BorgWarner

Kysor On/Off Rear Air Fan Drive

INSTALLATION | SERVICE

Proper precautions must be taken to prevent personal injury from contact with moving parts, unintended engine start, or other hazards present when working with powered equipment. Refer to the vehicle owner's manual and/or appropriate service manual for proper safety precautions before beginning any diagnostic or repair procedures.

CONTENTS

This fan clutch requires 90-120 PSI (6.2-8.2 bar) air pressure to DISENGAGE. The air pressure is vented to ENGAGE the fan.

Any interruption of the air supply will cause the fan to run, keeping it in fail-safe mode.

Maintenance: Clutch Series

Fan clutch maintenance should be performed at every "A" PM schedule, at every oil drain, or every 25,000 miles (40,225 km), whichever comes first.

1. Verify clutch operation. Turn key or jump the control system so that 90-120 PSI air pressure is supplied to the clutch. Clutch should disengage and turn freely. Remove air supply. Clutch should lock up and be difficult to turn by hand.
2. With engine stopped and clutch disengaged, check for air leaks at front of clutch and between the clutch and drive hub.
3. Inspect electrical and air connections at solenoid.
4. Examine wire and airline routing for damage and chafing. Repair as required.
5. Check exhaust port on solenoid for restrictions and debris. Remove any obstructions to insure positive engagement.

Clutch Lining Maintenance

It is very important to inspect fan clutch lining condition on a regular basis.

First Check: 100,000 miles (160,930 km)
Subsequent Checks: Every 50,000 miles (80,465 km)

System Alert Tool

This tool is a “go/no-go” gauge that will indicate whether the lining is due for replacement.

1. Start with the fan clutch engaged (No air to the clutch). If necessary, disconnect the air line from the fan clutch.

- The clutch in the top image has a new lining. Notice how the tool sits below the surface of the lining retainer plate.
- The clutch in the bottom image has a lining that is worn to the point that it should be replaced. Notice how the tool protrudes above surface of the lining retainer plate.

2. Order a new lining when the tool is exactly flush with the plate, and change it at the next scheduled service. Instructions for changing the lining are included in the appropriate lining kit. See the Components section of this Service Guide for lining kit part numbers.

Note: Rapid lining wear indicates a problem with the fan drive control system. See the Fan Control Systems section of this Service Guide for control system specifications. Call Technical Service for troubleshooting assistance, 800-927-7811.

Lining Replacement

The rear air fan clutch can be relined without removing it from the vehicle in most applications.

Tools & Parts Required

- **Inch-pound or Newton-meter torque wrench**
- **1/4” drive ratchet**
- **1/4” drive 5/16” socket**
- **Clutch lining kit (See the Components section of this Service Guide for kit part numbers)**

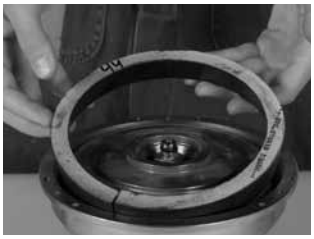
Caution:
Air pressure at 90-120 PSI (6.2-8.2 bar) must be applied to the fan clutchduring this procedure

1. Remove all retainer plate screws and retainer plates. Save the retainer plates as they will be reused. Discard the screws since new screws are provided in the lining kit.
2. Remove the old lining. If the lining sticks, use a hammer and a screwdriver to free it by tapping on the dividing cut in the lining.
3. Inspect the clutch shaft. If lining residue is present, or if surface appears glazed over (non-metallic), temporarily release air pressure from the clutch to allow the shaft to protrude, and use a ScotchBrite™ pad to break the glaze.
4. Re-apply air pressure to the clutch, and install the new lining as shown. In most applications, the lining is flexible enough to slip over the pulley nose. The lining may also be cut in half using a hacksaw, and the two halves can then be installed.
5. Install the retainer plates with sharp edge toward the clutch housing. Install the retainer plates using the new screws supplied in the kit. See the table of torque specifications in the Clutch Repair section of this Service Guide for proper screw torque.

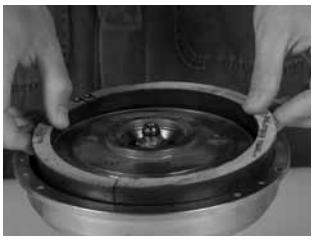
Note:
Front to rear end play at the fan blade tip with the clutch disengaged is normal and does not indicate a problem with the clutch.


Step 1a


Step 1b


Step 2


Step 3

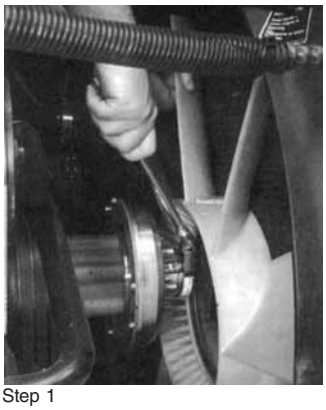

Step 4


Step 5a

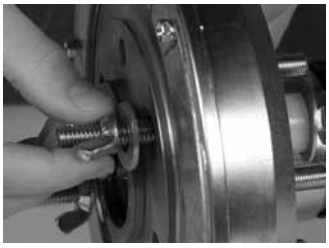

Step 5b


Step 5c

Clutch Repair


Step 1


Step 2


Step 3


Step 4a


Step 4b


Step 5

Tools & Parts Required

- **Inch-pound or Newton-meter torque wrench**
- **5/16” and 1/2” sockets with driver**
- **5/16” hex bit with driver**
- **5/8” open end wrench**

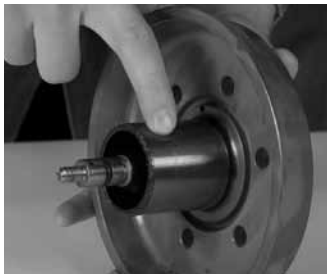
1. Remove the fan. If necessary, remove the clutch housing cover (this applies to clutches with a 5" fan pilot). Disengage the clutch with air pressure and align the access holes with the bolts inside the clutch. Remove the fan clutch with a flex head ratchet and 5/16” hex bit.
2. Two carriage bolts with washers and wing nuts are necessary for compressing the fan clutch. The bolts should be at least four inches long.
3. Alternately tighten the wing nuts until the fan clutch compresses by 1/16”. Caution: Do not over compress or clutch may be damaged.
4. While holding the rear end of the piston rod with a 5/8" open end wrench, remove and discard the locknut from the forward end of the piston rod.
5. Remove the cylinder cap and seal washer from the forward end of the piston rod.
6. Remove and discard the lip seal from the large groove in the piston. If present, remove and discard the dust seal from the small groove in the piston.
7. Remove all retainer plate screws and retainer plates. Save the retainer plates as they will be reused. Discard the screws since new screws are provided in the service kit. Remove the lining (see lining replacement images 1 - 2).
8. Inspect the two surfaces where the lining makes contact. These surfaces may be cleaned with a ScotchBrite™ pad. Complete this step before removing the housing from the shaft or abrasives may contaminate the needle bearings and result in clutch failure.
9. Alternately loosen and remove the carriage bolts, then lift the housing from the shaft. Inspect the needle bearing race on the shaft. Some discoloration is acceptable. If cracking, scoring, or


Step 6a


Step 6b


Step 8


Step 9


Step 9b


Step 10

Clutch Repair continued

Torque Specs	
Clutch to Hub	45 lbs-ft (61 Newton-meters)
Fan to Clutch (3.5" Fan Pilot)	26 lbs-ft (35.3 Newton-meters)
Fan to Clutch (5.0" Fan Pilot)	16.2 lbs-ft (22 Newton-meters)
Front Locknut	84 lbs-in (9.5 Newton-meters)
Retainer Plate Screws (Steel Clutch)	30 lbs-in (3.4 Newton-meters)
Retainer Plate Screws (Aluminum Clutch)	45 lbs-in (5.1 Newton-meters)


Step 11


Step 12a


Step 12b


Step 12c


Step 12d


Step 12e

wear is found, replace the clutch. The shaft may be cleaned with a ScotchBrite™ pad to make inspection easier, but the shaft must be free of abrasives prior to reassembling the clutch.

10. Install new front O-ring on the piston rod assembly.
11. Inspect the needle bearings in the housing. If any needles are damaged or missing, replace the clutch.
12. Remove grease seal from the bearing housing. Use a rag to thoroughly clean needle bearings and bearing housing. Use a flat plate to press in new grease seal, with lip toward needle bearings. Press in until flush with edge of hole. Liberally apply grease from service kit to the needle bearings. Push the shaft into the housing. Rotate the shaft a few times to work the grease into the needles. Remove the shaft and wipe any excess grease from the shaft (if there is no excess grease, then apply more grease to the needle bearings and repeat this process). Insert, rotate, and remove the shaft a second time, and wipe away any excess grease. The goal is to have a layer of grease packed within the needle bearings. Make sure no grease is present on the grease seal since it may get onto the lining.
13. Place rear spring cap (small) onto piston rod. Place spring onto piston rod. Liberally lubricate the inside of the front spring cap and place on piston rod. Wipe any grease or fingerprints from the shaft, where lining will contact.


Step 13a


Step 13b


Step 13c


Step 13d

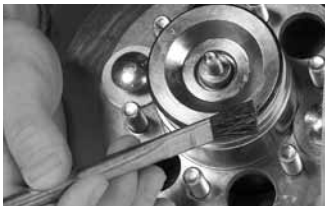
Clutch Repair continued


Step 14c


Step 14a


Step 14b


Step 15a


Step 15b


Step 16

14. Place the housing on the shaft assembly. During reassembly, use the carriage bolts again to compress the spring. Place new lining into pocket. Gradually compress clutch while pushing down on lining. Stop when lining becomes flush with outer edge of clutch. Install the retainer plates with sharp edge toward the clutch housing. Install the screws that were supplied in the service kit. See the table of torque specifications for proper screw torque.

15. Install the new lip seal in the piston groove, with the larger lip toward the front of the clutch (the front of the clutch is face-up in image 15a). Liberally apply grease from the service kit to the lip seal. Note: the Teflon® dust seal is no longer used. the new U-cup seal is dual purpose.

16. Lubricate the new seal washer and place it on the piston rod.

17. Install the new cylinder cap and torque the new locknut to 84 lbs-in while holding opposite end of piston rod with a 5/8” open end wrench. Release the clutch from the carriage bolts and pressurize it several times with 120 PSI shop air to check for leaks and proper operation. While clutch is disengaged, align access holes in front with bolt holes in rear. Install the new O-ring on rear of piston rod and lubricate with grease from service kit.

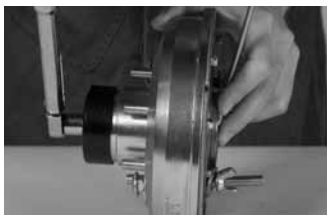
18. Before installing the clutch, loosen the fan belts and refer to the Preventative Maintenance: Hub Series 1077 section of this service guide to inspect hub condition. If problems are found, perform hub maintenance. Tighten the drive belts to manufacturer's specifications.

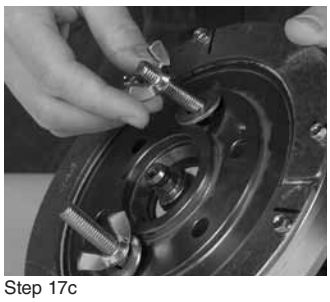
19. Reinstall clutch to fan hub using the new coupling and new nylon patch hex bolts supplied in the service kit. Apply air to clutch and check for normal operation.

20. If using a 5" fan pilot, install the clutch housing cover.

21. Install the fan.


Step 17a


Step 17b

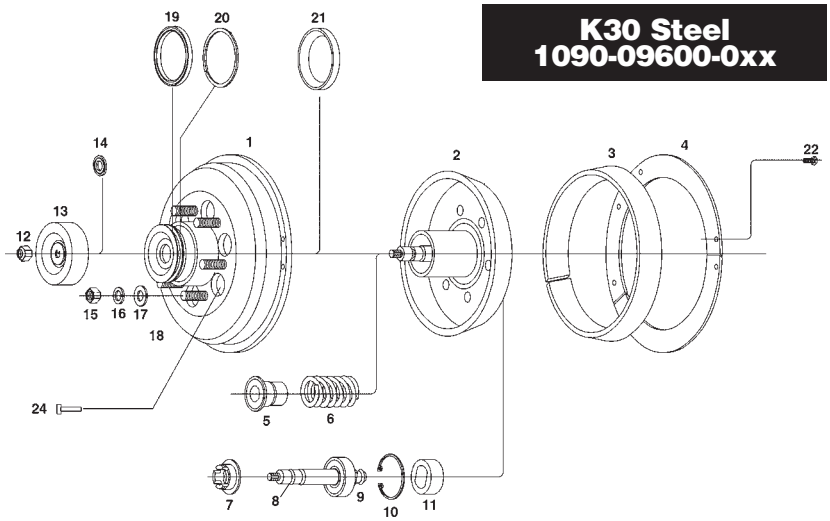

Step 17c


Step 17d

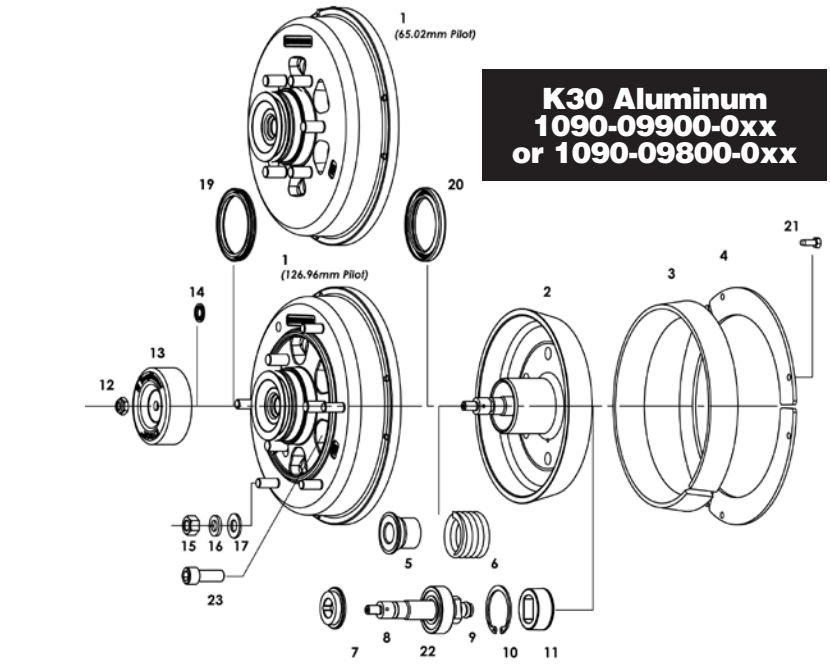

Step 19a


Step 19b

Components



Part	Item #
clutch housing	1
clutch shaft	2
clutch lining	3
retainer plates	4
front spring cap	5
spring	6
spring carrier	7
O-ring	8
O-ring	9
snap ring	10
coupling	11
5/16-24 locknut	12
cylinder	13
seal washer	14
3/8-24 hex nut	15
lock washer	16
washer	17
3/8 wheel bolt	18
U-cup	19
rotary seal	21
10-32 X .50 HHCS (Steel Clutch) or 10-32 X .59 (Aluminum Clutch)	22
piston rod	23
nylon patch SHCS	24



CAUTION: K22 components should not be interchanged with K26 or K30 components. Interchanging components may cause premature failure or prevent the clutch from functioning properly. K26 and K30 clutch linings have a groove in the rear face while K22 clutch linings have a flat rear face.

	K22 1090-08500-0xx				K26 1090-09500-0xx			
Kit Type	**Part Number**	**Description**	**Item**	**Qty**	**Part Number**	**Description**	**Item**	**Qty**
Service Kit	1033-05435-03	clutch lining	3	1ea	1033-09339-01	clutch lining	3	1ea
		coupling	11	1ea		coupling	11	1ea
		5/16-24 locknut	12	1ea		5/16-24 locknut	12	1ea
		seal washer	14	1ea		seal washer	14	1ea
		U-cup	19	1ea		U-cup	19	1ea
		rotary seal	21	1ea		rotary seal	21	1ea
		#10-32 X 0.50 HHCS	22	6ea		#10-32 X 0.50 HHCS	22	6ea
		O-ring	9	1ea		O-ring	9	1ea
		cylinder	13	1ea		cylinder	13	1ea
		nylon patch SHCS	24	6ea		nylon patch SHCS	24	6ea
		grease packet		1ea		grease packet		1ea
		O-ring	8	1ea		O-ring	8	1ea
Lining Kit	1033-08250-01	clutch lining	3	1ea	1033-09340-01	clutch lining	3	1ea
		#10-32 X 0.50 HHCS	22	6ea		#10-32 X 0.50 HHCS	22	6ea
Cylinder/ Seal Kit	1033-08233-01	O-ring	9	1ea	1033-08233-01	O-ring	9	1ea
		cylinder	13	1ea		cylinder	13	1ea
		U-cup	19	1ea		U-cup	19	1ea
		seal washer	14	1ea		seal washer	14	1ea
		5./16-24 locknut	12	1ea		5./16-24 locknut	12	1ea
		coupling	11	1ea		coupling	11	1ea
		grease packet		1ea		grease packet		1ea

	K30 Steel 1090-09600-0x				K30 Aluminum 1090-09900-0xx or 1090-09800-0xx			
Kit Type	**Part Number**	**Description**	**Item**	**Qty**	**Part Number**	**Description**	**Item**	**Qty**
Service Kit	1033-09339-01	clutch lining	3	1ea	1033-40595-02	clutch lining	3	1ea
		coupling	11	1ea		coupling	11	1ea
		5/16-24 locknut	12	1ea		5/16-24 locknut	12	1ea
		seal washer	14	1ea		seal washer	14	1ea
		U-cup	19	1ea		U-cup	19	1ea
		rotary seal	21	1ea		rotary seal	21	1ea
		#10-32 X 0.50 HHCS	22	6ea		#10-32 X 0.59 HHCS	22	6ea
		O-ring	9	1ea		O-ring	9	1ea
		cylinder	13	1ea		cylinder	13	1ea
		nylon patch SHCS	24	6ea		nylon patch SHCS	24	6ea
		grease packet		1ea		grease packet		1ea
		O-ring	8	1ea		O-ring	8	1ea
Lining Kit	1033-09340-01	clutch lining	3	1ea	1033-40595-01	clutch lining	3	1ea
		#10-32 X 0.50 HHCS	22	6ea		#10-32 X 0.59 HHCS	22	6ea
Cylinder/ Seal Kit	1033-08233-01	O-ring	9	1ea	1033-40595-03	O-ring	9	1ea
		cylinder	13	1ea		cylinder	13	1ea
		U-cup	19	1ea		U-cup	19	1ea
		seal washer	14	1ea		seal washer	14	1ea
		5/16-24 locknut	12	1ea		5/16-24 locknut	12	1ea
		coupling	11	1ea		coupling	11	1ea
		grease packet		1ea		grease packet		1ea
		O-ring	8	1ea		O-ring	8	1ea

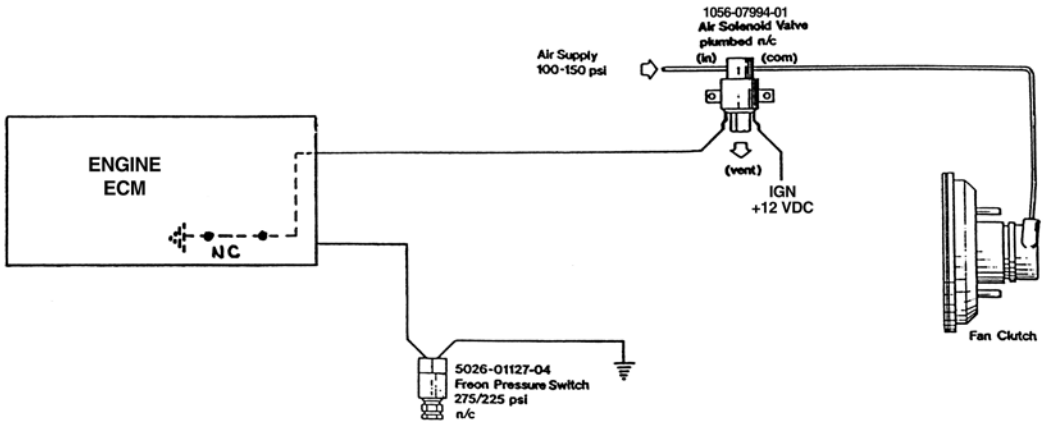
CAUTION:
K30 Steel components should not be interchanged with K30 Aluminum components. Interchanging components may cause premature failure or prevent the clutch from functioning properly.

Fan Control Systems

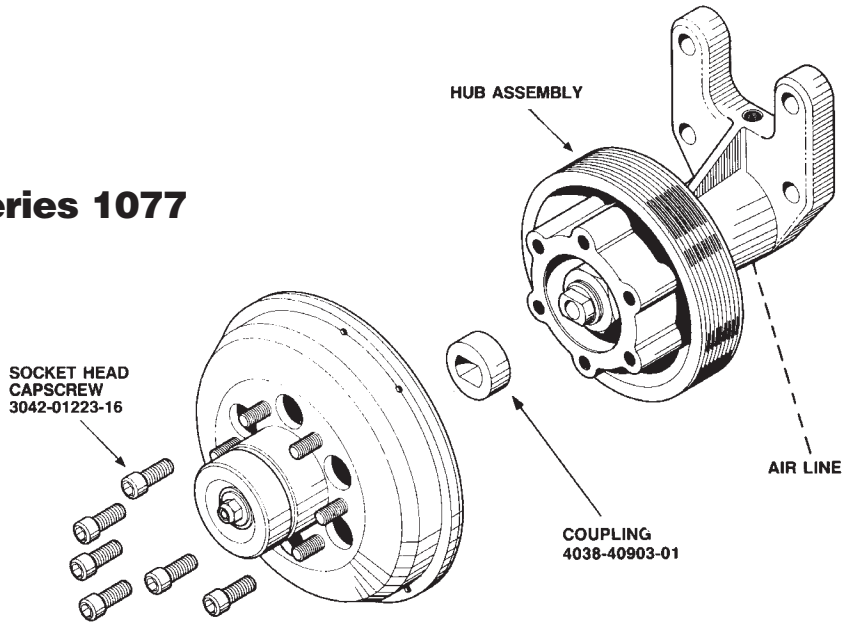
Control System Specifications

1. As a minimum, control systems must be thermal switches controlling solenoid valves. Mechanical thermal valves such as Shutterstat must not be used.
2. Air conditioning override pressure switches must have a built in hysteresis of 50 PSI (3.4 bar) minimum.
3. If the vehicle is used in any kind of stationary operation involving a PTO or turbo unloader, there MUST be a provision in the control system to automatically lock the fan clutch ON whenever the PTO or unloader is being operated. Failure to provide this will void all warranties.
4. BorgWarner recommends a minimum fan on time of at least 30 seconds for all fan engagements.
5. If the vehicle is a sleeper cab and the engine is fast idled with the AC on, then a timed AC override circuit MUST be provided so that the fan clutch will not be over cycled.

Typical Electronic Engine Control System



Installation: Hub Series 1077



Warning: Due care and caution must be exercised when installing a fan hub.

Failure to follow these instructions may cause vehicle damage, fan breakage, and/or possible serious personal injury.

1. Attach the hub to the engine according to the engine or vehicle manufacturer's instructions. If the fan clutch is installed to the hub, then the fan may need to be placed into position or set into the shroud before the fan drive assembly is installed to the engine.
2. Check for proper belt tension (engine manufacturers recommendation). Note: If the fan clutch is attached, the fan may have to be put into position on the fan clutch or set into the shroud before the fan drive assembly is put into position on the engine.
3. Check for adequate clearance at fan blades before starting engine. Component damage and possible injury to persons may result if fan contacts other objects.

Preventative Maintenance: Hub Series 1077

Periodic Checks

The items below are to be inspected as part of fan hub preventative maintenance. These items should be carefully checked any time the belts or the clutch are serviced or replaced. If preventative maintenance schedules are not available, refer to the engine or vehicle manufacturer's recommendations.

Maintenance Item	Action	Notes
Inspect for loose or frayed drive belts.	Replace/adjust as necessary.	Refer to engine manufacturer's belt tension specification and adjustment procedures.
Check fan hub endplay.	Verify with dial indicator if necessary. R&R and overhaul if play is present.	
Check for lube leaks.	R&R and overhaul if found.	
Check for loose attaching hardware.	Torque to specification if loose.	
Check pulley grooves for damage from belt slippage.	Replace pulley if damaged.	
Periodic teardown inspection/overhaul.		Per fleet PM interval, or per engine or vehicle manufacturer's recommendations.

Repair Kits: Hub Series 1077

Engine	Part Number
N14	1077-07756-01
L10	1077-07756-02
3116	1077-07756-03
3306	1077-07756-04
3306	1077-07756-05
Repair Kit	1033-07783-01

Tools & Material Required

Overhaul kit: See product catalog
Nut: 3029-01317-03 (hub)
Washer: 3058-01603-01 (hub)
Pulley installer tool for two bearing design: 4038-42192-01
Bearing driver that contacts outer race of bearing.

One Piece Bearing Design

Rear Air Fan Hubs & Idler Pulleys: One Piece Bearing Design

Overhaul is a matter of replacing the single piece bearing. Use LocTite® 271 on the nut, and torque it to 170 lbs-ft. (230.5 Newton-meters).

Two Piece Bearing Design

Rear Air Fan Hubs: Two Bearing Design

During overhaul, it is extremely important to use the pulley installer tool to press the pulley back onto the base. Failure to use this tool may result in damage to the bearings. Use LocTite®271 on the nut, and torque it to 170 lbs-ft. (230.5 Newton-meters).

For further information on
BorgWarner Thermal Systems contact:
Customer Service at 800-927-7811
or info@bwthermal.com

KYS-SG-10