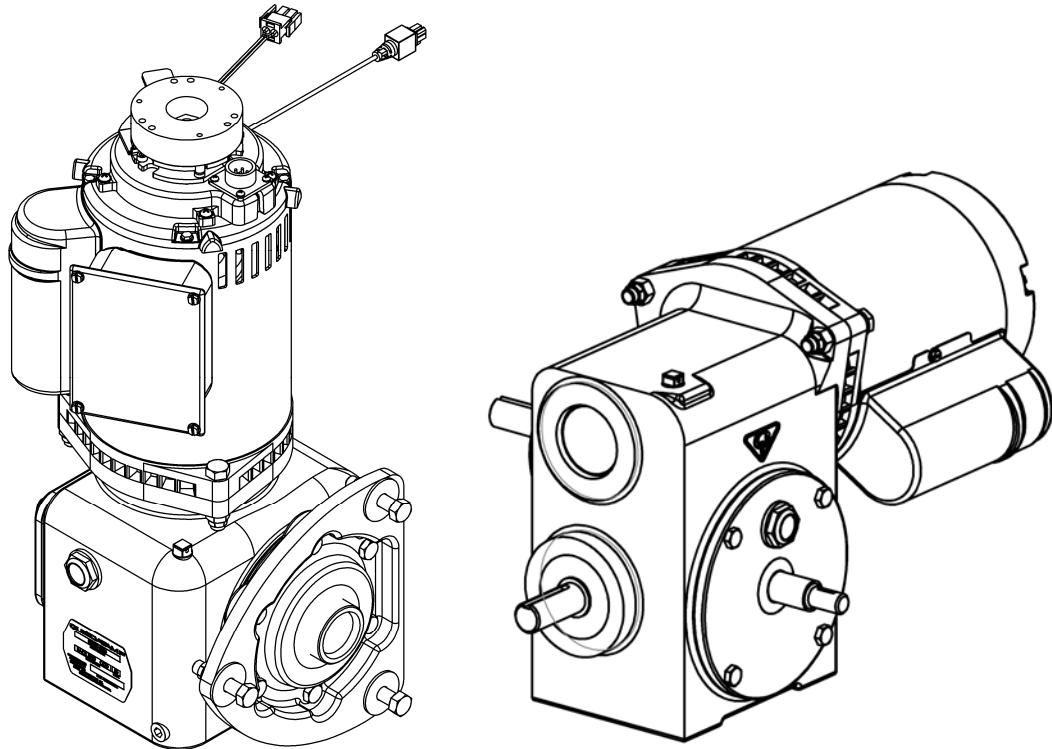




QUBICAAMF

***XLi* PINSPOTTER MOTOR AND GEARBOX MANUAL**



These Original Instructions were written in English.

P/N 400-088-017

Rev. B

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DOCUMENT UPDATES

In the interest of continual product and service improvement, QubicaAMF reserves the right to revise or update this manual at any time without obligation to notify any person or entity of such revision. The document number and revision date below indicate the edition of this manual.

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QubicaAMF XLi Pinspotter Motor & Gearbox Manual 400-088-017, Rev. B

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SECTION 1 FRONT END GEARBOX

1.1 PURPOSE

The purpose of this section is to provide a description of the front end gearbox as well as provides standard maintenance procedures for the XLi Pinspotter front end gearboxes.

1.2 SCOPE

This section contains instructions for performing the initial setup and periodic maintenance of the XLi front end gearboxes.

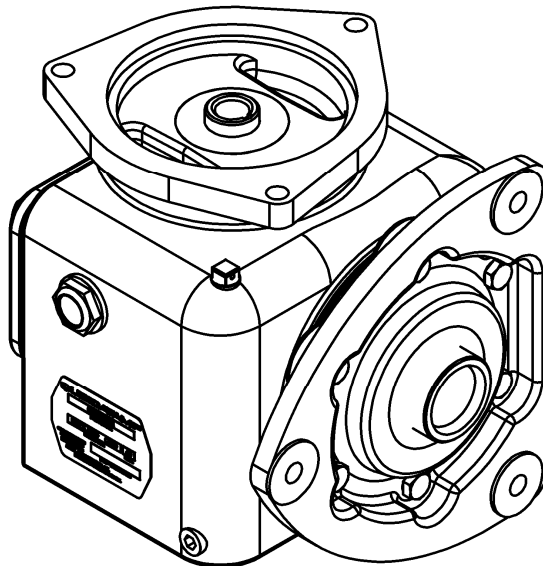
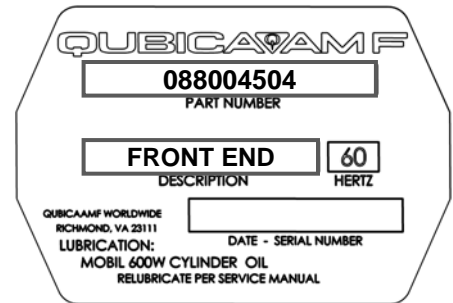
The front end gearbox is a speed reducing type gearbox with a single input and a single output. This gearbox is available in two different gear ratios for use with 50-hertz or 60-hertz motors. The procedures for both gearboxes are identical, although the two types have unique gear assemblies. The 50-hertz and 60-hertz gearboxes can be identified by the frequency rating located on the nameplate attached to the gearbox. As a visual indicator, nameplates with black printing are associated with 60-hertz gearboxes, and nameplates with red printing signify 50-hertz gearboxes.

GEARBOX APPLICATION

50 Hz Front End Gearbox
60 Hz Front End Gearbox

QubicaAMF PART NO.

088-004-509
088-004-504



Front End Gearbox



1.3 PROCEDURES

This section provides instructions for the initial setup of the front end gearboxes as well as procedures for servicing the gearbox, changing the gearbox oil, detecting gearbox problems, and separating the gearbox and motor.

1.3.1 INITIAL SETUP

The front end gearboxes are shipped installed on the pinspotter. Before initial operation, it is necessary to verify that the oil level is correct and to replace the solid fill plug with the vent plug. The vent plug is shipped in an envelope attached to the solid fill plug.

CAUTION! DO NOT OPERATE THE GEARBOX WITH THE SOLID PIPE PLUG INSTALLED IN THE TOP OF THE GEARBOX. DOING SO CAN CAUSE THE GEARBOX TO PRESSURIZE AND LEAK!

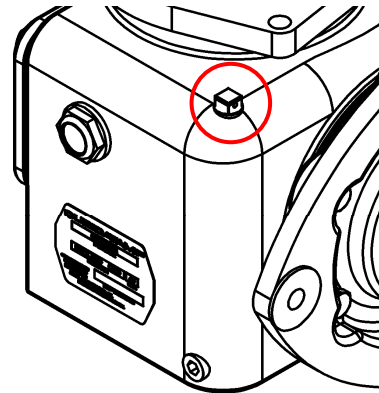
Tools Required

1/4-inch Hex Wrench
5/8-inch Wrench

1. Remove the solid pipe plug on top of the gearbox. This was installed for shipping only.
2. Verify that the gearbox oil level is visible in the built-in sightglass. It is important that the oil level is not above or below the sightglass. Do **NOT** overfill. If it is necessary to add oil, use Mobil 600w Oil (p/n 715-021-716).

Note: The gearboxes are inspected and oil levels checked before being installed at the factory. Unless oil has leaked during shipping, the gearbox should have the appropriate amount of oil.

3. Coat the threads of the vent plug with Loctite® #515 Gasket Eliminator.
4. Install the vent plug in the threaded opening on top of the gearbox. Tighten securely.
5. Repeat Steps 1 through 4 for the remaining gearboxes.



Whenever a gearbox is removed from the pinspotter or whenever the motor is removed from the gearbox, coat the motor shaft, the bore of the gearbox input and output shafts, and the splines of the table or sweep drive shaft, as applicable, with antiseize compound before reassembling. Pure Nickel Special Never-Seez by Bostic™ is recommended.



1.3.2 SERVICING THE SWEEP GEARBOX

Perform this procedure every 100,000 frames in conjunction with servicing the Sweep Drive Motor.

Tools Required

Cranking Tool
Flat Blade Screwdriver
9/16-inch Wrenches (2)

1. Run the sweep until sweep bar is stopped at the 2 - 3 line on the pin deck.
2. Remove power from the pinspotter. Follow appropriate Lockout/Tag Out procedures.
3. Disconnect the power cord from the sweep motor.
4. Remove the crossbeam cover.
5. Disconnect the Sweep brake and motor encoder cables from their harnesses in the wireway.
6. Remove the three bolts and nuts securing the Sweep gearbox to the crossbeam.
7. Carefully slide the sweep motor and gearbox assembly from the sweep drive shaft and move the assembly to a work bench.
8. Remove the three bolts and nuts that secure the sweep motor to the gearbox and separate the sweep motor from the gearbox.
9. Clean all surfaces of the sweep motor and gearbox with a cloth dampened with a water-based cleaner.
10. Check the gearbox for any signs of oil leakage. Repair as needed.
11. Check for loose bolts (6) holding the gearbox flange to the gearbox housing. Tighten as needed.
12. Check the sweep motor key and antifretting sleeve (088-004-518) for excessive wear. Replace as needed.
13. Drain and fill the oil in the gearbox in accordance with Section 1.3.4, *Changing the Gearbox Oil*.
14. Service the sweep motor, brake, and encoder in accordance with Section 2.3.1, *Servicing the Front End Motor, Brake, and Encoder*.
15. Apply a liberal amount of antiseize compound to the sweep motor shaft and to the bore of the input shaft of the gearbox.
16. With the antifretting sleeve in place on the motor shaft, attach the sweep motor to the gearbox, aligning the key with the keyway. Note the orientation of the sweep motor to the gearbox. The capacitor and the electrical box must be toward the front of the gearbox (sight glass side).
17. Install the three bolts and nuts to secure the sweep motor to the gearbox and tighten.
18. Rotate the gearbox output shaft by cranking the motor shaft 20 revolutions to develop a new wear pattern on the gears.
19. Wipe the old grease and antiseize compound from the sweep drive shaft splines.



20. Apply a liberal amount of antiseize compound to the splines of the sweep drive shaft and the bore of the output shaft of the gearbox.
21. Install the sweep motor and gearbox assembly by aligning the splines of the sweep gearbox and the sweep drive shaft. Push the gearbox onto the sweep drive shaft.
22. Install and tighten the three bolts and nuts securing the gearbox to the crossbeam.
23. Connect the sweep brake and encoder cables to the wire harness in the wireway. Cables should pass thru the grommet.
24. Install the crossbeam cover.
25. Connect the power cord to the sweep motor.
26. Restore power to the pinspotter.
27. Run the sweep to the home position.
28. Cycle the pinspotter and observe for correct operation.

1.3.3 SERVICING THE TABLE GEARBOX

Perform this procedure every 100,000 frames in conjunction with servicing the table drive motor.

Tools Required

Cranking Tool	2 x 4 (approximately 2-3 feet long)
Flat Blade Screwdriver	Spring Puller
9/16-inch Wrenches (2)	

1. Run the table to the pin spotting height, supported on a block of wood (2 x 4).
2. Run the sweep to the 1st guard position.
3. Remove power from the pinspotter. Follow appropriate Lockout/Tag Out procedures.
4. Disconnect the power cord from the table motor.
5. Remove the crossbeam cover.
6. Disconnect the table brake and sweep motor encoder cables from their harnesses in the wireway.
7. Remove the spring hangers and springs from the spot and respot arm link assemblies.
8. Remove the three bolts and nuts securing the table motor and gearbox assembly to the crossbeam.
9. Carefully slide the table gearbox assembly from the table drive shaft and move the assembly to a work bench.
10. Remove the three bolts and nuts that secure the table motor to the gearbox.
11. Remove the table motor from the gearbox.



12. Clean all surfaces of the table motor and gearbox with a cloth dampened with a water-based cleaner.
13. Check the gearbox for any signs of oil leakage. Repair as needed.
14. Check for loose bolts (6) holding the gearbox flange to the gearbox housing. Tighten as needed.
15. Check the table motor key and antifretting sleeve for excessive wear. Replace as needed.
16. Drain and fill the oil in the gearbox in accordance with Section 1.3.4, *Changing the Gearbox Oil*.
17. Service the table motor, brake, and encoder in accordance with Section 2.3.1, *Servicing the Front End Motor, Brake, and Encoder*.
18. Apply a liberal amount of antiseize compound to the table motor shaft and to the bore of the input shaft of the gearbox.
19. With the antifretting sleeve in place on the motor shaft, attach the table motor to the gearbox, aligning the key with the keyway. Note the orientation of the sweep motor to the gearbox. The capacitor and electrical box must be toward the front of the gearbox (sight glass side).
20. Install and tighten the three bolts and nuts securing the table motor to the gearbox.
21. Rotate the gearbox output shaft by cranking the motor shaft 20 revolutions to develop a new wear pattern on the gears.
22. Wipe the old grease from the table drive shaft splines.
23. Apply a liberal amount of antiseize compound to the splines of the table drive shaft and the bore of the output shaft of the gearbox.
24. Install the table motor and gearbox assembly by aligning the splines of the table gearbox and the table drive shaft. Push the table gearbox onto the table drive shaft.
25. Install and tighten the three bolts and nuts securing the table gearbox assembly to the crossbeam.
26. Install the spring hangers and springs to the spot and respot arm link assemblies.
27. Connect the table brake and encoder cables to the wire harness in the wireway. The cables should pass thru the grommet.
28. Install the crossbeam cover.
29. Crank the table so that the block of wood can be removed.
30. Connect the power cord to the table motor.
31. Restore power to the pinspotter.
32. Run the table thru one complete cycle.
33. Run the sweep and table to the home position.
34. Cycle the pinspotter and observe for correct operation.



1.3.4 CHANGING THE GEARBOX OIL

Replace the gearbox oil following every 100,000 frames of pinspotter operation. The amount of oil needed for each front end gearbox is 45 ounces. The oil can be drained with the gearbox installed on the pinspotter or removed to a work area. If draining the oil with the gearbox installed in the pinspotter, take adequate precautions to collect the waste oil and prevent it from dripping onto the pinspotter or the lane surface.

Tools Required

1/4-inch Hex Wrench
5/8-inch Wrench

Waste Oil Container
Funnel

1. Lock out and tag out the pinspotter in accordance with your bowling center's established procedures.
2. Unplug the gearbox motor's electrical connector.
3. Position a funnel between the drip pan and the gearbox drain plug and then insert the small end of the funnel into a waste container.
4. Remove the drain plug from the gearbox. The oil used in the gearbox will drain slowly. Removing the vent plug can speed draining. Secure the funnel in place, as needed, while the gearbox is draining. Allow the gearbox to drain completely.
5. Inspect the waste oil for metal filings. Significant quantities indicate excessive gear wear and may warrant further inspection.
6. Clean off and coat the threads of the drain plug with Loctite® #515 Gasket Eliminator.
7. Wipe away any oil from the threads of the drain opening and install the drain plug. Tighten securely. **Allow 30 minutes for the thread sealant to cure before filling the gearbox with oil. Failure to do so can result in oil leakage.**
8. If not done previously, remove the vent plug.
9. Fill the gearbox with Mobil 600w Oil, p/n 715-021-716 [one-quart bottle] or 715-021-706 [case of 12 one-quart bottles] until the oil level is clearly visible in the sight glass. **DO NOT OVERFILL!**
10. Clean the threads of the vent plug, apply Loctite #515 Gasket Eliminator to the threads, and reinstall the vent plug in the fill opening. Tighten securely.
11. Reconnect the gearbox motor's electrical connector and if maintenance is complete, return the pinspotter to service.
12. Dispose of the used oil and any oily rags properly.

CAUTION! OILY RAGS CAN BE A FIRE HAZARD. DISPOSE OF THEM IN AN APPROVED METAL CONTAINER ONLY!



1.3.5 DETECTING GEARBOX PROBLEMS

Inspect the gearboxes at least once every 60 days to identify the need for service or replacement. The following symptoms can be detected without any disassembly.

➤ **Oil Leakage**

Oil leakage from seals may indicate shaft and/or seal wear.

➤ **High Internal Operating Temperature**

The maximum normal operating temperature of a front end gearbox is 50° F (28° C) above ambient temperature. Higher temperatures may be caused by low oil level or internal component failure. As a general rule, higher operating temperatures warrant a more complete examination.

➤ **Shaft End Play and/or Gear Backlash**

Excessive radial or axial gearbox shaft movement (end play) indicates worn bearings, broken retaining rings, incorrect shimming, etc. Excessive backlash (rotational shaft movement without resistance) indicates gear wear.

➤ **Excessive Noise**

A certain amount of noise is inherent in gearbox assemblies and is normal. Excessive noise such as grinding or popping sounds coming from a gearbox indicates internal problems. The unit should be removed from service and replaced or repaired if possible.

1.3.6 SEPARATING THE GEARBOX AND MOTOR

Whenever the motor is removed from the gearbox, inspect the motor shaft, key, and antifretting sleeve (if applicable) for damage or excessive wear. Replace as necessary. On gearboxes manufactured on or after 08/01/2009 (those with serial numbers of 080109-X and newer [see below*]), the worm input shaft has been modified and an antifretting sleeve (quill liner) has been added to reduce wear and make disassembly easier. If your gearbox contains an antifretting sleeve, do NOT reassemble the motor and gearbox without this sleeve in place or damage to the motor shaft or gearbox worm shaft will occur. Replacement sleeves are available. When reattaching the motor to the gearbox, coat the motor shaft, antifretting sleeve, and the inside of the gearbox input shaft with antiseize compound.

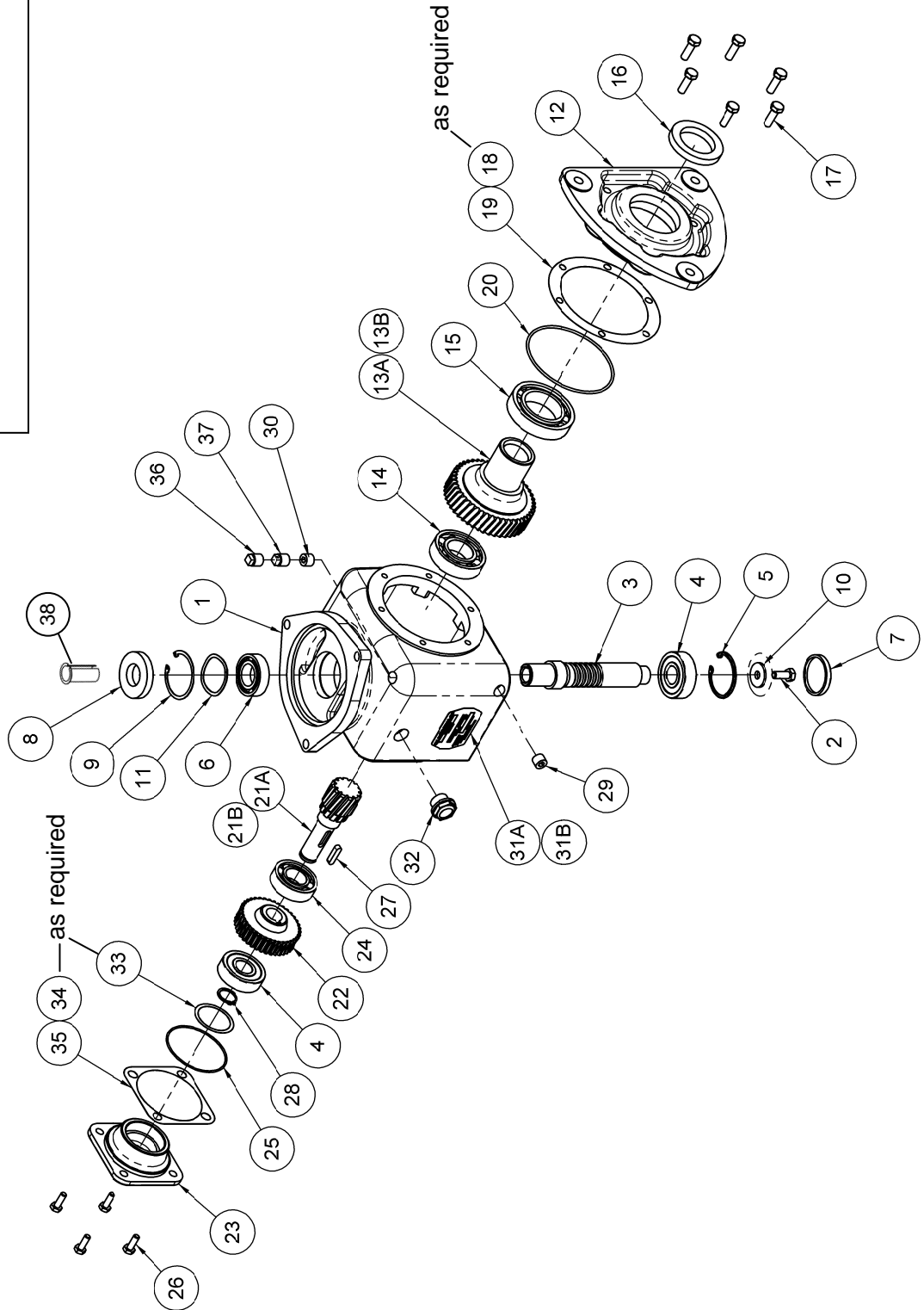
***A word about serial numbers**

Gearbox serial numbers are based on their manufacturing date so that a gearbox with serial number 080109-1 represents the first gearbox manufactured on August (08) 1st (01) 2009 (09). Because of this, a gearbox with a seemingly lower serial number, such as 010510-1, would actually have been manufactured after the gearbox with serial number 080109-1 (010510-1 would represent a gearbox manufactured on January (01) 5th (05) 2010 (10) even though the serial number is numerically lower than the one in the first example. **The key thing to remember is that serial numbers are date codes and not a sequential number series.**



**Front End Gearbox
Exploded View**

This exploded view drawing is provided for part identification only. Most individual parts are not for sale. Certain subassemblies, such as gear and bearing assemblies and seal kits, are for sale as indicated on the following pages.





1.3.7 Front End Gearbox Parts List

<u>ITEM #</u>	<u>DESCRIPTION</u>	<u>QTY</u>
1	Housing	1
2*	Screw, Hex, 5/16 NC x ¾	1
3	Worm, 38:1	1
4*	Bearing	2
5*	Beveled Retaining Ring	1
6	Bearing	1
7 [§] *	Expansion Plug	1
8 [§] *	Seal	1
9*	Retaining Ring	1
10*	Washer, .35 x 1.08 x .12	1
11*	Wave Spring	1
12	Mounting Flange	1
13A	Gear, 44 Tooth, 50 Hz Gearbox	1
13B	Gear, 46 Tooth, 60 Hz Gearbox	1
14	Bearing	1
15	Bearing	1
16 [§] *	Seal	1
17*	Screw, Hex, 5/16 NC x 1	6
18 [§] *	Shim, .002	1
19 [§] *	Shim, .005	1
20 [§] *	O-Ring	1
21A	Gear, 14 Tooth, 50 Hz Gearbox	1
21B	Gear, 12 Tooth, 60 Hz Gearbox	1
22	Worm Gear, 38:1	1
23	End Cap	1
24	Bearing	1
25 [§] *	O-Ring	1
26*	Screw, Hex, ¼ NC x ¾	4
27*	Key, 1 x 3/16 Square	1
28*	Retaining Ring	1
29	Pipe Plug, Hex Socket, ¼ NPT	1
30	Cap Plug Protective Closure	1
31A	Nameplate, 50 Hz, Red	1
31B	Nameplate, 60 Hz, Black	1
32	Sight Gauge	1
33*	Shim, Steel, .002	4
34 [§] *	Shim, Red, .002	1
35 [§] *	Shim, Blue, .005	1
36	Breather Plug, Square Head, ¼ NPT	1
37	Pipe Plug, Square Head, ¼ NPT	1
38**	Quill Liner (Antifretting Sleeve)	1

§ Included in the Front End Seal Repair Kit, 088-004-516

* Included in the Front End Gearbox Repair Kit, 088-004-513

** Applicable to gearboxes manufactured on or after 08/01/09.



1.3.8 Repair Parts and Kits

Front End Gearbox Seal Repair Kit, 088-004-516

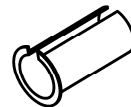
Use this kit to repair leaky seals or expansion plugs. This kit contains items 7, 8, 16, 18, 19, 20, 25, 34, & 35 from the previous page plus a tube of sealant.

Front End Gearbox Repair Kit, 088-004-513

This kit consists of all of the parts from the list on the previous page that are flagged with an asterisk (*) plus a tube of sealant. This kit is required whenever it is necessary to replace any of the internal components of the gearbox.

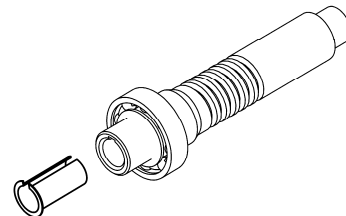
Quill Liner (Antifretting Sleeve), 088-004-518cocoa123 Cocoa123

Required for all front end gearboxes manufactured on or after 08/01/09 and all gearboxes that have had a replacement worm assembly (090-003-640) installed.



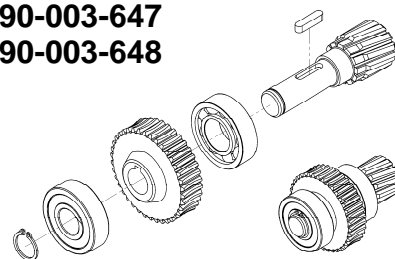
Worm Assembly, 50/60 HZ, 090-003-640

This assembly consists of the worm (input shaft) and upper (motor end) bearing as well as an antifretting sleeve. The worm and bearing are shipped assembled. The lower bearing is included in the Front End Gearbox Repair Kit. When installing, insert the worm from the top of the housing and press the bottom bearing onto the worm shaft.



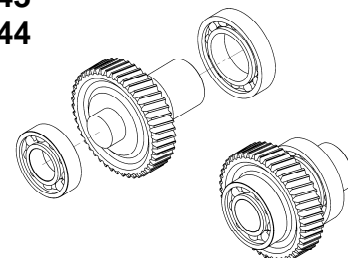
Front End Gearbox Intermediate Shaft Assembly, 50 HZ, 090-003-647 60 HZ, 090-003-648

This assembly consists of a helical gear and integral shaft, a worm gear, and bearings. The unit must be matched with the frequency rating of the gearbox and is shipped assembled.



Front End Gearbox Output Shaft Assembly, 50 HZ, 090-003-643 60 HZ, 090-003-644

This assembly consists of a helical gear and integral shaft and bearings. The unit must be matched to the frequency rating of the gearbox and is shipped assembled.





SECTION 2 FRONT END GEARBOX DRIVE MOTOR

2.1 PURPOSE

This section describes the procedures for the operation, maintenance, and repair of the XLi pinspotter's front end gearbox drive motor. This section also contains servicing and repair information for the brake and encoder that are attached to these motors.

2.2 SCOPE

Front end motor problems, while uncommon, are generally covered under warranty during the warranty period. Some of the motor's components, while attached to the motor, are not actually part of the motor. These are the brake and encoder assemblies. Replacement of these components is covered in this section. The motors are provided in 50 Hz and 60 Hz configurations rated for continuous service. Both models are rated at 1/3 horsepower; however, starting current and instantaneous torque may be 200-300% higher than rated operating current. The QubicaAMF part numbers for the different motors are as follows:

<u>APPLICATION</u>	<u>QubicaAMF PART NO.</u>	
50 Hz Front End	088-000-115 (motor only)	088-000-145 (incl. brake & encoder)
60 Hz Front End	088-000-116 (motor only)	088-000-146 (incl. brake & encoder)

Replacement rotor assemblies and rebuilt motors are also available (see Section 2.3.4).

The table and sweep drives use identical motor & gearbox assemblies (088-000-172 for 50-Hz machines and 088-000-173 for 60-Hz machines) consisting of a new style gearbox and an encoder-equipped drive motor. The front end motors have a brake as well as provisions for disengaging the brake and manual cranking. Front end motors contain thermal overload protection that will interrupt current flow to the motor windings in the event of a problem. A red reset button is located on the end of the motor. Allow the motor to cool before resetting, and always attempt to determine and fix the cause of the overload before returning the motor to service. The XLi front end motors are different from the back end gearbox motor, and are NOT interchangeable.

The following repairs are described in the sections that follow. All other repairs are not covered in this manual.

- Replacing the brake
- Replacing the encoder assembly
- Replacing the rotor assembly

Whenever connecting a front end motor to a gearbox, be sure to use the shaft key, and if supplied with your gearbox, the antifretting sleeve on the motor shaft. Also coat the motor shaft, antifretting sleeve, and the inside of the gearbox input shaft with antiseize compound.

Whenever attaching a front end gearbox to a drive shaft, be sure to apply a light coat of aluminum or copper antiseize compound to the drive shaft splines as well as to the inside of the gearbox input shaft.

For hand cranking of the table or sweep drive motors, the tab on the motor brake must be depressed and held down to release the brake. Once you stop pressing on the tab, the brake re-engages.



2.3 PROCEDURES

The two front end motors are individual components that attach directly to the front end gearboxes and are used to run the table and sweep. **NEVER attempt to operate a motor when it is in a partially disassembled state or when it has been removed from its gearbox housing!**

2.3.1 SERVICING THE FRONT END MOTOR, BRAKE, AND ENCODER



Wear eye protection and a dust mask when using compressed air to blow out components.

Perform this maintenance activity every 100,000 frames.

1. Run the sweep(s) to the 1st guard position.
2. Remove power from the pinspotters. Follow the appropriate Lockout/Tag Out procedures.
3. Loosen the screws holding the crossbeam covers to the crossbeam and remove the covers.
4. Cut and remove the plastic wire tie (if still attached) holding the brake and encoder wire to the motor housing.
5. Remove the four Phillips head screws attaching the motor enclosure to the top of the motor.
6. Carefully lift the motor enclosure with brake from the motor top. Be careful of the motor plug wires, allowing the motor enclosure to hang.
7. Using compressed air, blow the dust & dirt from the top of the motor and encoder.
8. Holding the motor enclosure with brake in one hand, blow out the brake with compressed air.
9. Inspect brake and encoder components and replace any damaged or excessively worn parts in accordance with Sections 2.3.2 and 2.3.3.
10. Reattach the motor enclosure with brake to the motor top by aligning the splines on the brake disc with the splines on the brake hub. (Depressing the brake release will allow for brake disc movement, that will ease the reattachment of the motor enclosure).
11. Install the four Phillips head screws and secure the motor enclosure to the top of the motor.
12. Check that the wires from the brake and encoder run through the grommet and into the crossbeam.
13. Install the crossbeam covers and tighten the screws that secure them to the crossbeam.
14. Install a new plastic wire tie around the brake and encoder wires routing it through the motor vents.
15. Repeat this procedure for the other front end motor(s), as applicable.
16. Restore power to the pinspotter.
17. Run the sweep(s) to the Home position.
18. Cycle the pinspotter and observe for correct operation.



2.3.2 REPLACING THE BRAKE

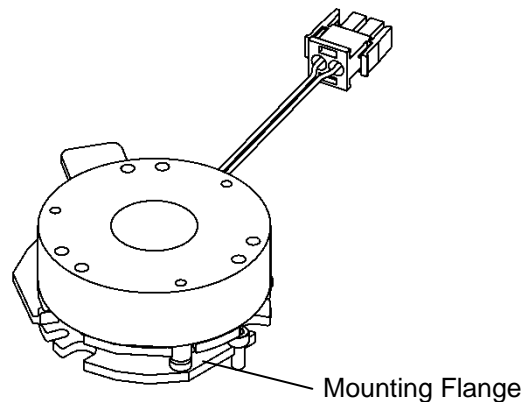
Each front end motor contains a brake assembly to stop the table or sweep quickly and precisely. The brake is an independent auxiliary device that should require little or no service other than cleaning. If a brake fails, the entire brake should be replaced since none of its internal components are user replaceable.

Note - It is recommended that you check the condition of the hubs when replacing a brake, and if needed, replace the hubs and the key with new parts.

Tools Required

9/64-inch Hex Wrench

1. Run the sweep to the 1st guard position.
2. Lock out and tag out the pinspotter in accordance with your bowling center's established procedures.
3. Disconnect the motor's power cable.
4. Disconnect the brake cable.



5. Remove the brake by removing the three socket head screws that secure it (see the drawing on page 15). These screws can be accessed through holes in the top of the brake housing.

The hexagonal hub (used for manually cranking the motor) and the splined hub (used by the brake) do not need to be replaced unless they are excessively worn or damaged. The manufacturer supplies a splined hub with each brake. When replacing the hubs, replace the key as well. The part numbers for the hexagonal hub as well as the key can be found at the back of this section. To replace the hubs, follow the applicable steps in Section 2.3.3, *Replacing the Encoder Assembly*.

6. Align the splined hub with the spline in the new brake and place the brake on the encoder enclosure such that the straight edge of the brake's mounting flange is next to the motor plug, and fasten the brake in place with the three socket head cap screws.
7. Reconnect the brake cable and the motor's power cable.
8. Restore power to the pinspotter.
9. Run the sweep to the Home position.
10. Cycle the pinspotter and observe for correct operation.



2.3.3 REPLACING THE ENCODER ASSEMBLY

Tools Required

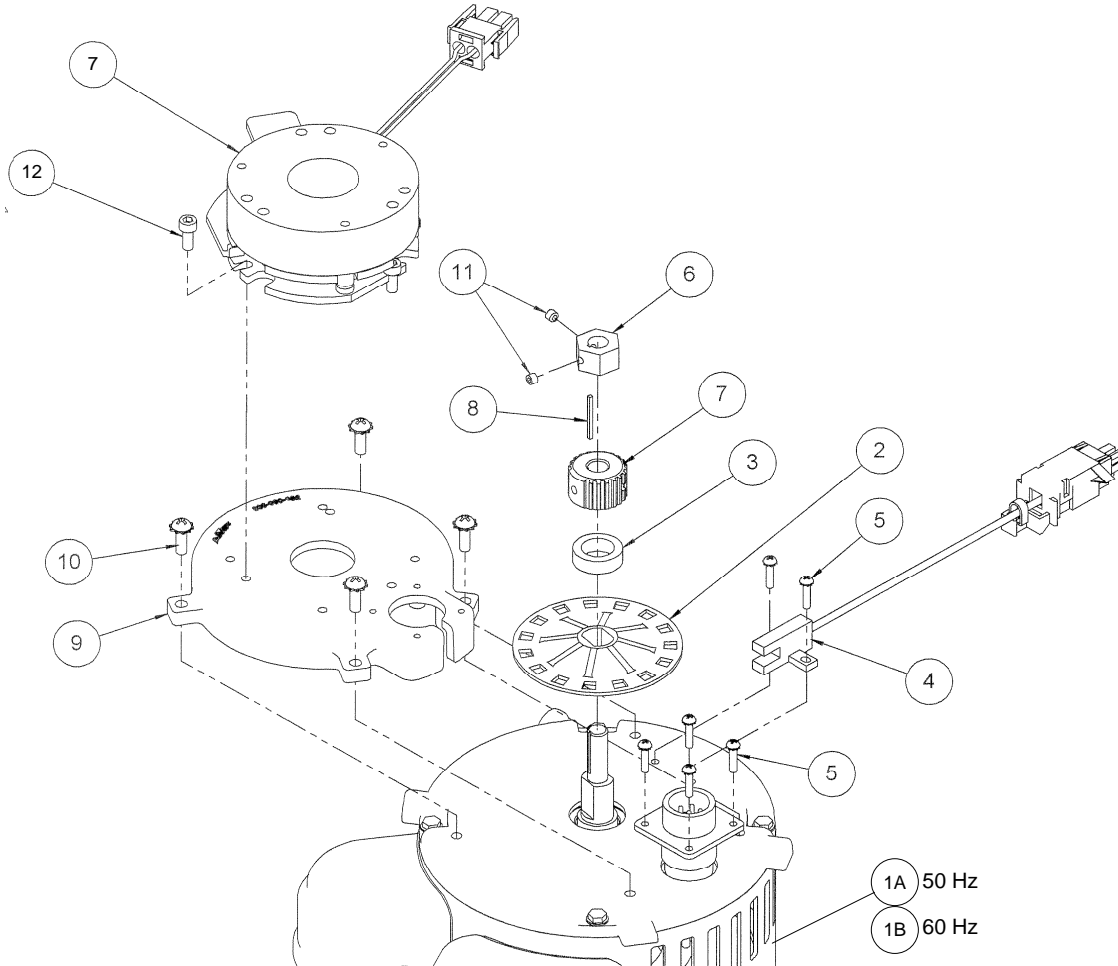
9/64-inch Hex Wrench
5/64-inch Hex Wrench
Flat Blade Screwdriver

1. Run the sweep to the 1st Guard position.
2. Lock out and tag out the pinspotter in accordance with your bowling center's established procedures.
3. Disconnect the motor's power cable.
4. Disconnect the brake cable.
5. Disconnect the electrical connector for the encoder sensor.
6. Remove the four screws that secure the motor's electrical receptacle to the encoder enclosure.
7. Remove the encoder enclosure and brake assembly from the top of the motor by removing the four Phillips head screws that hold the encoder enclosure in place (see drawing on page 15 for parts identification).
8. Remove the encoder sensor by removing the two Phillips head screws that hold it in place.
9. If the encoder disk or spacer needs to be replaced, perform the following steps.
 - a. Remove the hexagonal hub, brake hub, and key. This can be done by loosening the two set screws on each of the hubs. Then, using a flat blade screwdriver, pry between the top and bottom brake hub to slide the top one off the shaft. Remove the remaining brake hub and key. You might need to use a bearing puller on stubborn hubs.
 - b. Remove the spacer and encoder disk. Replace these items with the new ones.
 - c. Replace the hubs making sure that the keyways line up with the keyway on the shaft. Install a new key by pushing it through the gap created by the lined up keyways. In the event that the fit is too snug to replace the key by hand, a slight tap might be required to get it to insert completely.
 - d. Tighten the setscrews on the hubs.
10. Install the encoder sensor.
11. Reinstall the encoder enclosure and brake assembly aligning the splined hub with the spline in the brake, and then fasten the encoder enclosure in place with the four Phillips head screws.
12. Secure the motor's electrical receptacle to the encoder enclosure using the four Phillips screws that were removed earlier.
13. Reconnect the brake and encoder cables.
14. Reconnect the motor's power cable.
15. Restore power to the pinspotter.
16. Run the sweep to the Home position.
17. Cycle the pinspotter and observe for correct operation.



2.3.4 BRAKE AND ENCODER REPLACEMENT PARTS

The following parts are available as replacement items separately from the motor. Failure of any of these parts does not require replacing the motor and are easily replaced in the field. Any other warranty replacement is done by replacing the motor. Below is a diagram showing these parts and a table listing the part numbers.



ITEM #	PART NUMBER	DESCRIPTION
1A	088-000-115	50-Hertz Motor (motor only)
1B	088-000-116	60-Hertz Motor (motor only)
2	088-000-028	Encoder Disc
3	088-000-029	Encoder Disc Spacer
4	088-000-022	Encoder/Home Sensor Assembly
5	817-921-060	Screw, 4-40 X 1/2, Phillips Head, Sems
6	088-000-030	Brake Hub 5/8
7	088-001-286	Brake & Splined Hub
8	907-200-080	Key, .80 X 1/16 Square
9	088-000-032	Encoder Enclosure
10	818-233-082	Screw, 8-32 X 1/2, Phillips Pan Head
11	805-133-020	Setscrew, 8-32 X 1/8, 5/64 Hex Socket
12	810-233-060	Screw, 8-32 X 3/8, 9/64 Hex Socket Cap



2.3.5 REPLACING THE ROTOR ASSEMBLY

Replacement rotor assemblies are available should the rotor shaft become damaged due to dropping, bearing failure, or improper gearbox engagement. Use care when removing the encoder and brake assemblies because they can be reused and new ones are not included with the replacement rotor assembly. A rotor assembly consists of the shaft, integral fan and squirrel cage, and upper and lower bearings. The unit is shipped preassembled along with a new shaft key. Be sure to use the antifretting sleeve if your gearbox assembly originally came with one.

Part Number	Description
785-880-115	Front End Motor Rotor Assembly, 50 Hz
785-880-116	Front End Motor Rotor Assembly, 60 Hz

Rebuilt motors are also available. Rebuilt motors do not include the encoder and brake assemblies.

Part Number	Description
088-000-115-R	Rebuilt Front End Motor, 50 Hz
088-000-116-R	Rebuilt Front End Motor, 60 Hz

2.3.5.1 Rotor Replacement (Refer to the drawing on the previous page for component identification.)

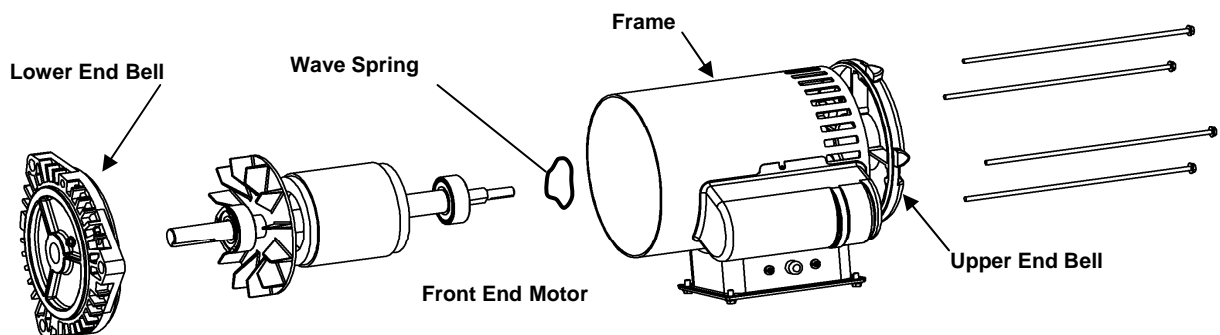
Tool List

¼" Nut Driver	#2 Phillips Screwdriver
Rubber Mallet	Flat Blade Screwdriver
9/16" Socket and Ratchet	9/16" Wrench
6" Ratchet Extension	5/64" Hex Wrench

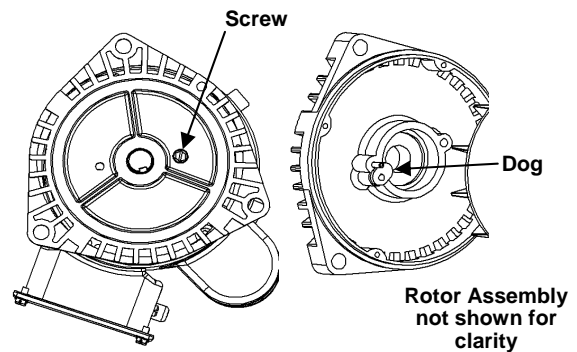
1. Run the sweep to the 1st Guard position.
2. Turn off power to the pinspotter. Lock out and tag out the pinspotter in accordance with your bowling center's established procedures.
3. Disconnect the motor's power plug, brake cable connector, and encoder cable connector.
4. Unbolt and remove the three screws and nuts that secure the motor to the gearbox.
5. Move the motor to a work area to complete the rotor replacement.
6. Remove the four screws that secure the motor's electrical receptacle to the encoder enclosure.
7. Remove the four screws that secure the encoder enclosure to the motor.
8. Remove the two screws that secure the encoder sensor to the motor and remove the sensor.
9. Loosen the two setscrews on the hexagonal brake hub and the two setscrews on the splined hub, and remove the hubs and key. Save them for reuse. Stubborn hubs could require the use of a bearing puller.
10. Remove the spacer and encoder disc.



- Using a marker or pencil, mark a line on the upper end bell extending it onto the motor frame. Do the same for the lower end bell and frame. When reassembling the motor, align the marks on the frame with the marks on the end bells to ensure that the motor is reassembled in the same orientation that it was before disassembly.
- Remove the four long bolts that secure the end bells to the motor frame. Tap on the upper end bell with a mallet to free the end bell from the upper rotor bearing.
- Pull the rotor and lower end bell away from the motor frame. The rotor will remain attached to the lower end bell until the next two steps are performed. The upper end bell, while loose, cannot be completely removed because of the wiring connections. Take care to prevent damaging the motor's wiring.



- There is a wave spring that will either remain in the recess on the inside of the upper end bell (if it is, leave it there) or could have stuck to the upper bearing of the rotor assembly when the rotor was removed. If the wave spring is on the rotor bearing, remove it and save for reuse.
- Loosen the screw on the lower end bell (see the illustration at the right) and rotate the dog away from the rotor assembly's lower bearing. Remove the rotor assembly.
- Remove the key taped to the new rotor assembly, and insert the shaft of the new rotor through the opening in the lower end bell so that the bearing seats within the recess in the end bell. (You may need to tap the end bell with the mallet.)



- Tighten the screw in the lower end bell (see above). Ensure that the dog rotates over the bearing and stops against the roll pin. Tighten the screw securely.
- If the wave spring was removed from the recess in the upper end bell, place the wave spring into the recess in the upper end bell and insert the rotor assembly into the frame and through the hole in the upper end bell. Ensure that the upper bearing is seated within the recess in the end bell. Use the mallet to seat the bearing, if necessary.



19. With both the upper and lower end bells firmly against the motor frame, and being careful not to pinch any of the motor's wiring, align the orientation marks on the frame with the marks on the end bells, and secure the end bells in place with the four long bolts. Tighten securely.
20. Rotate the motor's shaft to verify that there is no binding.
21. Reinstall the encoder disc and spacer, and then the splined hub, hexagonal hub, and key, ensuring that the key is inserted completely into the keyway. Tighten the four setscrews securely.
22. Reinstall the encoder sensor so that it straddles the encoder disc, and secure with the two Phillips screws that were removed earlier.
23. Reinstall the encoder enclosure and brake assembly. Slide the motor wires through the slit in the enclosure and seat the enclosure against the end bell. You will need to align the splined hub with the brake spline correctly for it to slide together. Don't force it. Secure with four Phillips screws.
24. Secure the motor's electrical receptacle to the encoder enclosure using the four Phillips screws that were removed earlier.
25. Hold down the brake release lever and rotate the motor's shaft by hand to ensure that there is no binding. The front end motor is ready to be reinstalled in the front end gearbox. Use the new key, antifretting sleeve (if applicable), and antiseize compound on the motor's shaft.
26. Install the motor on the gearbox using the three screws and nuts that were removed earlier.
27. Connect the encoder cable connector, brake cable connector, and motor power plug.
28. Restore power to the pinspotter
29. Run the sweep to the Home position.
30. Cycle the pinspotter and observe for correct operation.



SECTION 3 BACK END GEARBOX

3.1 PURPOSE

The purpose for this section is to provide a description of the XLi back end gearbox as well as to provide maintenance and repair procedures for the gearbox.

3.2 SCOPE

This section provides an operating overview of the back end gearbox as well as procedures for the initial setup and subsequent maintenance and repair of the XLi pinspotter back end gearbox.

The back end gearbox is a speed reducing, single input, triple output gearbox that is available in two different gear ratios: one for 50-hertz motors and another for 60-hertz motors, as well as right hand (odd) and left hand (even) versions for each gear ratio for a total of 4 different models. The gearbox's three output shafts turn at different speeds to operate the Distributor, the Pin Lift, and the Pit Conveyor Belt, Light Ball Sensor, and Positive Ball Lift.

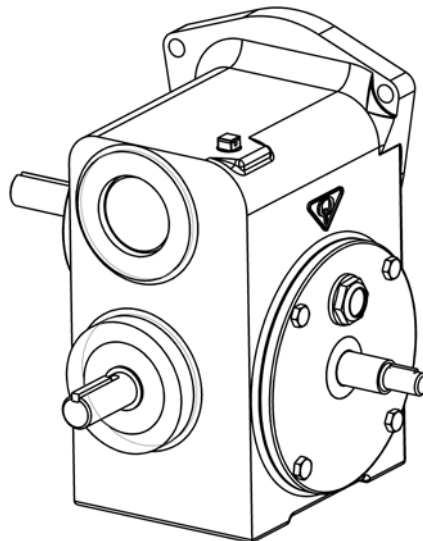
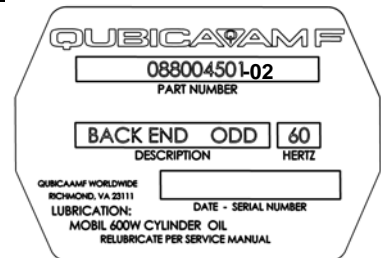
The procedures for all back end gearboxes are identical, although the two gear ratios have unique worm assemblies. The 50-hertz and 60-hertz gearboxes can be identified by the frequency rating located on the nameplate attached to the gearbox. As a visual indicator, nameplates with black printing are associated with 60-hertz gearboxes, and nameplates with red printing signify 50-hertz gearboxes.

APPLICATION

- 60 Hz, Back End, Odd
- 60 Hz, Back End, Even
- 50 Hz, Back End, Odd
- 50 Hz, Back End, Even

QubicaAMF PART NO.

- 088-004-501-02
- 088-004-502-02
- 088-004-506-02
- 088-004-507-02



Back End Gearbox



3.3 PROCEDURES

This section provides instructions for the initial setup of the back end gearboxes as well as procedures for servicing the back end gearbox, changing the gearbox oil, detecting gearbox problems, and separating the gearbox and motor.

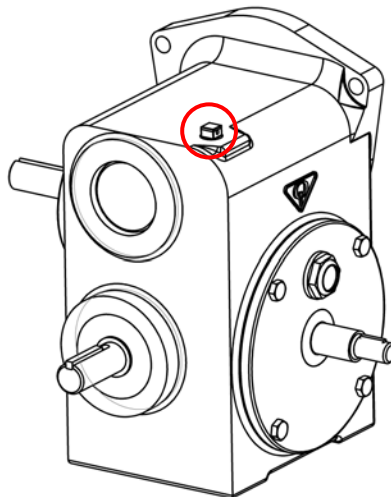
The gearbox is made of cast iron and is relatively heavy. It is recommended that if the back end gearbox needs to be removed, the back end motor should be removed before removing the gearbox.

3.3.1 INITIAL SETUP

Back end gearboxes are shipped installed on the pinspotter. The oil level has been verified before shipping and unless there has been leakage, should not need to be adjusted. If necessary, fill with Mobil 600w Oil (p/n 715-021-716) until the oil level is clearly visible in the sight glass. Do NOT overfill.

CAUTION! DO NOT OPERATE THE GEARBOX WITH THE SOLID PIPE PLUG INSTALLED ON THE TOP OF THE GEARBOX. DOING SO CAN CAUSE THE GEARBOX TO PRESSURIZE AND LEAK!

1. Remove the solid fill plug from the top of the gearbox. This was installed for shipping only.
2. Coat the threads of the vent plug with Loctite® #515 Gasket Eliminator. The vent plug is shipped in an envelope attached to the solid fill plug.
3. Install the vent plug in the threaded opening on top of the gearbox. Tighten securely.
4. Repeat Steps 1 through 3 for the remaining back end gearboxes.



Vent Plug Location



3.3.2 SERVICING THE BACK END MOTOR & GEARBOX

Whenever the motor is removed from the gearbox, coat the motor shaft and the bore of the gearbox input shaft with antiseize compound before reassembling. Pure Nickel Special Never-Seez by Bostic™ is recommended.

Perform this maintenance activity every 100,000 frames of pinspotter operation.

Tool List

9/16" Wrench
9/16" Socket and Ratchet
Flat Blade Screwdriver

1. Run the sweep to the 1st guard position.
2. Remove power from the pinspotter. Follow the appropriate Lock out/Tag out procedures.
3. Remove the wireway extension cover.
4. Disconnect the back end motor power cord plug from the wire harness and remove the power cord from the wireway extension.
5. Remove the distributor drive shaft. Set it aside.
6. Remove the pit conveyor / PBL drive belt from the gearbox pulley.
7. Remove the EDGE Performance Lift drive belt.
8. Remove the three nuts and bolts securing the backend motor to the gearbox.
9. Remove the backend motor from the gearbox by pulling on the motor. Use penetrating oil if needed. Do not pry or hammer.
10. Move the backend motor to a work bench.
11. Clean the motor shaft with a solvent-based cleaner.
12. Remove the four bolts securing the gearbox to the motor mount weldment.
13. Carefully move back end gearbox to a work bench.
14. Clean all surfaces of the motor and gearbox with a cloth dampened with a water-based cleaner.
15. Clean the gearbox input shaft with a solvent-based cleaner.
16. Check the gearbox for any signs of oil leakage. Repair or replace as needed.
17. Check the back end motor key for excessive wear. Replace as needed.
18. Drain and refill the gearbox oil in accordance with Section 3.3.2, *Changing the Gearbox Oil*.
19. Place a fiber washer at each bolt hole location (4) on the oil pan located on the back end motor mount weldments.
20. Place the backend gearbox on the motor mount weldments and install and tighten the four bolts that were removed earlier to secure the gearbox to the motor mount weldment.
21. Apply a liberal amount of antiseize compound to the back end motor shaft and to the bore of the input shaft of the gearbox.



22. Attach the back end motor to the gearbox, aligning the key with the keyway. Note the orientation of the backend motor to the gearbox. Secure by installing and tightening the three nuts and bolts that were removed earlier.
23. Install the pit conveyor / PBL drive belt.
24. Install the distributor drive shaft.
25. Install the EDGE Performance Lift drive belt.
26. Route the back end motor power cord into the wireway extension and connect the back end motor power cord plug to the wire harness in the wireway.
27. Install the wireway extension cover.
28. Restore power to the pinspotter.
29. Adjust the EDGE Performance Lift drive belt tension in accordance with the procedure in the *EDGE Performance Lift Pinspotter Manual Supplement, 400-088-091*.
30. Run the sweep to the Home position.
31. Cycle the pinspotter and observe for correct operation.



3.3.3 CHANGING THE GEARBOX OIL

Replace the gearbox oil following every 100,000 frames of pinspotter operation. The amount of oil needed for each back end gearbox is 40 ounces. When draining the oil from the gearbox, take adequate precautions to collect the waste oil and prevent it from dripping onto the work area.

Tools Required

1/4-inch Hex Wrench
9/16-inch Wrench
5/8-inch Wrench

Waste Oil Container
Funnel

1. Run the sweep to the 1st Guard position.
2. Lock out and tag out the pinspotter in accordance with your bowling center's procedures.
3. Unplug the gearbox motor's electrical connector.
4. Disconnect the distributor drive shaft and remove the belts from the gearbox pulleys.
5. Remove the motor from the gearbox.
6. Unbolt the gearbox from the mounting plate and remove the gearbox from the machine.
7. Position a funnel below the gearbox drain plug and then place the small end of the funnel into a waste container.
8. Remove the drain plug from the gearbox. The oil used in the gearbox is thick and will drain slowly. Removing the breather plug can speed draining. Secure the funnel in place, as needed, while the gearbox is draining. Allow the gearbox to drain completely.
9. Inspect the waste oil for metal filings. Significant quantities indicate excessive gear wear and may warrant further inspection.
10. Clean off and coat the threads of the drain plug with Loctite[®] #515 Gasket Eliminator.
11. Wipe away any oil from the threads of the drain opening and install the drain plug. Tighten to 10 - 12 ft-lbs. Allow 30 minutes for the thread sealant to cure before filling the gearbox with oil. Failure to do so can result in oil leakage.
12. Fill with Mobil 600w Oil, p/n 715-021-716 [one-quart bottle] or 715-021-706 [case of 12 one-quart bottles] until the oil level is clearly visible in the sight glass. The recommended amount of oil to put in is 40 ounces which should bring the level into the sight glass.
13. Clean off and coat the threads of the breather plug with Loctite[®] #515 Gasket Eliminator, and reinstall the plug in the fill opening. Tighten securely.
14. Reinstall the gearbox in the pinspotter and the motor to the gearbox. Install the drive belts and distributor drive shaft, and reconnect the gearbox motor's electrical connector.
15. If maintenance is complete, return the pinspotter to service.
16. Dispose of the used oil and any oily rags properly.

CAUTION! OILY RAGS CAN BE A FIRE HAZARD. DISPOSE OF THEM IN AN APPROVED METAL CONTAINER ONLY!



3.3.4 DETECTING BACK END GEARBOX PROBLEMS

Inspect the gearboxes at least once every 60 days to identify the need for service or replacement. The following symptoms can be detected without any disassembly.

➤ **Oil Leakage**

Oil leakage from seals can indicate shaft and/or seal wear. A small amount of oil seeping past a gearbox seal is normal and expected. A trace of oil may be seen under the output shaft(s). This streak of oil should be wiped away with a clean dry rag. As long as less than one tablespoon (15 mL) of oil gathers in the drip pan over a one week period, the seal is still functioning properly.

➤ **High Internal Operating Temperature**

The maximum normal operating temperature of a back end gearbox is 50 °F (28 °C) above ambient. Higher temperatures may be caused by low oil level or internal component failure. As a general rule, higher operating temperatures warrant a complete examination.

➤ **Shaft End Play and/or Gear Backlash**

Excessive radial or axial gearbox shaft movement (end play) indicates worn bearings, broken retaining rings, incorrect shimming, etc. Excessive backlash (rotational shaft movement without resistance) indicates gear wear.

➤ **Excessive Noise**

A certain amount of noise is inherent in gearbox assemblies and is normal. Excessive noise such as grinding or popping sounds coming from a gearbox indicates internal problems. This unit should be removed from service and replaced or repaired if possible.

3.3.5 SEPARATING THE GEARBOX AND MOTOR

Whenever the motor is removed from the gearbox, inspect the motor shaft and key for damage or excessive wear. Replace as necessary. When reattaching the motor to the gearbox, coat the motor shaft and the inside of the gearbox input shaft with antiseize compound.

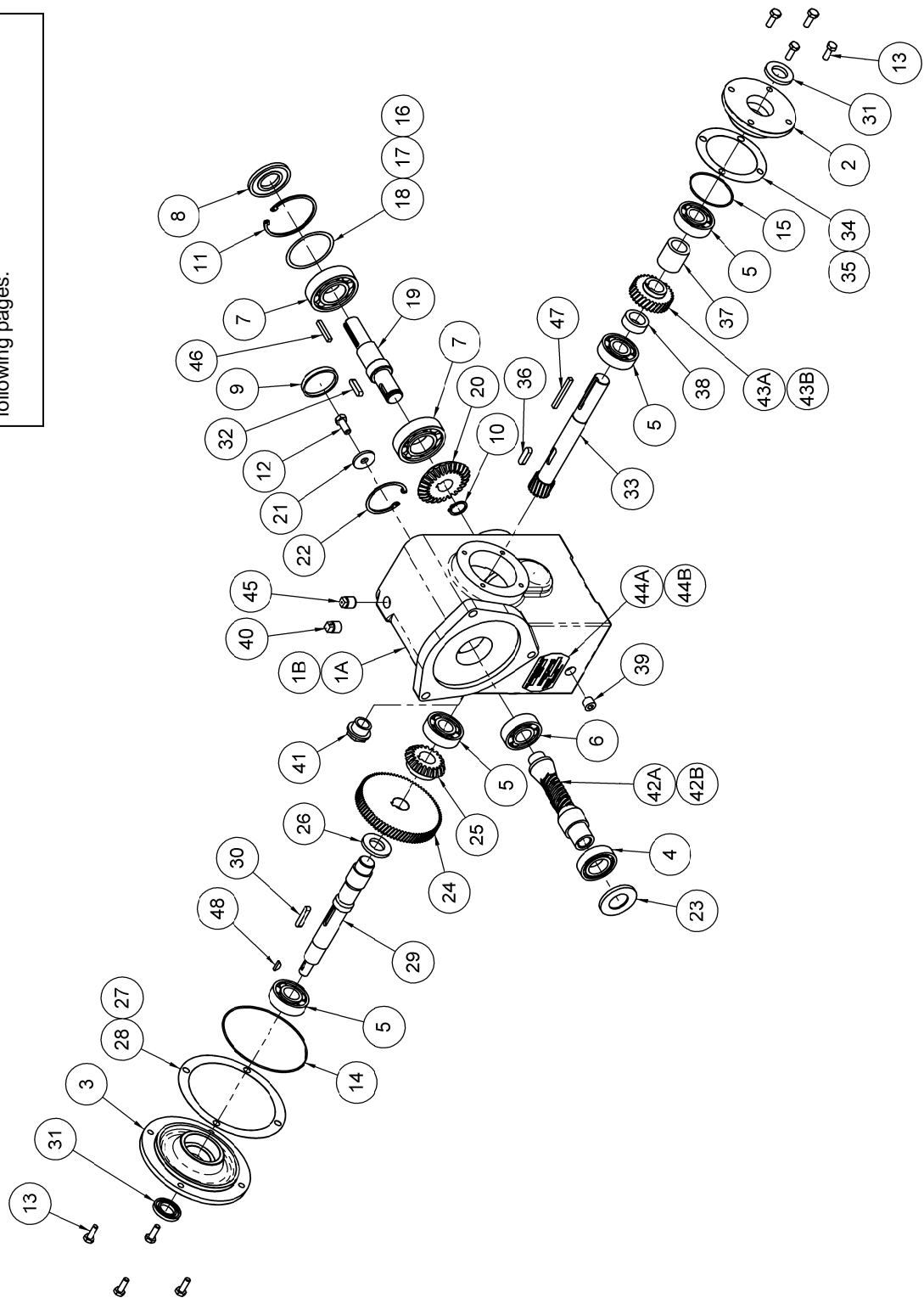
A word about serial numbers

Gearbox serial numbers are based on their manufacturing date so that a gearbox with serial number 080109-1 represents the first gearbox manufactured on August (08) 1st (01) 2009 (09). Because of this, a gearbox with a seemingly lower serial number, such as 010510-1, would actually have been manufactured after the gearbox with serial number 080109-1 (010510-1 would represent a gearbox manufactured on January (01) 5th (05) 2010 (10) even though the serial number is numerically lower than the one in the first example. **The key thing to remember is that serial numbers are date codes and not a sequential number series.**



**Back Eng Gearbox
Exploded View**

Exploded view drawing provided for part identification only. Most individual parts are not for sale. Certain subassemblies, such as gear and bearing assemblies and seal kits, are for sale as indicated on the following pages.





3.3.6 Back End Gearbox Parts List

<u>ITEM #</u>	<u>DESCRIPTION</u>	<u>QTY</u>
1A	Housing, R.H.	1
1B	Housing, L.H.	1
2	Cap, Open	1
3	Cap, Open	1
4	Bearing	1
5	Bearing	4
6*	Bearing	1
7	Bearing	2
8*§	Seal	1
9*§	Expansion Plug	1
10	Retaining Ring	1
11*	Retaining Ring	1
12*	Screw, Hex, 5/16 NC x ¾	1
13*	Screw, Hex, ¼ NC x ¾	8
14*§	O-Ring	1
15*§	O-Ring	1
16*	Shim, .002	1
17	Shim, .003	1
18	Shim, .005	1
19	Output Shaft	1
20	Gear, 26 Tooth	1
21*	Washer, .35 x 1.08 x .12	1
22*	Beveled Retaining Ring	1
23*§	Seal	1
24	Gear, 82 Tooth	1
25	Gear, 20 Tooth	1
26	Spacer	1
27*	Shim, .002, Red	1
28*	Shim, .005, Blue	2
29	Intermediate Shaft	1
30	Key, 1-1/2 x 3/16 Square	1
31*§	Seal	2
32	Key, 1 x 3/16 Square	1
33	Spur Gear, 18 Tooth	1
34*	Shim, .002, Red	3
35*	Shim, .005, Blue	2
36	Key, 3/4 x 3/16 Square	1
37	Spacer	1
38	Spacer	1
39	Pipe Plug, ¼ NPT	1
40	Pipe Plug, Square Head, ¼ NPT	1
41	Sight Gauge	1
42A	Worm, 5:1, 50 Hz	1
42B	Worm, 6:1, 60 Hz	1
43A	Worm Gear, 5:1, 50 Hz	1
43B	Worm Gear, 6:1, 60 Hz	1
44A	Nameplate, 50 Hz	1
44B	Nameplate, 60 Hz	1
45*	Breather Plug, ¼ NPT	1
46	Key, 1-1/4 x 3/16 Square	1
47	Key, 1-7/8 x 3/16 Square	1
48	Key, Hy-Pro 405	1

§ Included in the Back End Seal Repair Kit, 088-004-517

* Included in the Back End Gearbox Repair Kit, 088-004-512.



3.3.7 Repair Parts and Kits

Back End Gearbox Seal Repair Kit, 088-004-517

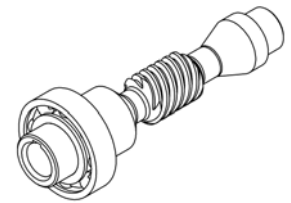
Use this kit to repair leaky seals or expansion plugs. This kit contains items 8, 9, 14, 15, 23, & 31 from the previous page plus a tube of sealant.

Back End Gearbox Repair Kit, 088-004-512

This kit consists of all of the parts from the list on the previous page that are flagged with an asterisk (*) plus a tube of sealant. This kit is required whenever it is necessary to replace any of the internal components of the gearbox.

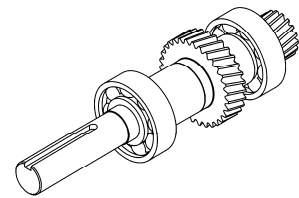
Worm Assembly, 50 HZ, 088-004-510 60 Hz, 088-004-511

This assembly consists of the worm and input (motor) end bearing. The output end bearing is included in the Back End Gearbox Repair Kit. When installing, insert the worm from the flange side of the gearbox housing and then press the other bearing onto the worm shaft.



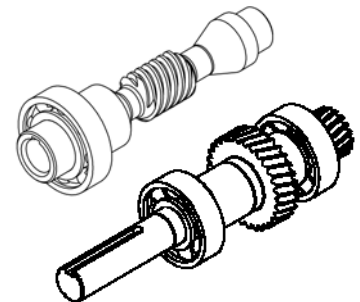
Carpet Drive, 50 HZ, 090-003-645 60 Hz, 090-003-646

This assembly consists of a shaft with integral spur gear, a worm gear, bearings, & spacers. The drive is shipped preassembled.



Worm Set, 50 HZ, 088-004-514 60 Hz, 088-004-515

The Worm Set consists of a worm assembly and the carpet drive assembly. The set requires the worm's output bearing which is included in the Back End Gearbox Repair Kit.



Distributor Drive Shaft Assembly (not shown), 090-003-637

This assembly consists of the intermediate drive shaft (29), large spur gear (24), beveled gear (25), bearings (5), and spacer (26). The drive shaft assembly is shipped assembled.

Pin Elevator Drive Shaft Assembly (not shown), 090-003-638

This assembly consists of a drive shaft (19), beveled gear (20), bearings (7), and retaining ring (10) and is shipped assembled.



SECTION 4 BACK END GEARBOX MOTOR

4.1 PURPOSE

This section describes the procedures for the operation, maintenance, and repair of the XLi pinspotter's back end gearbox drive motor.

4.2 SCOPE

Back end motor problems, while uncommon, are generally covered under warranty during the warranty period. Periodic motor maintenance is performed in conjunction with back end gearbox maintenance in accordance with the steps detailed in Section 3.3.1. Section 4.3.1 below describes the procedure for replacing the rotor assembly.

The back end motors are 1/3 horsepower, dual voltage motors and are available in 50 Hz and 60 Hz configurations rated for continuous service. The back end motors contain thermal overload protection that will interrupt current flow to the motor windings in the event of a problem. A red reset button is located on the end of the motor. Allow the motor to cool before resetting, and always attempt to determine and fix the cause of the overload before returning the motor to service. The QubicaAMF part numbers for the different motors are as follows:

<u>APPLICATION</u>	<u>QubicaAMF PART NO.</u>
50 Hz Back End	090-007-310 (flat plug)
60 Hz Back End	090-003-766 (flat plug)

When replacing a drive motor, ensure that the model used matches the frequency and voltage of the electrical power that is being supplied to the pinspotter. The same model of back end motor is used for both odd and even gearboxes, but these motors are NOT interchangeable with the front end gearbox motors. Whenever attaching the motor to the gearbox, be sure to apply a light coat of antiseize compound to the motor shaft and key as well as to the bore of the gearbox input shaft.

4.3 PROCEDURES

The back end motor attaches directly to the back end gearbox and is used to run the pin lift, distributor, positive ball lift (PBL), pit conveyor, and light ball Sensor (LBS). **NEVER attempt to operate a motor when it has been removed from its gearbox housing!**

4.3.1 REPLACING THE ROTOR ASSEMBLY

Replacement rotor assemblies are available should the rotor shaft become damaged due to dropping, bearing failure, or improper gearbox engagement. A rotor assembly consists of the shaft, integral fan and squirrel cage, and upper and lower bearings. The unit is shipped preassembled along with a new shaft key.

Part Number	Description
785-907-310	Back End Motor Rotor Assembly, 50 Hz
785-903-766	Back End Motor Rotor Assembly, 60 Hz



Rebuilt motors are also available under the following part numbers:

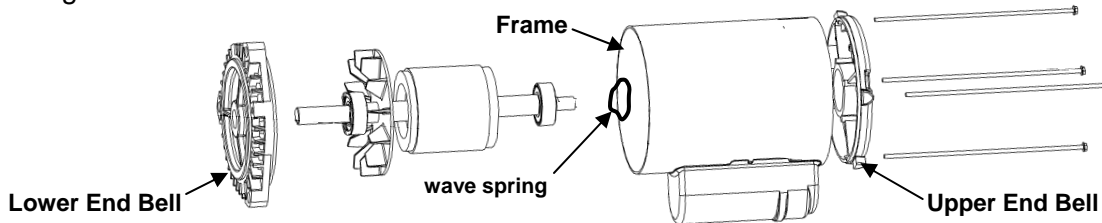
Part Number	Description
090-907-310-R	Rebuilt Back End Motor, 50 Hz
090-003-766-R	Rebuilt Back End Motor, 60 Hz

4.3.1.1 Rotor Replacement (Refer to illustrations below for component identification.)

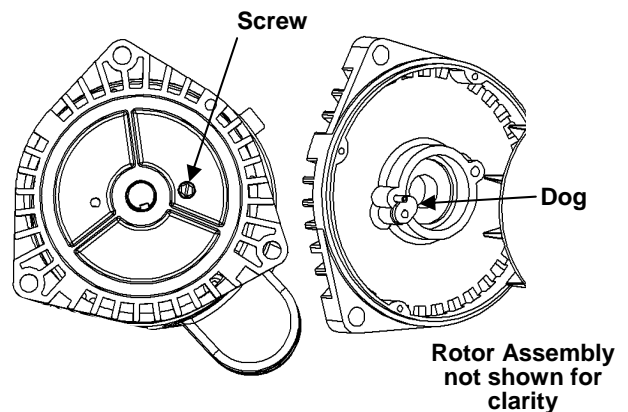
Tool List

1/4" Nut Driver	9/16" Socket and Ratchet	Flat Blade Screwdriver
Rubber Mallet	6" Ratchet Extension	#2 Phillips Screwdriver
5/64" Hex Wrench	9/16" Wrench	

1. Turn off power to the pinspotter. Lock out and tag out the pinspotter in accordance with your bowling center's established procedures.
2. Disconnect the motor's power plug.
3. Remove the motor from the gearbox assembly and move it to a work area.
4. Remove the four long bolts that secure the end bells to the motor frame.
5. Tap the upper end bell with a mallet to free the end bell from the upper rotor bearing.
6. Pull the rotor and lower end bell away from the frame. The rotor will remain attached to the lower end bell until the next two steps are performed. The upper end bell, while loose, cannot be completely removed because of the wiring connections. Take care to prevent damaging the motor's wiring.



7. There is a wave spring that will either remain in the recess on the inside of the upper end bell (if it is, leave it there) or could have stuck to the upper bearing of the rotor assembly when the rotor was removed. If the wave spring is on the rotor bearing, remove it and save for reuse.
8. Loosen the screw on the lower end bell (see the illustration at the right) and rotate the dog away from the rotor assembly's lower bearing. Remove the rotor assembly.
9. Remove the key taped to the new rotor assembly, and insert the shaft of the new rotor through the opening in the lower end bell so that the bearing seats within the recess in the end bell. (You may need to tap the end bell with the mallet.)





10. Tighten the screw in the lower end bell (refer to the illustration above). Ensure that the dog rotates over the bearing and stops against the roll pin. Tighten the screw securely.
11. If the wave spring was removed from the recess in the upper end bell, place the wave spring into the recess in the upper end bell.
12. Insert the rotor assembly into the frame and guide the upper bearing into the recess in the upper end bell. Ensure that the upper bearing is seated within the recess. Use the mallet to seat the bearing, if necessary.
13. With both the upper and lower end bells firmly against the motor frame and being careful not to pinch any of the motor's wiring, secure them in place with the four long bolts. Tighten securely.
14. Rotate the motor's shaft to verify that there is no binding. The back end motor is ready to be reinstalled in the back end gearbox. Use antiseize compound on the motor's shaft.