savings and down time savings to the end user. Since the clutch has the ability to be adjusted while it is on the machine, the end user can greatly extend the life of the clutch on the machine.

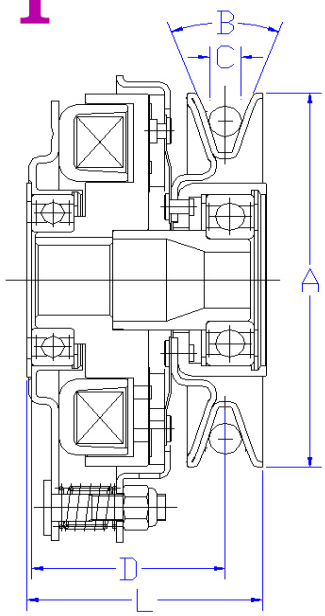
9. **Six spring design:**
Six armature springs apply an even dynamic braking force and allow for greater overall armature movement.

10. **Adjustable brake force:**
In some models, the springs can be changed to increase the brake force to help stop higher inertia blades.

11. **Heavy duty field plate:**
To resist deflection or breakage due to vibration, a thick backing plate is used. Projection welding enhances the connection to the coil shell. Many models also incorporate an exit wire protector.

Ogura PTO Clutch/Brake Types

1



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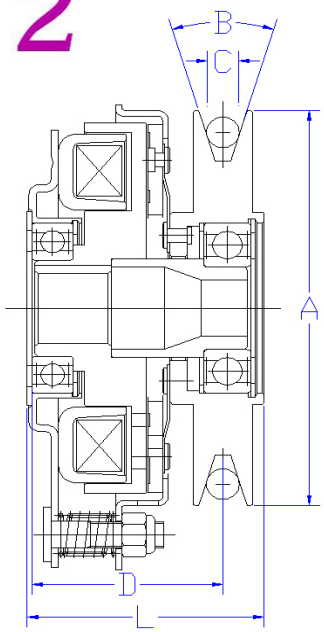

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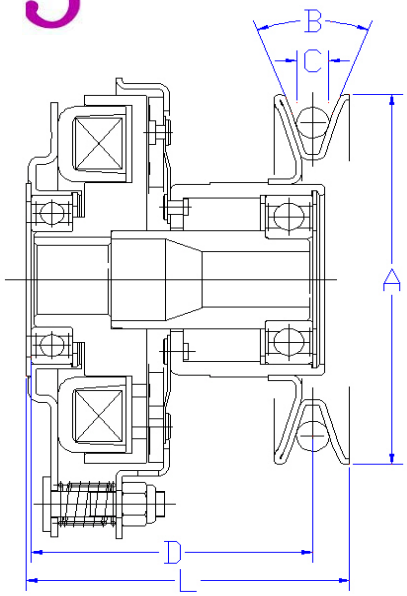

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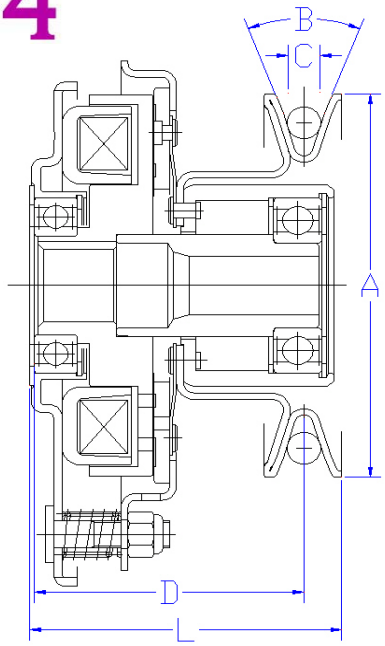

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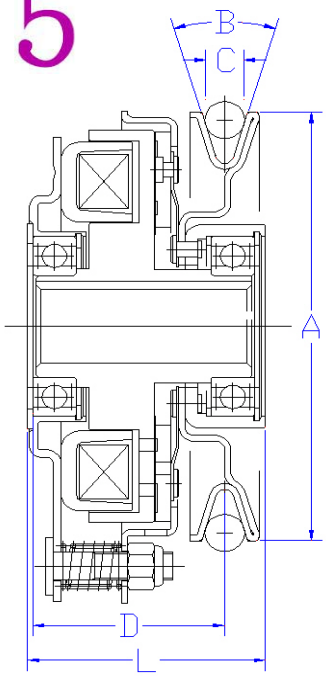

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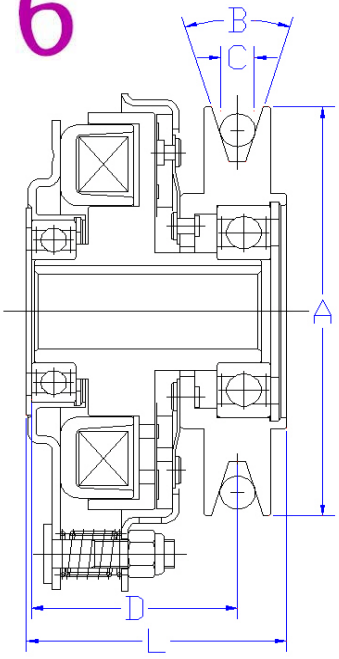

Ogura PTO Clutch/Brake Types

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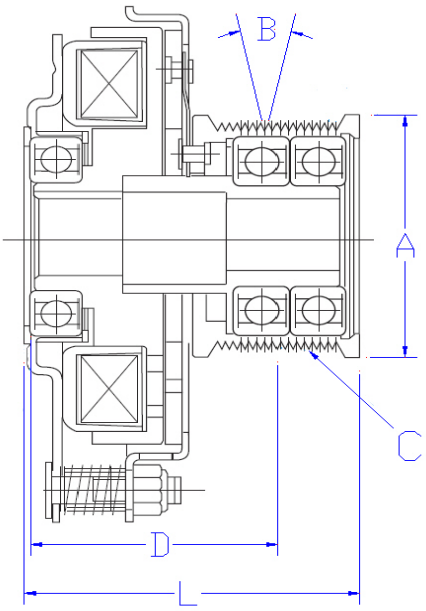

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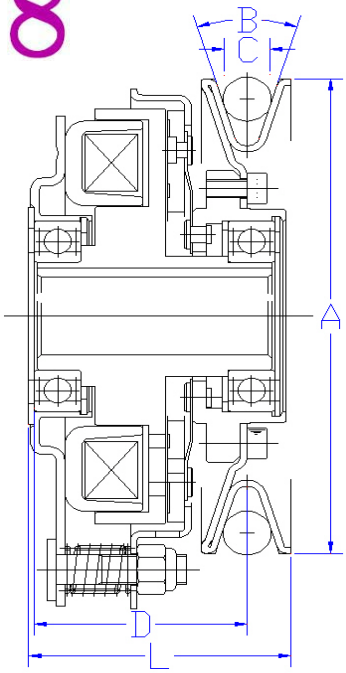

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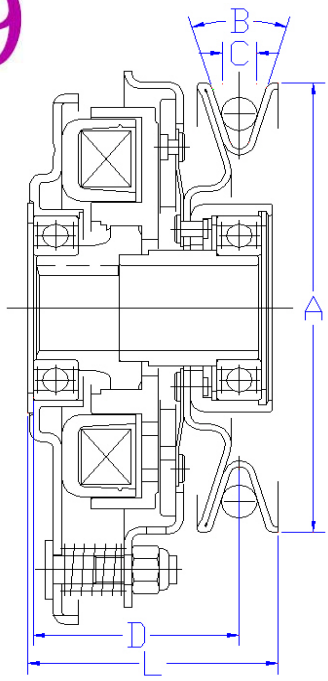

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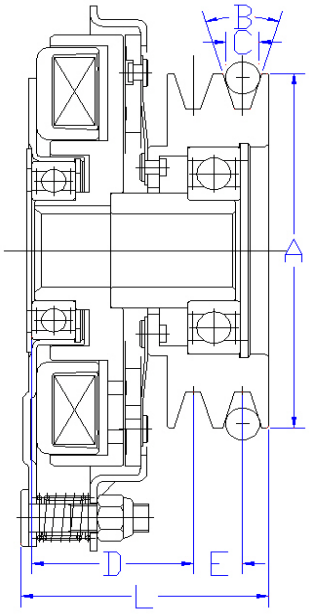

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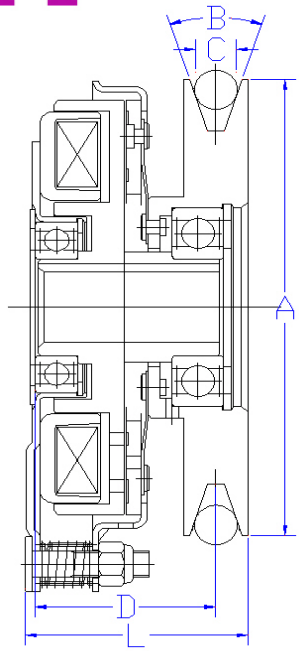

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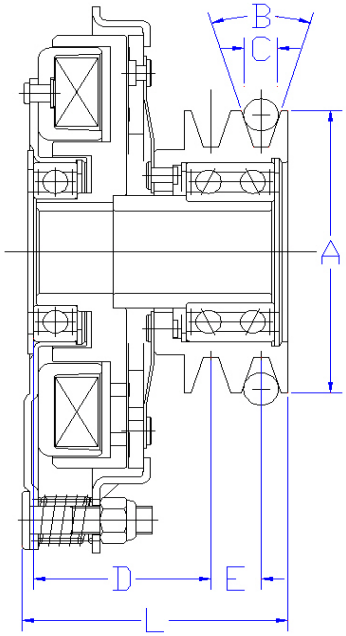

Ogura PTO Clutch/Brake Types

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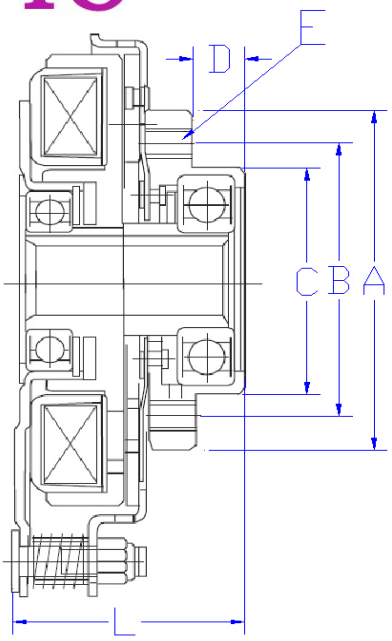

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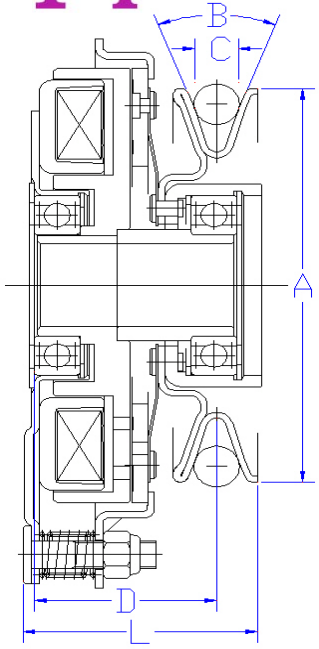

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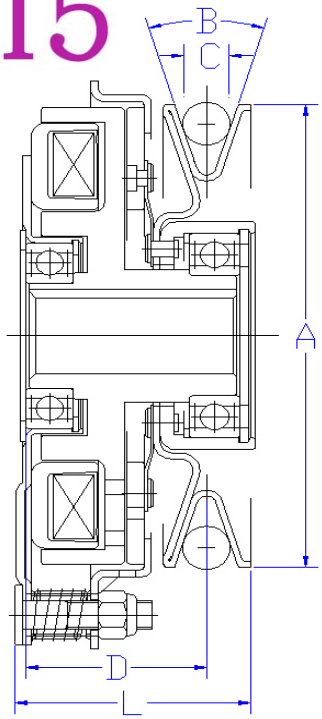

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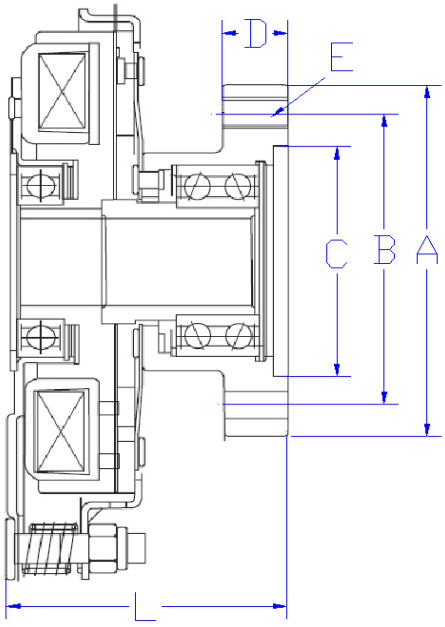

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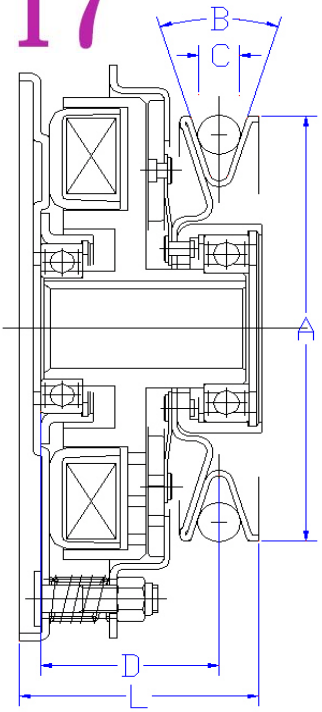

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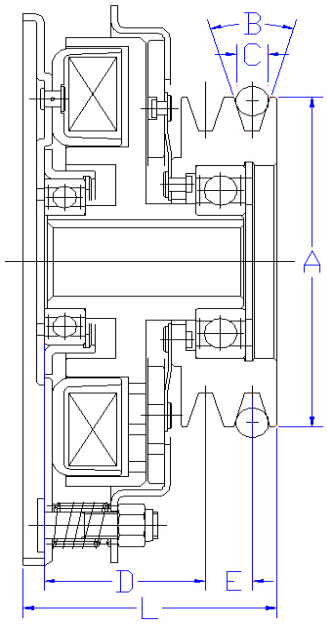

Ogura PTO Clutch/Brake Types

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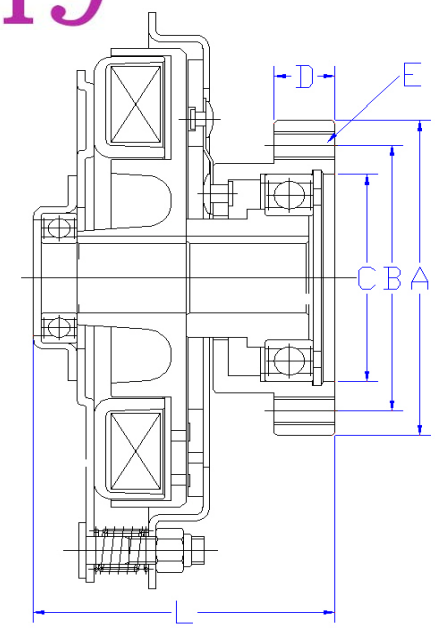

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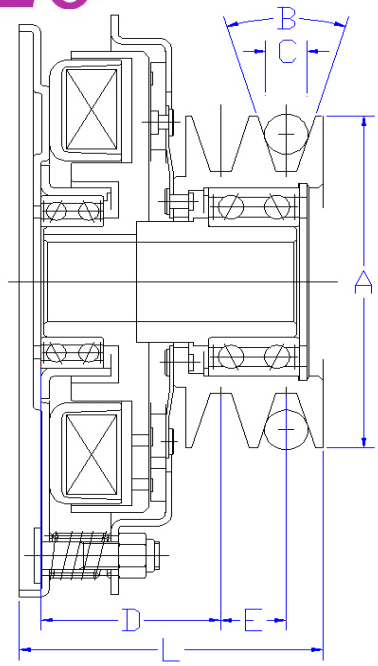

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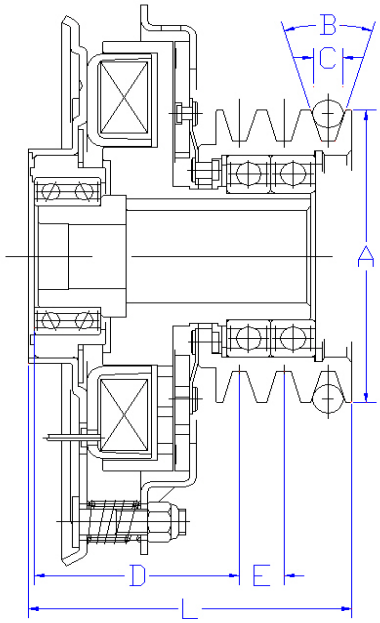

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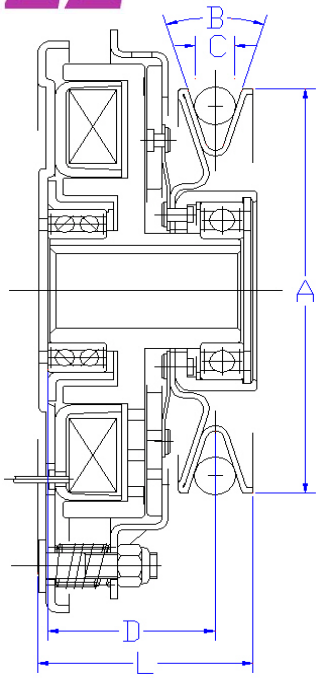

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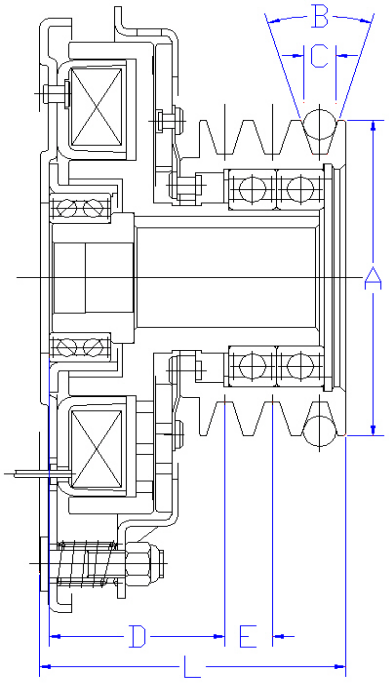

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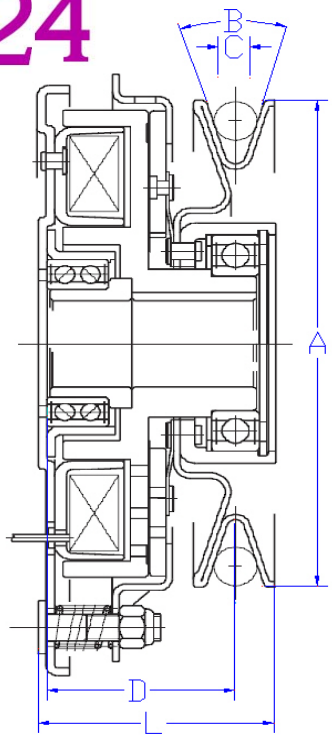


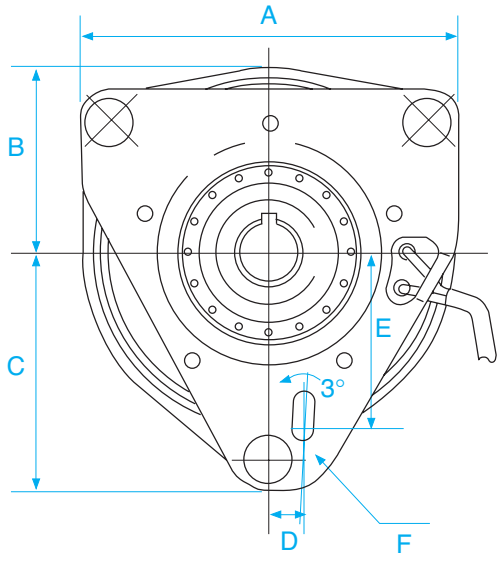
PTO Clutch/Brake Dimensions

Ogura Part No.	Static Torque (ft-lbs)	Bore	Keyway	Clutch Type	Field Type	Voltage / Watt	L: Overall Length	A: Pulley/Hub Diameter	Pitch Diameter Nominal	Over Ball Diameter	Gauge Ball Diameter	B	C	D	E	WEIGHT (lbs)
504586	75	1"	1/4" x 1/8"	1	A	12/50	3.27"	5.34"	4.65"	4.97"	0.4375"	34°	0.54"	2.56"	-	9
521788	87	1"	1/4" x 1/8"	8	A	12/50	3.15"	6.08"	5.72"	6.12"	0.5625"	34°	0.75"	2.48"	-	11
523163	87	1"	1/4" x 1/8"	4	A	12/50	4.17"	5.34"	4.65"	4.97"	0.4375"	34°	0.54"	3.5"	-	10
534095	87	1"	1/4" x 1/8"	8	A	12/50	3.23"	7.72"	6.92"	7.32"	0.5625"	38°	0.53"	2.48"	-	11
526296	87	1"	1/4" x 1/8"	4	A	12/50	4.13"	5.34"	4.65"	4.97"	0.4375"	34°	0.54"	3.50"	-	11
527444	87	1"	1/4" x 1/8"	4	A	12/50	4.17"	5.34"	4.65"	4.97"	0.4375"	34°	0.54"	3.50"	-	12
528311	87	1"	1/4" x 1/8" Integral	1	A	12/50	3.66"	5.94"	5.25" 5.75"	5.57" 6.12"	0.4375" 0.5625"	34°	0.71"	3.00"	-	-
528330	87	1"	1/4" x 1/8"	5	A	12/50	3.13"	5.81"	5.5"	5.82"	0.5000"	34°	0.50"	2.43"	-	-
528333	87	1"	1/4" x 1/8" Integral	1	A	12/50	3.27"	5.94"	5.25" 5.75"	5.57" 6.12"	0.4375" 0.5625"	34°	0.71"	2.53"	-	-
529544	87	1.125"	1/4" x 1/8" Integral	1	A	12/50	3.70"	5.34"	4.65"	4.97"	0.4375"	34°	0.54"	3.11"	-	-
533765	87	1.125"	1/4" x 1/8" Integral	9	A	12/50	3.19"	5.94"	5.25" 5.75"	5.57" 6.12"	0.4375" 0.5625"	34°	0.71"	2.53"	-	-
509019	95	1"	1/4" x 1/8"	7	A	12/50	3.94"	2.98"	2.78"	2.81"	0.0650"	40°	J-16	2.77"	0.092"	9
511101	95	1"	1/4" x 1/8"	1	A	12/50	3.27"	5.34"	4.65"	4.97"	0.4375"	34°	0.54"	2.56"	-	10
512585	95	1"	1/4" x 1/8"	2	A	12/50	3.27"	5.67"	5.17"	5.48"	0.4375"	34°	0.54"	2.56"	-	11
513090	95	1.125"	1/4" x 1/8"	2	A	12/50	3.27"	5.67"	5.17"	5.48"	0.4375"	34°	0.54"	2.56"	-	11
514068	95	1"	1/4" x 1/8"	6	A	12/50	3.33"	5.34"	4.65"	4.97"	0.4375"	34°	0.54"	2.56"	-	11
520356	95	1"	1/4" x 1/8"	5	A	12/50	3.01"	5.81"	5.5"	5.82"	0.5000"	34°	0.50"	2.48"	-	10
520413	95	1"	1/4" x 1/8"	7	A	12/50	3.44"	3.62"	3.43"	3.48"	0.0984"	40°	K-7	2.32"	0.140"	9
525521	108	1.125"	1/4" x 1/8"	14	B	12/50	2.95"	5.34"	4.65"	4.97"	0.4375"	34°	0.54"	2.21"	-	10
528704	108	1"	1/4" x 1/8"	10	B	12/50	3.27"	4.85"	4.86"	5.18"	0.4375"	34°	0.49"	2.05"	0.626"	-
513711	110	1"	1/4" x 1/8"	10	B	12/50	2.87"	4.07"	4.08"	4.40"	0.4375"	34°	0.49"	1.85"	0.626"	11
513962	110	1"	1/4" x 1/8"	13	B	12/50	2.61"	4.49"	-	-	-	3.63"	3.00"	0.59"	3-5/16"	11
520165	110	1.125"	1/4" x 1/8"	12	B	12/50	3.23"	3.85"	3.86"	4.18"	0.4375"	34°	0.49"	2.21"	0.625"	12
522229	110	1.125"	1/4" x 1/8"	10	B	12/50	3.06"	4.85"	4.86"	5.18"	0.4375"	34°	0.49"	2.05"	0.626"	12
522665	110	1"	1/4" x 1/8"	11	B	12/50	2.82"	6.50"	6.37"	6.77"	0.5625"	36°	0.50"	2.34"	-	12
522829	110	1"	1/4" x 1/8"	16	B	12/50	3.27"	4.50"	-	-	-	3.78"	2.95"	0.75"	4-3/8"	12
523064	110	1.125"	1/4" x 1/8"	12	B	12/50	3.35"	3.85"	3.86"	4.18"	0.4375"	34°	0.49"	2.21"	0.626"	12
505161	130	25mm	6.03mm x 2.75mm	19	C	12/40	3.94"	4.53"	-	-	-	3.78"	3.78"	0.71"	4-M10	11.5
525944	135	1.125"	1/4" x 1/8"	15	B	12/60	2.87"	6.08"	5.72"	6.12"	0.5625"	34°	0.53"	2.13"	-	11
526102	150	1.125"	1/4" x 1/8"	15	B	12/60	2.87"	6.08"	5.72"	6.12"	0.5625"	34°	0.53"	2.33"	-	11
526115	150	1.125"	1/4" x 1/8"	15	B	12/60	2.89"	6.46"	6.10"	6.50"	0.5625"	34°	0.53"	2.12"	-	11
526157	150	1"	1/4" x 1/8"	15	B	12/60	2.87"	6.08"	5.72"	6.12"	0.5625"	34°	0.53"	2.12"	-	11
526238	150	1"	1/4" x 1/8"	15	B	12/60	2.87"	6.08"	5.72"	6.12"	0.5625"	34°	0.53"	2.13"	-	11
516378	175	25mm	6.03mm x 2.75mm	19	C	12/40	3.94"	4.49"	-	-	-	3.78"	2.95"	0.71"	4-M10	12
523967	175	1.125"	1/4" x 1/8"	20	C	12/50	4.06"	4.71"	4.35"	4.75"	0.5625"	34°	0.53"	2.75"	0.846"	17
525362	200	1.125"	1/4" x 1/8"	20	D	12/68	4.33"	3.65"	3.65"	3.91"	0.3149"	38°	0.35"	2.83"	0.406"	-
528005	200	1.4375"	3/8" x 3/16"	21	D	12/68	4.70"	4.55"	4.56"	4.87"	0.4375"	34°	0.49"	2.91"	-	19
525957	250	1.125"	1/4" x 1/8"	17	E	12/68	2.91"	6.08"	5.72"	6.12"	0.5625"	34°	0.75"	2.33"	-	15
526105	250	1.125"	1/4" x 1/8"	17	E	12/68	2.91"	6.08"	5.72"	6.12"	0.5625"	34°	0.53"	2.33"	-	15
526638	250	1"	1/4" x 1/8"	17	E	12/68	2.91"	6.08"	5.72"	6.12"	0.5625"	34°	0.75"	2.33"	-	15
526986	250	1.125"	1/4" x 1/8"	17	E	12/68	2.33"	6.46"	6.10"	6.50"	0.5625"	34°	0.75"	2.33"	-	15
527668	250	1"	1/4" x 1/8"	18	E	12/68	4.17"	4.85"	4.86"	5.18"	0.4375"	34°	0.49"	2.17"	-	16
529722	250	1.125"	1/4" x 1/8"	18	E	12/68	3.15"	4.85"	4.86"	5.18"	0.4375"	34°	0.49"	2.12"	0.626"	-
526232	350	1.125"	1/4" x 1/8"	24	F	12/68	3.07"	6.08"	5.72"	6.12"	0.5625"	34°	0.53"	2.30"	-	19
527825	350	1.4375"	3/8" x 3/16"	23	F	12/68	4.17"	4.55"	4.56"	4.87"	0.4375"	34°	0.49"	2.31"	-	18
528319	350	1.25"	1/4" x 1/8"	24	F	12/68	3.27"	7.09"	6.65"	7.05"	0.5625"	34°	0.53"	2.48"	-	-

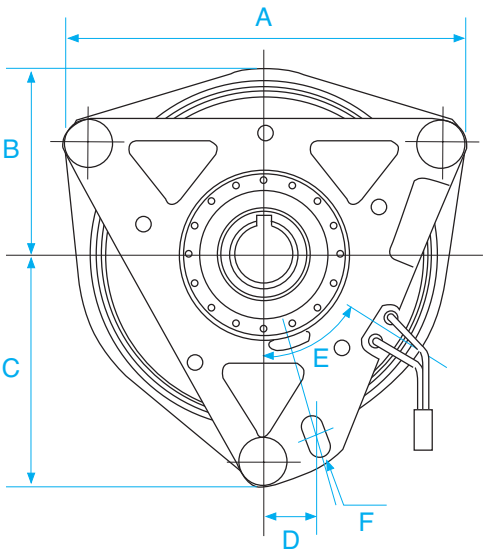
Almost all clutch models are available in clockwise or counter clockwise rotation
Weight is apprximate. Keyway is actually smaller than listed, and square key is suggested.
Ogura has many other modified standard clutches available. Contact us if the above clutches do not meet your design requirements.

Ogura PTO Field Types

A



B



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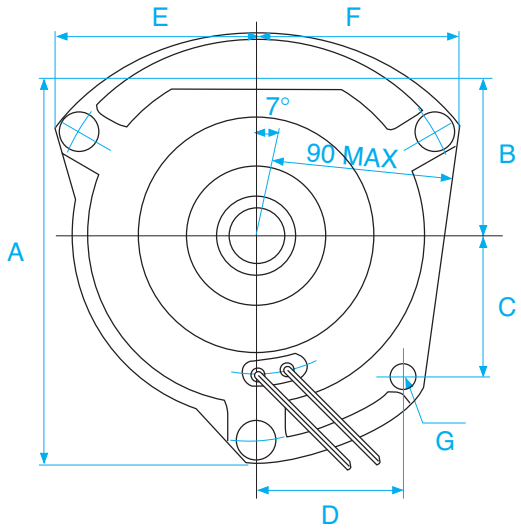

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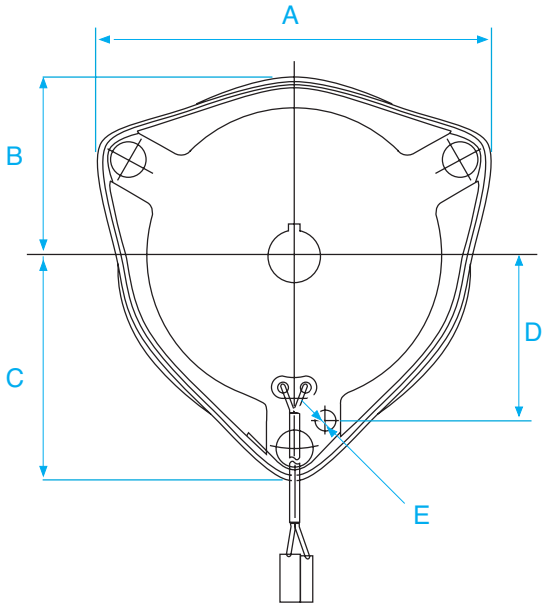

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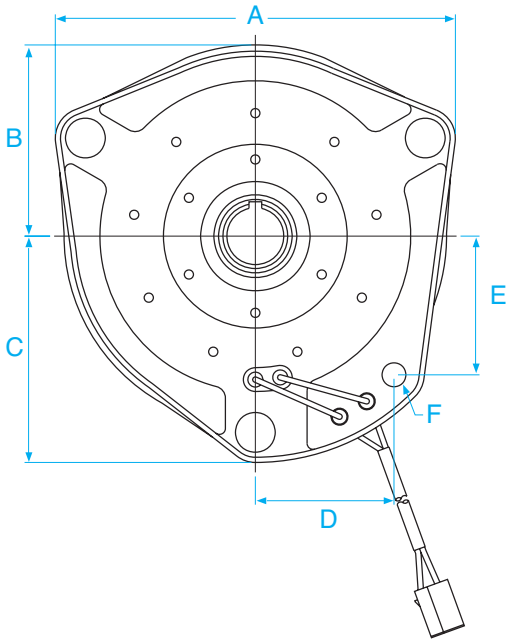
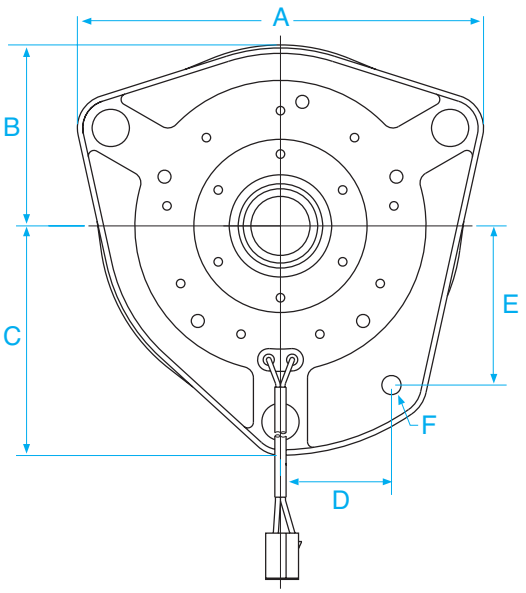


F



PTO Field Dimensions

FIELD TYPE	A	B	C	D	E	F	G
TYPE A	150.45	75	95	15	70	8.74x20	-
TYPE B	180	83	104	23.9	82	11.9x18	-
TYPE C	195	76	69.6	69.6	95	103	12
TYPE D	220	98	124	90	11	-	-
TYPE E	202	97	115	69.6	69.6	12	-
TYPE F	220	98	124.4	59.5	85.3	10.3	-

Field Back Plate Mounting Options

All PTO clutch / brakes need to have the field backing plate restrained. The restraining for the backing plate is equal to the brake torque in the unit. This could be anywhere from 3 to 10 lbs. depending upon the size of the PTO clutch / brake. There are a variety of methods acceptable. Some general acceptable methods are as follows:

1. Put a flat metal piece through the slots (F) of types A (1/4" x 5/8") or B (3/8" x 5/8").

2. Restrain one of the triangular pieces of the backing plate of type A or B inside a triangular cup coming from the frame.

3. Mount a piece of rubber to the clutch and then capture that rubber between a U-bracket coming from the frame.

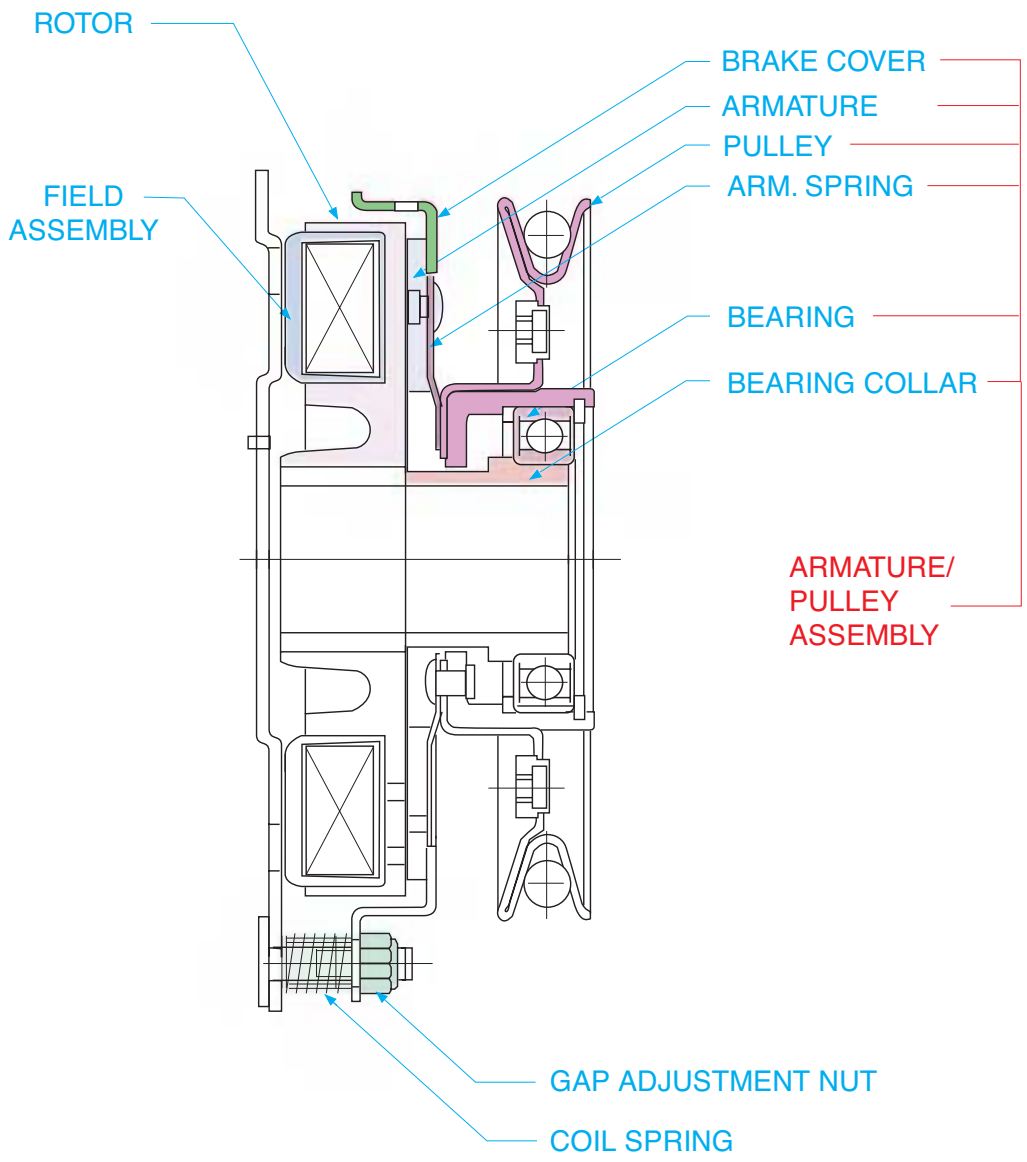
With all bearing clutch / brakes approximately 1/16" of axial and radial movements needs to be allowed to prevent field bearing failure. Flange mounted models bolt down firmly.

Ogura Flange Mounted PTO Clutch/Brakes

The drawing below shows a typical flange mounted PTO clutch/brake assembly. Although we have many designs of flange mounted PTO clutch/brakes (these were first used in the 1970's), there are very few that are still used in production today. These clutches are made so that the field is mounted directly to the engine face. The other components are then slid onto the shaft and kept on by the center bolt. (Most customers have switched to the bearing mounted style because of the ease of installation.)

A flange mounted clutch does not have a field bearing. Although this makes installation more time consuming, there is also no possibility of bearing failure in this area. This means that flange mounted clutches are ideal for installations that would remain engaged for long periods of time.

If you believe you have an application that would benefit from this design, please contact us and we will work out the details with you.



Installation Of A PTO Clutch/Brake

Things to check before installation:

Engine shaft size: Most of the time, PTO clutch/brakes are mounted directly on the engine shaft. If the installation is not on an engine shaft, please make sure that the tolerances are close enough to provide a snug fit between the bore of our clutch and the shaft. (All engine manufacturers should produce shafts within the required tolerances.) Also, a standard rule of thumb is that the minimum diameter of the shaft, for one piece designs, is also the minimum amount of shaft engagement. (Two-piece designs would require shaft engagement in both pieces.) The engine shaft step radius needs to be smaller than the chamfer on the clutch or the clutch will not seat properly. If interference occurs, a spacer with the proper chamfer is required. Some of our clutches have a small bearing carrier (it looks like a taper). The shaft should be short enough so it does not make contact with this internal piece.

Direction of rotation: We manufacture our units for either clockwise or counter-clockwise rotation. They can be mounted with the pulley toward the engine or they can be mounted with the pulley away from the engine. This mounting is critical because this determines which direction the leaf springs are orientated. If springs are not run in tension, they could suffer premature failure because they will be running in compression. If the torque required from the clutch is low enough (less than 75%), and vibration and inertia are low, it is not as critical that the springs be mounted in the correct configuration.) All PTO clutch/ brakes have to operate with the pulley being the output. In no case can a PTO clutch/brake be installed with the pulley as the input. If you require a pulley input design, please use a general purpose clutch.

Backing plate restraint: If the installation uses a pin or a flat going through the slot on the backing plate, approximately 1/16" of movement should be allowed in both the radial and axial direction. Various other options are also acceptable such as a plate contacting one of the flats of the backing plate as well as clevis pins or cables. In all cases, a good way to check is after the clutch is completely installed, you should be able to feel movement in the radial direction back and forth. In heavy vibration applications, greater surface contact should be used to help prevent notching of the backing plate and the restraining piece.

Key length and height: In many of the clutches, the key does not go all the way through the clutch. Therefore, the key length can only be as long as the keyway length within the rotor. Please check this before installation. In some clutches, the bearing inner race may be exposed on the top of the keyway. In this case, the key needs to be slightly undersized in this area so it does not force itself against the bearing inner race.

Installation Of A Bearing Mounted PTO Clutch/Brake

A bearing mounted clutch/brake refers to a unit that has the bearing mounted in the field/rotor assembly.

Step 1: Slide the clutch onto the shaft, (for a two-piece clutch, slide both pieces on one at a time) making sure that the key is in the proper location. Do not force the clutch onto the shaft because if the key is off slightly, damage could occur to the key or to the bore of the clutch. The clutch should be slid onto the shaft until the bearing inner race on the clutch contacts a step, washer or other drive pulley. In all cases, the mounting surfaces of these components need to be parallel to each other within .003". If these surfaces are not parallel, the clutch could become cocked on the shaft. (This would show up as a wobbling pulley.) The contact of these components, to the bearing inner race, can extend beyond the inner race because the seal is recessed. (If you are using a washer, make sure it is not cupped otherwise this cupping could dig into the bearing seal.) Make sure to check the chamfer on the ground drive pulley, washer or clutch so they do not interfere with the radius on the step in the engine crankshaft. On some of our clutches, the bearing is kept on the inner sleeve via a snap ring, (pulley side). With this design, the rotor would then contact the appropriate step in the shaft.

Step 2: A center bolt and washer (customer supplied) is then placed into the end of the tapped shaft and then tightened down. The washer should be .250" in thickness. Bolt tightening torque will vary depending upon the bolt used in the application. This can be anywhere from 20 – 50 ft. lbs. of tightening torque depending upon the bolt. If vibration is heavy an adhesive may be required to prevent the bolt from coming loose. The washer should contact the inner race of the bearing. It can extend beyond the inner race as long as it does not contact the outer race.

Step 3: If the torque restraining piece has not been installed, please do so at this time. Whichever method you choose to restrict rotation of the backing plate, please make sure that there is 1/16" of both axial and radial movement allowed in the backing plate of the clutch/brake. Without this movement, the backing plate can cock the field bearing which would cause a premature field bearing failure. Whether you choose to use the slot that is already manufactured in the clutch or other method, please make sure that your hardware can hold the braking torque of the brake, which can be anywhere from 2.2 to 20 pounds depending upon clutch size.

Step 4: <u>This step is for two piece designs only</u>. Place the springs on to the studs. The brake shroud is then placed on the studs and the nuts are loosely tightened on the studs.

PLEASE PROCEED TO AIR GAP ADJUSTMENT PROCEDURE.

Installation
Of A PTO Flange Mounted Clutches And Brakes

Flange mounted clutches do not have a field bearing and therefore the field has to mount directly on the face of the engine. Please make sure that the engine bearing bore and bolt hole locations are compatible with our clutch field. In these types of applications, an inboard ground drive pulley cannot be used. In general, field mounted clutches are not as flexible as bearing mounted clutches and with the cost of installation time, they are not as widely used.

The assembly consists of four separate items. They are the:

1. **Field -** Provides magnetic flux for engagement
2. **Rotor -** Connected to the engine shaft and is the input to the clutch
3. **Armature/pulley -** Is the output of the clutch
4. **Brake shroud assembly -** Assists in slowing the mower blades to a stop

Step 1: Mount the field on the engine. Pilots on the back of the field line up and locate on the bearing bore on the engine block. Once this pilot is slid into the bearing bore, the four bolts to hold the field onto the engine face should be installed and tightened. (Torque to be determined by bolt used and engine thread size.)

Step 2: Place the key (customer supplied) into the shaft keyway. Slide the rotor onto the shaft. The rotor should be slid back all the way until it contacts the step on the engine shaft. If no contact is made or the rotor can slide all the way until it contacts the field, there is a problem in using this clutch. You need to adjust installation at this point by putting some type of spacer between the engine shaft step and the clutch rotor. Please refer to individual clutch drawing for this dimension.

Step 3: Slide the pulley/armature onto the shaft. This should fit flush against the rotor face. Depending upon clutch style, there may or may not be a keyway underneath this area. (If there is no keyway underneath this area, make sure your key does not extend into this piece.)

Step 4: The center bolt and washer is then installed to keep the entire assembly together. The center bolt should be tightened down to the bolt manufacturer recommendations. Usually 20-50 lb. ft. of torque is required. Please make sure that the washer contacts the inner race of the bearing. The washer can extend beyond the inner race as long as it does not contact the outer race because the seal is recessed. Please make sure the washer is not cupped in the direction of the seal or the seal will be damaged.

Step 5: The springs and the brake shroud are then placed on the units and the gap adjustment nuts are loosely tightened down.

PLEASE PROCEED TO AIR GAP ADJUSTMENT PROCEDURE.

Air Gap Adjustment

If you have a bearing mounted one-piece design your clutch should automatically be adjusted at the factory and no adjustment is required. This section is for your reference only. Please proceed to the burnishing section. If you have a two piece design or a flange mount design, please adjust using the following procedure:

1. Mount all components to the clutch according to our installation procedure. Please make sure that the brake plate and coil springs are in the proper position.

Start to tighten down the gap adjustment nuts. The same number of turns should be applied to each nut successively so the adjustment is as even as possible.

2. There are three inspection slots on the brake cover. With a feeler gauge of between .013-.015 for clutches used on 25 horsepower and under, and .015-.022 for clutches used on 25-31 horsepower, tighten each nut down until slight contact is felt on the feeler gauge. Once all three are finished, go back and check the air gap (occasionally some minor adjustment will be required).

3. Once the air gap is within the specified range, engage the clutch at full coil voltage and rotate it. If there is no contact on the brake shroud, the clutch is okay; however, if there is any contact with the brake shroud, the gap adjustment nuts should be backed off slightly to eliminate the contact.

Burnishing

Burnishing is the cycling of the clutch to allow a wearing in of the engagement surface area which increases the torque transmitted. The reason for burnishing a clutch is to increase the initial starting torque. If the starting torque required from the clutch is less than half of what the torque rating is, no burnishing is required. If there is a potential for high torque to be initially required from the clutch, burnishing should be done.

To burnish a clutch, reduce the engine speed to about half. A typical burnishing time will take anywhere from 5 to 30 cycles depending upon inertia. The burnishing frequency should be done at 2 to 6 cycles per minute. Frequency of cycles and amount of cycles required will depend upon inertia. Typically the larger the inertia, the fewer cycles per minute allowed, and the fewer overall cycles required.

(For a specific recommendation for your application, please contact us.)

OGURA INDUSTRIAL CORP.

Troubleshooting Guide

CLUTCH WILL NOT DISENGAGE

Potential Problem	Possible Reasons	Fix
Voltage not releasing.	Faulty switch.	Replace switch.
Rotor and armature locked together.	The clutch has been severely galled and has locked up. (Galling is the condition whereby a piece of metal is trapped between the armature and the rotor and melts due to high pressure and heat, spot welding the surfaces together.)	If rotor and armature connot be separated, replace the clutch. If they do separate, follow burnishing procedure.
Pulley bearing locked.	Bearing lost grease due to seal problem, temperature or water contamination.	Replace clutch.
▲ Brake plate clamped down too tightly.	If the brake nuts are screwed down too tight, the armature will be pressed against the rotor all the time. This should be evident by discoloration of the brake plate. If the unit ran long enough, the brake plate and the clutch would be destroyed.	Loosen brake nuts and reset air gap according to recommendations. If clutch is destroyed, replace clutch.

CLUTCH WILL NOT ENGAGE

Potential Problem	Possible Reasons	Fix
No voltage going to the clutch.	Wiring connector not seated properly.	Pull apart and re-seat connector.
	No voltage or low voltage coming from the battery.	Check with voltmeter, battery should be 8-16 volts. (Assuming 12 volt battery.)
	Defective charging system.	Fix charging system.
	Lead wire cut or broken internally.	Fix or replace lead wire. If destroyed, replace clutch.
	Fuse blown.	Replace fuse.
	Defective switch operating clutch.	Replace the switch.

▲ PTO Clutch/Brakes Only

Troubleshooting Guide

CLUTCH WILL NOT ENGAGE (continued)

Potential Problem	Possible Reasons	Fix
If voltage is going to the clutch, but the clutch will still not engage.	Coil open or shorted.	Check coil with ohmmeter. A range close to 3 to 4 ohms should be present at an ambient coil temperature of 70 F. Replace coil.
	Check coil voltage to make sure it is compatible with the voltage coming in. (If voltage is too high, this could cause the coil to burn out.)	Change battery or coil to meet your requirement.
	Burnt out coil caused by frictional contact (flange mounted clutches, rotor strike). If so, coil will be discolored, can be cracked, burnt or epoxy can be melted.	Replace coil.
	■ Rotor/armature air gap too large.	If straight bore, air gap can be readjusted. If unit has set screws, bottom out armature hub against field then back off to .1" and retighten set screws. If spacer on straight bore, reduce width of the spacer. If taper bore clutch, tap on armature cover to close gap.
	▲ Rotor/armature air gap too large.	Re-adjust according to air gap adjustment procedure.
Clutch engages, but load will not engage.	Rivets or springs broken.	Replace clutch.
	Key missing.	Put in key.
	Armature could be warped because of heat due to slippage. This means it will pull in, but will slip when a load is supplied. Clutch should show signs of heat.	Replace clutch and determine why it slipped.

▲ PTO Clutch/Brakes Only
■ Mobile Clutches Only

Troubleshooting Guide

CLUTCH SLIPS

Potential Problem	Possible Reasons	Fix
Low voltage going into the clutch.	Defective battery.	Replace battery
	Lead wire cut which could be intermittently grounding out the lead wire causing the clutch to turn on and off or not to give full voltage.	Fix or replace lead wire.
Erratic engagement.	If lead wire is kinked or pinched and the break is internal, the clutch operation may show up as being erratic engagement.	Fix or replace lead wire.
Clutch is contaminated.	Oil or other lubricant has been sprayed on the clutch surface. Sometimes this shows up after the clutch is disassembled. Physical evidence is either burnt oil or a greasy metallic surface showing oil still present.	Clean off surfaces with solvent and reburnish. Replace the clutch if damage is severe enough.
Clutch overloaded.	Output torque required is greater than what the clutch can handle. If input torque going into clutch is greater than the output torque required, the clutch will slip. If it slips too long, the clutch surfaces will be galled.	Size clutch correctly for the application. Replace clutch.
Output stalled.	If output is stalled, clutch could slip to the point where it will burn up and destroy either bearings or the field.	Replace clutch.
Clutch not burnished.	If full torque is required immediately and clutch is not burnished, it will slip and could become galled.	Try to reburnish clutch. If slipping is to severe, clutch will have to be replaced.

NOISY CLUTCH

Potential Problem	Possible Reasons	Fix
If clutch is able to move on the shaft:	Check center bolt and washer to make sure it is tight. If it is tight, make sure that the shaft is not too long. Clutch shaft should end before the end of the clutch to allow some deflection in the center bolt and washer to keep clutch on tightly.	Retighten center bolt or change spacer or shaft length

Troubleshooting Guide

NOISY CLUTCH (continued)

Potential Problem	Possible Reasons	Fix
Noise from pulley bearing.	Check if bearing feels rough. Check belt load to make sure pulley and bearings are not over loaded.	Reduce belt load.
	High temperature can be caused by either operating environment or due to slippage. If slippage, clutch should be discolored. Refer to slippage section for potential reasons.	Reduce the heat or eliminate slippage.
Pinging or scraping noise noticed when clutch is disengaged ■ Noise is evident when the clutch is first installed and rotated by hand.	Air gap too close.	Increase air gap.
	Surface is heavily galled.	Re-burnish the clutch.
	Possible causes are bolts in field not tightened down properly.	Tighten bolts.
	Key in keyway not seated properly. This could cause it to cock to one side.	Remove rotor assembly and reseat keyway.
	Lead wire pinched between mounting face and field bracket cocking field assembly.	Loosen the bolts, remove wire and retighten field mounting bolts.
	If set screw version, this could be because of improper air gap between pulley/armature and field.	Loosen set screw, push together, then back off .1", and retighten setscrew.
	Mounting face not concentric with the shaft.	Re-machine mounting holes or switch mounting face (by switching you will be able to verify if mounting holes on the clutch are the problem or the mounting holes on the face are the problem.)
■ Mounting bracket has come loose from back of field assembly.	Check to see if projection welds are broken. If they are, check to see if rotor strike has occurred. Possible misalignment in combination of belt side load has broken projection welds.	Replace the clutch.

■ Mobile Clutches Only

Troubleshooting Guide

NOISY CLUTCH (continued)

Potential Problem	Possible Reasons	Fix
Noise from field bearing (Noisy field bearing has failed or is about to fail.) In general purpose and PTO brakes	Check to see if the clutch is discolored to see if it shows signs of slippage.	Refer to slippage section.
	Check for damage to both the outer race and inner race of the bearing. Make sure key is not too tight forcing pressure on the inner race. In the outer race area, check for marks or damage that could have caused the clearances to close up.	Replace clutch.
	Check temperature if shaft clutch is mounted on to make sure it is under 300 F.	Reduce reason for the high temperature overloading on the engine.
	Check torque tab or backing plate to make sure that there is freedom of movement of 1/16 of an inch axially and radially. Check to see if any marks are evident that would indicate axial forces applied.	Loosen torque tab to make sure it has freedom of movement both axially and radially.
▲ Pinging or scraping noise noticed when clutch is engaged.	Brake shroud and air gap set too close. This means that the armature is contacting the brake while the clutch is engaged.	Back off the air gap to the higher end of the air gap range.
▲ Brake plate rattles.	In a heavy vibration application, the pin holding the backing plate can become worn because of vibration opening up clearance. This can then generate noise because of the additional movement in the braking plate.	Change the method of securing the clutch to allow for a greater surface area of contact so force is more spread out and less wear takes place.

▲ PTO Clutch/Brakes Only

Formulas to Determine Selection

The following formulas will help you arrive at the required torque for your application. Most mobile clutches accelerate in .2 seconds. Please use this as the time required in section #3.

1) How to calculate torque when horsepower and speed are known

$$\text{torque ft lb} = \frac{5252 \times \text{horsepower} \times \text{service factor}}{\text{speed}} \qquad T = \frac{5252 \times hp \times k}{n}$$

2) Inertia - How to determine inertia when material and shape are known.

(Total system inertia is total inertia of all the components. If the components are not simple shafts or flanges, break down each of the components into its basic shape and calculate inertia of that individual component. When inertia is being calculated in relation to the clutch or brake, remember to adjust for reflected inertia amounts which may have a significant increase or decrease on the inertia that the clutch has to handle based upon a speed differential.

(Inertia constants lb. in.^{3})

(aluminum) = 0.924

(bronze) = 0.321

(cast iron) = 0.26

(steel) = 0.282

Values

wk^2 = lb. ft.^{2}

D, D_o, D_i, L = in.

Formula to determine inertia of a solid shaft

$wk^2 = .000681 \times p \times \text{Length} \times \text{Diameter}^4$

$wk^2 = .000681 \times p \times L \times D^4$

Formula to determine inertia of a hollow shaft

$wk^2 = .000681 \times p \times \text{length} \times (\text{outer diameter}^4 - \text{inner diameter}^4)$

$wk^2 = .000681 \times P \times L \times (D_o^4 - D_i^4)$

Reflected inertia via gears, chain or belt

reflected inertia = load inertia divided by the square of the speed ratio

$$wk^2_R = \frac{wk^2_L}{r^2}$$

3) How to calculate the amount of torque required to accelerate or decelerate a load when inertia value is known (t = time to speed or time to stop depending if you are using a clutch or a brake.)

$$\text{torque ft lb} = \frac{(\text{inertia} \times \text{the change in rpm})}{308 \times \text{the time required}} \qquad T = \frac{wk^2 \times rpm}{308t}$$