



## On/Off Fan Drive Diagnostic and Service Guide

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Revision 20130607



## On/Off Fan Drive Diagnostic and Service Guide

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## On/Off Fan Drive Diagnostic and Service Guide

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### Additional Support

This guide is intended to assist in troubleshooting the BorgWarner On/Off fan drive, and to identify fan drive failure modes that are warrantable through BorgWarner.

Additional information, including product overview, sales literature, general service, maintenance, disassembly, detailed repair instructions and other service literature is available at:

<http://www.borgwarner.com/en/Thermal/products/Pages/Kysor-On-Off-Fan-Drives.aspx>

For all other questions, Technical Support is available from 8:00am to 5:00pm (Eastern), Monday through Friday, at 1-800-927-7811.

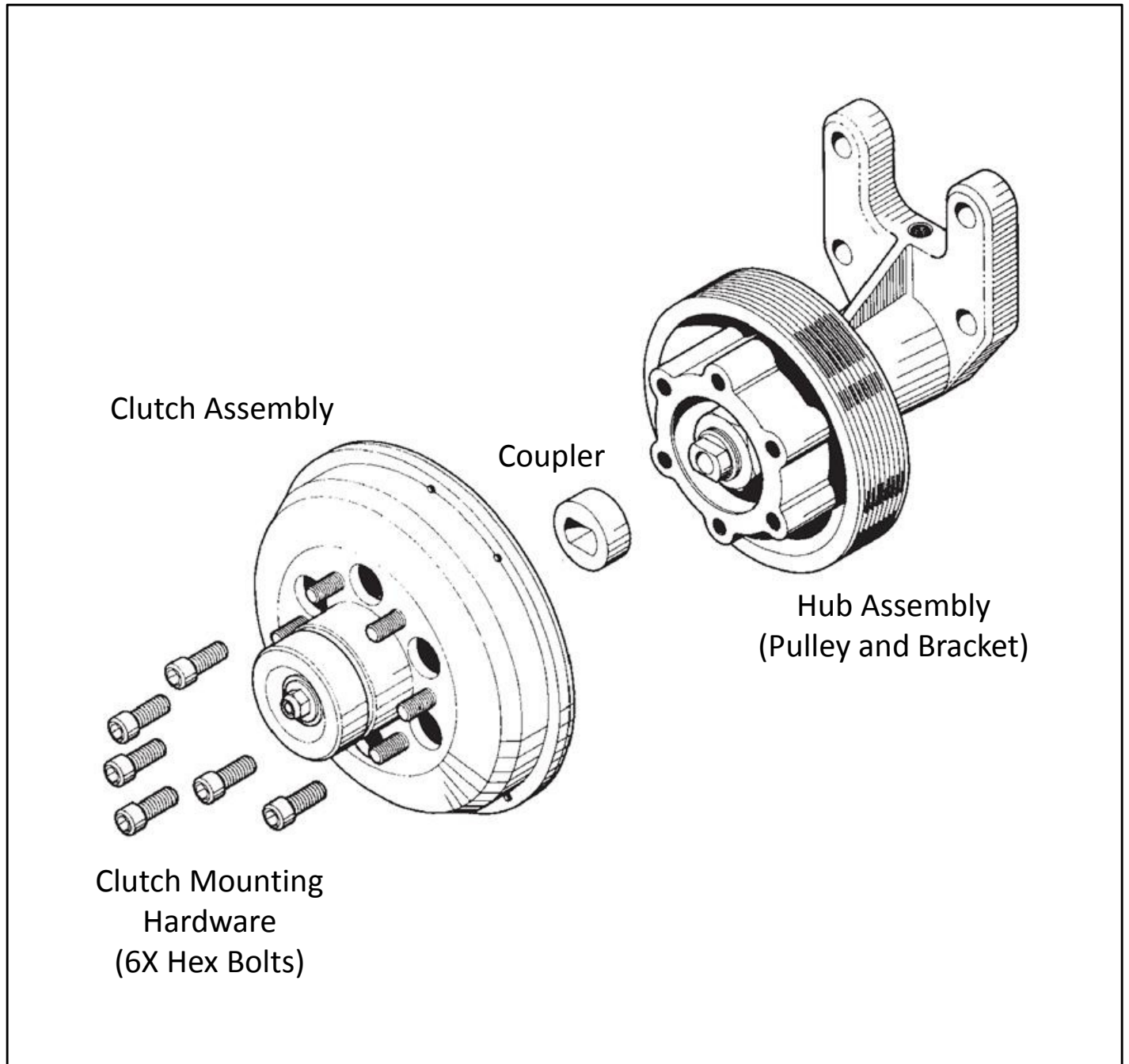
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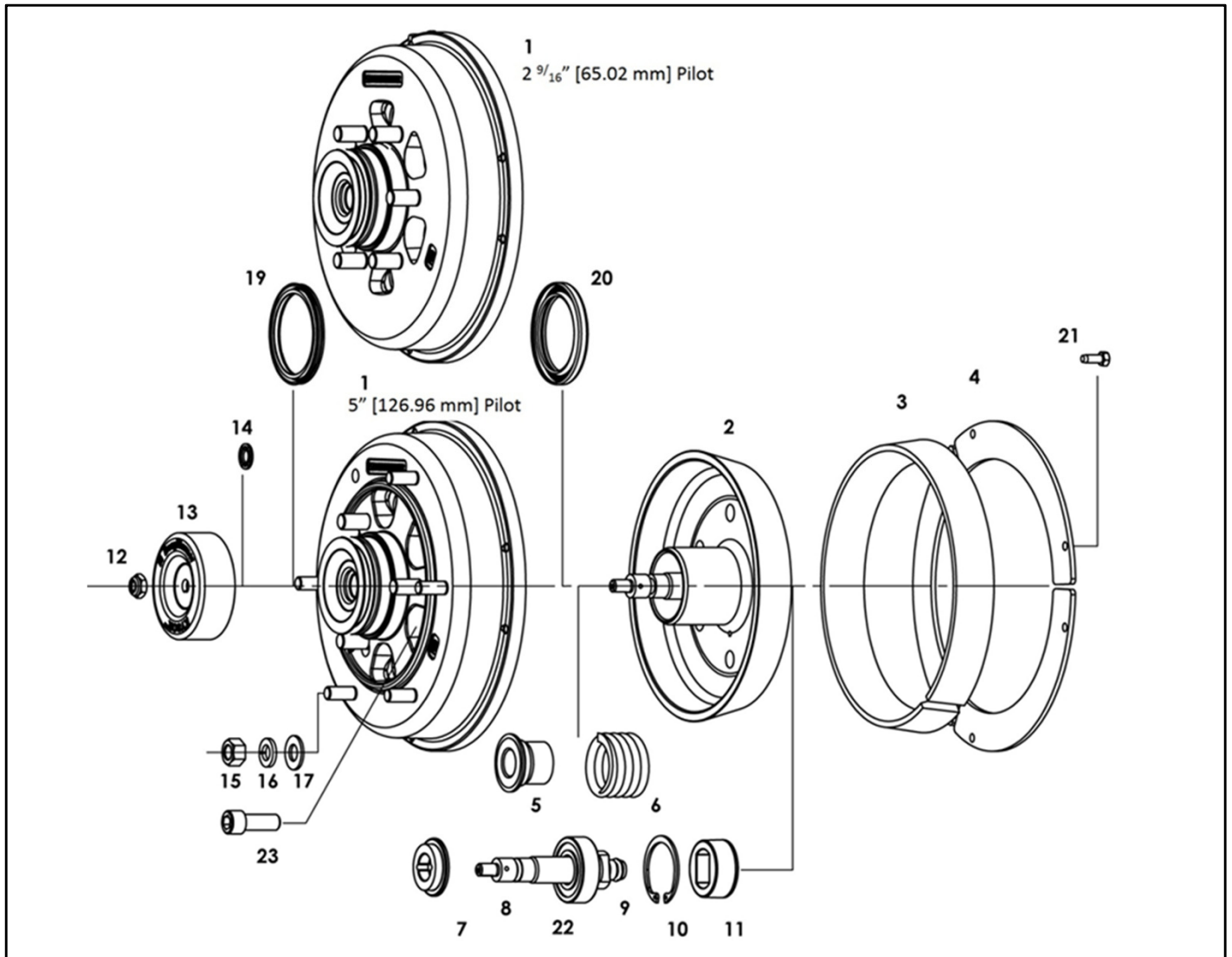
### Recommended Practices

For best performance from the BorgWarner On/Off fan drive, follow these recommended practices:

*Manually engage the clutch prior to the use of any PTO, and maintain clutch engagement for the duration of PTO usage.*

*Do not engage the clutch during an engine over-speed condition.*

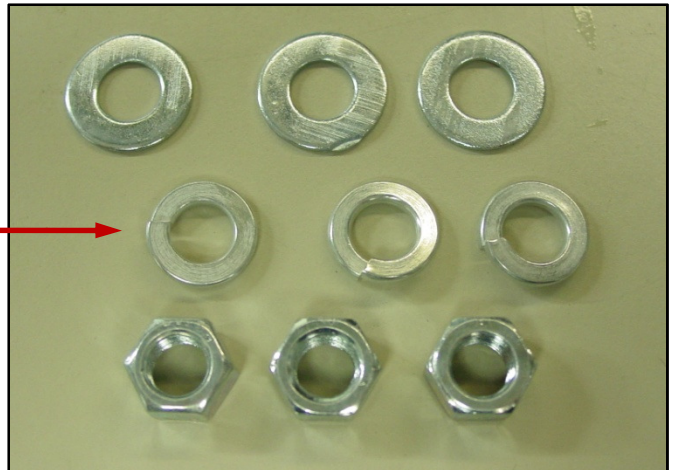
**Components of the Fan Drive**

**Components of the Clutch Assembly**

(1) Clutch Housing; (2) Clutch Shaft; (3) Liner; (4) Retainer Plate; (5) Spring End-Cap; (6) Spring; (7) Spring Carrier; (8) Front O-Ring; (9) O-Ring at Base of Piston Rod; (10) Snap Ring; (11) Coupler; (12) 5/16" Locknut; (13) Cylinder; (14) Seal-Washer; (15) Fan Mounting Nut; (16) Fan Lock-Washer; (17) Fan Flat-Washer; (18) Fan Stud; (19) U-Cup Seal; (20) Grease Seal; (21) Retainer Plate Fastener; (22) Piston Rod and Rear Bearing Assembly; (23) Clutch Mounting Hardware

## On/Off Fan Drive Diagnostic and Service Guide

### Housing Cover Aluminum Clutches With 5" Fan Pilot (1090-09900-0xx and 1090-09950-0xx)



Clutch Mount  
Access Holes

Hardware



Housing Cover

These aluminum clutches have a 5-inch diameter fan pilot and use a housing cover to protect the inside of the clutch assembly from foreign debris. The housing cover must be removed to gain access to the clutch mounting hardware. The cover is retained by either 3 serrated flange nuts or a combination of 3 nuts, 3 lock washers and 3 flat washers. Service kit 1097-06880-09 contains the housing cover and 3 serrated flange nuts. When reinstalling the housing cover, torque each nut to 37 Nm (28 lbf-ft).

## Clutch Repair Kit and Replacement Guide

The following pages provide clutch repair kit and replacement options, including available upgrades.

**Caution: Only interchange clutches and components as indicated on the following pages. Failure to follow these guidelines may result in high wear or premature failure.**

Kit part numbers for products prior to the K30 series are available in the “BorgWarner Product Catalog”

### *Repair Kit Contents*

Kit Type	Part Description	Quantity
Seal Kit	O-ring at base of piston rod	1
	Cylinder	1
	U-cup seal	1
	Seal-washer	1
	$\frac{5}{16}$ " locknut	1
	Coupler	1
	Grease packet	1
	Front o-ring	1
Liner Kit	Liner	1
	Retainer plate fasteners	6
Seal and Liner Kit	Contents of seal kit	1
	Contents of liner kit	1
	Clutch mounting bolt	6

## Clutch Repair Kit and Replacement Guide

Part Number	Product Description
1090-08000-0xx	K22 Front Air Clutch
1090-08500-0xx	K22 Rear Air Clutch



K22 Rear Air  
Pictured

Fan Pilot Diameter =  $2 \frac{9}{16}$ "

### Repair Kits

Clutch Type	Seals	Liner	Seals and Liner
K22 Front Air	N/A	1033-08250-01	1033-05435-02
K22 Rear Air	1033-08233-01	1033-08250-01	1033-05435-03

### Optional Clutch and Repair Kit Upgrades

Clutch Type	Clutch Upgrade Part Numbers	Liner Upgrade Repair Kit	Seal and Liner Upgrade Repair Kit
K22 Front Air	1090-09000-0xx	N/A	N/A
K22 Rear Air	1090-09500-0xx 1090-09600-0xx 1090-09650-0xx	N/A	N/A

*Note: the K22 Clutch has a unique liner. This liner cannot be interchanged with any other K-series clutch. The K22 clutch cannot accept a liner from any other K-series clutch.*



**Clutch Repair Kit and Replacement Guide**

Part Number	Product Description
1090-09000-0xx	K26 Front Air Clutch
1090-09500-0xx	K26 Rear Air Clutch



K26 Rear Air  
Pictured

Fan Pilot Diameter = 2 <sup>9</sup>/<sub>16</sub>''

**Repair Kits**

Clutch Type	Seals	Liner	Seals and Liner
K26 Front Air	4043-41130-01	1033-09340-01	N/A
K26 Rear Air	1033-08233-01	1033-09340-01	1033-09339-01

**Optional Clutch and Repair Kit Upgrades**

Clutch Type	Clutch Upgrade Part Numbers	Liner Upgrade Repair Kit	Seal and Liner Upgrade Repair Kit
K26 Front Air	N/A	1033-40600-01	N/A
K26 Rear Air	1090-09600-0xx 1090-09650-0xx	1033-40600-01	1033-40600-02

### Clutch Repair Kit and Replacement Guide

Part Number	Product Description
1090-09600-0xx	K30 Steel Rear Air Clutch

Fan Pilot Diameter = 2 <sup>9</sup>/<sub>16</sub>''



K30 Steel

#### *Repair Kits*

Clutch Type	Seals	Liner	Seals and Liner
K30 Steel	1033-08233-01	1033-09340-01	1033-09339-01

#### *Optional Clutch and Repair Kit Upgrades*

Clutch Type	Clutch Upgrade Part Numbers	Liner Upgrade Repair Kit	Seal and Liner Upgrade Repair Kit
K30 Steel	1090-09650-0xx	1033-40600-01	1033-40600-02

## Clutch Repair Kit and Replacement Guide

*\*Note: aluminum clutches are offered with 2 fan pilot diameter options*

Part Number	Product Description*
1090-09800-0xx	K30 Aluminum Rear Air Clutch 2 <sup>9</sup> / <sub>16</sub> " Diameter Fan Pilot
1090-09900-0xx	K30 Aluminum Rear Air Clutch 5" Diameter Fan Pilot



K30 Aluminum  
With 5" Fan Pilot Pictured

### Repair Kits

Current Clutch	Seals	Liner	Seals and Liner
K30 Aluminum (both fan pilot diameters)	1033-40595-03	1033-40595-01	1033-40595-02

### Optional Clutch and Repair Kit Upgrades

*\*\*Note: when upgrading an aluminum clutch with a 5" diameter fan pilot, a steel clutch and new fan blade with 2 <sup>9</sup>/<sub>16</sub>" diameter pilot must be used.*

Current Clutch	Clutch Upgrade Part Numbers	Liner Upgrade Repair Kit	Seal and Liner Upgrade Repair Kit
K30 Aluminum 2 <sup>9</sup> / <sub>16</sub> " Diameter Fan Pilot	1090-09650-0xx	1033-40650-01	1033-40650-02
K30 Aluminum 5" Diameter Fan Pilot	1090-09650-0xx New Fan with 2 <sup>9</sup> / <sub>16</sub> " Pilot Required**	1033-40650-01	1033-40650-02

### Clutch Repair Kit and Replacement Guide

Part Number	Product Description
1090-09650-0xx	K32 Steel Rear Air Clutch



K32 Steel

Fan Pilot Diameter = 2 <sup>9</sup>/<sub>16</sub>''

#### *Repair Kits*

Clutch Type	Seals	Liner	Seals and Liner
K32 Steel	1033-08233-01	1033-40600-01	1033-40600-02

#### *Optional Clutch and Repair Kit Upgrades*

Clutch Type	Clutch Upgrade Part Numbers	Liner Upgrade Repair Kit	Seal and Liner Upgrade Repair Kit
K32 Steel	N/A	N/A	N/A

## Clutch Repair Kit and Replacement Guide

*\*Note: aluminum clutches are offered with 2 fan pilot diameter options*

Part Number	Product Description*
1090-09850-0xx	K32 Aluminum Rear Air Clutch 2 <sup>9</sup> / <sub>16</sub> " Diameter Fan Pilot
1090-09950-0xx	K32 Aluminum Rear Air Clutch 5" Diameter Fan Pilot



K32 Aluminum  
With 5" Fan Pilot Pictured

### Repair Kits

Clutch Type	Seals	Liner	Seals and Liner
K32 Aluminum (both fan pilot diameters)	1033-40595-03	1033-40650-01	1033-40650-02

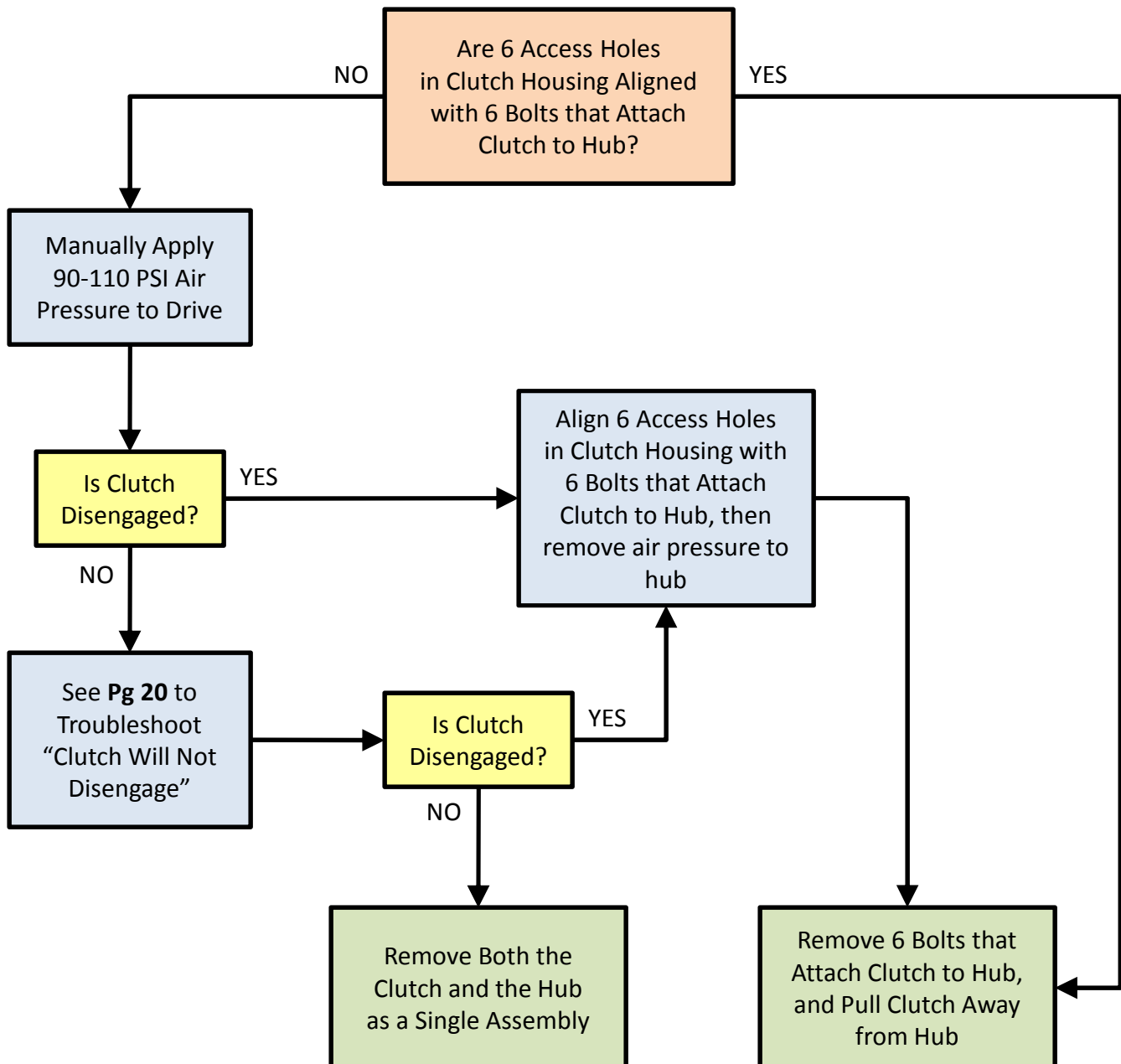
### Optional Clutch and Repair Kit Upgrades

*\*\*Note: when upgrading an aluminum clutch with a 5" diameter fan pilot, a steel clutch and new fan blade with 2 <sup>9</sup>/<sub>16</sub>" diameter pilot must be used.*

Clutch Type	Clutch Upgrade Part Numbers	Liner Upgrade Repair Kit	Seal and Liner Upgrade Repair Kit
K32 Aluminum 2 <sup>9</sup> / <sub>16</sub> " Diameter Fan Pilot	1090-09650-0xx	N/A	N/A
K32 Aluminum 5" Diameter Fan Pilot	1090-09650-0xx New Fan with 2 <sup>9</sup> / <sub>16</sub> " Pilot Required**	N/A	N/A

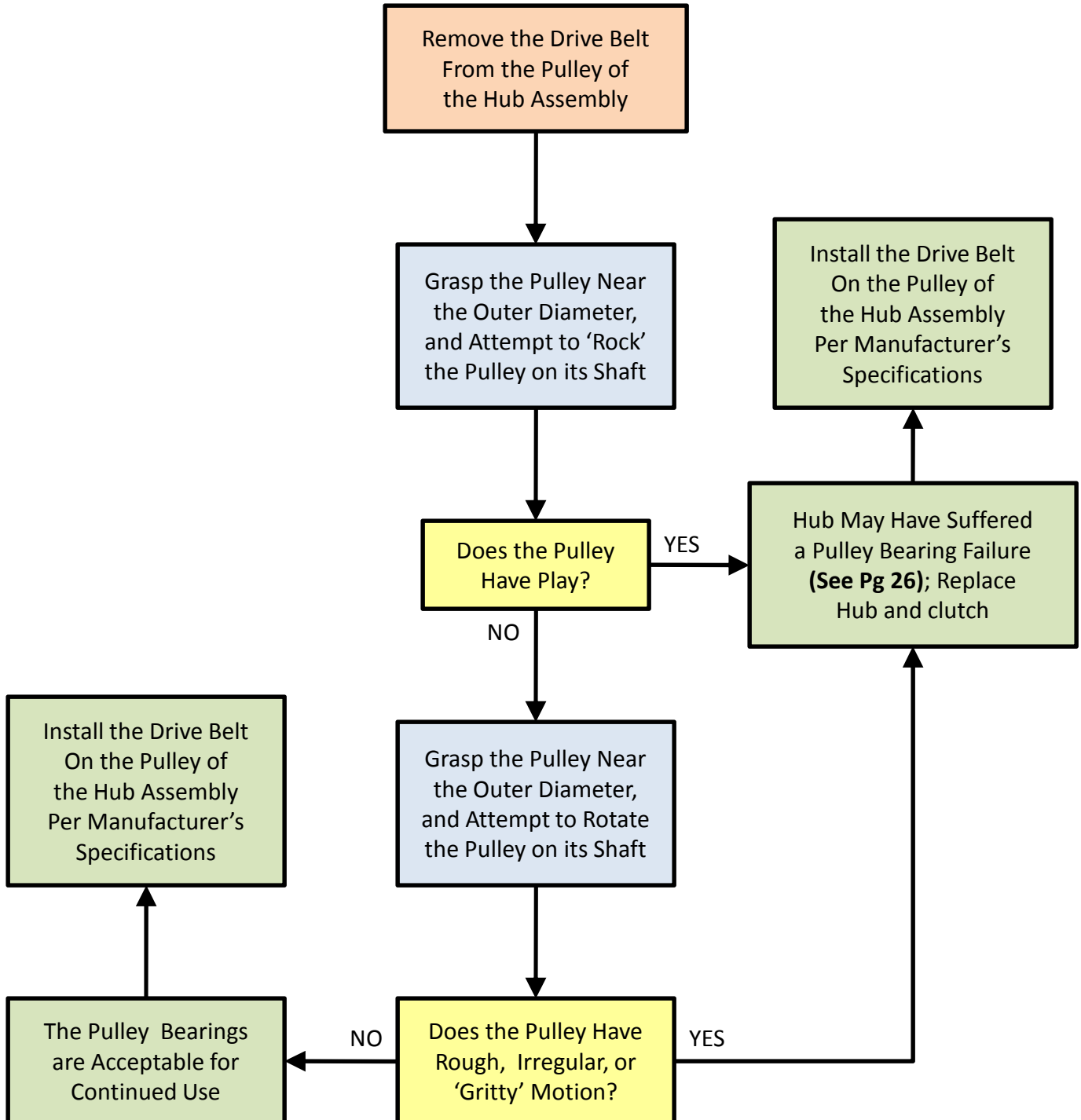
## Removal of the Clutch Assembly

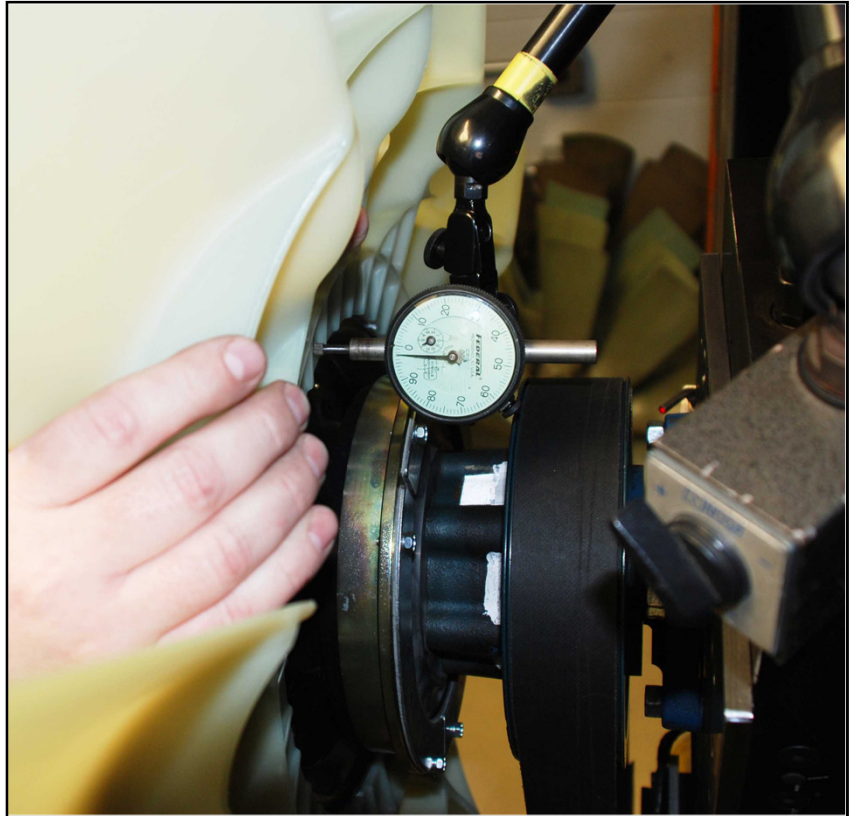
Troubleshooting the fan drive should begin with the clutch assembly still installed on the vehicle. However, at some point during the troubleshooting process, it may become necessary to remove the clutch assembly. Below is a procedure for removing the clutch assembly from the hub assembly:



**Inspecting the Hub Assembly for Play**

The hub assembly may be inspected for play, with or without the clutch installed. For best results, use the following procedure:



**Inspecting the Clutch Assembly for Play**

Supply 90-110 PSI air pressure to the fan drive to disengage the clutch. Setup a dial indicator on a flat rear surface of the fan, very close to the outer rim of the clutch (see the image to the upper left).

Grasp the fan as close to the position of the dial indicator as possible (see the image to the upper right). Gently move the fan forward and rearward (do not force), and record the total indicator reading.

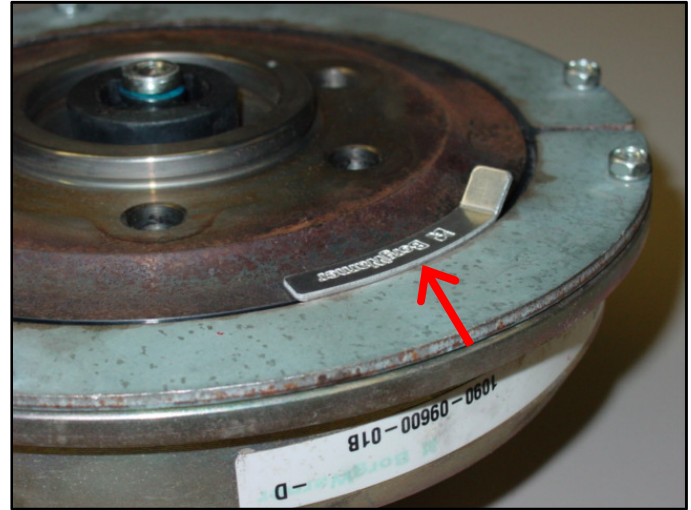
If the total indicator reading exceeds 0.050" (1.27mm) then the clutch should be replaced. If the total indicator reading is less than or equal to 0.050" (1.27mm) then the amount of clutch play is acceptable.



### Checking the Remaining Liner Life



Liner Life Remaining



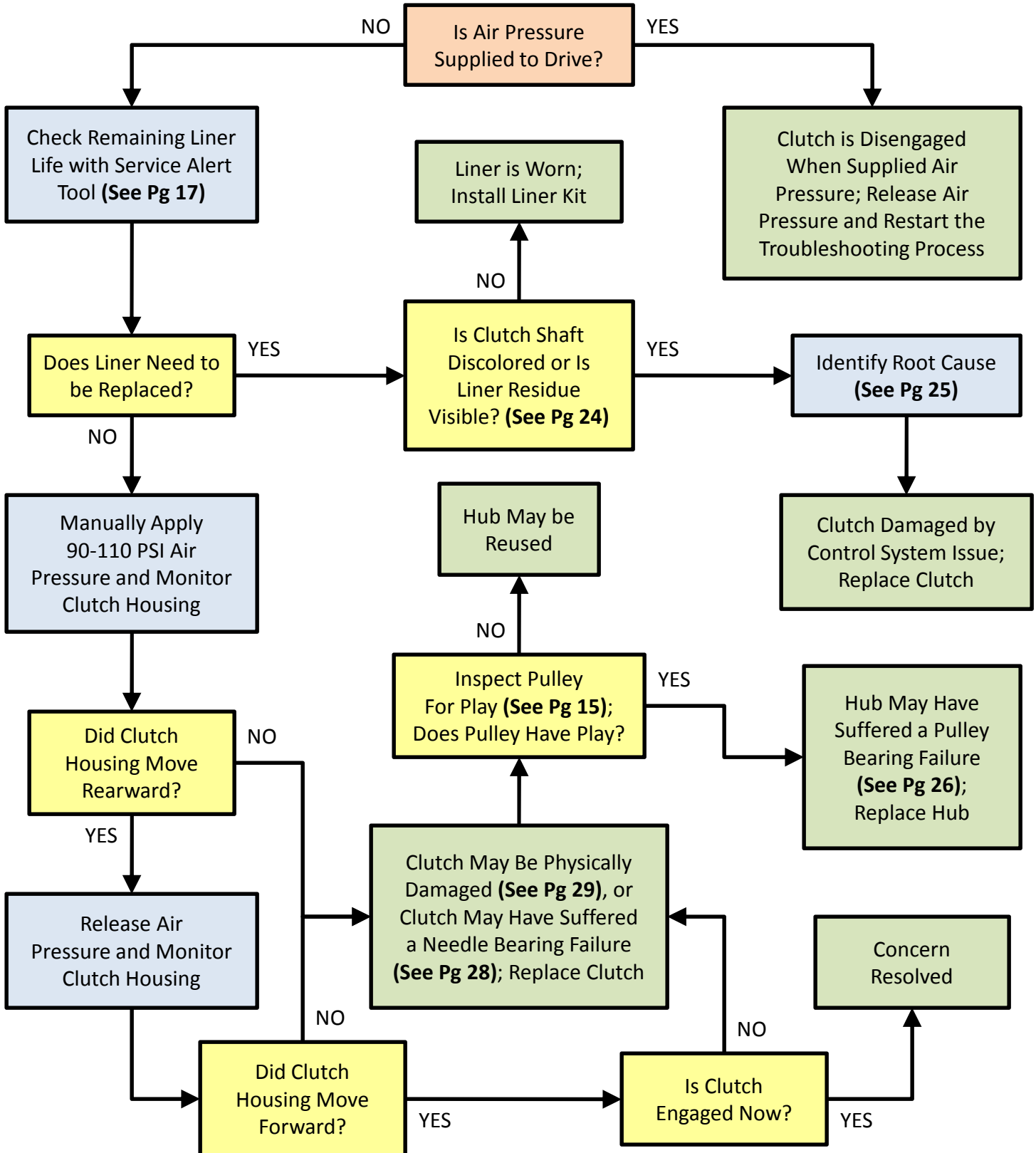
Liner Replacement Necessary

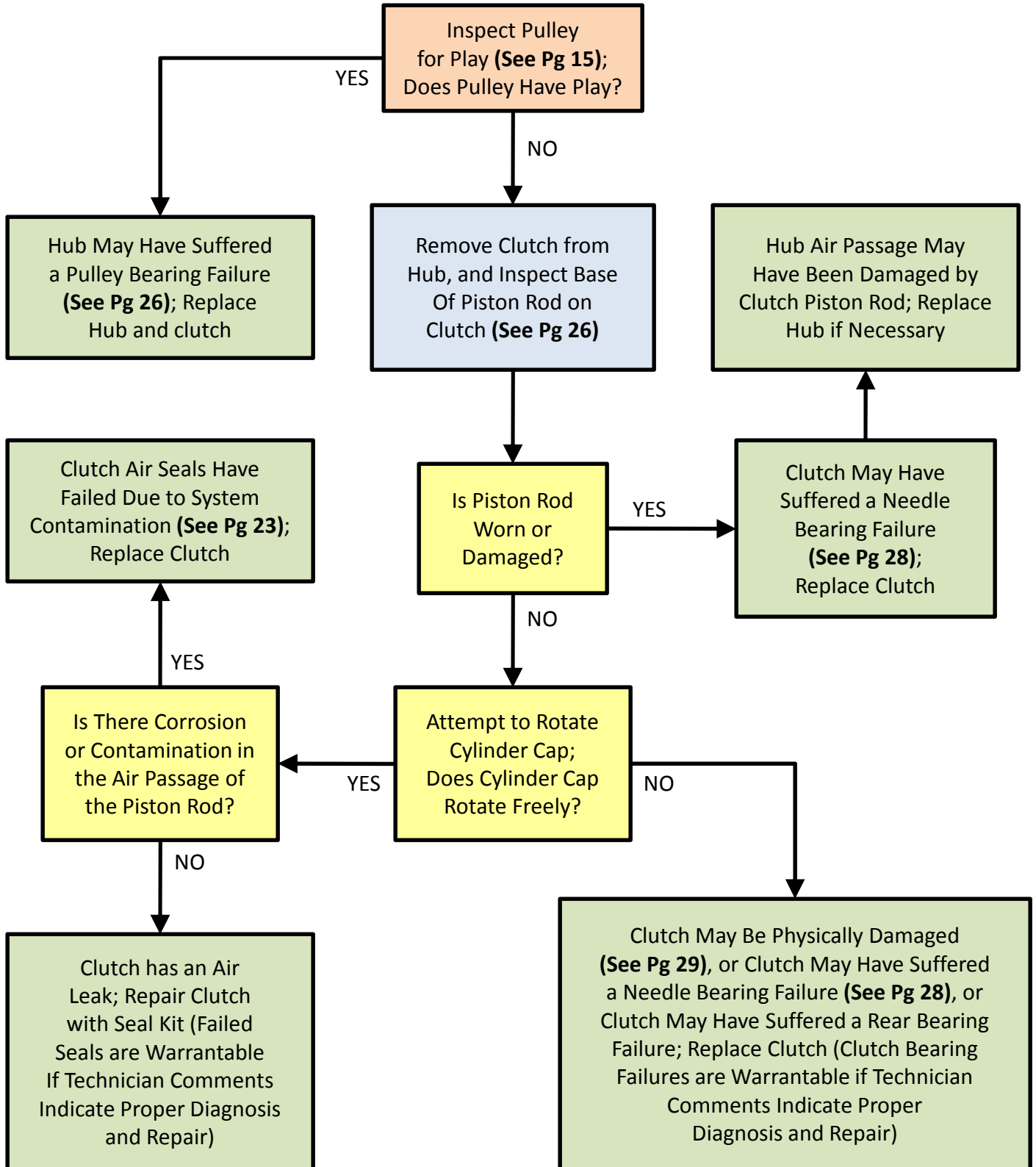
Remaining liner life may be checked by using the Service Alert Tool. This tool is available for no cost at [www.borgwarner.com/thermallit](http://www.borgwarner.com/thermallit).

Start with the clutch engaged (no air pressure to the drive). Place the Service Alert Tool flush against the rear face of the clutch shaft as shown in the images above (this may be done with the clutch installed on the vehicle).

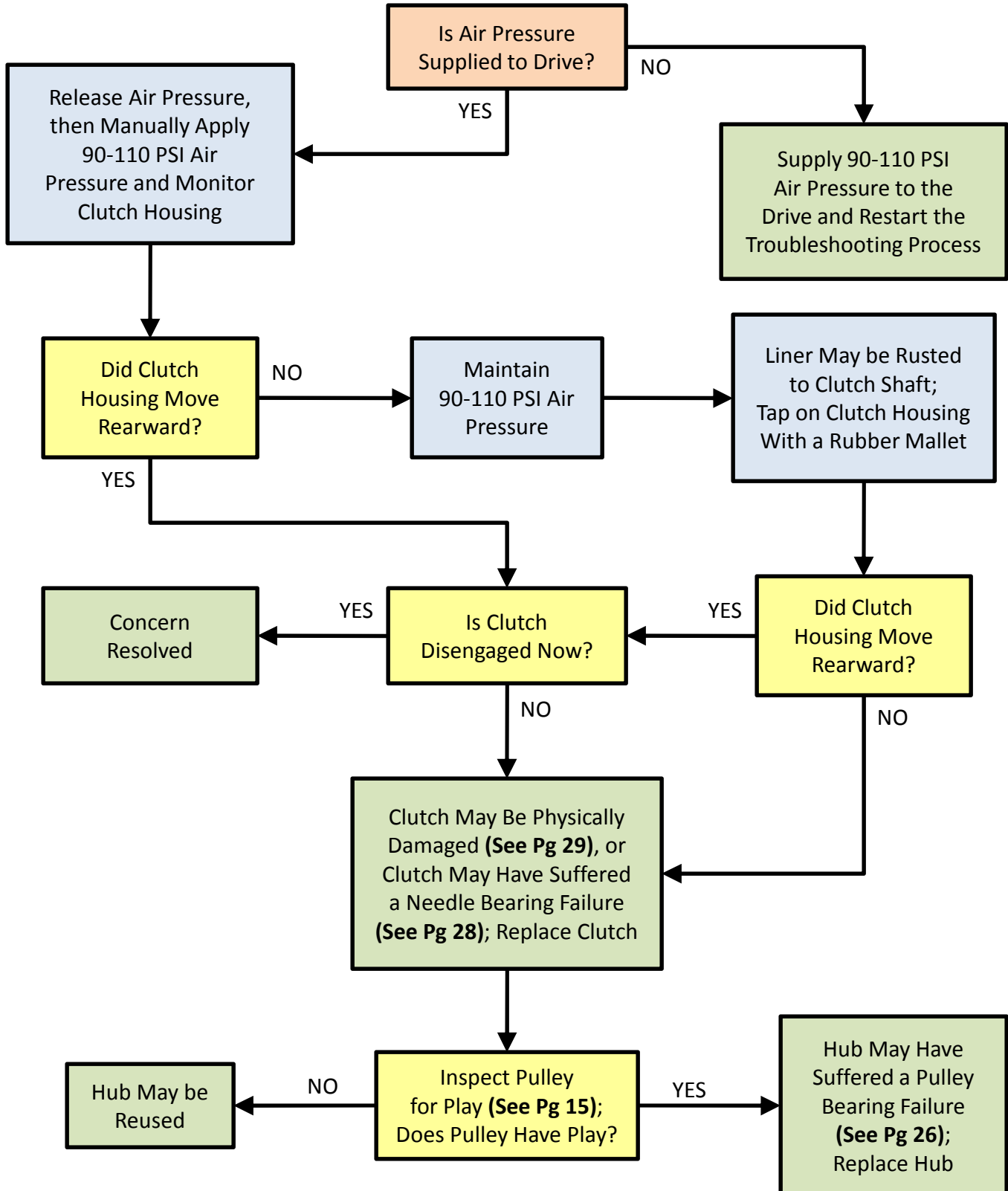
If the Service Alert Tool sits below the surface of the retainer plate (as shown in the image on the left) then the liner has life remaining. If the Service Alert Tool sits above the surface of the retainer plate (as shown in the image on the right) then the liner should be replaced as soon as possible. See Pg 24 to determine whether a control system issue is responsible for rapid liner wear.

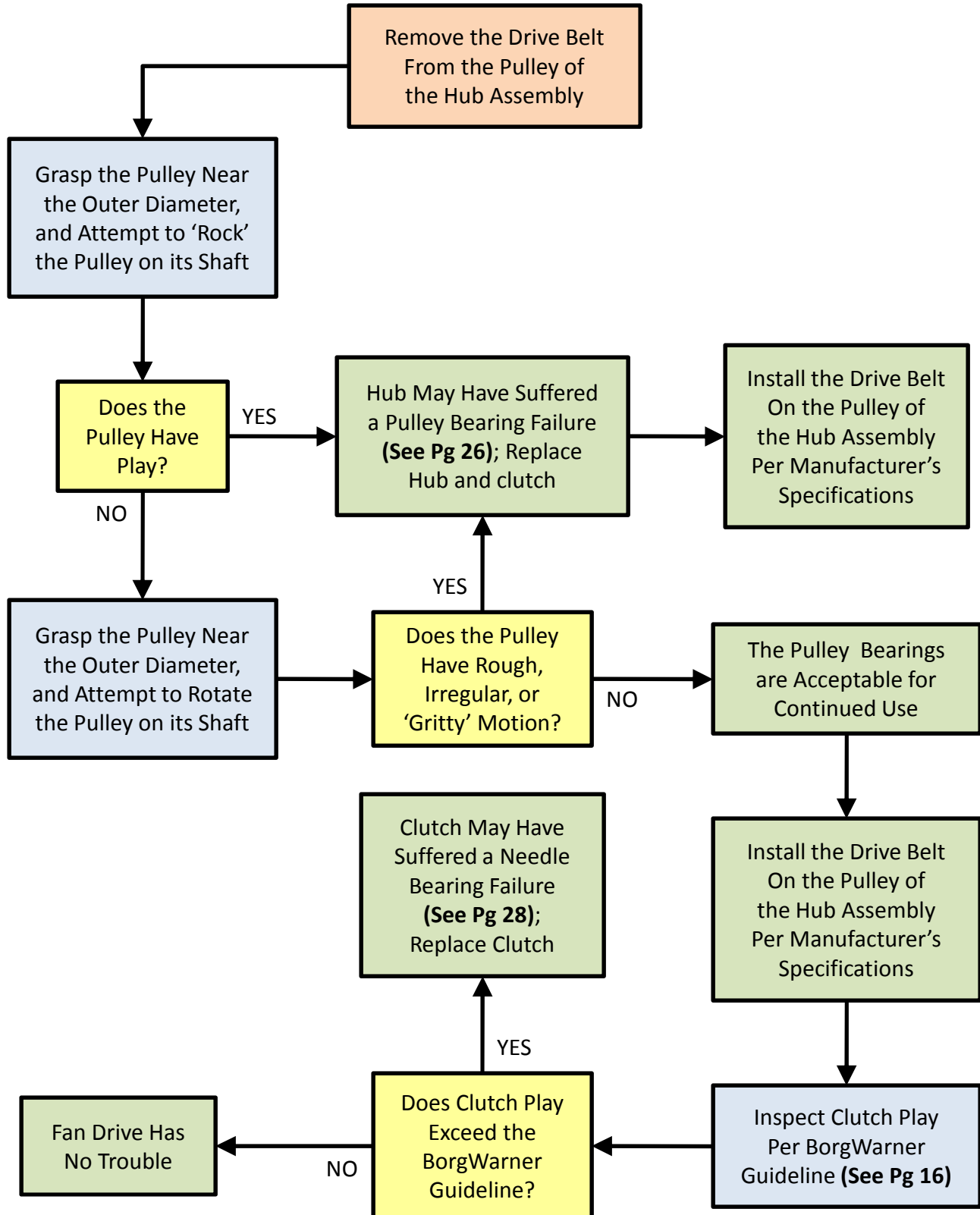
*Note: the Service Alert Tool has a thickness of 0.062" – if the Service Alert Tool is not available, then the liner should be replaced when the clutch shaft's rear face is less than 0.062" forward of the retainer plate's rear face.*

**Troubleshoot: Clutch Will Not Engage**


**Troubleshoot: Fan Drive Has An Air Leak**


### Troubleshoot: Clutch Will Not Disengage (If Air Leak, See Pg 19)



**Troubleshoot: Fan Drive Has Play**


## **Clutch Failure Modes and Warranty Coverage**

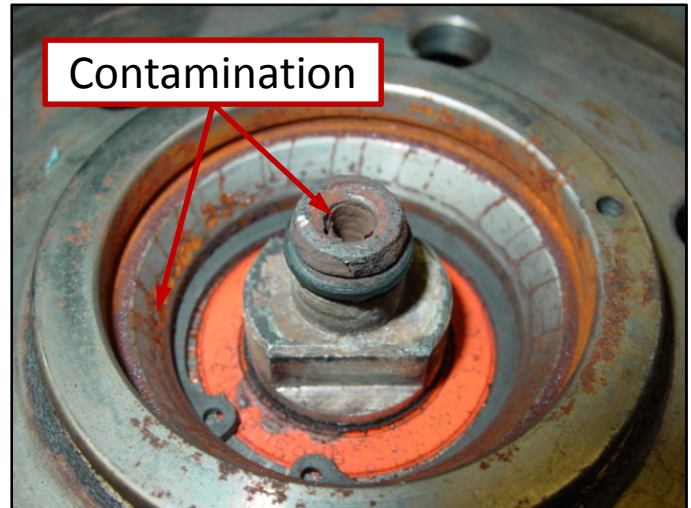
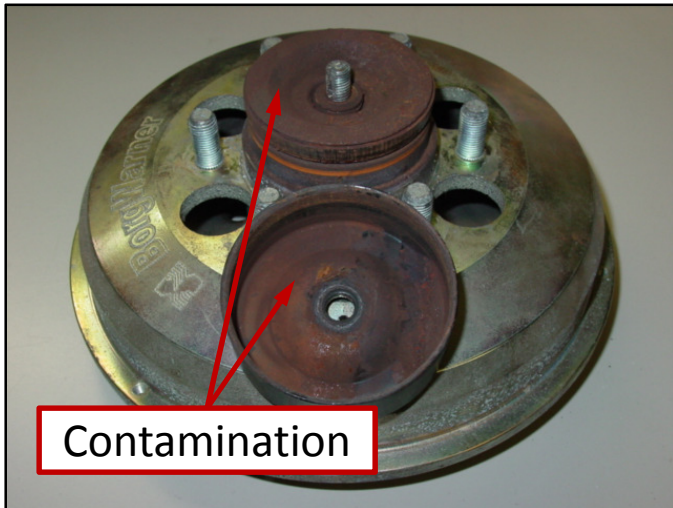
Note: The troubleshooting guides should be used to determine the root cause of a clutch failure before referring to this section (see “Troubleshoot” in the Index on Pg 2).

The following pages illustrate the possible failure modes of the clutch assembly. **Disassembly of the clutch is not necessary to diagnose the failure mode.**

### Failure Mode:

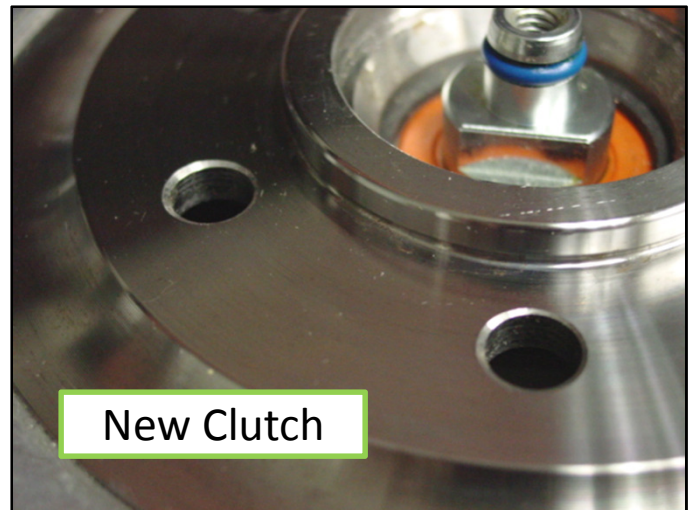
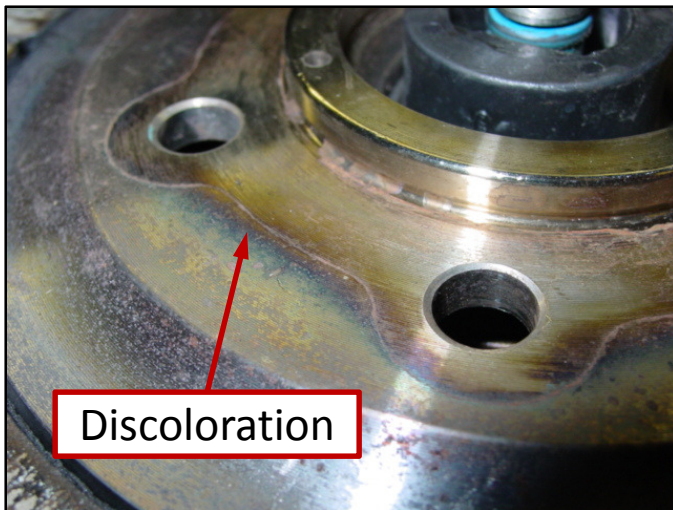
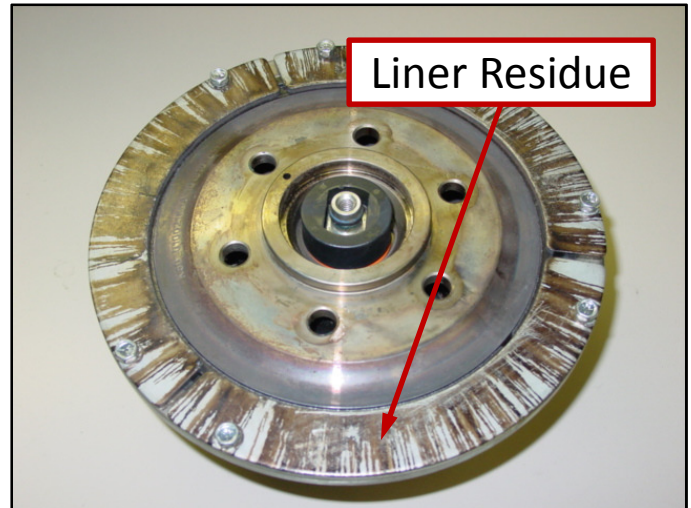
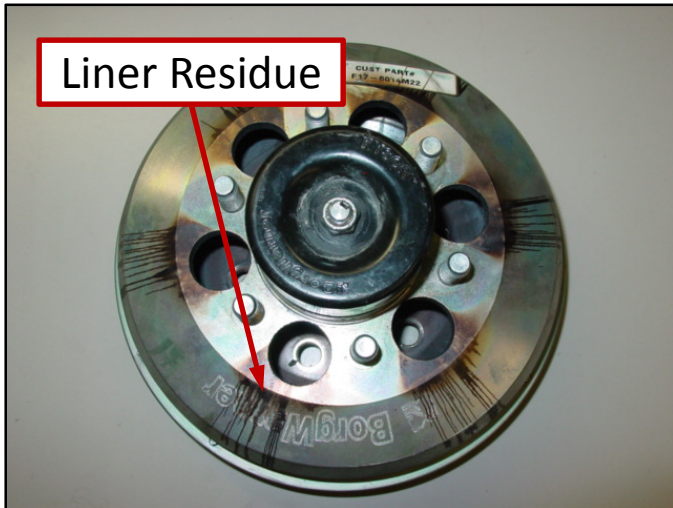
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### Air System Contamination



Disassembly of the clutch is not required - images are provided for reference only. Contamination in the air system may cause air seal leaks, operation troubles, or clutch failure. **Any failure due to air system contamination is not warrantable through BorgWarner.**

### Control System Issue



A control system issue (potential root causes identified on Pg 25) or restricted fan rotation may cause the clutch to overheat and ultimately fail. Evidence of an overheated clutch includes liner residue on the forward and/or rear face of the clutch, discoloration of the rear face of the clutch, an extremely worn liner, or even a melted coupler. **Any failure due to a control system issue is not warrantable through BorgWarner – check with the OEM for possible warranty coverage.**



## **Control System Issue (Root Causes)**

Control system issues, which may cause the clutch to wear excessively or overheat, include any of the following root causes:

- Incomplete clutch disengagement (liner still in contact) due to air pressure below 90 PSI. Verify that air pressure at the hub fitting is 90-110 PSI when the clutch is disengaged.
- Slow clutch disengagement due to a low air flow rate caused by a contaminated air solenoid, pinched air line, air leak, or high air demand. Verify that air pressure at the hub fitting increases almost instantaneously from 0 PSI to at least 90 PSI (in less than 1 second).
- Slow clutch disengagement or incomplete clutch disengagement due to insufficient air pressure or insufficient air flow rate ultimately caused by vehicle electrical issues. Verify that air pressure at the hub fitting increases almost instantaneously from 0 PSI to at least 90 PSI (in less than 1 second).
- Slow clutch engagement due to a plugged air vent, a contaminated air solenoid, or a pinched air line (air pressure must be released quickly to engage clutch with minimal slippage). Verify that air pressure at the hub fitting decreases almost instantaneously from more than 90 PSI down to 0 PSI (in less than 1 second).
- Frequent clutch (and fan) engagements lasting less than 30 seconds (clutch over-cycling) due to the lack of a fan “on-time” timer within the engine or vehicle control module, A/C problems, or defective control system.

### Indications of Pulley Bearing (Hub) Problems



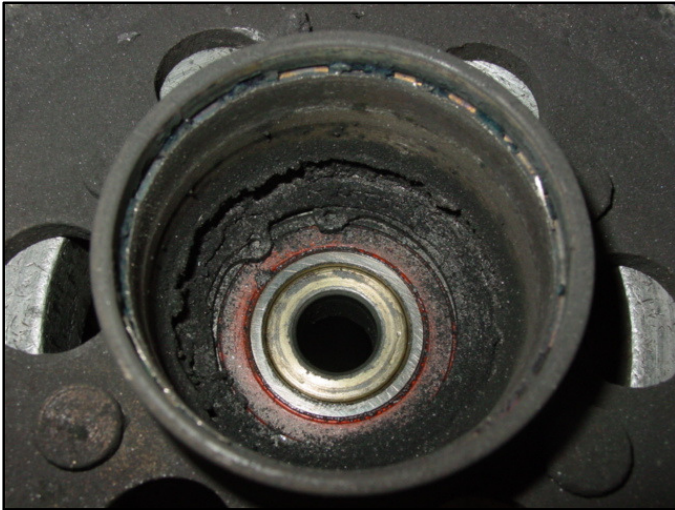
Damage to the base of the piston rod or o-ring; a rounded out or melted coupler may be caused by pulley bearing problems. Inspect for play or rough motion in the pulley bearings (See Pg 15). **If a clutch is damaged by pulley bearing problems, and the hub is still under warranty, then both the clutch and hub must be returned to BorgWarner for warranty consideration.**

## Improper Installation



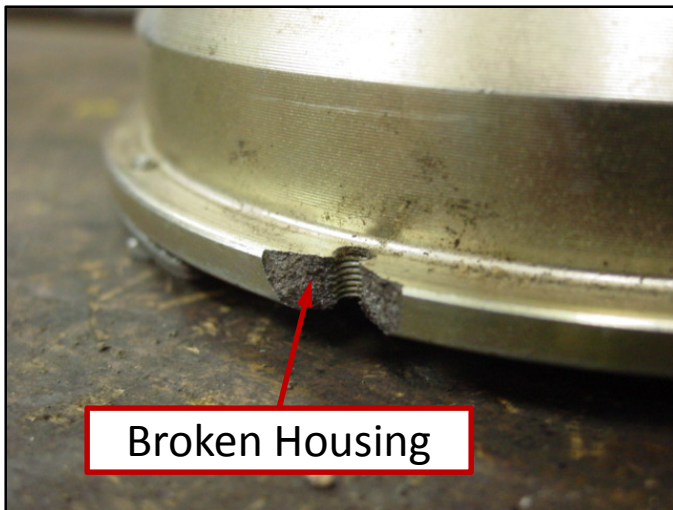
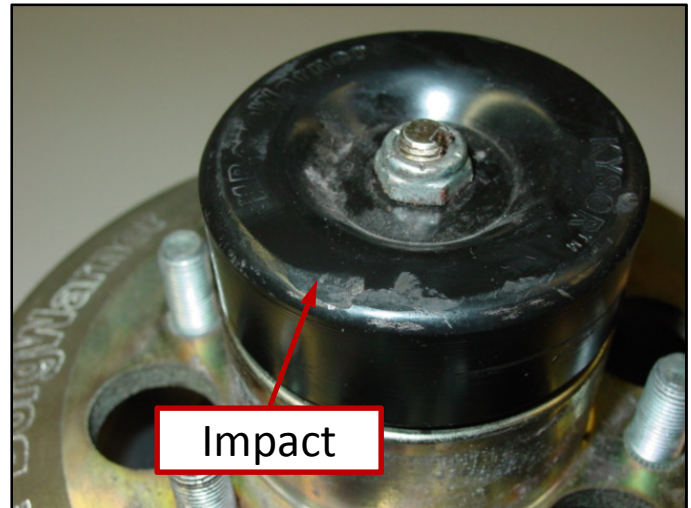
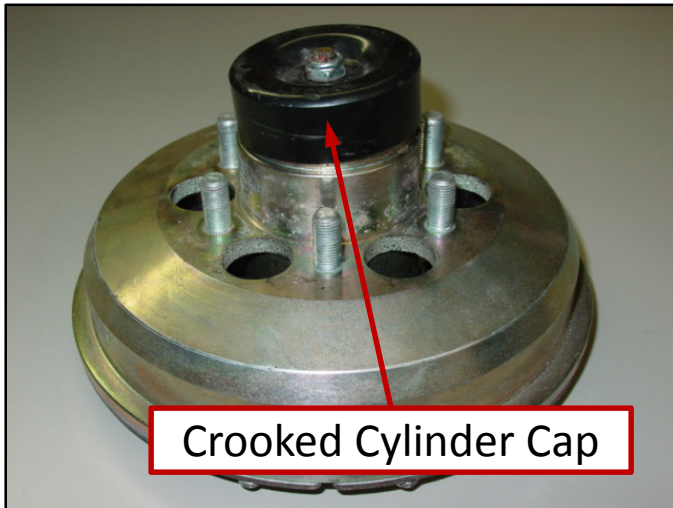
Any extra bolts left loose inside the clutch housing will cause internal damage during clutch operation. Any of the 6 clutch mounting bolts that are not torqued to 45 lbf-ft (61 Nm) may become loose inside the clutch housing and cause internal damage. Bolts that are properly torqued will leave a witness mark in the clutch shaft. **A failure due to improper installation is not warrantable through BorgWarner, unless the failure occurred on an original equipment factory installation.**

## Needle Bearing Failure



Disassembly of the clutch is not required - images are provided for reference only. Needle bearing problems are rare, but can occur. **If a needle bearing fails due to a hub failure (see Pg 26), and the hub is still under warranty, then both the clutch and hub must be returned for warranty consideration.** If a needle bearing fails without a hub failure, then the clutch alone may be returned for warranty consideration. A needle bearing failure due to a defect in material or workmanship is warrantable through BorgWarner.

## Physical Damage



An impact to the cylinder cap may bend the piston rod (which carries the cylinder cap) and produce an air seal leak. The bent piston rod may even prevent the clutch from engaging or disengaging. An impact to the clutch housing, especially near a fastener hole, may fracture the housing and cause a fastener to become loose or lost. **A failure due to physical damage of any kind is not warrantable through BorgWarner.**